เอกสารอ้างอิง

1. พอพันธ์ วัชจิตพันธ์ การบริหารงานผลิตและบริการ สำนักพิมพ์โอเดียนสโตร์ กรุงเทพ, 2522.

2. Claycombe, W.W and W.G. Sullivan Fundamentals of Forecasting Reston Publishing Company Inc., Reston Verginia, 1977.

3. Makridakis, S. and S.C. Wheelwright Forecasting : Methods and Applications John Wiley & Sons, Inc., Toronto Canada, 1978.

4. Buffa, E.S. Modern Production/Operations Management Seventh Edition, John Wiley & Sons, Inc., Toronto Canada, 1983.

5. Vollmann, T.E. Operations Management : A Systems Model-Building Approach Addison-Wesley Publishing Company, Reading Massachusetts, 1973.

6. Riggs, J.L. Production Systems : Planning, Analysis and Control Second Edition, John Wiley & Sons, Inc., Santa Barbara, 1976.

7. Greene, J.H. Production and Inventory Control Richard D. Irwin, Inc., Homewood Illinois, 1974.

8. Ebert, R.J. "Aggregate Planning With Learning Curve Productivity Management Science 23(2), (1976) : 171-182.

9. Buffa, E.S. Operations Management : Problems and Models Third Edition, John Wiley & Sons, Inc., New York, 1972.

10. ---------- Operations Management : The Management of Production Systems John Wiley & Sons, Inc., New York, 1976.

11. Buffa, E.S. Production - Inventory Systems : Planning and Control First Printing, Richard D. Irwin, Inc., Illinois, 1968.

12. King. J.R. Production Planning and Control : An Introduction to Quantitative Methods First Edition, Pergamon Press, Oxford, 1975.

13. Kao, E.P.C. "A Multiproduct Dynamic Lot Size Model with Individual and Joint Set-up costs" Operations Research 27(2), (1979): 279-289.

14. Dantzig, G.B. and P. Wolfe "Dccomposition Principle of Linear Programs" Operations Research 8, (1960) : 101-111.

15. Morton, K. "On Production Smoothing" Management Science 7(3),(1961)

16. Kachitvichyanukul, V. "Optimal Production Planning for A Pencil Factory in Thailand" Master's Thesis, Department of Industrial Engineering & Management AIT, Bangkok, 1976.

17. Jones, C.H. "Parametric Production Planning" Management Science 13(11), (1967) : 843-865.

18. Zubair, T. "An Aggregate Production Planning Model in A Heavy Manufacturing Industry" Master's Thesis Department of Industrial Engineering & Management AIT, Bangkok, 1979.

19. Taubert, W.H. "Search Decision Rules for Aggregate Scheduling Problem" Management Science 14(2),(1967) : 343-395.

20. Havang, C.L., L.T. Fan and L.E. Erickson "Optimum Production Planning by The Maximum Principle" Management Science 13(9),(1967): 751-755.

21. Orrbeck, M.g., D.R. Schuette and H.E. Thomson, "The Effect of Worker Productivity on Production Smoothing" Management Science 14(6), (1968) : B 332-B342.

22. Denzler, D.R. "A Heuristic Production Lot Scheduling Model" AIIE Transaction 2(1), (1970) : 59-63.

23. Chang, R.H. and C.H. Jones "Production and Workforce Scheduling Extensions" AIIE Transaction 2(4), (1970) : 843-866.

24. Bergstrom, G.L. and R.E. Smith "Multi-Item Production Planning : An Extension of The HMMS Rules" Management Science 16(10),(1970): B614-B629.

25. Zoller, K. "Optimal Disaggregation of Aggregate Production Plans" Management Science 17(8), (1971) : B533-B549.

26. Lee, S. and V. Jaaskelainen "Goal Programming : Management's Math Model" Journal of Industrial Engineering, February (1971) : 30-35.

27. Lee, W.B. and B.M. Khumawala "Simulation Testing of Aggregate Production Planning Models in An Implementation Methodology" Management Science 20(6), (1974) : 903-911.

28. Gabby, H. "Multi-Stage Production Planning" Management Science 25(11), (1979) : 1138-1148.

29. LaForge, R.L. and D.W. Kroeber "Production Program Sets Levels When Demand Varies" Journal of Industrial Engineering October (1983) : 20-28.

30. Montgomery, D.C. and L.A. Johnson Forecasting and Time Series Analysis, McGraw-Hill Book Company, Inc., New York, 1976.

31. โชคชัย ธนเมธี และภูมิพงษ์ วรวัฒนะกูล "การหาดุลย์ถ่วงที่เหมาะสมของตัวแบบการพยากรณ์โดยคอมพิวเตอร์" วิทยานิพนธ์ปริญญาบัณฑิต ภาควิชาวิศวกรรมอุตสาหการ สถาบันเทคโนโลยีพระจอมเกล้าธนบุรี 2527.

32. สัณห์ชัย กลิ่นพิกุล "การควบคุมปริมาณผลิตภัณฑ์สำหรับโรงงานที่ผลิตสินค้าหลายชนิดและใช้เครื่องจักรร่วมกัน" การประชุมข่ายงานวิศวกรรมอุตสาหการ : เทคนิคการผลิตและการจัดการสมัยใหม่สำหรับธุรกิจและอุตสาหกรรม (ศิริจันทร์ ทองประเสริฐ) หน้า PI 80 - PI 88, 2526.

33. สุรศักดิ์ นานานุกูล การบริหารงานผลิต พิมพ์ครั้งที่ 1 บริษัทสำนักพิมพ์ไทยวัฒนาพานิช จำกัด กรุงเทพฯ 2517.

34. Burbidge, J.L. Production Planning The Heinemann Accountancy and Administration Series, William Heienemann Ltd., London, 1971.

35. Gillett, B.E., "Introduction to Operations Research : A Computer Oriented Algorithmic Approach" McGraw-Hill Book Company, New York, 1976.

36. Hausman, W.H. and R. Petersons "Multiproduct Production Schedulign for Style Goods with Limited Capacity, Forecast Revisions and Terminal Delivery" Management Science 18(7), (1972) : 370-383.

37. Love, S.F. Inventory Control McGraw-Hill Book Company, New York, 1979.

38. Makridakis, S. and S.C. Wheelwright Forecasting Methods for Management Second Edition, John Wiley & Sons, Inc., New York, 1977.

39. Miller, D.W. and M.K. Starr Executive Decisions and Operations Research Second Deition, Prentice-Hall of India Privated ltd., New Delhi, 1978.

40. Taha, H.A. Operations Research : An Introduction Second Edition, Macmillan Publishing Co., Inc., New York, 1976.

41. Thomson, J.E. "Sales Forecasting Errors and Inventory Fluctuation Random Error and Random Sales" Management Science 12(5), (1966): 448-456

42. Zimmerman, S.M. and D. Glover "Safety Stocks : Balancing Outages and Inventory Costs" Journal of Industtial Engineering, May (1982) : 38-42.

43. Naddor, E. Inventory Systems John Wiley & Sons, Inc., New York, 1966.

44. Perksanusak, P. "A Heuristic Approach to An Aggregate Lot Size Production Planning of A Printing Stage in A Cap Company" Master's Thesis, Department of Industrial Engineering & Management AIT, Bangkok, 1981.

45. Shore, B. Quantitative Methods for Business Decisions : Text and Cases International Student Edition, McGraw-Hill Book Kogakusha ltd., Tokyo, 1978.

ภาคผนวก

ภาคผนวก ก.

แสดงรายการผลิตภัณฑ์กระเบื้องครอบชนิดต่าง ๆ ของ บกด.[1]

ครอบประเภทภายในมาตรฐานการผลิต (Standard Hand Mould) แบ่งออกเป็น

ก) ครอบภายในมาตรฐานแบบไม่มีสี (รหัส 210) แบ่งออกเป็น

ก.1) แบบธรรมดา (Regular) : รหัส 2100

รหัส	ชื่อผลิตภัณฑ์
2150001	CL.FIT.ANG.RIDGE WHI.10 (ครอบมุมลอนคู่ 10 องศา)
2150001	CL.FIT.ANG.RIDGE WHI.15 (ครอบมุมลอนคู่ 15 องศา)
2150001	CL.FIT.ANG.RIDGE WHI.20 (ครอบมุมลอนคู่ 20 องศา)
2150002	2 PIECE ADJ.RIDGE WHI. (ครอบปรับมุมลอนคู่)
2150003	HIP.RIDGE WHI. (ครอบตะเข้ ลอนคู่)
2150004	APRON FLANGE WHI.(ชนฝา ลอนคู่)
2150005	EAVE RIDGE WHI. (ครอบเพิงแหงน ลอนคู่)
2150006	S.3 CORNER RIDGE WHI. (ครอบสามทาง ตัววาย)
2150006	S.3 CORNER RIDGE WHI. (ครอบสามทาง ตัวที)
2150007	CORNER PIECE WHI. (ปิดจั่ว)
2150008	SOAKER FLANGE WHI.(ปลองควัน)
2150009	FIXED SKYL 50 ≠ 120 WHI. (กระเบื้องแสงสว่าง 120)
2150010	FIXED SKYL 50 ≠ 150 WHI. (กระเบื้องแสงสว่าง 150)
2150017	EAVE SHEET 54 ≠ 120 WHI. (ลูกฟูกลอนเล็ก ปลายงอน)
2150021	CL.FIT.ANG.RIDGE WHI.10 (ครอบมุมลอนเล็ก 10 องศา)
2150021	CL.FIT.ANG.RIDGE WHI.15 (ครอบมุมลอนเล็ก 15 องศา)

[1] จาก เอกสารของบริษัทกระเบื้องกระดาษไทย จำกัด

รหัส	ชื่อผลิตภัณฑ์
2150021	CL.FIT.ANG.RIDGE WHI.20 (ครอบมุมลอนเล็ก 20 องศา)
2150022	2 PIECE ANJ.RIDGE WHI. (ครอบปรับมุม ลอนเล็ก)
2150023	HIP.RIDGE WHI. (ครอบตะเข้ ลอนเล็ก)
2150024	APRON FLANGE WHI. (ชนฝา ลอนเล็ก)
2150025	EAVE RIDGE WHI. (ครอบเพิงแหวน ลอนเล็ก)
2150026	HIP.RIDGE COVER WHI.(ครอบครึ่งวงกลมสำหรับตะเข้)
2150027	EAVE SHEET 55 / 150 WHI. (ลูกฟูกลอนเล็ก ปลายงอน 150)
2150041	CL.FIT.ANG.RIDGE 10 (ครอบมุมลอนใหญ่ 10 องศา)
2150041	CL.FIT.ANG.RIDGE 15 (ครอบมุมลอนใหญ่ 15 องศา)
2150041	CL.FIT.ANG.RIDGE 20 (ครอบมุมลอนใหญ่ 20 องศา)
2150042	2 PIECE ADJ.RIDGE (ครอบปรับมุมลูกฟูก ลอนใหญ่)
2150044	APRON FLANGE (ชนฝา ลอนใหญ่)
2150045	EAVE RIDGE (ครอบเพิงแหงน ลอนใหญ่)
2150046	L.C.FLASH 102 / 11.5 / 0.6
2150065	END PIECE WHI. (อุดจั่ว)
2150072	A/C CAP 15.5 / 120 / 0.8 (ครอบทับหลัง)
2150103	H.R.RIDGE 30 / 120 CM.
2150104	H.R.RIDGE 30 / 180 CM.
2150105	ANG.PIECE 30 / 120 WHI.
2150137	SPECIAL RIDGE (K.C.)
2150139	EAVE BLOCK (กันนก)
2150141	SPECIAL RIDGE 70 / 120 / 0.5
2150142	SPECIAL RIDGE 102 / 60 / 0.5

ข) ครอบภายในมาตรฐานแบบมีสี (รหัส 211) แบ่งออกเป็น

ข.1) แบบสีแดง (RED) : รหัส 2110

รหัส	ชื่อผลิตภัณฑ์
2150106	ANG.PIECE 30 / 120 RED
2150127	H.R.RIDGE 30 / 120 RED
2150127	H.R.RIDGE 30 / 180 RED
2153011	CL.FIT.ANG.RIDGE RED 10 (ครอบมุมลอนคู่ 10 องศา)
2153011	CL.FIT.ANG.RIDGE RED 15 (ครอบมุมลอนคู่ 15 องศา)
2153011	CL.FIT.ANG.RIDGE RED 20 (ครอบมุมลอนคู่ 20 องศา)
2153012	2 PIECE ADJ.RIDGE RED(ครอบปรับมุม ลอนคู่)
2153013	HIP.RIDGE RED (ครอบตะเข้ ลอนคู่)
2153014	APRON FLANGE RED (ชนฝา ลอนคู่)
2153015	EAVE RIDGE RED (ครอบเพิงแหงน ลอนคู่)
2153016	S.3 CORNER RIDGE RED (ครอบสามทาง ตัววาย)
2153016	S.3 CORNER RIDGE RED (ครอบสามทาง ตัวที)
2153017	CORNER PIECE RED (ปิดจั่ว)
2153018	SOAKER FLANGE RED (ปลองควัน)
2153019	FIXED SKYL 50 / 120 RED(กระเบื้องแสงสว่าง 120)
2153020	FIXED SKYL 50 / 150 RED(กระเบื้องแสงสว่าง 150)
2153027	EAVE SHEET 54 / 120 CM.RED (ลูกฟูกลอนเล็ก ปลายงอน)
2153031	CL.FIT.ANG.RIDGE RED 10 (ครอบมุม ลอนเล็ก 10 องศา)
2153031	CL.FIT.ANG.RIDGE RED 15 (ครอบมุม ลอนเล็ก 15 องศา)
2153031	CL.FIT.ANG.RIDGE RED 20 (ครอบมุม ลอนเล็ก 20 องศา)
2153032	2 PIECE ADJ.RIDGE RED (ครอบปรับมุม ลอนเล็ก)
2153033	HIP.RIDGE RED (ครอบตะเข้ ลอนเล็ก)
2153034	APRON FLANGE RED (ชนฝา ลอนเล็ก)

รหัส	ชื่อผลิตภัณฑ์
2153035	EAVE RIDGE RED (ครอบเพิงแหงน ลอนเล็ก)
2153036	HIP.RIDGE COVER RED (ครอบครึ่งวงกลมสำหรับตะเข้)
2153037	EAVE SHEET 55 ⁄ 150 RED (ลูกฟูก ลอนเล็กปลายงอน 150)
2153075	END PIECE RED (อุดจั่ว)

ข.2) แบบสีเขียว (GREEN) : รหัส 2111

รหัส	ชื่อผลิตภัณฑ์
2150107	ANG.PIECE 30 ⁄ 120 GRN.
2150128	H.R.RIDGE 30 ⁄ 120 GRN.
2150130	H.R.RIDGE 30 ⁄ 190 GRN.
2155011	C.L.FIT.ANG.RIDGE GRE.10 (ครอบมุมลอนคู่ 10 องศา)
2155011	C.L.FIT.ANG.RIDGE GRE.15 (ครอบมุมลอนคู่ 15 องศา)
2155011	C.L.FIT.ANG.RIDGE GRE.20 (ครอบมุมลอนคู่ 20 องศา)
2155012	2 PIECE ADJ.RIDGE GRE. (ครอบปรับมุม ลอนคู่)
2155013	HIP.RIDGE GRE. (ครอบตะเข้ ลอนคู่)
2155014	APRON FLANGE GRE. (ชนฝา ลอนคู่)
2155015	EAVE RIDGE GRE. (ครอบเพิงแหงน ลอนคู่)
2155016	S.3 CORNER RIDGE GRE. (ครอบสามทาง ตัววาย)
2155016	S.3 CORNER RIDGE GRE. (ครอบสามทาง ตัวที)
2155017	CORNER PIECE GRE. (ปิดจั่ว)
2155018	SOAKER FLANGE GRE.(ปลองควัน)
2155019	FIXED SKYL 50 ⁄ 120 GRE. (กระเบื้องแสงสว่าง 120)
2155020	FIXED SKYL 50 ⁄ 150 GRE. (กระเบื้องแสงสว่าง 150)
2155027	EAVE SHEET £$ ⁄ 120 CM. (ลูกฟูกลอนเล็ก ปลายงอน)
2155031	C.L.FIT.ANG.RIDGE GRE.10 (ครอบมุมลอนเล็ก 10 องศา)

รหัส	ชื่อผลิตภัณฑ์
2155031	C.L.FIT.ANG.RIDGE GRE.15 (ครอบมุมลอนเล็ก 15 องศา)
2155031	C.L.FIT.ANG.RIDGE GRE.20 (ครอบมุมลอนเล็ก 20 องศา)
2153032	2 PIECE ADJ.RIDGE GRE. (ครอบปรับมุมลอนเล็ก)
2153033	HIP.RIDGE GRE. (ครอบตะเข้ ลอนเล็ก)
2153034	APRON FLANGE GRE.(ชนฝา ลอนเล็ก)
2153035	EAVE RIDGE GRE. (ครอบเพิงแหงน ลอนเล็ก)
2153036	HIP.RIDGE COVER GRE. (ครอบครึ่งวงกลมสำหรับตะเข้)
2153037	EAVE SHEET 55 / 150 GRE.(ลูกฟูกลอนเล็ก ปลายงอน 150)
2153075	END PIECE GRE. (อุดจั่ว)

ข.3) แบบสีอื่น ๆ(OTHER COLORED): รหัส 2112

รหัส	ชื่อผลิตภัณฑ์
2154075	END PIECE ORANGE (อุดจั่ว)
2156075	END PIECE OLIVE-GRE. (อุดจั่ว)

ครอบประเภทภายนอกมาตรฐาน (Non-Standard Hand Mould) แบ่งออกเป็น

ก) กระเบื้องราง (CAR PORT UNIT): รหัส 2150

รหัส	ชื่อผลิตภัณฑ์
2150062	CAR PORT UNIT .84 / 5 M.(กระเบื้องราง 84 / 500)
2150067	CAR PORT UNIT .98 / 5 M.(กระเบื้องราง 98 / 500)
2150068	CAR PORT UNIT .98 / 3.80 M.(กระเบื้องราง 98 / 380)
2150077	CAR PORT UNIT 98 / 400 CM.(กระเบื้องราง 98 / 400)
2150078	CAR PORT UNIT 98 / 300 CM.(กระเบื้องราง 98 / 300)

ข) กระเบื้องบานเกล็ด (VENETIAN LOUVER SHEETS) : รหัส 2151

รหัส	ชื่อผลิตภัณฑ์
2150060	VE LO 40 / 120 (SPECIAL) (บานเกล็กพิเศษ 40 / 120)
2150061	VENETIAN LOUVER SHEET (กระเบื้องบานเกล็ด 40 / 120)
2150108	VE LO SHEET 60 / 120 (กระเบื้องบานเกล็ด 60 / 120)
2150109	VE LO SHEET 60 / 240 (กระเบื้องบานเกล็ด 60 / 240)
2151311	LOUVER P.V.2 30 / 180
2150132	LOUVER P.V.1 15 / 90

ค) กระเบื้องกันแสง (SOLAR SCREENS) : รหัส 2152

รหัส	ชื่อผลิตภัณฑ์
2150063	SOLAR SCREEN 12 / 60 (กระเบื้องกันแสง)
2150066	SOLAR SCREEN 30 / 60 CM. (กระเบื้องกันแสงพิเศษ)
2150080	SOLAR SCREEN HONEY C. (กระเบื้องกันแสงรังผึ้ง)

ง) กระเบื้องลอน (CORRUGATED SHEETS) : รหัส 2153

รหัส	ชื่อผลิตภัณฑ์
2150069	A/C CORR 244 - 84 / 150 (กระเบื้องลอน 244-84/150)
2150070	A/C CORR 244 - 84 / 240 CM.(กระเบื้องลอน 244-84/240)
2150071	A/C CORR 244 - 84 / 300 CM.(กระเบื้องลอน 244-84/300)
2150073	A/C CORR 280 - 94 / 150 CM.(กระเบื้องลอน 280-94/150)
2150074	A/C CORR 280 - 94 / 240 CM.(กระเบื้องลอน 280-94/240)
2150075	A/C CORR 280 - 94 / 300 CM.(กระเบื้องลอน 280-94/300)
2150079	A/C CORR 244 - 84 / 350 CM.(กระเบื้องลอน 244-84/350)

จ) กระเบื้องชนิดอื่น ๆ (MISCELLENEOUS) : รหัส 2159

รหัส	ชื่อผลิตภัณฑ์
2150050	ROUND RIDGE FOR L.C.(ครอบสันกระเบื้องราง)
2150051	C.L.FIT.ANG.R.CAR PORT (ครอบมุมกระเบื้องราง)
2150054	APRON FLANGE CAR PORT (ครอบชนฝากระเบื้องราง)
2150064	SPACER BLOCK (ฟูกรองบานเกล็ด)
2150076	CABLE TRAY 11 ⁄ 22 ⁄ 200 (ท่อร้อยสายไฟ)
2150101	TABLE (โต๊ะสนาม)
2150102	STOOL (เก้าอี้สนาม)
2150110	CUR. SHEET 54 ⁄ 150 ⁄ 0.4 (กระเบื้องลอนเล็กโค้งรัศมี150)
2150119	CUR. SHEET 1.5 M.
2150133	DOME TYPE 8 MM.(โดม)
2150134	ROOFING PYRAMID 50 ⁄ 50 (ปิรามิด 50 ⁄ 50)
2150138	ROOFING PYRAMID 60 ⁄ 60 (ปิรามิด 60 ⁄ 60)
2150140	L.COR.CURVE 83 ⁄ 251.5 (กระเบื้องลูกฟูกลอนใหญ่โค้งเอซโซ่)
2150144	CUR.FLAT 20 ⁄ 217.5 ⁄ .8
2150145	L.COR.CURVE 102 ⁄ 220 ⁄ 6 (กระเบื้องลูกฟูกลอนใหญ่โค้งเชลล์)
2150147	L.C.CURVED SH.NO.280
2150151	L/C CURVED SHEET R 23(กระเบื้องลูกฟูกลอนใหญ่โค้ง เอซโซ่)
2150153	LOU BLA R. .37 ⁄ 3.15 M.
2150154	LOU BLA R. .37 ⁄ 3.00 M.
2150155	LOU BLA R. .37 ⁄ 2.90 M.
2150156	LOU BLA R. .37 ⁄ 2.00 M.
2150157	LOU BLA R. .37 ⁄ 1.70 M.
2150158	VL 90 BENDED TIP

ภาคผนวก ข

โปรแกรมคอมพิวเตอร์การพยากรณ์ปริมาณความต้องการสินค้า

```
0001 C
0002 C
0003 C      PROGRAM EX : MULTIPLE EXPONENTIAL SMOOTHING (PART I)
0004 C      FUNCTION   : FIND INITIAL VALUES AND A SMOOTHING CONSTANT
0005 C
0006 C
0007        IMPLICIT INTEGER(D-E)
0008        DIMENSION X(72),XDE(4),S(72),S2(72),S3(72),R(72),F(72),Y(108)
0009 C              ***********************************
0010 C              *   MULTIPLE SMOOTHING PROGRAM      *
0011 C              ***********************************
0012 C      WILL PERFORM CONSTANT, LINEAR, OR QUADRATIC SMOOTHING, DEPENDING
0013 C        ON THE VALUE OF K
0014 C
0015 C      F(I) IS THE FORECAST MADE AT PERIOD I FOR PERIOD I+L
0016 C      R(I) IS THE ERROR DERIVED AT PERIOD I CALCULATED BY
0017 C      SUBTRACTING THE ESTIMATED VALUE ( MADE L PERIODS BEFORE)
0018 C      FFP(I) IS THE FORECAST FOR PERIOD I (MADE L PERIODS AGO)
0019 C      X(I) IS THE ACTUAL DATA FOR PERIOD I
0020 C
0021        READ(10,1)KP
0022 1      FORMAT(I4)
0023        DO 105 LL=1,KP
0024        READ(10,2)CO,XDE
0025 2      FORMAT(I8,4A2)
0026        READ(10,3)K,N,N1,L,IMF,EST,JA,KN,JS,KS
0027        XL=L
0028        XLSQ=XL*XL
0029        N1ML=N1-L
0030 3      FORMAT(I1,5I3,4I1)
0031 C
0032 C      N IS THE NUMBER OF DATA ENTRIES TO BE PROCESSED.
0033 C      N1 IS THE NUMBER OF DATA ENTRIES TO BE USED IN THE PARAMETER
0034 C         ESTIMATION PHASE.
0035 C      L IS THE LEAD TIME USED FOR FORECASTING.
0036 C      EST IS THE NUMBER OF POINTS IN THE ESTIMATION PHASE
0037 C        TO BE USED IN PERIOD '0' ESTIMATION.
0038 C      THE REMAINDER OF THE N1-EST POINTS ARE USED IN THE
0039 C      ALPHA OPTIMATION SECTION.
0040 C
0041        IF(N1.LT.L)N1=L
0042        ESTP1=EST+1
0043 C
0044 C      IFKS=1 READ IN AU,AD,AL .. ELSE READ IN SELECTED ALPHA
0045        IF(KS.EQ.1) GO TO 300
0046        READ(10,4)A
0047 4      FORMAT(3F4.0)
0048        GO TO 400
0049 300    READ(10,4)AL,AD,AU
0050 C      ALIS THE LOWER BOUND FOR THE ALPHA SEARCH
0051 C      AD IS THE DELTA CHANGE BETAWEEN ALPHA SIMULATIONS
0052 C      AU IS THE UPPER BOUND ON POSSIBLE ALPHA'S
0053 C
0054 C      INPUT THE DATA VALUES FOR DEMAND
```

```
0055 400    READ(10,5)(Y(I),I=1,N)
0056 5      FORMAT(12F6.0)
0057        IF(JS.EQ.0)GO TO 500
0058        N=N-IMP
0059        DO 104 II=1,N
0060        I=II+IMP
0061 104    X(II)=Y(I)
0062        WRITE(11,111)
0063 111    FORMAT(///,50X,'MULTIPLE SMOOTHING PROGPRAM')
0064        WRITE(11,102)LL,CO,XDE
0065 102    FORMAT(///30X,'FORECASTING FOR PRODUCT',I4,'  CODE',I8,1X,4A2//)
0066        WRITE(11,112)K
0067 112    FORMAT(1HO,10X,'DEGREE OF SMOOTHING SELECTED=',I2/)
0068 500    IF(KN.EQ.1) GO TO 10
0069 C
0070 C      READ IN THE REQUIRED PARAMETERS (KN=1)
0071 C
0072        IF(K-2)7,8,9
0073 7      READ(10,17)S(EST)
0074        WRITE(11,113)S(EST)
0075 113   FORMAT(1HO,10X,'STARTING VALUE OF THE SMOOTHED STATISTIC SPECIFIED
0076       * AS'//11X,' S=',F12.4)
0077        GO TO 11
0078 8      READ(10,17)S(EST),S2(EST)
0079        WRITE(11,114)S(EST),S2(EST)
0080 114    FORMAT(1HO,10X,'STARTING VALUES OF THE SMOOTHED STATISTIC SPECIFI
0081       *ED AS'//11X,'S =',F12.4//11X,'S2=',F12.4)
0082        GO TO 11
0083 9      READ(10,17)S(EST),S2(EST),S3(EST)
0084 17     FORMAT(4F10.4)
0085        WRITE(11,115)S(EST),S2(EST),S3(EST)
0086 115    FORMAT(1HO,10X,'STARTING VALUES OF THE SMOOTHED STATISTICS SPECIF
0087       *IED AS'//11X,'S =',F12.4//11X,'S2=',F12.4//11X,'S3=',F12.4)
0088        GO TO 11
0089 10     IF(JS.EQ.0)GO TO 105
0090 C
0091 C      SECTION TO ESTIMATE  PARAMETERS FROM THE DATA (KN NOT =1)
0092 C
0093        WRITE(11,116)EST
0094 116    FORMAT(1HO,10X,'STARTING VALUES OF THE SMOOTHED STATISTICS TO BE
0095       *ESTIMATED FROM ',I3,' DATA POINTS')
0096        TX=0.0
0097        T2X=0.0
0098        T3X=0.0
0099        T4=0.0
0100        V=EST
0101        IF(K-2)210,30,40
0102 C
0103 C      BEGIN SECTION TO ESTIMATE PARAMETERS FOR CONSTANT MODEL (K=1)
0104 210    DO 211 J=1,EST
0105 211    TX=TX+X(J)
0106        S(EST)=TX/V
0107        WRITE(11,212)S(EST)
0108 212    FORMAT(1HO,'ESTIMATE OF PARAMETER IN CONSTANT MODEL-INTERCEPT'
```

```
0109        *,F12.4)
0110          WRITE(11,217)S(EST)
0111 217      FORMAT(1HO,'STARTING VALUE OF THE SMOOTHED STATISTIC ESTIMATED FR
0112        *OM THE DATA AS'//11X,'S =',F12.4)
0113          GO TO 11
0114 C
0115 C        BEGIN SECTION TO ESTIMATE PARAMETERS FOR LINEAR MODEL (K=2)
0116 30       DO 31 J=1,EST
0117          TX=TX+X(J)
0118          U=J
0119 31       T2X=T2X+U*X(J)
0120          U=6.0/(V*(V-1.0))
0121          B0=(2.0*(2.0*V+1.0))/(V*(V-1.0))*TX-U*T2X
0122          B1=12.0/(V*(V**2-1.0))*T2X-U*TX
0123          B0=B0+EST*B1
0124          WRITE(11,32)B0,B1
0125 32       FORMAT(1HO,'ESTIMATES OF PARAMETERS IN LINEAR MODEL'//11X,'INTERC
0126        *EPT(B0)=',F12.4//11X'SLOPE     (B1)=',F12.4)
0127          GO TO 11
0128 C
0129 C        BEGIN SECTION TO ESTIMATERS FOR QUADRATIC MODEL .(K=3)
0130 40       DO 42 I=1,EST
0131          U=I
0132          T4=T4+U**4
0133          TX=TX+X(I)
0134          T2X=T2X+U*X(I)
0135 42       T3X=T3X+U**2*X(I)
0136          T=V*(V+1.0)/2.0
0137          T2=V*(V+1.0)*(2.0*V+1.0)/6.0
0138          T3=V**2*(V+1.0)**2/4.0
0139 C
0140 C        PERFORM INVERSION
0141          DET=V*(T2*T4/4.0-(T3/2.0)**2)+T*T2*T3/2.0-T2**3/4.0-T**2*(T4/4.0)
0142          A11=T2*T4/4.0-(T3/2.0)**2
0143          A12=T*T4/4.0-(T2*T3/2.0)/2.0
0144          A13=T*T3/2.0-(T2**2)/2.0
0145          A22=V*T4/4.0-T2*T2/4.0
0146          A23=V*T3/2.0-T*T2/2.0
0147          A33=V*T2-T**2
0148          B0=(A11*TX-A12*T2X+0.5*A13*T3X)/DET
0149          B1=(-A12*TX+A22*T2X-0.5*A23*T3X)/DET
0150          B2=(A13*TX-A23*T2X+0.5*A33*T3X)/DET
0151          B0=B0+EST*B1+EST*EST*B2*.5
0152          WRITE(11,218)B0,B1,B2
0153 218     FORMAT(1HO,'ESTIMATES OF PARAMETERS IN QUADRATIC MODEL'//11X,'INTE
0154        *RCEPT(B0)=',F12.4//11X,'LINEAR COMPONENT(B1)=',F12.4//11X,'QUADRAT
0155        *IC COMPONENT(B2)=',F14.2)
0156 C
0157 C        BEGIN SEARCH FOR OPTIMUM SMOOTHING CONSTANT
0158 C         USING DATA VALUES (EST+1) THRU N1
0159 C
0160 11       IF(KS.EQ.0)GO TO 16
0161          B=AL
0162          ABEST=0.0
```

```
0163          TBEST=1.0E+38
0164          WRITE(11,215)
0165 215      FORMAT(1HO,'SMOOTHING CONSTANT OPTIMIZATION'/)
0166          WRITE(11,216)
0167 216      FORMAT(10X,'SMOOTHING CONSTANT ',10X,'RESIDUAL SUM OF SQUARES'/)
0168 12       BB=1.0-B
0169          BGAMMA=BB/B
0170          BTERM1=(2.0+B*XL/BB)
0171          BTERM2=(1.0+B*XL/BB)
0172          BTERM3=(B/BB/BB/2.0)
0173          BTERM4=(6.-5.*B)
0174          BTERM5=2.*(5.-4.*B)
0175          BTERM6=(4.-3.*B)
0176          BTERM7=B*B/BB/BB
0177          IF(KN.EQ.0)GO TO 20
0178          IF(K-2)20,21,22
0179 21       S(EST)=B0-BGAMMA*B1
0180          S2(EST)=B0-2.0*BGAMMA*B1
0181          GO TO 20
0182 22       DD=2.0*B**2
0183          S(EST)=B0-BGAMMA*B1+BB*(2.0-B)/DD*B2
0184          S2(EST)=B0-2.0*BB/B*B1+2.0*BB*(3.0-2.0*B)/DD*B2
0185          S3(EST)=B0-3.0*BB/B*B1+3.0*BB*(4.0-3.0*B)/DD*B2
0186 20       CONTINUE
0187 C        INITIALIZE T TO THE SUM OF SQUARED ERROR
0188          T=0.0
0189 C
0190 C        PERFORM CALCULATIONS FOR THE REMAINDER OF THE PERIOD
0191          DO 13 I=ESTP1,N1ML
0192          S(I)=B*X(I)+BB*S(I-1)
0193          IF(K.GT.1)GO TO 213
0194          RS=X(I+L)-S(I)
0195          GO TO 13
0196 213      S2(I)=B*S(I)+BB*S2(I-1)
0197          IF(K.EQ.3)GO TO 214
0198          RS=X(I+L)-BTERM1*S(I)+BTERM2*S2(I)
0199          GO TO 13
0200 214      S3(I)=B*S2(I)+BB*S3(I-1)
0201          AHAT=3.*S(I)-3.*S2(I)+S3(I)
0202          BHT=BTERM3*(BTERM4*S(I)-BTERM5*S2(I)+BTERM5*S2(I)+BTERM6.*S3(I))
0203          CHAT=BTERM7*(S(I)-2.*S2(I)+S3(I))
0204          XHAT=AHAT+BHT*XL+.5*CHAT*XLSQ
0205          RS=X(I+L)-XHAT
0206 13       T=T+RS**2
0207          IF(JA.EQ.0)GO TO 351
0208          WRITE(11,117)B,T
0209 117      FORMAT(12X,F10.4,10X,E16.7)
0210 351      IF(T.GE.TBEST)GO TO 14
0211          TBEST=T
0212          ABEST=B
0213 14       IF(ABS(B-AU).LE.0.0001.OR.B.GT.AU)GO TO 15
0214          B=B+AD
0215          GO TO 12
0216 C
```

```
0217 C       BEST SMOOTHING CONSTANT HAS BEEN FOUND AND STORED IN A
0218 C       ESTIMATION USING THE OPTIMUM ALPHA
0219 C
0220 15      A=ABEST
0221 16      WRITE(11,118)A
0222 118     FORMAT(1H0,10X,'SMOOTHING CONSTANT=',F10.4/1X,120(1H=)/)
0223 105     CONTINUE
0224         STOP
0225         END
0226 C
0227 C
0228 C       PROGRAM  EX1 : MULTIPLE EXPONENTIAL SMOOTHING (PART II)
0229 C       FUNCTION     : TEST,UPDATE,CONTROL AND FORECAST
0230 C
0231 C
0232         IMPLICIT INTEGER(D-E)
0233         REAL K2,K3
0234         DIMENSION X(72),S(72),S2(72),S3(72),R(72),F(72),FFP(72),XDE(4)
0235         DIMENSION Y(108)
0236         COMMON S,S2,S3,X,R,FFP,F
0237         READ(10,1)KP,IBC
0238 1       FORMAT(2I4)
0239         LL=0
0240 105     LL=LL+1
0241         READ(10,2)CO,XDE
0242 2       FORMAT(I8,4A2)
0243         READ(10,3)K,N,N1,L,IMP,LA,EST,KN,JS,XJN
0244 3       FORMAT(I1,6I4,2I1,F2.0)
0245         READ(10,4)A
0246 4       FORMAT(3F4.0)
0247         IF(KN.EQ.0)GO TO 15
0248         IF(K-2)11,12,13
0249 11      READ(10,5)S(EST)
0250         GO TO 14
0251 12      READ(10,5)B0,B1
0252         GO TO 14
0253 13      READ(10,5)B0,B1,B2
0254 5       FORMAT(3F10.4)
0255         GO TO 14
0256 15      READ(10,5)S(EST),S2(EST),S3(EST)
0257 14      READ(10,6)(Y(I),I=1,N)
0258 6       FORMAT(12F6.0)
0259         IF(JS.EQ.0)GO TO 105
0260         XL=L
0261         ESTP1=EST+1
0262         ESTPL=EST+L
0263         N=N-IMP
0264         DO 104 II=1,N
0265         I=II+IMP
0266 104     X(II)=Y(I)
0267         WRITE(11,111)
0268 111     FORMAT(////50X,'MULTIPLE SMOOTHING PROGRAM')
0269         WRITE(11,112)LL,CO,XDE
0270 112     FORMAT(////11X,'FORECASTING FOR PRODUCT',I4,'  CODE',I8,4A2//)
```

```
0271          IF(N1.LT.L)N1=L
0272          IN=N+LA
0273          CALL FORE(A,KN,K,BO,B1,B2,N,L,IN,EST)
0274          DO 75 I= 1,EST
0275 75       WRITE(11,1299)I,X(I)
0276 1299     FORMAT(1X,I4,F12.2)
0277 70       T=0.0
0278          T2=0.0
0279          TA=0.0
0280          DO 71 I=ESTP1,N1
0281          T=T+R(I)
0282          T2=T2+R(I)**2
0283          TA=TA+ABS(R(I))
0284 71       CONTINUE
0285          V=N1-EST
0286          TA=TA/V
0287          T=T/V
0288          VAR=(T2-V*T**2)/(V-1.0)
0289          T2=T2/V
0290          STD=SQRT(VAR)
0291          V=XJN*STD
0292          DO 72 I=ESTP1,N1
0293          JJI=L+1
0294          IF(K.EQ.1)WRITE(11,127)I,X(I),S(I),S(JJI),R(I)
0295          IF(K.EQ.2)WRITE(11,128)I,X(I),S(I),S2(I),FFP(I),R(I)
0296          IF(K.EQ.3)WRITE(11,129)I,X(I),S(I),S2(I),S3(I),FFP(I),R(I)
0297 127     FORMAT(1X,I4,2X,F10.2,2X,F10.2,28X,F10.2,5X,F10.2)
0298 128     FORMAT(1X,I4,2X,F10.2,2X,F10.2,2X,F10.2,16X,F10.2,5X,F10.2)
0299 129     FORMAT(1X,I4,2X,F10.2,2X,F10.2,2X,F10.2,2X,F10.2,2X,F10.2,5X,F10.2
0300         *)
0301          IF(R(I).GT.V.OR.R(I).LT.(-V))WRITE(11,17)
0302 17       FORMAT(1H+,T83,'THE DATA IS OUT OF CONTROL')
0303 72       CONTINUE
0304          WRITE(11,130)T,VAR,STD,T2,TA
0305 130      FORMAT(45X,'AVERAGE OF ERROR   (AE)=',F14.4/45X,
0306         *            'VARIANCE          (VAR)=',F14.4/45X,
0307         *            'STANDARD DEVIATION(STD)=',F14.4/45X,
0308         *            'MEAN SQUARE ERROR (MSE)=',F14.4/45X,
0309         *            'MEAN ABS. DEV.    (MAD)=',F14.4)
0310          IF(N.EQ.N1)GO TO 74
0311          WRITE(11,133)
0312 133      FORMAT(////40X,'OUTPUT OF FORECASTING PHASE'/)
0313          WRITE(11,122)K,A,L
0314 122      FORMAT(10X,'DEGREE OF SMOOTHING=',I2,5X,'SMOOTHING CONSTANT=',
0315        *F10.2,10X,'FORECASTING LEAD TIME=',I2,1X,'PERIODS'/)
0316          WRITE(11,135)
0317 135      FORMAT(1HO,'PERIOD',5X,'DATA',13X,'SMOOTHED STATISTICS',12X,'FORE
0318        *CAST',6X,'ERROR',12X,'TRACKING SIGNAL',13X,'OUT OF CONTROL')
0319          IF(K.EQ.1)WRITE(11,136)
0320          IF(K.EQ.2)WRITE(11,137)
0321          IF(K.EQ.3)WRITE(11,138)
0322 136      FORMAT(24X,'FIRST',55X,'CUMULATIVE ERROR',2X,'SMOOTHD ERROR'/)
0323 137      FORMAT(24X,'FIRST',6X,'SECOND',44X,'CUMULATIVE ERROR',2X,'SMOOTHE
0324        *D ERROR')
```

```
0325 138     FORMAT(24X,'FIRST',6X,'SECOND',6X,'THIRD',35X,'CUMULATIVE ERROR'
0326        *,2X,'SMOOTHED ERROR'/)
0327          J=N1+1
0328          V=0.0
0329          T=0.0
0330          T2=0.0
0331          K2=XJN*(0.884*SQRT((2.-A)/(1.-(1.-A)**(2*K))))
0332          K3=(1.25*SQRT(A)/(2.-A))*XJN
0333          DO 73 I=J,N
0334          T=T+R(I)
0335          T2=T2+R(I)**2
0336          TA=A*ABS(R(I))+(1-A)*TA
0337          V=A*R(I)+(1-A)*V
0338          TSC=T/TA
0339          TSS=V/TA
0340          JJI=I+L
0341         IF(K.EQ.1)WRITE(11,139)I,X(I),S(I),S(JJI),R(I),TSC,TSS
0342 139     FORMAT(1X,I4,2X,F10.2,2X,F10.2,28X,F10.2,2X,F10.2,5X,F10.2,5X,F10
0343        *.2)
0344          IF(TSC.GT.K2.OR.TSC.LT.(-K2))WRITE(11,190)
0345          IF(TSS.GT.K3.OR.TSS.LT.(-K3))WRITE(11,190)
0346 190     FORMAT(1H+,T120,'**TSC.**')
0347 191     FORMAT(1H+,T128,'%%TSS.%%')
0348 73      CONTINUE
0349          V=N-N1
0350          T=T/V
0351          VAR=(T2-V*T**2)/(V-1.0)
0352          STD=SQRT(VAR)
0353          T2=T2/V
0354          WRITE(11,130)T,VAR,STD,T2,TA
0355          WRITE(11,131)K2,K3
0356 131     FORMAT(45X,'TSC. CONTROL LIMIT    =',F14.4/45X,
0357        *           'TSS. CONTROL LIMIT    =',F14.4)
0358 74      WRITE(11,2960)IBC,K,A,LL,CO,XDE
0359 2960    FORMAT(///30X,'FORECAST DEMANDS FOR YEAR',I4,2X,'BY EXPONENTIAL S
0360       *MOOTHING METHOD'///11X,'DEGREE OF SMOOTHING SELECTED=',I2//11X,'SM
0361       *OOTHING CONSTANT=',F6.3//1X,'PRODUCT',3X,'CODE',25X,'DEMANDS FOR E
0362       *ACH PERRIOD'//28X,'JAN',6X,'FEB',6X,'MAR',6X,'APR',6X,'MAY',6X,'JU
0363       *N',6X,'JUL',6X,'AUG',6X,'SEP',6X,'OCT',6X,'NOV',6X,'DEC'/I3,5X,I8,
0364       *1X,4A2)
0365          J=N+L+1
0366 1111    WRITE(11,142)(S(I),I=J,IN)
0367 142     FORMAT(1H+,25X,12(F6.0,3X)/1X,132(1H-))
0368          IF(LL.LT.KP)GO TO 105
0369          STOP
0370          END
0371          SUBROUTINE FORE(A,KN,K,BO,B1,B2,N,L,IN,EST)
0372          IMPLICIT INTEGER(D-E)
0373          DIMENSION S(72),S2(72),S3(72),X(72),R(72),FFP(72),F(72)
0374          COMMON S,S2,S3,X,R,FFP,F
0375          XL=L
0376          ESTP1=EST+1
0377          ESTPL=EST+L
0378          AA=1.0-A
```

```
0379          WRITE(11,121)
0380 121      FORMAT(////40X,'OUTPUT OF MODEL INITIALIZATION PHASE'/)
0381          WRITE(11,122)K,A,L
0382 122      FORMAT(10X,'DEGREE OF SMOOTHING=',I2,5X,'SMOOTHING CONSTANT=',
0383     *F6.2,10X,'FORECAST LEAD TIME=',I2,1X,'PERIODS'/)
0384          WRITE(11,143)EST
0385 143      FORMAT(30X,I4,'SAMPLES WERE USED IN ESTIMATION OF INTIAL CONSTANT
0386     *S')
0387          IF(KN.EQ.0)GO TO 50
0388          IF(K-2)50,25,400
0389 25       S(EST)=B0-AA/A*B1
0390          S2(EST)=B0-2.*AA/A*B1
0391          WRITE(11,119)S(EST),S2(EST)
0392 119      FORMAT(1H0,'STARTING VALUES OF THE SMOOTHED STATISTICS ESTIMATED
0393     *FROM THE DATA AS S1=',F10.4,5X,'S2=',F10.4)
0394          GO TO 50
0395 400      S(EST)=B0-AA/A*B1+AA*(2.0-A)/(2.0*A**2)*B2
0396          S2(EST)=B0-2.0*AA/A*B1+2.0*AA*(3.0-2.0*A)/(2.0*A**2)*B2
0397          S3(EST)=B0-3.0*AA/A*B1+3.0*AA*(4.0-3.0*A)/(2.0*A**2)*B2
0398          WRITE(11,152)S(EST),S2(EST),S3(EST)
0399 152      FORMAT(1H0,'STARTING VALUES OF THE SMOOTHED STATISTICS ESTIMATED
0400     *FROM THE DATA AS S1=',F10.4,5X,'S2=',F10.4,5X,'S3=',F10.4)
0401 50       WRITE(11,127)S(EST)
0402 127      FORMAT(1H0,'STARTING VALUES OF THE SMOOTHED STATISTICS ESTIMATED
0403     *FROM THE DATA AS S1=',F10.4)
0404          WRITE(11,123)
0405 123      FORMAT(1H0,'PERIOD',5X,'DATA',10X,'SMOOTHED STATISTICS',13X,'FITT
0406     *ED MODEL',5X,'RESIDUAL')
0407          IF(K.EQ.1)WRITE(11,124)
0408 124      FORMAT(24X,'FIRST'/)
0409          IF(K.EQ.2)WRITE(11,125)
0410 125      FORMAT(24X,'FIRST',5X,'SECOND'/)
0411          IF(K.EQ.3)WRITE(11,126)
0412 126      FORMAT(24X,'FIRST',5X,'SECOND',5X,'THIRD'/)
0413          DO 58 J=ESTP1,IN
0414          JL=J+L
0415          IF(J.GT.N)GO TO 53
0416          S(J)=A*X(J)+AA*S(J-1)
0417          IF(K.GT.1)GO TO 51
0418          F(J)=S(J)
0419          GO TO 57
0420 51       S2(J)=A*S(J)+AA*S2(J-1)
0421          IF(K.EQ.3)GO TO 52
0422          F(J)=(2.+A*XL/AA)*S(J)-(1.+XL*A/AA)*S2(J)
0423          GO TO 57
0424 52       S3(J)=A*S2(J)+AA*S3(J-1)
0425          AHAT=3.*S(J)-3.*S2(J)+S3(J)
0426         BHT=A/AA/AA/2.*((6.-5.*A)*S(J)-2.*(5.-4.*A)*S2(J)+(4.-3.*A)*S3(J))
0427          CHAT=A*A/AA/AA*(S(J)-2.*S2(J)+S3(J))
0428          F(J)=AHAT+BHT*XL+.5*XL*XL*CHAT
0429          GO TO 57
0430 53       XF=J-N+L
0431          IF(K-2)54,55,56
0432 54       F(J)=S(N)
```

```
0433          GO TO 57
0434 55       F(J)=(2.+A*XF/AA)*S(N)-(1.+XF*A/AA)*S2(N)
0435          GO TO 57
0436 56       F(J)=AHAT+BHT*XF+.5*XF*XF*CHAT
0437 57       FFP(JL)=F(J)
0438          IF(J.GT.N)GO TO 58
0439          R(JL)=X(JL)-F(J)
0440 58       CONTINUE
0441          DO 561 I=1,ESTPL
0442          FFP(I)=0.
0443 561      R(I)=0.
0444          DO 563 I=1,EST
0445          S(I)=0.
0446          S2(I)=0.
0447 563      S3(I)=0.
0448          RETURN
0449          END
0450 C
0451 C
0452 C       PROGRAM QQ :   WINTERS'METHOD (PART I)
0453 C       FUNCTION   : FIND INITIAL VALUES AND SMOOTHING CONSTANTS
0454 C
0455 C
0456          DIMENSION X(72),A(72),B(72),S(12),V(10),DE(4)
0457          DIMENSION Y(108),FF(5,12),R(72),SAVE(12)
0458          REAL ONEMAA,ONEMBB,ONEMGG
0459 C       ------------------------------------------------------------------
0460 C       WINTERS' METHOD-ADDTIVE TREND AND MULTIPLICATIVE SEASNALS
0461 C       ------------------------------------------------------------------
0462 C       F(I) IS THE FORECAST MADE IN PERIOD I
0463 C       FFP(I) IS THE FORECAST MADE FOR PERIOD I
0464 C       X(I) IS THE DATA WHICH IS RECIEVED IN PERIOD I
0465 C       R(I) IS X(I)-FFP(I)
0466 C       IMP IS THE FIRST IMP PRIODLY DATA ARE NOT INVOLVED INFORECASTING
0467 C       KP IS THE NUMBER OF PRODUCT
0468 C       ------------------------------------------------------------------
0469          READ(10,1)KP
0470 1        FORMAT(I3)
0471 C       ++++++++++++++++++++++++++++++++++
0472 C       +   FORECASTING OF EACH PRODUCT   +
0473 C       ++++++++++++++++++++++++++++++++++
0474          DO 105 LL=1,KP
0475          READ(10,2)CO,DE
0476 2        FORMAT(I8,4A2)
0477          READ(10,3)N,N1,KS,KN,L,LT,IMP,JA
0478 3        FORMAT(2I3,2I1,3I3,I1)
0479          XLT=LT
0480          WRITE(11,555)
0481 555      FORMAT(////25X,'WINTERS'' METHOD FOR FORECASTING A SEASONAL TIME
0482         *SERIES'/)
0483          WRITE(11,102)LL,CO,DE
0484 102      FORMAT(//30X,//1X,'FORECASTING FOR PRODUCT ',I4,'  CODE',I8,1X,4A2
0485         *//)
0486          IF(N1.EQ.0)N1=L
```

```
0487          IF(KS.EQ.0)READ(10,4)ALPHA,BETA,GAMMA
0488          IF(KS.EQ.1)READ(10,4)AL,AD,AU,BL,BD,BU,GL,GD,GU
0489 4        FORMAT(9F4.2)
0490 C        ************************************
0491 C        *  READ DATA OF EACH PRODUCTS      *
0492 C        ************************************
0493          READ(10,5)(Y(I),I=1,N)
0494 5        FORMAT (12F6.0)
0495          N=N-IMP
0496          DO 104 II=1,N
0497          I=II+IMP
0498 104      X(II)=Y(I)
0499          IF(KN.EQ.1) GO TO 12
0500          WRITE(11,101)
0501 101      FORMAT(1HO,10X,'INITIAL VALUES OF THE PERMANENT, TREND AND SEASONA
0502         *L COMPONENTS SPECIFIED')
0503          READ(10,6)A0
0504          READ(10,6)B0
0505 6        FORMAT(F10.4)
0506          DO 7 I=1,L
0507          READ(10,6)S(I)
0508 7        SAVE(I)=S(I)
0509          WRITE(11,8)A0
0510 8        FORMAT(1HO,20X,'INITIAL PERMANENT COMPONENT=',F14.4)
0511          WRITE(11,9)B0
0512 9        FORMAT(1HO,20X,'INITIAL TREND COMPONENT=',F14.4)
0513          DO 10 I=1,L
0514 10       WRITE(11,11)I,S(I)
0515 11       FORMAT(1HO,20X,'INITIAL SEASONAL FACTOR FOR PERIOD',I3,1X,'=',
0516         *F14.4)
0517          GO TO 22
0518 12       WRITE(11,13)
0519 13       FORMAT(1HO,10X,'INITIAL VALUES OF THE PERMANENT, TREND AND SEASONA
0520         *L COMPONENT TO BE ESTIMATED FROM THE DATA.')
0521          KK=N1/L
0522          WRITE(11,14)N1,KK
0523 14       FORMAT(1HO,10X,'THE FIRST',I3,1X,'PERIODS OF DATA WHICH CORRESPOND
0524         * TO',I3,1X,'SEASONS WILL BE USED')
0525          RL=L
0526          J1=1
0527          J2=L
0528          DO 16 I=1,KK
0529          V(I)=0.0
0530          DO 15 J=J1,J2
0531 15       V(I)=V(I)+X(J)
0532          V(I)=V(I)/RL
0533          J1=J2+1
0534          J2=J1+L-1
0535 16       CONTINUE
0536          IF(KK.LE.2)GO TO 1111
0537          RR=N1-L
0538          B0=(V(KK)-V(1))/RR
0539          A0=V(1)-RL/2.*B0
0540 1111     IF(KK.GT.2)GO TO 2222
```

```
0541          TY=0.0
0542          TX=0.0
0543          TXX=0.0
0544          TXY=0.0
0545          XN1=N1
0546          TX=XN1*(XN1+1.)/2.
0547          DO 77 J=1,N1
0548          TY=TY+X(J)
0549          XJ=J
0550          TXY=TXY+XJ*X(J)
0551  77      TXX=TXX+XJ**2
0552          A0=(TY*TXX-TX*TXY)/(XN1*TXX-TX**2)
0553          B0=(TXY-(TX/XN1)*TY)/(TXX-(TX/XN1)*TX)
0554  2222    J1=0
0555          DO 18 I=1,KK
0556          DO 17 J=1,L
0557          JT=J+J1*L
0558          RJ=J
0559          VDT=V(I)-(((RL+1.0)/2.0)-RJ)*B0
0560  17      FF(I,J)=X(JT)/VDT
0561          J1=J1+1
0562  18      CONTINUE
0563          SUMS=0.0
0564          RKK=KK
0565          DO 20 J=1,L
0566          SUM=0.0
0567          DO 19 I=1,KK
0568  19      SUM=SUM+FF(I,J)
0569          S(J)=SUM/RKK
0570  20      SUMS=SUMS+S(J)
0571          WRITE(11,8)A0
0572          WRITE(11,9)B0
0573          DO 21 J=1,L
0574          S(J)=S(J)*(RL/SUMS)
0575          SAVE(J)=S(J)
0576  21      WRITE(11,11)J,S(J)
0577  22      IF(KS.EQ.0) GO TO 32
0578          IF(JA.EQ.0) GO TO 423
0579          WRITE(11,23)
0580  23      FORMAT(1H1,10X,'SMOOTHING CONSTANT OPTIMIZATION ROUTINE')
0581          WRITE(11,24)
0582  24      FORMAT(1H0,10X,'ALPHA',10X,'BETA',10X,'GAMMA',10X,'RESIDUAL SUM OF
0583         * SQUARE')
0584  C       ------------------------------------------------------------------
0585  C       SEARCH FOR OPTIMUM VALUE
0586  C       ------------------------------------------------------------------
0587  423     KA=(AU-AL)/AD+1.0
0588          KB=(BU-BL)/BD+1.0
0589          KG=(GU-GL)/GD+1.0
0590          AA=AL
0591          ABEST=0.0
0592          BBEST=0.0
0593          GBEST=0.0
0594          EBEST=1.0E+38
```

```
0595          DO 30 II=1,KA
0596          ONEMAA=1.0-AA
0597          BB=BL
0598          DO 29 IJ=1,KB
0599          ONEMBB=1.0-BB
0600          GG=GL
0601          DO 28 IK=1,KG
0602          DO 205 IL=1,L
0603 205      S(IL)=SAVE(IL)
0604          ONEMGG=1.0-GG
0605          A(1)=AA*(X(1)/S(1))+ONEMAA*(A0+B0)
0606          B(1)=BB*(A(1)-A0)+ONEMBB*B0
0607          S(1)=GG*(X(1)/A(1))+ONEMGG*S(1)
0608          XHAT=(A(1)+XLT*B(1))*S(1+LT)
0609          E=(X(1+LT)-XHAT)**2
0610          DO 26 I=2,N1
0611          IL=MOD(I,L)
0612          IF(IL.EQ.0) IL=L
0613 25       A(I)=AA*(X(I)/S(IL))+ONEMAA*(A(I-1)+B(I-1))
0614          B(I)=BB*(A(I)-A(I-1))+ONEMBB*B(I-1)
0615          S(IL)=GG*(X(I)/A(I))+ONEMGG*S(IL)
0616          ILLT=IL+LT
0617          IF(ILLT.GT.L) ILLT=ILLT-L
0618          XHAT=(A(I)+XLT*B(I))*S(ILLT)
0619 26       E=E+(X(I+LT)-XHAT)**2
0620          IF(JA.EQ.0)GO TO 3333
0621          WRITE(11,27)AA,BB,GG,E
0622 27       FORMAT(8X,F10.4,5X,F10.4,5X,F10.4,15X,E15.7)
0623 3333     IF(E.GE.EBEST) GO TO 28
0624          ALPHA=AA
0625          BETA=BB
0626          GAMMA=GG
0627          EBEST=E
0628 28       GG=GG+GD
0629 29       BB=BB+BD
0630 30       AA=AA+AD
0631          WRITE(11,31)
0632 31       FORMAT(///,10X,'THE OPTIMUM SMOOTHING CONSTANTS ARE')
0633 32       IF(KS.EQ.0) WRITE(11,33)
0634 33       FORMAT(1HO,10X,'THE SMOOTHING CONSTANTS ARE SPECIFIED AS')
0635          WRITE(11,34)ALPHA,BETA,GAMMA
0636 34       FORMAT(1HO,10X,'ALPHA=',F10.4,5X,'BETA=',F10.4,5X,'GAMMA=',
0637         *F10.4/1X,132(1H_))
0638 105      CONTINUE
0639          STOP
0640          END
0641 C
0642 C        PROGRAM QQ1:    WINTERS'METHOD (PART II)
0643 C
0644 C        FUNCTION    : TEST,UPDATE,CONTROL AND FORECAST
0645 C
0646 C
0647          DIMENSION X(72),A(72),B(72),S(24),R(72),F(72),Y(108)
0648          DIMENSION  FFP(72),SAVE(24),SS(72),DE(4)
```

```
0649          REAL ONEMAA,ONEMBB,ONEMGG,K2,K3
0650 C        ------------------------------------------------------------------
0651 C        WINTERS' METHOD-ADDTIVE TREND AND MULTIPLICATIVE SEASNALS
0652 C        ------------------------------------------------------------------
0653 C        F(I) IS THE FORECAST MADE IN PERIOD I
0654 C        FFP(I) IS THE FORECAST MADE FOR PERIOD I
0655 C        X(I) IS THE DATA WHICH IS RECIEVED IN PERIOD I
0656 C        R(I) IS X(I)-FFP(I)
0657 C        IMP IS THE FIRST IMP MONTHLY DATA ARE NOT INVOLVED IN FORECASTING
0658 C        KP IS THE NUMBER OF PRODUCT
0659 C        ------------------------------------------------------------------
0660          READ(10,100)KP,IBC
0661 100      FORMAT(2I4)
0662          DO 105 LL=1,KP
0663          READ(10,1)N,N1,KS,KN,L,LT,IMP,JN,CO,DE
0664 1        FORMAT (2I3,2I1,3I3,I1,I8,4A2)
0665          XLT=LT
0666          READ(10,2)ALPHA,BETA,GAMMA
0667 2        FORMAT(3F4.2)
0668 C        **********************************
0669 C        *  READ DATA OF ALL PRODUCTS     *
0670 C        **********************************
0671          READ(10,4)(Y(I),I=1,N)
0672 4        FORMAT (12F6.0)
0673          N=N-IMP
0674          DO 104 II=1,N
0675          I=II+IMP
0676          X(II)=Y(I)
0677 104      CONTINUE
0678          WRITE (11,5)
0679 5        FORMAT(26X,'WINTERS'' METHOD FOR FORECASTING A SEASONAL TIME SERIE
0680         *S'//)
0681 C        ++++++++++++++++++++++++++++++++++++
0682 C        +   FORECASTING OF EACH PRODUCT    +
0683 C        ++++++++++++++++++++++++++++++++++++
0684          WRITE(11,102)LL,CO,DE,ALPHA,BETA,GAMMA
0685 102      FORMAT(1H ,10X,'FORECASTING FOR PRODUCT',I4,' CODE',I8,1X,4A2//1X,
0686         *'SMOOTHING CONSTANT:  ALPHA=',F4.2,'  BETA=',F4.2,'  GAMMA=',F4.2)
0687 C        ------------------------------------------------------------------
0688 C        X(I) IS EQUAL TO Y(II,JJ,KK) OF EACH PRODUCT
0689 C        ------------------------------------------------------------------
0690          READ(10,101)A0
0691          READ(10,101)B0
0692          DO 7 I=1,L
0693          READ(10,101)S(I)
0694 101      FORMAT(F10.4)
0695 7        SAVE(I)=S(I)
0696 C        ------------------------------------------------------------------
0697 C        FORECAST WITH OPTIMUM SMOOTHING CONSTANTS
0698 C        ------------------------------------------------------------------
0699          ONEMAA=1.0-ALPHA
0700          ONEMBB=1.0-BETA
0701          ONEMGG=1.0-GAMMA
0702          A(1)=ALPHA*(X(1)/S(1))+ONEMAA*(A0+B0)
```

```
0703          B(1)=BETA*(A(1)-A0)+ONEMBB*BO
0704          S(1)=GAMMA*(X(1)/A(1))+ONEMGG*S(1)
0705          F(1)=(A(1)+XLT*B(1))*S(LT+1)
0706          SS(1)=S(1)
0707          FFP(1+LT)=F(1)
0708          R(1+LT)=X(1+LT)-F(1)
0709          SUM=0.0
0710          SUMSQ=0.0
0711          XMAD=0.0
0712          DO 36 I=2,Ni
0713          IL=MOD(I,L)
0714          IF(IL.EQ.0)IL=L
0715  35      A(I)=ALPHA*(X(I)/S(IL))+ONEMAA*(A(I-1)+B(I-1))
0716          B(I)=BETA*(A(I)-A(I-1))+ONEMBB*B(I-1)
0717          S(IL)=GAMMA*(X(I)/A(I))+ONEMGG*S(IL)
0718          SS(I)=S(IL)
0719          ILLT=IL+LT
0720          IF(ILLT.GT.L) ILLT=ILLT-L
0721          F(I)=(A(I)+XLT*B(I))*S(ILLT)
0722          FFP(I+LT)=F(I)
0723          R(I+LT)=X(I+LT)-F(I)
0724          SUM=SUM+R(I)
0725          XMAD=XMAD+ABS(R(I))
0726  36      SUMSQ=SUMSQ+R(I)**2
0727          DO 306 I=1,LT
0728          R(I)=0.
0729  306     FFP(I)=0.
0730          J=N1+1
0731          SUME=0.0
0732          SUME2=0.0
0733  C       ------------------------------------------------------------------
0734  C       START THE FORECAST PHASE
0735  C       ------------------------------------------------------------------
0736          IN=N+L
0737          DO 38 I=J,IN
0738          IL=MOD(I,L)
0739          IF(IL.LE.0) IL=L
0740          IF(I.GT.N)GO TO 103
0741  37      FFP(I)=(A(I-LT)+XLT*B(I-LT))*S(IL)
0742          A(I)=ALPHA*(X(I)/S(IL))+ONEMAA*(A(I-1)+B(I-1))
0743          B(I)=BETA*(A(I)-A(I-1))+ONEMBB*B(I-1)
0744          S(IL)=GAMMA*(X(I)/A(I))+ONEMGG*S(IL)
0745          SS(I)=S(IL)
0746          R(I)=X(I)-FFP(I)
0747          SUME=SUME+R(I)
0748          SUME2=SUME2+R(I)**2
0749          GO TO 38
0750  103     XIL=I-N
0751          IF((I-LT).LE.N)GO TO 76
0752          FFP(I)=(A(N)+XIL*B(N))*S(IL)
0753          GO TO 38
0754  76      FFP(I)=(A(I-LT)+XLT*B(I-LT))*S(IL)
0755  38      CONTINUE
0756          WRITE(11,39)
```

```
0757 39     FORMAT(///,50X,'OUTPUT OF THE INITIAL PHASE'//)
0758        WRITE(11,47)L,LT
0759        WRITE(11,40)
0760 40     FORMAT(1HO,10X,'PERIOD',5X,'OBSERVATION',5X,'PERMANENT COMPONENT',
0761       *2X,'TREND',7X,'SEASONAL FACTOR',5X,'FITTED MODEL',4X,'  ERROR '/)
0762        T=N1
0763        AVE=SUM/T
0764        VAR=(SUMSQ-T*AVE**2)/(T-1.0)
0765        STD=SQRT(VAR)
0766        XMAD=XMAD/T
0767        KTR=0
0768        XJN=JN
0769        STDM=STD*XJN
0770        DO 41 I=1,N1
0771        WRITE(11,42)I,X(I),A(I),B(I),SS(I),FFP(I),R(I)
0772 42     FORMAT(12X,I3,6X,F10.4,11X,F10.4,4X,F10.4,7X,F10.4,7X,F10.4,5X,F12
0773       *.4)
0774        IF(R(I).GT.STDM.OR.R(I).LT.(-STDM))WRITE(11,44)
0775 44     FORMAT(T108,'***DATA***')
0776 41     CONTINUE
0777        WRITE(11,43)SUM,AVE,VAR,STD,XMAD
0778 43     FORMAT(//50X,'SUM OF ERRORS           =',F14.4/50X,
0779       *            'AVERAGE ERROR           =',F14.4/50X,
0780       *            'VARIANCE                =',F14.4/50X,
0781       *            'STANDARD DEVIATION      =',F14.4/50X,
0782       *            'MEAN ABSOLUTE DEVIATION=',F14.4)
0783        IF(N1.EQ.N)GO TO 444
0784        WRITE(11,46)
0785 46     FORMAT(1H1,50X,'OUTPUT OF FORECASTING PHASE'//)
0786        WRITE(11,47)L,LT
0787 47     FORMAT(1HO,'LENGTH OF THE SEASON IS',I3,1X,'PERIODS',5X,
0788       *'FORECAST LEAD TIME IS',I3,1X,'PERIODS')
0789        WRITE(11,48)
0790 48     FORMAT(1HO,'PERIOD',5X,'OBSERVATION',5X,'PERMANENT COMPONENT',5X,
0791       *'TREND',5X,'SEASONAL FACTOR',5X,'FORECAST',5X,'ERROR',10X,
0792       *'TRACKING SIGNALS')
0793        WRITE(11,49)
0794 49     FORMAT(104X,'CUM. ERROR',2X,'SMOOTHED ERROR')
0795        YY=0.0
0796        ZZ=0.0
0797        DO 51 I=J,N
0798 50     YY=YY+R(I)
0799        ZZ=0.1*R(I)+0.9*ZZ
0800        XMAD=0.1*ABS(R(I))+0.9*XMAD
0801        TC=YY/XMAD
0802        TS=ZZ/XMAD
0803        K2=XJN*1.25/(SQRT(1.1372*(1.-(.9)**4)))
0804        K3=XJN*0.55*SQRT(0.1)
0805        WRITE(11,52)I,X(I),A(I),B(I),SS(I),FFP(I),R(I),TC,TS
0806 52     FORMAT(3X,I3,6X,F10.4,11X,F10.4,5X,F10.4,7X,F10.4,5X,F10.4,2X,F12.
0807       *4,1X,F10.4,2X,F10.4)
0808        IF(TC.GT.K2.OR.TC.LT.(-K2))WRITE(11,54)
0809        IF(TS.GT.K3.OR.TS.LT.(-K3))WRITE(11,55)
0810 54     FORMAT(1H ,T106,'***TSC.***')
```

```
0811 55     FORMAT(1H+,T118,'***TSS.***')
0812 51     CONTINUE
0813        XN=N-N1
0814        AVG=SUME/XN
0815        VAR=(SUME2-XN*AVG**2)/(XN-1.0)
0816        STD=SQRT(VAR)
0817        WRITE(11,43)SUME,AVG,VAR,STD,XMAD
0818        WRITE(11,53)K2,K3,N
0819 53     FORMAT(50X,'TSC. CONTROL LIMIT       =',F14.4/50X,
0820       *           'TSS. CONTROL LIMIT       =',F14.4/50X,
0821       *'THESE VALUES ARE CONSIDERED UP TO ORSERVATION ',I3)
0822 444    WRITE(11,2960)IBC,LL,CO,DE
0823 2960   FORMAT(1H1,20X,'FORECAST DEMANDS FOR YEAR',I6,2X,'BY WINTER  METHO
0824       *D'///1X,'PRODUCT',3X,'CODE',25X,'DEMANDS FOR EACH PERIOD'//28X,'JA
0825       *N',6X,'FEB',6X,'MAR',6X,'APR',6X,'MAY',6X,'JUN',6X,'JUL',6X,'AUG',
0826       *6X,'SEP',6X,'OCT',6X,'NOV',6X,'DEC'/,I3,5X,I8,1X,4A2)
0827        M=N+LT
0828        DO 107 J=M,IN
0829        IKZ=IFIX(FFP(I))
0830        AK=FFP(I)-IKZ
0831        IF(AK.GT.0.5) IKZ=IKZ+1
0832        FFP(I)=IKZ
0833 107    CONTINUE
0834        WRITE(11,106)(FFP(I),I=M,IN)
0835 106    FORMAT(1H+,26X,12(F6.0,3X)/1X,132(1H-)/////)
0836 105    CONTINUE
0837        STOP
0838        END
```

WINTERS' METHOD FOR FORECASTING A SEASONAL TIME SERIES

FORECASTING FOR PRODUCT CODE 2150001 (10deg.)

INITIAL VALUES OF THE PERMANENT, TREND AND SEASONAL COMPONENT TO BE ESTIMATED FROM THE DATA.

THE FIRST 24 PERIODS OF DATA WHICH CORRESPOND TO 2 SEASONS WILL BE USED

INITIAL PERMANENT COMPONENT= 33143.7617

INITIAL TREND COMPONENT= -389.7373

INITIAL SEASONAL FACTOR FOR PERIOD 1 = .6906

INITIAL SEASONAL FACTOR FOR PERIOD 2 = .9741

INITIAL SEASONAL FACTOR FOR PERIOD 3 = 1.8007

INITIAL SEASONAL FACTOR FOR PERIOD 4 = 1.3149

INITIAL SEASONAL FACTOR FOR PERIOD 5 = 1.6225

INITIAL SEASONAL FACTOR FOR PERIOD 6 = .9608

INITIAL SEASONAL FACTOR FOR PERIOD 7 = .7145

INITIAL SEASONAL FACTOR FOR PERIOD 8 = .9432

INITIAL SEASONAL FACTOR FOR PERIOD 9 = .7995

INITIAL SEASONAL FACTOR FOR PERIOD 10 = .6222

INITIAL SEASONAL FACTOR FOR PERIOD 11 = .8189

INITIAL SEASONAL FACTOR FOR PERIOD 12 = .7379

SMOOTHING CONSTANT OPTIMIZATION ROUTINE

ALPHA	BETA	GAMMA	RESIDUAL SUM OF SQUARE
.0500	.0500	.0500	.7647155E 09
.0500	.0500	.1500	.8126904E 09
.0500	.0500	.2500	.8662753E 09
.0500	.1500	.0500	.8194685E 09
.0500	.1500	.1500	.8697779E 09
.0500	.1500	.2500	.9262551E 09
.0500	.2500	.0500	.8691072E 09
.0500	.2500	.1500	.9224197E 09
.0500	.2500	.2500	.9827845E 09
.1500	.0500	.0500	.6836818E 09
.1500	.0500	.1500	.7214380E 09
.1500	.0500	.2500	.7645937E 09
.1500	.1500	.0500	.7197123E 09
.1500	.1500	.1500	.7618824E 09
.1500	.1500	.2500	.8106967E 09
.1500	.2500	.0500	.7443415E 09
.1500	.2500	.1500	.7921818E 09
.1500	.2500	.2500	.8479567E 09
.2500	.0500	.0500	.6453512E 09
.2500	.0500	.1500	.6811540E 09
.2500	.0500	.2500	.7222036E 09
.2500	.1500	.0500	.6774792E 09
.2500	.1500	.1500	.7201848E 09
.2500	.1500	.2500	.7695101E 09
.2500	.2500	.0500	.7091868E 09
.2500	.2500	.1500	.7614546E 09
.2500	.2500	.2500	.8218335E 09
.3500	.0500	.0500	.6571528E 09
.3500	.0500	.1500	.6938097E 09
.3500	.0500	.2500	.7353106E 09
.3500	.1500	.0500	.7010760E 09
.3500	.1500	.1500	.7464338E 09
.3500	.1500	.2500	.7979302E 09
.3500	.2500	.0500	.7503040E 09
.3500	.2500	.1500	.8061891E 09
.3500	.2500	.2500	.8695690E 09

THE OPTIMUM SMOOTHING CONSTANTS ARE

ALPHA= .2500 BETA= .0500 GAMMA= .0500

WINTERS' METHOD FOR FORECASTING A SEASONAL TIME SERIES

FORECASTING FOR PRODUCT .CODE 2150001 (15des.)

INITIAL VALUES OF THE PERMANENT, TREND AND SEASONAL COMPONENT TO BE ESTIMATED FROM THE DATA.

THE FIRST 24 PERIODS OF DATA WHICH CORRESPOND TO 2 SEASONS WILL BE USED

INITIAL PERMANENT COMPONENT= 45980.9727

INITIAL TREND COMPONENT= -213.5826

INITIAL SEASONAL FACTOR FOR PERIOD 1 = .7678

INITIAL SEASONAL FACTOR FOR PERIOD 2 = 1.1193

INITIAL SEASONAL FACTOR FOR PERIOD 3 = 1.6109

INITIAL SEASONAL FACTOR FOR PERIOD 4 = 1.2631

INITIAL SEASONAL FACTOR FOR PERIOD 5 = 1.3971

INITIAL SEASONAL FACTOR FOR PERIOD 6 = 1.0479

INITIAL SEASONAL FACTOR FOR PERIOD 7 = .7414

INITIAL SEASONAL FACTOR FOR PERIOD 8 = .9127

INITIAL SEASONAL FACTOR FOR PERIOD 9 = .7791

INITIAL SEASONAL FACTOR FOR PERIOD 10 = .7684

INITIAL SEASONAL FACTOR FOR PERIOD 11 = .8223

INITIAL SEASONAL FACTOR FOR PERIOD 12 = .7700

WINTERS' METHOD FOR FORECASTING A SEASONAL TIME SERIES

FORECASTING FOR PRODUCT CODE 2150001 (10deg.)

INITIAL VALUES OF THE PERMANENT, TREND AND SEASONAL COMPONENT TO BE ESTIMATED FROM THE DATA.

THE FIRST 24 PERIODS OF DATA WHICH CORRESPOND TO 2 SEASONS WILL BE USED

INITIAL PERMANENT COMPONENT= 33143.7617

INITIAL TREND COMPONENT= -389.7373

INITIAL SEASONAL FACTOR FOR PERIOD 1 = .6906

INITIAL SEASONAL FACTOR FOR PERIOD 2 = .9741

INITIAL SEASONAL FACTOR FOR PERIOD 3 = 1.8007

INITIAL SEASONAL FACTOR FOR PERIOD 4 = 1.3149

INITIAL SEASONAL FACTOR FOR PERIOD 5 = 1.6225

INITIAL SEASONAL FACTOR FOR PERIOD 6 = .9608

INITIAL SEASONAL FACTOR FOR PERIOD 7 = .7145

INITIAL SEASONAL FACTOR FOR PERIOD 8 = .9432

INITIAL SEASONAL FACTOR FOR PERIOD 9 = .7995

INITIAL SEASONAL FACTOR FOR PERIOD 10 = .6222

INITIAL SEASONAL FACTOR FOR PERIOD 11 = .8189

INITIAL SEASONAL FACTOR FOR PERIOD 12 = .7379

SMOOTHING CONSTANT OPTIMIZATION ROUTINE

ALPHA	BETA	GAMMA	RESIDUAL SUM OF SQUARE
.0500	.0500	.0500	.2097913E 10
.0500	.0500	.1500	.2210051E 10
.0500	.0500	.2500	.2382508E 10
.0500	.1500	.0500	.2216378E 10
.0500	.1500	.1500	.2334661E 10
.0500	.1500	.2500	.2463839E 10
.0500	.2500	.0500	.2339859E 10
.0500	.2500	.1500	.2463753E 10
.0500	.2500	.2500	.2600055E 10
.1500	.0500	.0500	.2135199E 10
.1500	.0500	.1500	.2288337E 10
.1500	.0500	.2500	.2352097E 10
.1500	.1500	.0500	.2266308E 10
.1500	.1500	.1500	.2377025E 10
.1500	.1500	.2500	.2500025E 10
.1500	.2500	.0500	.2346883E 10
.1500	.2500	.1500	.2463980E 10
.1500	.2500	.2500	.2594993E 10
.2500	.0500	.0500	.2111198E 10
.2500	.0500	.1500	.2208129E 10
.2500	.0500	.2500	.2315549E 10
.2500	.1500	.0500	.2192335E 10
.2500	.1500	.1500	.2296929E 10
.2500	.1500	.2500	.2413833E 10
.2500	.2500	.0500	.2216910E 10
.2500	.2500	.1500	.2330000E 10
.2500	.2500	.2500	.2457316E 10

THE OPTIMUM SMOOTHING CONSTANTS ARE

ALPHA= .0500 BETA= .0500 GAMMA= .0500

WINTERS' METHOD FOR FORECASTING A SEASONAL TIME SERIES

FORECASTING FOR PRODUCT CODE 2150001 (20des.)

INITIAL VALUES OF THE PERMANENT, TREND AND SEASONAL COMPONENT TO BE ESTIMATED FROM THE DATA.

THE FIRST 24 PERIODS OF DATA WHICH CORRESPOND TO 2 SEASONS WILL BE USED

INITIAL PERMANENT COMPONENT= 8220.8164

INITIAL TREND COMPONENT= -.7852

INITIAL SEASONAL FACTOR FOR PERIOD 1 = .8170

INITIAL SEASONAL FACTOR FOR PERIOD 2 = 1.0028

INITIAL SEASONAL FACTOR FOR PERIOD 3 = 1.2719

INITIAL SEASONAL FACTOR FOR PERIOD 4 = .9989

INITIAL SEASONAL FACTOR FOR PERIOD 5 = 1.2398

INITIAL SEASONAL FACTOR FOR PERIOD 6 = 1.1414

INITIAL SEASONAL FACTOR FOR PERIOD 7 = .8002

INITIAL SEASONAL FACTOR FOR PERIOD 8 = 1.0297

INITIAL SEASONAL FACTOR FOR PERIOD 9 = .8704

INITIAL SEASONAL FACTOR FOR PERIOD 10 = .9628

INITIAL SEASONAL FACTOR FOR PERIOD 11 = .9854

INITIAL SEASONAL FACTOR FOR PERIOD 12 = .8796

SMOOTHING CONSTANT OPTIMIZATION ROUTINE

ALPHA	BETA	GAMMA	RESIDUAL SUM OF SQUARE
.1000	.1000	.0500	.1041217E 09
.1000	.1000	.1500	.1112728E 09
.1000	.1000	.2500	.1193559E 09
.1000	.2000	.0500	.1092155E 09
.1000	.2000	.1500	.1171191E 09
.1000	.2000	.2500	.1261015E 09
.1000	.3000	.0500	.1130964E 09
.1000	.3000	.1500	.1215905E 09
.1000	.3000	.2500	.1312934E 09
.1000	.4000	.0500	.1150061E 09
.1000	.4000	.1500	.1238480E 09
.1000	.4000	.2500	.1339990E 09
.2000	.1000	.0500	.1012563E 09
.2000	.1000	.1500	.1076991E 09
.2000	.1000	.2500	.1150678E 09
.2000	.2000	.0500	.1021889E 09
.2000	.2000	.1500	.1089155E 09
.2000	.2000	.2500	.1166668E 09
.2000	.3000	.0500	.1001748E 09
.2000	.3000	.1500	.1068889E 09
.2000	.3000	.2500	.1146786E 09
.2000	.4000	.0500	.9682509E 08
.2000	.4000	.1500	.1033700E 09
.2000	.4000	.2500	.1110046E 09
.3000	.1000	.0500	.9824984E 08
.3000	.1000	.1500	.1040069E 09
.3000	.1000	.2500	.1105916E 09
.3000	.2000	.0500	.9740232E 08
.3000	.2000	.1500	.1033240E 09
.3000	.2000	.2500	.1101362E 09
.3000	.3000	.0500	.9572650E 08
.3000	.3000	.1500	.1017000E 09
.3000	.3000	.2500	.1085928E 09
.3000	.4000	.0500	.9505974E 08
.3000	.4000	.1500	.1011010E 09
.3000	.4000	.2500	.1080748E 09
.4000	.1000	.0500	.9819818E 08
.4000	.1000	.1500	.1035382E 09
.4000	.1000	.2500	.1095960E 09
.4000	.2000	.0500	.9811147E 08
.4000	.2000	.1500	.1037020E 09
.4000	.2000	.2500	.1100658E 09
.4000	.3000	.0500	.9859717E 08
.4000	.3000	.1500	.1044218E 09
.4000	.3000	.2500	.1110612E 09
.4000	.4000	.0500	.1005127E 09
.4000	.4000	.1500	.1066318E 09
.4000	.4000	.2500	.1136115E 09

THE OPTIMUM SMOOTHING CONSTANTS ARE

ALPHA= .3000 BETA= .4000 GAMMA= .0500

SMOOTHING CONSTANT OPTIMIZATION ROUTINE

ALPHA	BETA	GAMMA	RESIDUAL SUM OF SQUARE
.0500	.0500	.0500	.3919926E 09
.0500	.0500	.2000	.4278426E 09
.0500	.2000	.0500	.4805148E 09
.0500	.2000	.2000	.5228268E 09
.2000	.0500	.0500	.4792612E 09
.2000	.0500	.2000	.5138330E 09
.2000	.2000	.0500	.6790881E 09
.2000	.2000	.2000	.7168960E 09

THE OPTIMUM SMOOTHING CONSTANTS ARE

ALPHA= .0500 BETA= .0500 GAMMA= .0500

WINTERS' METHOD FOR FORECASTING A SEASONAL TIME SERIES

FORECASTING FOR PRODUCT CODE 2150021 (15des.)

INITIAL VALUES OF THE PERMANENT, TREND AND SEASONAL COMPONENT TO BE ESTIMATED FROM THE DATA.
THE FIRST 24 PERIODS OF DATA WHICH CORRESPOND TO 2 SEASONS WILL BE USED

INITIAL PERMANENT COMPONENT= 14737.3047

INITIAL TREND COMPONENT= 246.9626

INITIAL SEASONAL FACTOR FOR PERIOD 1 = .9556

INITIAL SEASONAL FACTOR FOR PERIOD 2 = .9064

INITIAL SEASONAL FACTOR FOR PERIOD 3 = .8160

INITIAL SEASONAL FACTOR FOR PERIOD 4 = .5535

INITIAL SEASONAL FACTOR FOR PERIOD 5 = .6042

INITIAL SEASONAL FACTOR FOR PERIOD 6 = 1.1403

INITIAL SEASONAL FACTOR FOR PERIOD 7 = 1.3716

INITIAL SEASONAL FACTOR FOR PERIOD 8 = 1.1391

INITIAL SEASONAL FACTOR FOR PERIOD 9 = 1.2652

INITIAL SEASONAL FACTOR FOR PERIOD 10 = 1.1162

INITIAL SEASONAL FACTOR FOR PERIOD 11 = .8868

INITIAL SEASONAL FACTOR FOR PERIOD 12 = 1.2431

SMOOTHING CONSTANT OPTIMIZATION ROUTINE

ALPHA	BETA	GAMMA	RESIDUAL SUM OF SQUARE
.0500	.0500	.0500	.6452516E 09
.0500	.0500	.1500	.6742157E 09
.0500	.0500	.2500	.7018545E 09
.0500	.2000	.0500	.6516923E 09
.0500	.2000	.1500	.6839081E 09
.0500	.2000	.2500	.7155295E 09
.2000	.0500	.0500	.6537403E 09
.2000	.0500	.1500	.6814500E 09
.2000	.0500	.2500	.7077606E 09
.2000	.2000	.0500	.7265198E 09
.2000	.2000	.1500	.7581906E 09
.2000	.2000	.2500	.7883763E 09

THE OPTIMUM SMOOTHING CONSTANTS ARE

ALPHA= .0500 BETA= .0500 GAMMA= .0500

WINTERS' METHOD FOR FORECASTING A SEASONAL TIME SERIES

FORECASTING FOR PRODUCT CODE 2150021 (10dem)

INITIAL VALUES OF THE PERMANENT, TREND AND SEASONAL COMPONENT TO BE ESTIMATED FROM THE DATA.

THE FIRST 24 PERIODS OF DATA WHICH CORRESPOND TO 2 SEASONS WILL BE USED

INITIAL PERMANENT COMPONENT= 10497.6875

INITIAL TREND COMPONENT= -112.7383

INITIAL SEASONAL FACTOR FOR PERIOD 1 = .6628

INITIAL SEASONAL FACTOR FOR PERIOD 2 = .8016

INITIAL SEASONAL FACTOR FOR PERIOD 3 = 2.1576

INITIAL SEASONAL FACTOR FOR PERIOD 4 = 1.0735

INITIAL SEASONAL FACTOR FOR PERIOD 5 = 1.5971

INITIAL SEASONAL FACTOR FOR PERIOD 6 = 1.2632

INITIAL SEASONAL FACTOR FOR PERIOD 7 = .5067

INITIAL SEASONAL FACTOR FOR PERIOD 8 = 1.1253

INITIAL SEASONAL FACTOR FOR PERIOD 9 = .8584

INITIAL SEASONAL FACTOR FOR PERIOD 10 = .5554

INITIAL SEASONAL FACTOR FOR PERIOD 11 = .6675

INITIAL SEASONAL FACTOR FOR PERIOD 12 = .7309

SMOOTHING CONSTANT OPTIMIZATION ROUTINE

ALPHA	BETA	GAMMA	RESIDUAL SUM OF SQUARE
.0500	.0500	.0500	.8843054E 08
.0500	.0500	.2500	.1007083E 09
.0500	.0500	.4500	.1155576E 09
.0500	.2500	.0500	.9716611E 08
.0500	.2500	.2500	.1106475E 09
.0500	.2500	.4500	.1274484E 09
.0500	.4500	.0500	.1013373E 09
.0500	.4500	.2500	.1167872E 09
.0500	.4500	.4500	.1346181E 09
.2500	.0500	.0500	.6549906E 08
.2500	.0500	.2500	.7363437E 08
.2500	.0500	.4500	.8389381E 08
.2500	.2500	.0500	.6925949E 08
.2500	.2500	.2500	.8137714E 08
.2500	.2500	.4500	.9676693E 08
.2500	.4500	.0500	.7944114E 08
.2500	.4500	.2500	.9704939E 08
.2500	.4500	.4500	.1191663E 09
.4500	.0500	.0500	.7656344E 08
.4500	.0500	.2500	.8538184E 08
.4500	.0500	.4500	.9595384E 08
.4500	.2500	.0500	.9456600E 08
.4500	.2500	.2500	.1081965E 09
.4500	.2500	.4500	.1245772E 09
.4500	.4500	.0500	.1197413E 09
.4500	.4500	.2500	.1377973E 09
.4500	.4500	.4500	.1598120E 09

THE OPTIMUM SMOOTHING CONSTANTS ARE

ALPHA= .2500 BETA= .0500 GAMMA= .0500

WINTERS' METHOD FOR FORECASTING A SEASONAL TIME SERIES

FORECASTING FOR PRODUCT CODE 2150022

INITIAL VALUES OF THE PERMANENT, TREND AND SEASONAL COMPONENT TO BE ESTIMATED FROM THE DATA.

THE FIRST 24 PERIODS OF DATA WHICH CORRESPOND TO 2 SEASONS WILL BE USED

INITIAL PERMANENT COMPONENT= 12160.1914

INITIAL TREND COMPONENT= -105.0583

INITIAL SEASONAL FACTOR FOR PERIOD 1 = .6520

INITIAL SEASONAL FACTOR FOR PERIOD 2 = .7663

INITIAL SEASONAL FACTOR FOR PERIOD 3 = 1.7802

INITIAL SEASONAL FACTOR FOR PERIOD 4 = .9382

INITIAL SEASONAL FACTOR FOR PERIOD 5 = 1.2035

INITIAL SEASONAL FACTOR FOR PERIOD 6 = 1.4286

INITIAL SEASONAL FACTOR FOR PERIOD 7 = .8774

INITIAL SEASONAL FACTOR FOR PERIOD 8 = 1.1242

INITIAL SEASONAL FACTOR FOR PERIOD 9 = .9236

INITIAL SEASONAL FACTOR FOR PERIOD 10 = .6768

INITIAL SEASONAL FACTOR FOR PERIOD 11 = .7533

INITIAL SEASONAL FACTOR FOR PERIOD 12 = .8757

SMOOTHING CONSTANT OPTIMIZATION ROUTINE

ALPHA	BETA	GAMMA	RESIDUAL SUM OF SQUARE
.0500	.0500	.0500	.1087984E 09
.0500	.0500	.2500	.1244655E 09
.0500	.0500	.4500	.1438419E 09
.0500	.2500	.0500	.1196133E 09
.0500	.2500	.2500	.1383064E 09
.0500	.2500	.4500	.1619882E 09
.0500	.4500	.0500	.1325877E 09
.0500	.4500	.2500	.1554628E 09
.0500	.4500	.4500	.1849116E 09
.2500	.0500	.0500	.1078901E 09
.2500	.0500	.2500	.1216356E 09
.2500	.0500	.4500	.1387929E 09
.2500	.2500	.0500	.1193522E 09
.2500	.2500	.2500	.1375703E 09
.2500	.2500	.4500	.1606103E 09
.2500	.4500	.0500	.1247058E 09
.2500	.4500	.2500	.1466737E 09
.2500	.4500	.4500	.1746812E 09
.4500	.0500	.0500	.1132333E 09
.4500	.0500	.2500	.1251378E 09
.4500	.0500	.4500	.1395046E 09
.4500	.2500	.0500	.1271450E 09
.4500	.2500	.2500	.1430409E 09
.4500	.2500	.4500	.1625042E 09
.4500	.4500	.0500	.1434299E 09
.4500	.4500	.2500	.1633804E 09
.4500	.4500	.4500	.1883354E 09

THE OPTIMUM SMOOTHING CONSTANTS ARE

ALPHA= .2500 BETA= .0500 GAMMA= .0500

WINTERS' METHOD FOR FORECASTING A SEASONAL TIME SERIES

FORECASTING FOR PRODUCT CODE 2153027

INITIAL VALUES OF THE PERMANENT, TREND AND SEASONAL COMPONENT TO BE ESTIMATED FROM THE DATA.

THE FIRST 24 PERIODS OF DATA WHICH CORRESPOND TO 2 SEASONS WILL BE USED

INITIAL PERMANENT COMPONENT=	3026.0034
INITIAL TREND COMPONENT=	9.0361
INITIAL SEASONAL FACTOR FOR PERIOD 1 =	1.2881
INITIAL SEASONAL FACTOR FOR PERIOD 2 =	.9056
INITIAL SEASONAL FACTOR FOR PERIOD 3 =	1.4922
INITIAL SEASONAL FACTOR FOR PERIOD 4 =	1.0278
INITIAL SEASONAL FACTOR FOR PERIOD 5 =	.7424
INITIAL SEASONAL FACTOR FOR PERIOD 6 =	1.5506
INITIAL SEASONAL FACTOR FOR PERIOD 7 =	.9877
INITIAL SEASONAL FACTOR FOR PERIOD 8 =	.7443
INITIAL SEASONAL FACTOR FOR PERIOD 9 =	.8262
INITIAL SEASONAL FACTOR FOR PERIOD 10 =	.5301
INITIAL SEASONAL FACTOR FOR PERIOD 11 =	.6061
INITIAL SEASONAL FACTOR FOR PERIOD 12 =	1.2988

SMOOTHING CONSTANT OPTIMIZATION ROUTINE

ALPHA	BETA	GAMMA	RESIDUAL SUM OF SQUARE
.6000	.0500	.0500	.3122189E 08
.6000	.0500	.2500	.3441102E 08
.6000	.0500	.4500	.3838906E 08
.6000	.2500	.0500	.3148912E 08
.6000	.2500	.2500	.3554501E 08
.6000	.2500	.4500	.4067910E 08
.6000	.4500	.0500	.3353275E 08
.6000	.4500	.2500	.3843649E 08
.6000	.4500	.4500	.4472552E 08
.7000	.0500	.0500	.3021390E 08
.7000	.0500	.2500	.3271781E 08
.7000	.0500	.4500	.3574918E 08
.7000	.2500	.0500	.3091456E 08
.7000	.2500	.2500	.3403333E 08
.7000	.2500	.4500	.3786304E 08
.7000	.4500	.0500	.3293216E 08
.7000	.4500	.2500	.3659387E 08
.7000	.4500	.4500	.4117845E 08
.8000	.0500	.0500	.2993741E 08
.8000	.0500	.2500	.3169406E 08
.8000	.0500	.4500	.3373630E 08
.8000	.2500	.0500	.3127283E 08
.8000	.2500	.2500	.3343107E 08
.8000	.2500	.4500	.3597654E 08
.8000	.4500	.0500	.3395544E 08
.8000	.4500	.2500	.3651469E 08
.8000	.4500	.4500	.3959549E 08

THE OPTIMUM SMOOTHING CONSTANTS ARE

ALPHA= .8000 BETA= .0500 GAMMA= .0500

WINTERS' METHOD FOR FORECASTING A SEASONAL TIME SERIES

FORECASTING FOR PRODUCT CODE 2155011 (10deg.)

INITIAL VALUES OF THE PERMANENT, TREND AND SEASONAL COMPONENT TO BE ESTIMATED FROM THE DATA.

THE FIRST 24 PERIODS OF DATA WHICH CORRESPOND TO 2 SEASONS WILL BE USED

INITIAL PERMANENT COMPONENT= 6573.7148

INITIAL TREND COMPONENT= -110.2035

INITIAL SEASONAL FACTOR FOR PERIOD 1 = .7077

INITIAL SEASONAL FACTOR FOR PERIOD 2 = .9734

INITIAL SEASONAL FACTOR FOR PERIOD 3 = 2.2539

INITIAL SEASONAL FACTOR FOR PERIOD 4 = .8984

INITIAL SEASONAL FACTOR FOR PERIOD 5 = 1.6443

INITIAL SEASONAL FACTOR FOR PERIOD 6 = 1.1724

INITIAL SEASONAL FACTOR FOR PERIOD 7 = .5903

INITIAL SEASONAL FACTOR FOR PERIOD 8 = .8125

INITIAL SEASONAL FACTOR FOR PERIOD 9 = .7672

INITIAL SEASONAL FACTOR FOR PERIOD 10 = .4211

INITIAL SEASONAL FACTOR FOR PERIOD 11 = .8348

INITIAL SEASONAL FACTOR FOR PERIOD 12 = .9242

SMOOTHING CONSTANT OPTIMIZATION ROUTINE

ALPHA	BETA	GAMMA	RESIDUAL SUM OF SQUARE
.1000	.0500	.0500	.2487754E 08
.1000	.0500	.2500	.2763107E 08
.1000	.0500	.4500	.3095235E 08
.1000	.2500	.0500	.3023619E 08
.1000	.2500	.2500	.3385950E 08
.1000	.2500	.4500	.3843062E 08
.1000	.4500	.0500	.3278754E 08
.1000	.4500	.2500	.3756050E 08
.1000	.4500	.4500	.4363043E 08
.2500	.0500	.0500	.2320920E 08
.2500	.0500	.2500	.2601789E 08
.2500	.0500	.4500	.2954544E 08
.2500	.2500	.0500	.2665091E 08
.2500	.2500	.2500	.3078219E 08
.2500	.2500	.4500	.3601051E 08
.2500	.4500	.0500	.2979834E 08
.2500	.4500	.2500	.3552379E 08
.2500	.4500	.4500	.4270110E 08
.4000	.0500	.0500	.2516294E 08
.4000	.0500	.2500	.2834234E 08
.4000	.0500	.4500	.3225899E 08
.4000	.2500	.0500	.3100446E 08
.4000	.2500	.2500	.3590590E 08
.4000	.2500	.4500	.4192099E 08
.4000	.4500	.0500	.3706395E 08
.4000	.4500	.2500	.4365861E 08
.4000	.4500	.4500	.5174782E 08

THE OPTIMUM SMOOTHING CONSTANTS ARE

ALPHA= .2500 BETA= .0500 GAMMA= .0500

WINTERS' METHOD FOR FORECASTING A SEASONAL TIME SERIES

FORECASTING FOR PRODUCT CODE 2155011 (15deg.)

INITIAL VALUES OF THE PERMANENT, TREND AND SEASONAL COMPONENT TO BE ESTIMATED FROM THE DATA.

THE FIRST 24 PERIODS OF DATA WHICH CORRESPOND TO 2 SEASONS WILL BE USED

INITIAL PERMANENT COMPONENT= 5841.6680

INITIAL TREND COMPONENT= -64.9800

INITIAL SEASONAL FACTOR FOR PERIOD 1 = .6563

INITIAL SEASONAL FACTOR FOR PERIOD 2 = .8980

INITIAL SEASONAL FACTOR FOR PERIOD 3 = 2.1787

INITIAL SEASONAL FACTOR FOR PERIOD 4 = 1.1362

INITIAL SEASONAL FACTOR FOR PERIOD 5 = 1.4640

INITIAL SEASONAL FACTOR FOR PERIOD 6 = 1.2291

INITIAL SEASONAL FACTOR FOR PERIOD 7 = .4969

INITIAL SEASONAL FACTOR FOR PERIOD 8 = .9001

INITIAL SEASONAL FACTOR FOR PERIOD 9 = .8344

INITIAL SEASONAL FACTOR FOR PERIOD 10 = .4250

INITIAL SEASONAL FACTOR FOR PERIOD 11 = .8178

INITIAL SEASONAL FACTOR FOR PERIOD 12 = .9635

SMOOTHING CONSTANT OPTIMIZATION ROUTINE

ALPHA	BETA	GAMMA	RESIDUAL SUM OF SQUARE
.1000	.0500	.0500	.2628683E 08
.1000	.0500	.2500	.2986251E 08
.1000	.0500	.4500	.3420760E 08
.1000	.2500	.0500	.3065424E 08
.1000	.2500	.2500	.3534869E 08
.1000	.2500	.4500	.4128051E 08
.1000	.4500	.0500	.3255430E 08
.1000	.4500	.2500	.3829729E 08
.1000	.4500	.4500	.4565184E 08
.2000	.0500	.0500	.2443008E 08
.2000	.0500	.2500	.2785320E 08
.2000	.0500	.4500	.3214165E 08
.2000	.2500	.0500	.2647582E 08
.2000	.2500	.2500	.3085042E 08
.2000	.2500	.4500	.3648435E 08
.2000	.4500	.0500	.2694451E 08
.2000	.4500	.2500	.3201904E 08
.2000	.4500	.4500	.3855373E 08
.3000	.0500	.0500	.2395842E 08
.3000	.0500	.2500	.2741366E 08
.3000	.0500	.4500	.3179269E 08
.3000	.2500	.0500	.2656056E 08
.3000	.2500	.2500	.3123627E 08
.3000	.2500	.4500	.3721635E 08
.3000	.4500	.0500	.2998317E 08
.3000	.4500	.2500	.3615496E 08
.3000	.4500	.4500	.4400488E 08
.4000	.0500	.0500	.2485312E 08
.4000	.0500	.2500	.2843158E 08
.4000	.0500	.4500	.3292952E 08
.4000	.2500	.0500	.2905827E 08
.4000	.2500	.2500	.3418531E 08
.4000	.2500	.4500	.4065402E 08
.4000	.4500	.0500	.3448661E 08
.4000	.4500	.2500	.4140050E 08
.4000	.4500	.4500	.5015829E 08

THE OPTIMUM SMOOTHING CONSTANTS ARE

ALPHA= .3000 BETA= .0500 GAMMA= .0500

WINTERS' METHOD FOR FORECASTING A SEASONAL TIME SERIES

FORECASTING FOR PRODUCT CODE 2150001 (10des.)

SMOOTHING CONSTANT: ALPHA= .25 BETA= .05 GAMMA= .05

OUTPUT OF THE INITIAL PHASE

LENGTH OF THE SEASON IS 12 PERIODS FORECAST LEAD TIME IS 1 PERIODS

PERIOD	OBSERVATION	PERMANENT COMPONENT	TREND	SEASONAL FACTOR	FITTED MODEL	ERROR
1	16763.0000	30633.7891	-495.7488	.6834	0.0000	0.0000
2	24148.0000	28801.0430	-562.5984	.9673	29357.4609	-5209.4609
3	49981.0000	28117.9336	-568.6235	1.7995	50848.9648	-867.9648
4	42700.0000	28780.4648	-507.0654	1.3233	36224.5937	6475.4062
5	43464.0000	27902.1172	-525.6292	1.6193	45873.5977	-2409.5977
6	27089.0000	27580.9141	-515.4077	.9619	26303.3242	785.6758
7	23623.0000	28564.6914	-440.4482	.7201	19338.3008	4284.6992
8	23764.0000	27391.9492	-477.0627	.9394	26526.7812	-2762.7812
9	18222.0000	25884.0937	-528.6021	.7947	21518.4453	-3296.4453
10	21185.0000	27528.7461	-419.9392	.6296	15776.1836	5408.8164
11	25389.0000	28082.5469	-371.2520	.8232	22199.3984	3189.6016
12	19177.0000	27280.6211	-392.7854	.7362	20448.1602	-1271.1602
13	24996.0000	29309.4492	-271.7046	.6919	18375.9531	6620.0469
14	33983.0000	30561.1016	-195.5365	.9745	28088.6992	5894.3008
15	55957.0000	30547.9570	-186.4169	1.8012	54644.0859	1312.9141
16	33493.0000	29098.5273	-249.5675	1.3147	40178.5352	-6685.5352
17	49489.0000	29277.3906	-228.1460	1.6228	46713.9844	2775.0156
18	27171.0000	28848.9648	-238.1599	.9609	27941.5391	-770.5391
19	16094.0000	27045.3242	-316.4338	.7139	20603.3516	-4509.3516
20	28092.0000	27522.5703	-276.7498	.9435	25109.5859	2982.4141
21	25155.0000	28347.4844	-221.6664	.7994	21652.9102	3502.0898
22	11923.0000	25828.9531	-336.5095	.6212	17707.1094	-5784.1094
23	17601.0000	24464.8906	-387.8870	.8180	20984.3359	-3383.3359
24	19070.0000	24533.9883	-365.0374	.7382	17724.3437	1345.6562

SUM OF ERRORS	= 7626.3555
AVERAGE ERROR	= 317.7646
VARIANCE	= 16226693.0000
STANDARD DEVIATION	= 4028.2371
MEAN ABSOLUTE DEVIATION	= 3396.9478

FORECAST DEMANDS FOR YEAR 1984 BY WINTER METHOD

PRODUCT	CODE	DEMANDS FOR EACH PERIOD											
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	2150001 (10des.)	16722.	23198.	42217.	30336.	36852.	21469.	15690.	20392.	16985.	12972.	16784.	14878.

WINTERS' METHOD FOR FORECASTING A SEASONAL TIME SERIES

FORECASTING FOR PRODUCT CODE 2150001 (20deg.)

SMOOTHING CONSTANT: ALPHA= .25 BETA= .45 GAMMA= .05

OUTPUT OF THE INITIAL PHASE

LENGTH OF THE SEASON IS 12 PERIODS FORECAST LEAD TIME IS 1 PERIODS

PERIOD	OBSERVATION	PERMANENT COMPONENT	TREND	SEASONAL FACTOR	FITTED MODEL	ERROR
1	6299.0000	8092.4961	-58.1760	.8151	0.0000	0.0000
2	7714.0000	7948.8477	-96.6386	1.0012	8056.8086	-342.8086
3	9170.0000	7691.5703	-168.9260	1.2679	9987.2227	-817.2227
4	8270.0000	7711.7539	-83.8267	1.0026	7514.3633	755.6367
5	7235.0000	7179.8437	-285.4641	1.2282	9457.1055	-2222.1055
6	10277.0000	7421.7422	-48.1510	1.1536	7869.2461	2407.7539
7	7715.0000	7940.5234	206.9685	.8088	5900.3437	1814.6562
8	7200.0000	7858.6914	77.0083	1.0240	8389.4687	-1189.4687
9	4928.0000	7367.2109	-178.8116	.8603	6907.2305	-1979.2305
10	9001.0000	7728.4883	64.2284	.9729	6920.9883	2080.0117
11	9471.0000	8247.3633	268.8193	.9935	7678.9375	1792.0625
12	8988.0000	8941.6992	460.3015	.8859	7490.8281	1497.1719
13	7137.0000	9240.5781	387.6611	.8129	7663.2734	-526.2734
14	8777.0000	9412.8320	290.7278	.9977	9639.6211	-862.6211
15	11773.0000	9598.9961	243.6741	1.2658	12303.2852	-530.2852
16	8126.0000	9408.2812	48.1991	.9956	9868.0000	-1742.0000
17	13256.0000	9790.6250	198.5642	1.2345	11614.3789	1641.6211
18	8415.0000	9315.5820	-104.5590	1.1411	11523.1680	-3108.1680
19	5364.0000	8566.3320	-394.6697	.7996	7449.5937	-2085.5937
20	9757.0000	8510.7656	-242.0732	1.0301	8367.9727	1389.0273
21	9458.0000	8949.8906	64.4660	.8701	7113.7656	2344.2344
22	6744.0000	8493.7422	-169.8105	.9639	8769.9961	-2025.9961
23	6631.0000	7911.4570	-355.4238	.9858	8270.2227	-1639.2227
24	5358.0000	7179.0781	-525.0532	.8789	6693.7266	-1335.7266

SUM OF ERRORS	=	-4684.5469
AVERAGE ERROR	=	-195.1895
VARIANCE	=	2896713.0000
STANDARD DEVIATION	=	1701.9734
MEAN ABSOLUTE DEVIATION	=	1505.3706

FORECAST DEMANDS FOR YEAR 1984 BY WINTER METHOD

PRODUCT	CODE	DEMANDS FOR EACH PERIOD											
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
3	2150001 (20deg.)	5409.	6115.	7094.	5057.	5622.	4597.	2802.	3068.	2135.	1859.	1384.	772.

WINTERS' METHOD FOR FORECASTING A SEASONAL TIME SERIES

FORECASTING FOR PRODUCT CODE 2150002

SMOOTHING CONSTANT: ALPHA= .05 BETA= .05 GAMMA= .05

OUTPUT OF THE INITIAL PHASE

LENGTH OF THE SEASON IS 12 PERIODS FORECAST LEAD TIME IS 1 PERIODS

PERIOD	OBSERVATION	PERMANENT COMPONENT	TREND	SEASONAL FACTOR	FITTED MODEL	ERROR
1	18872.0000	18367.6289	-267.2678	.7676	0.0000	0.0000
2	20748.0000	18245.1250	-260.0295	.9956	17886.7734	2861.2266
3	17772.0000	17975.8594	-260.4912	.9979	17956.3164	-184.3164
4	19035.0000	17925.8281	-249.9682	.8779	15380.4805	3654.5195
5	8833.0000	18171.7852	-225.1719	.3284	5658.0391	3174.9609
6	19916.0000	18045.3750	-220.2338	1.0049	17941.2227	1974.7773
7	24683.0000	17790.6328	-221.9592	1.4378	25677.1172	-994.1172
8	23438.0000	17568.1250	-221.9866	1.3349	23452.4180	-14.4180
9	16585.0000	17359.7891	-221.3041	.9420	16327.9180	257.0820
10	16707.0000	16908.5547	-232.8006	1.3151	22833.6055	-6126.6055
11	11424.0000	16516.8203	-240.7473	.8387	14114.3555	-2690.3555
12	8183.0000	15810.0898	-264.0464	1.1434	19145.5391	-10962.5391
13	7163.0000	15235.3320	-279.5818	.7527	11932.7969	-4769.7969
14	11852.0000	14803.1484	-287.2117	.9859	14890.6758	-3038.6758
15	13821.0000	14482.6289	-288.8770	.9957	14485.6367	-664.6367
16	8981.0000	13995.5703	-298.7856	.8661	12460.4609	-3479.4609
17	1846.0000	13293.0000	-318.9746	.3189	4498.0078	-2652.0078
18	10826.0000	12863.9805	-324.4766	.9967	13037.5586	-2211.5586
19	17770.0000	12530.4648	-324.9285	1.4369	18029.8633	-259.8633
20	15412.0000	12172.5469	-326.5776	1.3314	16292.6758	-880.6758
21	10368.0000	11803.9844	-328.6765	.9388	11158.9414	-790.9414
22	18756.0000	11614.6445	-321.7095	1.3301	15091.0352	3664.9648
23	10924.0000	11379.5586	-317.3779	.8447	9470.9609	1453.0391
24	19883.0000	11378.5664	-301.5583	1.1736	12648.0859	7234.9141

SUM OF ERRORS	=	-15444.4844
AVERAGE ERROR	=	-643.5200
VARIANCE	=	13801516.0000
STANDARD DEVIATION	=	3715.0391
MEAN ABSOLUTE DEVIATION	=	2666.4771

FORECAST DEMANDS FOR YEAR 1984 BY WINTER METHOD

PRODUCT	CODE	DEMANDS FOR EACH PERIOD											
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
5	2150002	8338.	10623.	10429.	8810.	3148.	9538.	13316.	11938.	8134.	11123.	6810.	9107.

WINTERS' METHOD FOR FORECASTING A SEASONAL TIME SERIES

FORECASTING FOR PRODUCT , CODE 2150021 (10des.)

SMOOTHING CONSTANT: ALPHA= .25 BETA= .05 GAMMA= .05

OUTPUT OF THE INITIAL PHASE

LENGTH OF THE SEASON IS 12 PERIODS FORECAST LEAD TIME IS 1 PERIODS

PERIOD	OBSERVATION	PERMANENT COMPONENT	TREND	SEASONAL FACTOR	FITTED MODEL	ERROR
1	5215.0000	9755.7383	-144.1988	.6564	0.0000	0.0000
2	6255.0000	9159.4375	-166.8039	.7957	7704.6094	-1449.6094
3	18880.0000	8932.0859	-169.8313	2.1554	19402.5078	-522.5078
4	9978.0000	8895.3945	-163.1743	1.0759	9406.2734	571.7266
5	14365.0000	8797.7695	-159.8968	1.5989	13946.2266	418.7734
6	9788.0000	8415.5430	-171.0133	1.2582	10911.3555	-1123.3555
7	6825.0000	9550.7695	-105.7013	.5171	4177.5000	2647.5000
8	9519.0000	9198.5625	-118.0266	1.1208	10628.5352	-1109.5352
9	6842.0000	8803.0586	-131.9004	.8543	7794.7305	-952.7305
10	4280.0000	8429.9062	-143.9630	.5530	4815.9570	-535.9570
11	7661.0000	9083.7383	-104.0732	.6763	5530.8633	2130.1367
12	6620.0000	8999.0742	-103.1028	.7311	6563.2344	56.7656
13	7608.0000	9569.6523	-69.4187	.6633	5839.2031	1768.7969
14	9073.0000	9975.9297	-45.6339	.8014	7559.0000	1514.0000
15	21778.0000	9973.6914	-43.4641	2.1568	21403.8125	374.1875
16	9975.0000	9765.4727	-51.7018	1.0732	10684.0156	-709.0156
17	14977.0000	9627.1133	-56.0347	1.5967	15531.1836	-554.1836
18	13213.0000	9803.6992	-44.4036	1.2627	12042.2617	1170.7383
19	2130.0000	8349.2578	-114.9055	.5040	5046.4805	-2916.4805
20	10412.0000	8498.2578	-101.7102	1.1260	9228.8633	1183.1367
21	8188.0000	8693.4062	-86.8673	.8587	7173.5156	1014.4844
22	5326.0000	8862.6055	-74.0639	.5554	4759.5469	566.4531
23	3587.0000	7917.3789	-117.6221	.6651	5943.6328	-2356.6328
24	5628.0000	7774.2109	-118.8993	.7308	5702.6836	-74.6836

SUM OF ERRORS	=	1112.0078
AVERAGE ERROR	=	46.3336
VARIANCE	=	1853009.0000
STANDARD DEVIATION	=	1361.2527
MEAN ABSOLUTE DEVIATION	=	1071.7246

FORECAST DEMANDS FOR YEAR 1984 BY WINTER METHOD

PRODUCT	CODE	DEMANDS FOR EACH PERIOD											
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10	2150021 (10des.)	5078.	6039.	15998.	7833.	11464.	8915.	3499.	7683.	5757.	3658.	4301.	4639.

WINTERS' METHOD FOR FORECASTING A SEASONAL TIME SERIES

FORECASTING FOR PRODUCT CODE 2150021 (15deg.)

SMOOTHING CONSTANT: ALPHA= .05 BETA= .05 GAMMA= .05

OUTPUT OF THE INITIAL PHASE

LENGTH OF THE SEASON IS 12 PERIODS FORECAST LEAD TIME IS 1 PERIODS

PERIOD	OBSERVATION	PERMANENT COMPONENT	TREND	SEASONAL FACTOR	FITTED MODEL	ERROR
1	19172.0000	15238.1875	259.6584	.9707	0.0000	0.0000
2	19212.0000	15782.7461	273.9033	.9219	14047.2422	5164.7578
3	17147.0000	16304.4844	286.2949	.8278	13102.2227	4044.7773
4	9562.0000	16625.0078	288.0061	.5546	9182.9922	379.0078
5	10451.0000	16929.3672	288.8235	.6068	10252.6641	198.3359
6	14741.0000	17003.6406	278.0957	1.1266	19633.8945	-4892.8945
7	25273.0000	17338.9375	280.9553	1.3759	23703.6289	1569.3711
8	20521.0000	17639.6484	281.9429	1.1403	20070.8164	450.1836
9	23544.0000	17955.9531	283.6609	1.2675	22674.3867	869.6133
10	19784.0000	18213.8477	282.3723	1.1147	20359.0625	-575.0625
11	10629.0000	18170.6953	266.0959	.8717	16402.4453	-5773.4453
12	21638.0000	18385.2695	263.5198	1.2398	22918.7734	-1280.7734
13	12026.0000	18335.7773	247.8692	.9550	18102.8945	-6076.8945
14	10809.0000	18240.6680	230.7202	.9055	17133.0742	-6324.0742
15	10290.0000	18169.3555	215.6186	.8147	15290.3086	-5000.3086
16	9367.0000	18310.2305	211.8814	.5524	10195.9883	-828.9883
17	10583.0000	18468.0937	209.1805	.6051	11238.4062	-655.4062
18	25496.0000	18874.9180	219.0626	1.1378	21042.3906	4453.6094
19	23646.0000	18998.5703	214.2921	1.3693	26271.3750	-2625.3750
20	20682.0000	19159.0703	211.6025	1.1373	21908.6367	-1226.6367
21	22832.0000	19302.8047	208.2090	1.2633	24552.3242	-1720.3242
22	21702.0000	19508.9023	208.1035	1.1146	21748.9102	-46.9102
23	22872.0000	20043.0586	224.4061	.8852	17187.4609	5684.5391
24	25805.0000	20294.7852	225.7721	1.2414	25127.3945	677.6055

SUM OF ERRORS = -13535.2930
AVERAGE ERROR = -563.9705
VARIANCE = 11533007.0000
STANDARD DEVIATION = 3396.0281
MEAN ABSOLUTE DEVIATION= 2521.6206

FORECAST DEMANDS FOR YEAR 1984 BY WINTER METHOD

PRODUCT	CODE	DEMANDS FOR EACH PERIOD											
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
6	2150021 (15deg.)	19597.	18785.	17086.	11710.	12963.	24634.	29954.	25135.	28205.	25137.	20163.	28557.

WINTERS' METHOD FOR FORECASTING A SEASONAL TIME SERIES

FORECASTING FOR PRODUCT CODE 2150022

SMOOTHING CONSTANT: ALPHA= .25 BETA= .05 GAMMA= .05

OUTPUT OF THE INITIAL PHASE

LENGTH OF THE SEASON IS 12 PERIODS FORECAST LEAD TIME IS 1 PERIODS

PERIOD	OBSERVATION	PERMANENT COMPONENT	TREND	SEASONAL FACTOR	FITTED MODEL	ERROR
1	6523.0000	11542.4961	-130.6901	.6477	0.0000	0.0000
2	6626.0000	10720.5352	-165.2537	.7589	8744.8633	-2118.8633
3	17765.0000	10411.2617	-172.4546	1.7765	18790.5117	-1025.5117
4	10574.0000	10496.7305	-159.5585	.9417	9606.0430	967.9570
5	15850.0000	11045.3594	-124.1491	1.2151	12440.7812	3409.2187
6	14865.0000	10791.8594	-130.6166	1.4262	15604.2148	-739.2148
7	10465.0000	10977.7500	-114.7912	.8812	9354.1719	1110.8281
8	14514.0000	11374.8437	-89.1970	1.1318	12212.1328	2301.8672
9	9832.0000	11125.5547	-97.2016	.9216	10423.4180	-591.4180
10	5922.0000	10458.7578	-125.6813	.6713	7463.9883	-1541.9883
11	10486.0000	11229.8242	-80.8439	.7623	7783.9023	2702.0977
12	9099.0000	10959.3633	-90.3248	.8734	9763.1562	-664.1562
13	8301.0000	11356.0156	-65.9759	.6518	7039.3984	1261.6016
14	10604.0000	11960.7930	-32.4383	.7653	8567.8750	2036.1250
15	21976.0000	12038.8477	-26.9136	1.7789	21190.7812	785.2187
16	10218.0000	11721.7148	-41.4245	.9382	11311.1328	-1093.1328
17	10655.0000	10952.4687	-77.8156	1.2030	14192.3984	-3537.3984
18	16169.0000	10990.2070	-72.0379	1.4285	15509.7461	659.2539
19	8458.0000	10588.2070	-88.5360	.8771	9621.0273	-1163.0273
20	9541.0000	9982.2539	-114.4068	1.1230	11883.3906	-2342.3906
21	9666.0000	10022.9336	-106.6525	.9237	9094.2656	571.7344
22	8180.0000	10483.6641	-78.2834	.6767	6656.5078	1523.4922
23	5199.0000	9509.0156	-123.1016	.7515	7932.2578	-2733.2578
24	8839.0000	9569.4023	-113.9272	.8759	8197.9102	641.0898

SUM OF ERRORS	=	420.1250
AVERAGE ERROR	=	17.5052
VARIANCE	=	3196006.0000
STANDARD DEVIATION	=	1787.7378
MEAN ABSOLUTE DEVIATION	=	1480.0352

FORECAST DEMANDS FOR YEAR 1984 BY WINTER METHOD

PRODUCT	CODE	DEMANDS FOR EACH PERIOD											
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
11	2150022	6163.	7149.	16415.	8550.	10826.	12693.	7694.	9723.	7893.	5705.	6250.	7185.

WINTERS' METHOD FOR FORECASTING A SEASONAL TIME SERIES

FORECASTING FOR PRODUCT . CODE 2153027

SMOOTHING CONSTANT: ALPHA= .80 BETA= .05 GAMMA= .05

OUTPUT OF THE INITIAL PHASE

LENGTH OF THE SEASON IS 12 PERIODS FORECAST LEAD TIME IS 1 PERIODS

PERIOD	OBSERVATION	PERMANENT COMPONENT	TREND	SEASONAL FACTOR	FITTED MODEL	ERROR
1	1938.0000			1.2626	0.0000	0.0000
2	2156.0000	1824.7266	-51.4795	.9080	1605.8523	550.1477
3	4258.0000	2259.2427	-27.1797	1.4956	3330.6836	927.3164
4	2445.0000	2729.2161	-2.3221	1.0263	2802.7002	-357.7002
5	2553.0000	2448.4731	-16.2431	.7447	1805.6875	747.3125
6	4214.0000	3237.5232	24.0215	1.5476	5057.3477	-843.3477
7	2461.0000	2826.4348	2.2660	.9864	2793.9075	-332.9075
8	1673.0000	2559.0576	-11.2161	.7433	1896.3582	-223.3582
9	2042.0000	2307.7676	-23.2198	.8268	1887.4932	154.5068
10	1901.0000	2434.1545	-15.7395	.5319	1282.0017	618.9983
11	1657.0000	3352.5754	30.9685	.6047	2050.7659	-393.7659
12	6395.0000	2863.8064	4.9816	1.3047	3725.9829	2669.0171
13	6418.0000	4512.7734	87.1809	1.2639	5808.0977	609.9023
14	3546.0000	4986.3789	106.5021	.9054	4624.5117	-1078.5117
15	4999.0000	4142.6836	58.9922	1.4919	6284.0117	-1285.0117
16	4068.0000	3514.3174	24.6243	1.0275	3632.1521	435.8479
17	1980.0000	3878.6714	41.6108	.7415	2919.4658	-939.4658
18	5550.0000	2911.0637	-8.8501	1.5507	4491.5078	1058.4922
19	3831.0000	3449.3730	18.5078	.9875	3420.7144	410.2856
20	3126.0000	3800.6345	35.1455	.7440	2851.2583	274.7417
21	3258.0000	4131.4648	49.9297	.8263	3457.3220	-199.3220
22	1372.0000	3988.5410	40.2870	.5293	2143.1196	-771.1196
23	2218.0000	2869.1316	-17.6978	.6061	1724.3330	493.6670
24	1276.0000	3504.5127	14.9562	1.2824	4591.8984	-3315.8984
		1486.2871	-86.7029			***DATA***

SUM OF ERRORS	=	-790.1738
AVERAGE ERROR	=	-32.9239
VARIANCE	=	1212047.0000
STANDARD DEVIATION	=	1100.9302
MEAN ABSOLUTE DEVIATION=		778.7759

FORECAST DEMANDS FOR YEAR 1984 BY WINTER METHOD

PRODUCT	CODE	DEMANDS FOR EACH PERIOD											
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
12	2153027	1769.	1189.	1829.	1171.	781.	1498.	868.	590.	583.	328.	323.	572.

WINTERS' METHOD FOR FORECASTING A SEASONAL TIME SERIES

FORECASTING FOR PRODUCT . CODE 2150001 (15des.)

SMOOTHING CONSTANT: ALPHA= .05 BETA= .05 GAMMA= .05

OUTPUT OF THE INITIAL PHASE

LENGTH OF THE SEASON IS 12 PERIODS FORECAST LEAD TIME IS 1 PERIODS

PERIOD	OBSERVATION	PERMANENT COMPONENT	TREND	SEASONAL FACTOR	FITTED MODEL	ERROR
					0.0000	0.0000
1	31878.0000	45469.4453	-223.9798	.7645	50643.2422	-13339.2422
2	37304.0000	44649.5859	-253.7738	1.1051	71517.1875	-6629.1875
3	64888.0000	44190.0430	-264.0620	1.6038	55482.8906	6651.1094
4	62134.0000	44189.2617	-250.8980	1.2702	61386.3047	-2937.3047
5	58449.0000	43833.2344	-256.1543	1.3939	45664.4258	-6304.4258
6	39360.0000	43276.2617	-271.1951	1.0410	31883.9531	869.0469
7	32753.0000	43063.6719	-268.2646	.7424	39059.3633	-5560.3633
8	33499.0000	42490.7891	-283.4954	.9065	32883.6992	-5047.6992
9	27836.0000	41883.3437	-299.6926	.7734	31952.8750	4424.1250
10	36377.0000	41871.5234	-285.2986	.7734	34221.3008	-88.3008
11	34133.0000	41580.8555	-285.5667	.8228	31797.3672	-1162.3672
12	30635.0000	41219.8047	-289.3406	.7687	31289.8711	4999.1289
13	36289.0000	41257.4258	-272.9924	.7702	45292.2305	17386.7695
14	62679.0000	41771.0820	-233.6600	1.1249	66616.5625	10294.4375
15	76911.0000	41858.3594	-217.6131	1.6155	52894.0898	-5795.0898
16	47099.0000	41412.6328	-229.0187	1.2636	57406.5000	5596.5000
17	63003.0000	41384.3555	-218.9817	1.4003	42852.3398	8965.6602
18	51818.0000	41596.0039	-197.4501	1.0512	30732.5625	74.4375
19	30807.0000	41403.5586	-197.1999	.7424	37352.9023	7842.0977
20	45195.0000	41638.9062	-175.5725	.9154	32066.7148	7017.2852
21	39084.0000	41917.0078	-152.8887	.7813	32301.1523	-4164.1523
22	28137.0000	41494.9102	-166.3492	.7687	34005.0977	1139.9023
23	35145.0000	41397.8242	-162.8860	.8241	31695.6641	2363.3359
24	34059.0000	41388.6641	-155.1997	.7714		

SUM OF ERRORS	=	26595.7031
AVERAGE ERROR	=	1108.1543
VARIANCE	=	46809808.0000
STANDARD DEVIATION	=	6841.7695
MEAN ABSOLUTE DEVIATION	=	5360.4883

FORECAST DEMANDS FOR YEAR 1984 BY WINTER METHOD

PRODUCT	CODE	DEMANDS FOR EACH PERIOD											
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2	2150001 (15des.)	31759.	46208.	66109.	51514.	56871.	42530.	29922.	36752.	31247.	30621.	32702.	30489.

WINTERS' METHOD FOR FORECASTING A SEASONAL TIME SERIES

FORECASTING FOR PRODUCT   CODE 2155011 (10des.)

SMOOTHING CONSTANT: ALPHA= .25 BETA= .05 GAMMA= .05

OUTPUT OF THE INITIAL PHASE

LENGTH OF THE SEASON IS 12 PERIODS   FORECAST LEAD TIME IS 1 PERIODS

PERIOD	OBSERVATION	PERMANENT COMPONENT	TREND	SEASONAL FACTOR	FITTED MODEL	ERROR
1	4230.0000	6341.9023	-116.2840	.7057	0.0000	0.0000
2	4612.0000	5853.7187	-134.8789	.9641	6060.0156	-1448.0156
3	13562.0000	5793.4062	-131.1506	2.2583	12889.6797	672.3203
4	4319.0000	5448.5430	-141.8362	.8931	5086.9687	-767.9687
5	8880.0000	5330.1445	-140.6643	1.6454	8725.8125	154.1875
6	6744.0000	5330.1797	-133.6293	1.1770	6084.1445	659.8555
7	3612.0000	5427.1406	-122.0998	.5941	3067.5217	544.4783
8	3341.0000	5006.7773	-137.0130	.8052	4310.3437	-969.3437
9	2885.0000	4592.4258	-150.8799	.7603	3736.0811	-851.0811
10	2123.0000	4591.5430	-143.3800	.4232	1870.3337	252.6663
11	5131.0000	4872.7148	-122.1524	.8457	3713.3240	1417.6760
12	4460.0000	4769.3672	-121.2121	.9247	4390.4648	69.5352
13	3875.0000	4858.9336	-110.6732	.7103	3280.0364	594.9636
14	6276.0000	5188.5742	-88.6575	.9764	4577.9062	1698.0937
15	11299.0000	5075.7930	-89.8637	2.2566	11516.8789	-217.8789
16	5350.0000	5237.0117	-77.3095	.8995	4453.0000	897.0000
17	8512.0000	5163.0859	-77.1404	1.6455	8489.6875	22.3125
18	5428.0000	4967.3477	-83.0702	1.1728	5986.3711	-558.3711
19	2402.0000	4674.0430	-93.5819	.5901	2901.5642	-499.5642
20	4684.0000	4889.5703	-78.1265	.8129	3688.3691	995.6309
21	4516.0000	5093.6172	-64.0178	.7666	3657.8999	858.1001
22	1877.0000	4881.1055	-71.4425	.4212	2128.3423	-251.3423
23	2672.0000	4397.1133	-92.0699	.8338	4067.5786	-1395.5786
24	3918.0000	4287.9883	-92.9227	.9242	3981.0740	-63.0740

SUM OF ERRORS	=	1814.6016
AVERAGE ERROR	=	75.6084
VARIANCE	=	691010.7500
STANDARD DEVIATION	=	831.2705
MEAN ABSOLUTE DEVIATION	=	660.7922

FORECAST DEMANDS FOR YEAR 1984 BY WINTER METHOD

PRODUCT	CODE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
		DEMANDS FOR EACH PERIOD											
15	2155011 (10des.)	2980.	4005.	9047.	3523.	6292.	4375.	2146.	2881.	2646.	1415.	2723.	2932.

WINTERS' METHOD FOR FORECASTING A SEASONAL TIME SERIES

FORECASTING FOR PRODUCT CODE 2155011 (15deg.)

SMOOTHING CONSTANT: ALPHA= .30 BETA= .05 GAMMA= .05

OUTPUT OF THE INITIAL PHASE

LENGTH OF THE SEASON IS 12 PERIODS FORECAST LEAD TIME IS 1 PERIODS

PERIOD	OBSERVATION	PERMANENT COMPONENT	TREND	SEASONAL FACTOR	FITTED MODEL	ERROR
1	3624.0000	5700.2383	-68.8025	.6553	0.0000	0.0000
2	3707.0000	5180.4180	-91.3533	.8889	5057.0273	-1350.0273
3	11818.0000	5189.6406	-86.3245	2.1836	11087.5391	730.4609
4	5562.0000	5040.8945	-89.4456	1.1346	5798.3828	-236.3828
5	6954.0000	4891.0078	-92.4676	1.4619	7248.9141	-294.9141
6	6042.0000	4833.7109	-90.7091	1.2301	5897.8828	144.1172
7	2914.0000	5079.4062	-73.8888	.5007	2356.7966	557.2034
8	4266.0000	4925.6992	-77.8797	.8984	4505.4609	-239.4609
9	2422.0000	4264.2734	-107.0570	.8211	4045.0178	-1623.0178
10	2015.0000	4332.4023	-98.2977	.4270	1766.8162	248.1838
11	4851.0000	4743.3984	-72.8330	.8280	3462.6482	1388.3518
12	5307.0000	4921.8047	-60.2710	.9692	4500.0859	806.9141
13	3391.0000	4955.5508	-55.5701	.6567	3185.6304	205.3696
14	5809.0000	5390.5430	-31.0420	.8983	4355.4883	1453.5117
15	10906.0000	5249.9805	-36.5180	2.1783	11703.1406	-797.1406
16	6157.0000	5277.4531	-33.3185	1.1362	5914.9687	242.0312
17	7960.0000	5304.3945	-30.3055	1.4638	7666.3359	293.6641
18	6313.0000	5231.4336	-32.4382	1.2290	6487.8750	-174.8750
19	2002.0000	4838.7187	-50.4521	.4964	2603.3401	-601.3401
20	4551.0000	4871.4883	-46.2910	.9002	4301.7695	249.2305
21	5688.0000	5455.8750	-14.7571	.8322	3961.8647	1726.1353
22	2037.0000	5239.9102	-24.8174	.4251	2323.3840	-286.3840
23	2808.0000	4667.8984	-52.1772	.8167	4318.3242	-1510.3242
24	3602.0000	4345.8984	-65.6683	.9622	4473.7305	-871.7305

SUM OF ERRORS	=	59.5762
AVERAGE ERROR	=	2.4823
VARIANCE	=	767556.1250
STANDARD DEVIATION	=	876.1028
MEAN ABSOLUTE DEVIATION	=	667.9482

FORECAST DEMANDS FOR YEAR 1984 BY WINTER METHOD

PRODUCT	CODE	DEMANDS FOR EACH PERIOD											
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
16	2155011 (15deg.)	2811.	3786.	9038.	4639.	5881.	4857.	1929.	3439.	3125.	1568.	2959.	3423.

ภาคผนวก ง

โปรแกรมคอมพิวเตอร์การทดสอบไคสแควร์

```
10 DIM X(200),MC(20),UC(20),LC(20),PN(20),O(20),E(20)
20 DIM OO(20),EE(20),EX(20),EEX(20),OEX(20),PE(20),PZ(20)
30 A1$="                        REVISED (DD/MM/YY) : 01/05/86                    "
40 A2$=" "
50 A3$="                          TECHNIQUE OF DATA ANALYSIS                     "
60 A4$="                          --------------------------                     "
70 A5$="
80 A6$="       TEST THE FORM OF A DISTRIBUTION by GOODNESS OF FIT TEST            "
90 A7$="
100 A8$="                           -  NORMAL  DISTRIBUTION                       "
110 A9$="                           -  EXPONENTIAL DISTRIBUTION                   "
120 B1$="
130 B2$="             NOTE  :    THIS PROGRAM TO BE USED FOR                      "
140 B3$="                        CONTINUOUS PROBABILITY DISTRIBUTION             "
150 B4$="
160 B5$="=============================================================================="
170 B6$="===                                                                      ==="
180 B7$="===          INPUT DATA   :    NUMBER OF GROUPED  DATA  ?               ==="
190 B8$="===                            NUMBER OF DETAILED DATA  ?               ==="
200 B9$="===                            PRODUCT CODE  ?                          ==="
210 C1$="===      DO YOU WANT FOR PRINTING RESULT TO PRINTER (Y/N)  ?            ==="
220 C2$="=============================================================================="
230 HOME
240 GOSUB 1310
250 HTAB 62:VTAB C+15: INPUT NG
260 HTAB 62:VTAB C+16: INPUT ND
270 HTAB 51:VTAB C+17: INPUT PCODE$
280 HTAB 68:VTAB C+18: INPUT PT$
290 FOR I=1 TO ND : READ X(I) : NEXT I
300 MAX=X(1) : MIN=X(1)
310 FOR I=2 TO ND
320 IF X(I)>MAX THEN MAX=X(I)
330 IF X(I)<MIN THEN MIN=X(I)
340 NEXT I
350 RANGE=(MAX-MIN)/NG
360 LC(1)=MIN : MC(1)=LC(1)+RANGE/2 : UC(1)=MIN+RANGE
370 FOR I=2 TO NG
380 LC(I)=UC(I-1)
390 MC(I)=LC(I)+RANGE/2
400 UC(I)=LC(I)+RANGE
410 NEXT I
420 UC(NG)=MAX
430 FOR I=1 TO ND
440 FOR J=1 TO NG-1
450 IF X(I)=UC(J) THEN X(I)=X(I)+1E-10
460 NEXT J
470 NEXT I
480 FOR I=1 TO NG : O(I)=0 : NEXT I
490 FOR I=1 TO NG
500 FOR J=1 TO ND
510 IF X(J) >= LC(I) AND X(J) <= UC(I) THEN O(I)=O(I)+1
520 NEXT J
530 NEXT I
540 SFX=0 : SF=0 : SDX=0
550 FOR I=1 TO ND
560 SFX=SFX+X(I)
570 NEXT I
580 XBAR=SFX/ND
```

```
590 FOR I=1 TO ND
600 SDX=SDX+((X(I)-XBAR)^2)
610 NEXT I
620 SIGMA=SQR(SDX/(ND-1))
630 REM
640 REM **********  TEST THE FORM OF EXPONENTIAL DISTRIBUTION  **********
650 REM
660 FOR I=1 TO NG
670 Z1 = -EXP(-LC(I)/XBAR)
680 Z2 = -EXP(-UC(I)/XBAR)
690 IF I=1 THEN Z1=-1
700 IF I=NG THEN Z2=0
710 PE(I) = Z2-Z1
720 EX(I) = ND*PE(I)
730 NEXT I
740 K=0 : SE=0 : SO=0
750 FOR I=1 TO NG
760 SE = SE+EX(I) : SO = SO+O(I)
770 IF SE < 5 THEN 810
780 K = K+1
790 EEX(K) = SE : OEX(K) = SO
800 SE = 0 : SO = 0
810 NEXT I
820 IF SE < 5 THEN EEX(K) = EEX(K)+SE : OEX(K) = OEX(K)+SO
830 CSQE = 0 : KK=K
840 FOR I=1 TO KK
850 CSQE = CSQE+(((OEX(I)-EEX(I))^2)/EEX(I))
860 NEXT I
870 REM
880 REM  ********** TEST THE FORM OF NORMAL DISTRIBUTION  **********
890 REM
900 GOSUB 1530
910 FOR I=1 TO NG
920 Z=(UC(I)-XBAR)/SIGMA
930 IF I=NG THEN 970
940 HTAB 52:VTAB V+4 : PRINT Z;")  =                "
950 HTAB 67:VTAB V+4 : INPUT PZ(I)
960 IF I=1 THEN PZ(I-1)=0
970 IF I=NG THEN PZ(I)=1
980 PN(I) = PZ(I)-PZ(I-1)
990 E(I) = ND*PN(I)
1000 NEXT I
1010 K=0 : SE=0 : SO=0
1020 FOR I=1 TO NG
1030 SE=SE+E(I) : SO=SO+O(I)
1040 IF SE < 5 THEN 1080
1050 K=K+1
1060 EE(K)=SE : OO(K)=SO
1070 SE=0 : SO=0
1080 NEXT I
1090 IF SE < 5 THEN EE(K)=EE(K)+SE : OO(K)=OO(K)+SO
1100 CSQN = 0
1110 FOR I=1 TO K
1120 CSQN = CSQN+(((OO(I)-EE(I))^2)/EE(I))
1130 NEXT I
1140 B6$="===  OUTPUT : CHI-SQUARE (NORMAL)       =                D.F. =       ==="
1150 B7$="===           CHI-SQUARE (EXPONENTIAL) =                D.F. =       ==="
```

```
1160 B8$="===                                    XBAR   =                                    ==="
1170 B9$="===                                   SIGMA   =                                    ==="
1180 C1$="===                          DO YOU WANT TO CONTINUE (Y/N)    ?                    ==="
1190 GOSUB 1310
1200 HTAB 51:VTAB C+14 : PRINT CSQN
1210 HTAB 71:VTAB C+14 : PRINT K
1220 HTAB 51:VTAB C+15 : PRINT CSQE
1230 HTAB 71:VTAB C+15 : PRINT KK
1240 HTAB 51:VTAB C+16 : PRINT XBAR
1250 HTAB 51:VTAB C+17 : PRINT SIGMA
1260 IF PT$ = "Y" THEN GOSUB 1630
1270 HTAB 64:VTAB C+18 : INPUT T$
1280 IF T$="Y" THEN 30
1290 HOME : HTAB 30:VTAB 10 : PRINT "PROGRAM COMPLETE"
1300 END
1310 HOME : R=10 : C=2
1320 HTAB R:VTAB C   : PRINT A1$
1330 HTAB R:VTAB C+1 : PRINT A2$
1340 HTAB R:VTAB C+2 : PRINT A3$
1350 HTAB R:VTAB C+3 : PRINT A4$
1360 HTAB R:VTAB C+4 : PRINT A5$
1370 HTAB R:VTAB C+5 : PRINT A6$
1380 HTAB R:VTAB C+6 : PRINT A7$
1390 HTAB R:VTAB C+7 : PRINT A8$
1400 HTAB R:VTAB C+8 : PRINT A9$
1410 HTAB R:VTAB C+9 : PRINT B1$
1420 HTAB R:VTAB C+10: PRINT B2$
1430 HTAB R:VTAB C+11: PRINT B3$
1440 HTAB R:VTAB C+12: PRINT B4$
1450 HTAB R:VTAB C+13: PRINT B5$
1460 HTAB R:VTAB C+14: PRINT B6$
1470 HTAB R:VTAB C+15: PRINT B7$
1480 HTAB R:VTAB C+16: PRINT B8$
1490 HTAB R:VTAB C+17: PRINT B9$
1500 HTAB R:VTAB C+18: PRINT C1$
1510 HTAB R:VTAB C+19: PRINT C2$
1520 RETURN
1530 HOME : H=10 : V=5
1540 D1$="      PROBABILITY OF SUCCESS from TABLE NORMAL DISTRIBUTION "
1550 D2$="                                                                    "
1560 D3$="             INPUT  :   Probability ( Z2 < Z < Z1 )          "
1570 D4$="                          Probability ( Z = "
1580 HTAB H:VTAB V  : PRINT D1$
1590 HTAB H:VTAB V+1: PRINT D2$
1600 HTAB H:VTAB V+2: PRINT D3$
1610 HTAB H:VTAB V+4: PRINT D4$
1620 RETURN
1630 LPRINT
1640 LPRINT "  ================================================================================
==========="
1650 LPRINT
1660 LPRINT TAB(10)"            TEST THE FORM OF A DISTRIBUTION  "
1670 LPRINT TAB(10)"                        by                   "
```

```
1680 LPRINT TAB(10)"                GOODNESS OF FIT TEST          "
1690 LPRINT
1700 LPRINT "    ================================================================
=========="
1710 LPRINT : LPRINT
1720 LPRINT TAB(15)"          PRODUCT CODE  :  ";PCODE$
1730 LPRINT
1740 LPRINT TAB(15)"                      N  =  ";ND
1750 LPRINT TAB(15)"                   XBAR  =  ";XBAR
1760 LPRINT TAB(15)"                  SIGMA  =  ";SIGMA
1770 LPRINT
1780 LPRINT "       CHI-SQUARE (NORMAL)        =  ";CSQN;"  DEGREE OF FREEDOM  =
";K
1790 LPRINT "       CHI-SQUARE (EXPONENTIAL)   =  ";CSQE;"  DEGREE OF FREEDOM  =
";KK
1800 LPRINT
1810 LPRINT "    ================================================================
=========="
1820 RETURN
1830 REM
1840 REM    ***************     DETAILED DATA     ****************
1850 REM
1860 DATA 200,565,355,0,412,86,100,20,0,0,100,100,0,0,0,30,0,0,400,0,42,610,122,
1650,1034,204,440,0,0,0,40,0,670,370,130,50,0,626,40
,0
1870 REM
1880 REM   ****************      END OF DATA      ****************
1890 REM
```

********** EXAMPLE : OUTPUT **********

```
=============================================================================

                    TEST THE FORM OF A DISTRIBUTION
                                by
                          GOODNESS OF FIT TEST

=============================================================================

                          PRODUCT CODE  :  PISTON-909875

                                     N  =   40
                                  XBAR  =   209.9
                                 SIGMA  =   339.957

     CHI-SQUARE (NORMAL)         =    1.34539   DEGREE OF FREEDOM  =    2
     CHI-SQUARE (EXPONENTIAL)    =    1.10487   DEGREE OF FREEDOM  =    2

=============================================================================
```

ผลการทดสอบการแจกแจงปริมาณความต้องการสินค้า

PRODUCT CODE : 2150001 (15 DEGREE)
MONTH : JANUARY

N = 48
XBAR = 1411.77
SIGMA(n-1) = 834.426

CHI-SQUARE (NORMAL) = 2.20451 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 15.3373 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150001 (15 DEGREE)
MONTH : FEBRUARY

N = 46
XBAR = 2175.72
SIGMA(n-1) = 1246.25

CHI-SQUARE (NORMAL) = 3.04297 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 15.4727 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150001 (15 DEGREE)
MONTH : MARCH

N = 53
XBAR = 2588.96
SIGMA(n-1) = 1410.64

CHI-SQUARE (NORMAL) = .665476 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 18.4999 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150001 (15 DEGREE)
MONTH : APRIL

N = 47
XBAR = 2324.4
SIGMA(n-1) = 1317.07

CHI-SQUARE (NORMAL) = 3.3362 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 18.1814 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150001 (15 DEGREE)
MONTH : MAY

N = 46
XBAR = 2662
SIGMA(n-1) = 1529.55

CHI-SQUARE (NORMAL) = .818249 DEGREE OF FREEDOM = 5
CHI-SQUARE (EXPONENTIAL) = 11.0806 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150001 (15 DEGREE)
MONTH : JUNE

N = 52
XBAR = 1752.65
SIGMA(n-1) = 702.366

CHI-SQUARE (NORMAL) = 5.54434 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 37.8087 DEGREE OF FREEDOM = 4

==========

PRODUCT CODE : 2150001 (15 DEGREE)
MONTH : JULY

N = 50
XBAR = 1255.24
SIGMA(n-1) = 594.026

CHI-SQUARE (NORMAL) = .200469 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 24.8091 DEGREE OF FREEDOM = 4

==========

PRODUCT CODE : 2150001 (15 DEGREE)
MONTH : AUGUST

N = 51
XBAR = 1509.75
SIGMA(n-1) = 705.212

CHI-SQUARE (NORMAL) = 1.43229 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 28.5463 DEGREE OF FREEDOM = 4

==========

PRODUCT CODE : 2150001 (15 DEGREE)
MONTH : SEPTEMBER

N = 52
XBAR = 1267.63
SIGMA(n-1) = 731.536

CHI-SQUARE (NORMAL) = .946713 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 14.0605 DEGREE OF FREEDOM = 4

==========

PRODUCT CODE : 2150001 (15 DEGREE)
MONTH : OCTOBER

N = 50
XBAR = 1285.08
SIGMA(n-1) = 1096.62

CHI-SQUARE (NORMAL) = -5.06453 DEGREE OF FREEDOM = 2
CHI-SQUARE (EXPONENTIAL) = 1.14003 DEGREE OF FREEDOM = 2

==========

PRODUCT CODE : 2150001 (15 DEGREE)
MONTH : NOVEMBER

N = 51
XBAR = 1375.39
SIGMA(n-1) = 599.38

CHI-SQUARE (NORMAL) = 1.23232 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 33.0959 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150001 (15 DEGREE)
MONTH : DECEMBER

N = 52
XBAR = 1240.27
SIGMA(n-1) = 718.264

CHI-SQUARE (NORMAL) = 2.77424 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 4.00359 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150021 (10 DEGREE)
MONTH : JANUARY

N = 47
XBAR = 267.787
SIGMA(n-1) = 183.675

CHI-SQUARE (NORMAL) = 5.01628 DEGREE OF FREEDOM = 5
CHI-SQUARE (EXPONENTIAL) = 3.22591 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150021 (10 DEGREE)
MONTH : FEBRUARY

N = 41
XBAR = 448.244
SIGMA(n-1) = 301.375

CHI-SQUARE (NORMAL) = 5.14056 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 11.6219 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150021 (10 DEGREE)
MONTH : MARCH

XBAR = 674.146
SIGMA(n-1) = 362.847

CHI-SQUARE (NORMAL) = .131017 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 19.0723 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150021 (10 DEGREE)
MONTH : APRIL

N = 47
XBAR = 482.83
SIGMA(n-1) = 347.78

CHI-SQUARE (NORMAL) = 2.48759 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 6.20081 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150021 (10 DEGREE)
MONTH : MAY

N = 47
XBAR = 670.596
SIGMA(n-1) = 377.029

CHI-SQUARE (NORMAL) = .740368 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 11.6106 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150021 (10 DEGREE)
MONTH : JUNE

N = 50
XBAR = 359.48
SIGMA(n-1) = 269.117

CHI-SQUARE (NORMAL) = .833851 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 4.75952 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150021 (10 DEGREE)
MONTH : JULY

N = 49
XBAR = 335.306
SIGMA(n-1) = 254.566

CHI-SQUARE (NORMAL) = .912546 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 3.09158 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150021 (10 DEGREE)
MONTH : AUGUST

N = 49
XBAR = 419.286
SIGMA(n-1) = 277.265

CHI-SQUARE (NORMAL) = 1.87114 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 5.50127 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150021 (10 DEGREE)
MONTH : SEPTEMBER

N = 51
XBAR = 253.02
SIGMA(n-1) = 209.381

CHI-SQUARE (NORMAL) = 5.47205 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = .0252417 DEGREE OF FREEDOM = 3

PRODUCT CODE : 2150021 (10 DEGREE)
MONTH : OCTOBER

N = 43
XBAR = 256.186
SIGMA(n-1) = 171.939

CHI-SQUARE (NORMAL) = 3.12334 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 18.0586 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150021 (10 DEGREE)
MONTH : NOVEMBER

N = 46
XBAR = 227.609
SIGMA(n-1) = 176.999

CHI-SQUARE (NORMAL) = 1.38283 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 3.94228 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150021 (10 DEGREE)
MONTH : DECEMBER

N = 49
XBAR = 212.367
SIGMA(n-1) = 171.589

CHI-SQUARE (NORMAL) = 1.729 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 1.48522 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150001 (10 DEGREE)
MONTH : JANUARY

N = 49
XBAR = 852.225
SIGMA(n-1) = 539.468

CHI-SQUARE (NORMAL) = .992364 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 5.84697 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150001 (10 DEGREE)
MONTH : FEBRUARY

N = 46
XBAR = 1263.72
SIGMA(n-1) = 814.131

CHI-SQUARE (NORMAL) = 1.15506 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 10.0862 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150001 (10 DEGREE)
MONTH : MARCH

N = 55
XBAR = 1980.15
SIGMA(n-1) = 1341.32

CHI-SQUARE (NORMAL) = 3.59877 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 17.3636 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150001 (10 DEGREE)
MONTH : APRIL

N = 46
XBAR = 1610.72
SIGMA(n-1) = 1067.04

CHI-SQUARE (NORMAL) = 1.82827 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 12.0991 DEGREE OF FREEDOM = 3

PRODUCT CODE : 2150001 (10 DEGREE)
MONTH : MAY

N = 47
XBAR = 1919.19
SIGMA(n-1) = 770.949

CHI-SQUARE (NORMAL) = 1.07302 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 19.6396 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150001 (10 DEGREE)
MONTH : JUNE

N = 53
XBAR = 1022.83
SIGMA(n-1) = 566.857

CHI-SQUARE (NORMAL) = .308041 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 23.2683 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150001 (10 DEGREE)
MONTH : JULY

N = 51
XBAR = 814.177
SIGMA(n-1) = 469.484

CHI-SQUARE (NORMAL) = 5.61652 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 15.8153 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150001 (10 DEGREE)
MONTH : AUGUST

N = 51
XBAR = 1016.8
SIGMA(n-1) = 541.234

CHI-SQUARE (NORMAL) = .80586 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 16.1604 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150001 (10 DEGREE)
MONTH : SEPTEMBER

N = 52
XBAR = 833.654
SIGMA(n-1) = 481.18

CHI-SQUARE (NORMAL) = 3.59399 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 10.439 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150001 (10 DEGREE)
MONTH : OCTOBER

N = 50
XBAR = 662.16
SIGMA(n-1) = 420.234

CHI-SQUARE (NORMAL) = 4.78715 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 1.66983 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150001 (10 DEGREE)
MONTH : NOVEMBER

N = 50
XBAR = 825.8
SIGMA(n-1) = 426.853

CHI-SQUARE (NORMAL) = 1.02937 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 27.3198 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150001 (10 DEGREE)
MONTH : DECEMBER

N = 52
XBAR = 706.712
SIGMA(n-1) = 412.212

CHI-SQUARE (NORMAL) = 5.50366 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 6.19727 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150001 (20 DEGREE)
MONTH : JANUARY

N = 46
XBAR = 292.087
SIGMA(n-1) = 215.217

CHI-SQUARE (NORMAL) = 3.81181 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 3.49234 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150001 (20 DEGREE)
MONTH : FEBRUARY

N = 45
XBAR = 361.133
SIGMA(n-1) = 246.337

CHI-SQUARE (NORMAL) = 1.09352 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 12.4276 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150001 (20 DEGREE)
MONTH : MARCH

N = 54
XBAR = 385.982
SIGMA(n-1) = 329.829

CHI-SQUARE (NORMAL) = 1.87305 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 2.43412 DEGREE OF FREEDOM = 3

PRODUCT CODE : 2150001 (20 DEGREE)
MONTH : APRIL

N = 47
XBAR = 351.021
SIGMA(n-1) = 275.102

CHI-SQUARE (NORMAL) = .7718 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 6.22675 DEGREE OF FREEDOM = 3

PRODUCT CODE : 2150001 (20 DEGREE)
MONTH : MAY

N = 48
XBAR = 431.146
SIGMA(n-1) = 323.34

CHI-SQUARE (NORMAL) = 3.9491 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 1.69118 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150001 (20 DEGREE)
MONTH : JUNE

N = 52
XBAR = 355.615
SIGMA(n-1) = 306.322

CHI-SQUARE (NORMAL) = 5.31278 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 7.40532 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150001 (20 DEGREE)
MONTH : JULY

N = 49
XBAR = 266.918
SIGMA(n-1) = 181.911

CHI-SQUARE (NORMAL) = 3.20492 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 11.0474 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150001 (20 DEGREE)
MONTH : AUGUST

N = 50
XBAR = 328.74
SIGMA(n-1) = 336.905

CHI-SQUARE (NORMAL) = 2.96312 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = .334784 DEGREE OF FREEDOM = 3

PRODUCT CODE : 2150001 (20 DEGREE)
MONTH : SEPTEMBER

N = 51
XBAR = 282.078
SIGMA(n-1) = 248.077

CHI-SQUARE (NORMAL) = 4.33863 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = .717636 DEGREE OF FREEDOM = 3

PRODUCT CODE : 2150001 (20 DEGREE)
MONTH : OCTOBER

N = 49
XBAR = 321.327
SIGMA(n-1) = 255.884

CHI-SQUARE (NORMAL) = 1.57939 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 5.54613 DEGREE OF FREEDOM = 3

MONTH : NOVEMBER

N = 51
XBAR = 303.961
SIGMA(n-1) = 269.296

CHI-SQUARE (NORMAL) = 3.73027 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 3.56812 DEGREE OF FREEDOM = 3

PRODUCT CODE : 2150001 (20 DEGREE)
MONTH : DECEMBER

N = 49
XBAR = 291.347
SIGMA(n-1) = 346.91

CHI-SQUARE (NORMAL) = 5.16641 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = .203234 DEGREE OF FREEDOM = 2

PRODUCT CODE : 2150003
MONTH : JANUARY

N = 49
XBAR = 478.592
SIGMA(n-1) = 516.177

CHI-SQUARE (NORMAL) = 6.90813 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = .672717 DEGREE OF FREEDOM = 3

PRODUCT CODE : 2150003
MONTH : FEBRUARY

N = 42
XBAR = 291.952
SIGMA(n-1) = 250.52

CHI-SQUARE (NORMAL) = 2.5666 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 1.44617 DEGREE OF FREEDOM = 3

PRODUCT CODE : 2150003
MONTH : MARCH

N = 52
XBAR = 277.308
SIGMA(n-1) = 254.454

CHI-SQUARE (NORMAL) = .603049 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 5.79983 DEGREE OF FREEDOM = 3

PRODUCT CODE : 2150003
MONTH : APRIL

N = 38
XBAR = 183.684
SIGMA(n-1) = 230.622

CHI-SQUARE (NORMAL) = 2.844 DEGREE OF FREEDOM = 2
CHI-SQUARE (EXPONENTIAL) = 3.813E-05 DEGREE OF FREEDOM = 2

PRODUCT CODE : 2150003
MONTH : MAY

N = 40
XBAR = 241.175
SIGMA(n-1) = 206.866

CHI-SQUARE (NORMAL) = 1.85983 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = .477766 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150003
MONTH : JUNE

N = 50
XBAR = 242.84
SIGMA(n-1) = 275.274

CHI-SQUARE (NORMAL) = 9.84554 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 2.83577 DEGREE OF FREEDOM = 3

PRODUCT CODE : 2150003
MONTH : JULY

N = 45
XBAR = 179.111
SIGMA(n-1) = 257.489

CHI-SQUARE (NORMAL) = 4.36007 DEGREE OF FREEDOM = 2
CHI-SQUARE (EXPONENTIAL) = .0242645 DEGREE OF FREEDOM = 2

PRODUCT CODE : 2150003
MONTH : AUGUST

N = 45
XBAR = 277.556
SIGMA(n-1) = 316.461

CHI-SQUARE (NORMAL) = 10.2365 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 6.32815 DEGREE OF FREEDOM = 3

PRODUCT CODE : 2150003
MONTH : SEPTEMBER

N = 38
XBAR = 154.079
SIGMA(n-1) = 150.137

CHI-SQUARE (NORMAL) = 2.26725 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = .0432686 DEGREE OF FREEDOM = 3

PRODUCT CODE : 2150003
MONTH : OCTOBER

N = 39
XBAR = 263.795
SIGMA(n-1) = 361.632

CHI-SQUARE (NORMAL) = 4.92346 DEGREE OF FREEDOM = 2
CHI-SQUARE (EXPONENTIAL) = .255229 DEGREE OF FREEDOM = 2

PRODUCT CODE : 2150003
MONTH : NOVEMBER

N = 48
XBAR = 196.313
SIGMA(n-1) = 242.528

CHI-SQUARE (NORMAL) = 2.49364 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 1.07886 DEGREE OF FREEDOM = 2

PRODUCT CODE : 2150003
MONTH : DECEMBER

N = 44
XBAR = 196.5
SIGMA(n-1) = 230.569

CHI-SQUARE (NORMAL) = 1.77033 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = .609221 DEGREE OF FREEDOM = 3

PRODUCT CODE : 2150021 (15 DEGREE)
MONTH : JANUARY

N = 49
XBAR = 356.918
SIGMA(n-1) = 281.423

CHI-SQUARE (NORMAL) = .536277 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 5.27096 DEGREE OF FREEDOM = 3

PRODUCT CODE : 2150021 (15 DEGREE)
MONTH : FEBRUARY

N = 44
XBAR = 599.227
SIGMA(n-1) = 377.396

CHI-SQUARE (NORMAL) = .600622 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 12.1706 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150021 (15 DEGREE)
MONTH : MARCH

N = 54
XBAR = 762.852
SIGMA(n-1) = 367.207

CHI-SQUARE (NORMAL) = .471963 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 23.7017 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150021 (15 DEGREE)
MONTH : APRIL

N = 46
XBAR = 778.826
SIGMA(n-1) = 538.321

CHI-SQUARE (NORMAL) = 3.07814 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 5.44639 DEGREE OF FREEDOM = 3

PRODUCT CODE : 2150021 (15 DEGREE)
MONTH : MAY

N = 48
XBAR = 798.354
SIGMA(n-1) = 542.398

CHI-SQUARE (NORMAL) = 1.41884 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 9.49439 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150021 (15 DEGREE)
MONTH : JUNE

N = 53
XBAR = 502.547
SIGMA(n-1) = 293.233

CHI-SQUARE (NORMAL) = 4.4279 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 6.80133 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150021 (15 DEGREE)
MONTH : JULY

N = 49
XBAR = 422.082
SIGMA(n-1) = 310.04

CHI-SQUARE (NORMAL) = 1.3221 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 9.55464 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150021 (15 DEGREE)
MONTH : AUGUST

N = 48
XBAR = 501.25
SIGMA(n-1) = 357.942

CHI-SQUARE (NORMAL) = 4.13492 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 1.17454 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150021 (15 DEGREE)
MONTH : SEPTEMBER

N = 52
XBAR = 412.404
SIGMA(n-1) = 398.131

CHI-SQUARE (NORMAL) = 3.30119 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = .658394 DEGREE OF FREEDOM = 3

PRODUCT CODE : 2150021 (15 DEGREE)
MONTH : OCTOBER

N = 49
XBAR = 303.633
SIGMA(n-1) = 227.779

CHI-SQUARE (NORMAL) = 1.12635 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 4.40338 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150021 (15 DEGREE)
MONTH : NOVEMBER

N = 49
XBAR = 324.041
SIGMA(n-1) = 251.861

CHI-SQUARE (NORMAL) = 3.54978 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 6.38403 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150021 (15 DEGREE)
MONTH : DECEMBER

N = 50
XBAR = 363.94
SIGMA(n-1) = 251.049

CHI-SQUARE (NORMAL) = 5.08383 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 8.26407 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150022
MONTH : JANUARY

N = 43
XBAR = 357.535
SIGMA(n-1) = 314.667

CHI-SQUARE (NORMAL) = 3.32465 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 1.41727 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150022
MONTH : FEBRUARY

N = 45
XBAR = 413.533
SIGMA(n-1) = 414.314

CHI-SQUARE (NORMAL) = 4.52423 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 2.35096 DEGREE OF FREEDOM = 3

PRODUCT CODE : 2150022
MONTH : FEBRUARY

N = 45
XBAR = 413.533
SIGMA(n-1) = 414.314

CHI-SQUARE (NORMAL) = 4.52423 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 2.35096 DEGREE OF FREEDOM = 3

PRODUCT CODE : 2150022
MONTH : MARCH

N = 53
XBAR = 679.774
SIGMA(n-1) = 480.824

CHI-SQUARE (NORMAL) = 2.27623 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 6.40283 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150022
MONTH : APRIL

N = 46
XBAR = 510.63
SIGMA(n-1) = 396.178

CHI-SQUARE (NORMAL) = .194548 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 5.62468 DEGREE OF FREEDOM = 3

PRODUCT CODE : 2150022
MONTH : MAY

N = 46
XBAR = 576.348
SIGMA(n-1) = 480.483

CHI-SQUARE (NORMAL) = 4.08636 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 1.22879 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150022
MONTH : JUNE

N = 52
XBAR = 537.712
SIGMA(n-1) = 265.638

CHI-SQUARE (NORMAL) = .521384 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 25.9684 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150022
MONTH : JULY

N = 50
XBAR = 432.14
SIGMA(n-1) = 315.148

CHI-SQUARE (NORMAL) = 2.78079 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 17.1568 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150022
MONTH : AUGUST

N = 49
XBAR = 534.674
SIGMA(n-1) = 686.878

CHI-SQUARE (NORMAL) = 6.16112 DEGREE OF FREEDOM = 2
CHI-SQUARE (EXPONENTIAL) = .590998 DEGREE OF FREEDOM = 2

PRODUCT CODE : 2150022
MONTH : SEPTEMBER

N = 52
XBAR = 295.923
SIGMA(n-1) = 245.642

CHI-SQUARE (NORMAL) = 2.43307 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 2.0261 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2150022
MONTH : OCTOBER

N = 46
XBAR = 395.957
SIGMA(n-1) = 407.316

CHI-SQUARE (NORMAL) = 1.34371 DEGREE OF FREEDOM = 2
CHI-SQUARE (EXPONENTIAL) = .338174 DEGREE OF FREEDOM = 2

PRODUCT CODE : 2153027
MONTH : JANUARY

N = 40
XBAR = 209.9
SIGMA(n-1) = 339.957

CHI-SQUARE (NORMAL) = 1.34539 DEGREE OF FREEDOM = 2
CHI-SQUARE (EXPONENTIAL) = 1.10487 DEGREE OF FREEDOM = 2

PRODUCT CODE : 2153027
MONTH : FEBRUARY

N = 40
XBAR = 173.9
SIGMA(n-1) = 185.17

CHI-SQUARE (NORMAL) = 2.67043 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = .160549 DEGREE OF FREEDOM = 3

PRODUCT CODE : 2153027
MONTH : MARCH

N = 40
XBAR = 206.25
SIGMA(n-1) = 242.878

CHI-SQUARE (NORMAL) = 4.93756 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 2.15861 DEGREE OF FREEDOM = 3

PRODUCT CODE : 2153027
MONTH : APRIL

N = 38
XBAR = 170.132
SIGMA(n-1) = 214.122

CHI-SQUARE (NORMAL) = 4.58491 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 3.13784 DEGREE OF FREEDOM = 3

PRODUCT CODE : 2153027
MONTH : MAY

N = 39
XBAR = 133.744
SIGMA(n-1) = 159.638

CHI-SQUARE (NORMAL) = 2.77796 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 2.37983E-04 DEGREE OF FREEDOM = 2

PRODUCT CODE : 2153027
MONTH : JUNE

N = 41
XBAR = 199.585
SIGMA(n-1) = 238.967

PRODUCT CODE : 2153027
MONTH : MAY

N = 39
XBAR = 133.744
SIGMA(n-1) = 159.638

CHI-SQUARE (NORMAL) = 2.77796 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 2.37983E-04 DEGREE OF FREEDOM = 2

PRODUCT CODE : 2153027
MONTH : JUNE

N = 41
XBAR = 199.585
SIGMA(n-1) = 238.967

CHI-SQUARE (NORMAL) = 4.69592 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = .178083 DEGREE OF FREEDOM = 2

PRODUCT CODE : 2153027
MONTH : JULY

N = 46
XBAR = 145.348
SIGMA(n-1) = 228.252

CHI-SQUARE (NORMAL) = 4.63459 DEGREE OF FREEDOM = 2
CHI-SQUARE (EXPONENTIAL) = 1.98619E-03 DEGREE OF FREEDOM = 2

PRODUCT CODE : 2153027
MONTH : AUGUST

N = 43
XBAR = 120.954
SIGMA(n-1) = 170.351

CHI-SQUARE (NORMAL) = 10.0954 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 7.39874 DEGREE OF FREEDOM = 3

PRODUCT CODE : 2153027
MONTH : SEPTEMBER

N = 42
XBAR = 109.857
SIGMA(n-1) = 176.518

CHI-SQUARE (NORMAL) = 3.84154 DEGREE OF FREEDOM = 2
CHI-SQUARE (EXPONENTIAL) = .0179459 DEGREE OF FREEDOM = 2

PRODUCT CODE : 2153027
MONTH : OCTOBER

N = 38
XBAR = 84.0263
SIGMA(n-1) = 131.812

CHI-SQUARE (NORMAL) = 8.81511 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 1.27191 DEGREE OF FREEDOM = 2

PRODUCT CODE : 2153027
MONTH : NOVEMBER

N = 45
XBAR = 137.4
SIGMA(n-1) = 171.955

CHI-SQUARE (NORMAL) = 7.24029 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = .269071 DEGREE OF FREEDOM = 3

PRODUCT CODE : 2153027
MONTH : DECEMBER

N = 36
XBAR = 133.056
SIGMA(n-1) = 184.129

CHI-SQUARE (NORMAL) = 2.85373 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 4.48124E-03 DEGREE OF FREEDOM = 2

PRODUCT CODE : 2155011 (15 DEGREE)
MONTH : JANUARY

N = 45
XBAR = 154.667
SIGMA(n-1) = 135.457

CHI-SQUARE (NORMAL) = 3.8042 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = .727539 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2155011 (15 DEGREE)
MONTH : FEBRUARY

N = 41
XBAR = 278.927
SIGMA(n-1) = 241.401

CHI-SQUARE (NORMAL) = 1.77983 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = .880625 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2155011 (15 DEGREE)
MONTH : MARCH

N = 53
XBAR = 402.906
SIGMA(n-1) = 235.659

CHI-SQUARE (NORMAL) = 1.42165 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 8.11391 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2155011 (15 DEGREE)
MONTH : APRIL

N = 43
XBAR = 274.954
SIGMA(n-1) = 173.113

CHI-SQUARE (NORMAL) = 5.57396 DEGREE OF FREEDOM = 5
CHI-SQUARE (EXPONENTIAL) = 3.82527 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2155011 (15 DEGREE)
MONTH : MAY

N = 43
XBAR = 381.186
SIGMA(n-1) = 341.216

CHI-SQUARE (NORMAL) = 2.24127 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 1.98943 DEGREE OF FREEDOM = 3

PRODUCT CODE : 2155011 (15 DEGREE)
MONTH : JUNE

N = 48
XBAR = 187.146
SIGMA(n-1) = 176.276

CHI-SQUARE (NORMAL) = 2.53265 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 7.43644 DEGREE OF FREEDOM = 3

PRODUCT CODE : 2155011 (15 DEGREE)
MONTH : JULY

N = 42
XBAR = 156.167
SIGMA(n-1) = 133.363

CHI-SQUARE (NORMAL) = 4.84404 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = .367871 DEGREE OF FREEDOM = 3

PRODUCT CODE : 2155011 (15 DEGREE)
MONTH : AUGUST

N = 47
XBAR = 188.745
SIGMA(n-1) = 136.636

CHI-SQUARE (NORMAL) = 1.78822 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 2.11382 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2155011 (15 DEGREE)
MONTH : SEPTEMBER

N = 44
XBAR = 167.318
SIGMA(n-1) = 155.195

CHI-SQUARE (NORMAL) = 6.45764 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 2.02496 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2155011 (15 DEGREE)
MONTH : OCTOBER

N = 36
XBAR = 173.417
SIGMA(n-1) = 184.734

CHI-SQUARE (NORMAL) = 2.1653 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = .0499437 DEGREE OF FREEDOM = 2

PRODUCT CODE : 2155011 (10 DEGREE)
MONTH : JANUARY

N = 41
XBAR = 195.537
SIGMA(n-1) = 177.655

CHI-SQUARE (NORMAL) = 2.18072 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = .623084 DEGREE OF FREEDOM = 3

==========

PRODUCT CODE : 2155011 (10 DEGREE)
MONTH : FEBRUARY

N = 41
XBAR = 296.463
SIGMA(n-1) = 239.382

CHI-SQUARE (NORMAL) = 1.55344 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 3.07986 DEGREE OF FREEDOM = 4

==========

PRODUCT CODE : 2155011 (10 DEGREE)
MONTH : MARCH

N = 54
XBAR = 420.574
SIGMA(n-1) = 260

CHI-SQUARE (NORMAL) = 10.4404 DEGREE OF FREEDOM = 5
CHI-SQUARE (EXPONENTIAL) = 12.3202 DEGREE OF FREEDOM = 5

==========

PRODUCT CODE : 2155011 (10 DEGREE)
MONTH : APRIL

N = 45
XBAR = 248.689
SIGMA(n-1) = 176.324

CHI-SQUARE (NORMAL) = .817652 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 4.34478 DEGREE OF FREEDOM = 4

==========

PRODUCT CODE : 2155011 (10 DEGREE)
MONTH : MAY

N = 46
XBAR = 385.283
SIGMA(n-1) = 209.82

CHI-SQUARE (NORMAL) = 2.63838 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 27.8271 DEGREE OF FREEDOM = 4

==========

PRODUCT CODE : 2155011 (10 DEGREE)
MONTH : JUNE

N = 45
XBAR = 219
SIGMA(n-1) = 183.648

CHI-SQUARE (NORMAL) = 2.68737 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 5.34327 DEGREE OF FREEDOM = 3

==========

PRODUCT CODE : 2155011 (10 DEGREE)
MONTH : JULY

N = 44
XBAR = 166.614
SIGMA(n-1) = 110.325

CHI-SQUARE (NORMAL) = 2.79653 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 8.02966 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2155011 (10 DEGREE)
MONTH : AUGUST

N = 48
XBAR = 198.729
SIGMA(n-1) = 150.675

CHI-SQUARE (NORMAL) = 5.91511 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = .883927 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2155011 (10 DEGREE)
MONTH : SEPTEMBER

N = 44
XBAR = 117.295
SIGMA(n-1) = 118.117

CHI-SQUARE (NORMAL) = .972122 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 3.62135 DEGREE OF FREEDOM = 3

PRODUCT CODE : 2155011 (10 DEGREE)
MONTH : OCTOBER

N = 33
XBAR = 155.333
SIGMA(n-1) = 129.3

CHI-SQUARE (NORMAL) = 2.86248 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 1.48769 DEGREE OF FREEDOM = 3

PRODUCT CODE : 2155011 (10 DEGREE)
MONTH : NOVEMBER

N = 45
XBAR = 167.311
SIGMA(n-1) = 122.707

CHI-SQUARE (NORMAL) = 4.50496 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 2.0828 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2155011 (10 DEGREE)
MONTH : DECEMBER

N = 44
XBAR = 164.455
SIGMA(n-1) = 113.835

CHI-SQUARE (NORMAL) = 5.64835 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 29.6421 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2155032
MONTH : JANUARY

N = 46
XBAR = 205.826
SIGMA(n-1) = 214.351

CHI-SQUARE (NORMAL) = 1.83023 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = .195077 DEGREE OF FREEDOM = 3

PRODUCT CODE : 2155032
MONTH : FEBRUARY

N = 40
XBAR = 249.75
SIGMA(n-1) = 242.681

CHI-SQUARE (NORMAL) = 1.30166 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = .339004 DEGREE OF FREEDOM = 3

PRODUCT CODE : 2155032
MONTH : MARCH

N = 47
XBAR = 560.66
SIGMA(n-1) = 455.325

CHI-SQUARE (NORMAL) = 2.80142 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = .859492 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2155032
MONTH : APRIL

N = 46
XBAR = 276.391
SIGMA(n-1) = 216.693

CHI-SQUARE (NORMAL) = 1.07238 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 8.04772 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2155032
MONTH : MAY

N = 45
XBAR = 325.022
SIGMA(n-1) = 269.748

CHI-SQUARE (NORMAL) = 1.14812 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 3.20737 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2155032
MONTH : JUNE

N = 45
XBAR = 276.356
SIGMA(n-1) = 270.573

CHI-SQUARE (NORMAL) = 5.18948 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = .548907 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2155032
MONTH : JULY

N = 46
XBAR = 241.413
SIGMA(n-1) = 222.323

CHI-SQUARE (NORMAL) = 2.34004 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = .30242 DEGREE OF FREEDOM = 3

PRODUCT CODE : 2155032
MONTH : AUGUST

N = 45
XBAR = 263.222
SIGMA(n-1) = 213.452

CHI-SQUARE (NORMAL) = 1.1943 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 1.88476 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2155032
MONTH : SEPTEMBER

N = 42
XBAR = 152.19
SIGMA(n-1) = 122.213

CHI-SQUARE (NORMAL) = 2.45263 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 2.04608 DEGREE OF FREEDOM = 4

PRODUCT CODE : 2155032
MONTH : OCTOBER

N = 42
XBAR = 175.143
SIGMA(n-1) = 178.202

CHI-SQUARE (NORMAL) = 3.62452 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = 1.1639 DEGREE OF FREEDOM = 3

PRODUCT CODE : 2155032
MONTH : NOVEMBER

N = 36
XBAR = 205.056
SIGMA(n-1) = 164.642

CHI-SQUARE (NORMAL) = 4.55374 DEGREE OF FREEDOM = 4
CHI-SQUARE (EXPONENTIAL) = 6.62998 DEGREE OF FREEDOM = 4

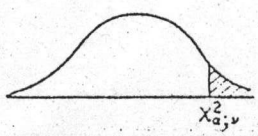
PRODUCT CODE : 2155032
MONTH : DECEMBER

N = 42
XBAR = 183.619
SIGMA(n-1) = 189.393

CHI-SQUARE (NORMAL) = 4.70474 DEGREE OF FREEDOM = 3
CHI-SQUARE (EXPONENTIAL) = .216785 DEGREE OF FREEDOM = 3

ภาคผนวก ฉ

ตารางแสดงจุด 100α% ของการแจกแจงแบบไคสแควร์



ν \ α	.995	.99	.975	.95	.90	.75	.50
1	$.0^4393$	$.0^3157$	$.0^3982$	.00393	.0158	.102	.455
2	.0100	.0201	.0506	.103	.211	.575	1.386
3	.0717	.115	.216	.352	.584	1.213	2.366
4	.207	.297	.484	.711	1.064	1.923	3.357
5	.412	.554	.831	1.145	1.610	2.675	4.351
6	.676	.872	1.237	1.635	2.204	3.455	5.348
7	.989	1.239	1.690	2.167	2.833	4.255	6.346
6	1.344	1.646	2.180	2.733	3.490	5.071	7.344
9	1.735	2.088	2.700	3.325	4.168	5.899	8.343
10	2.156	2.558	3.247	3.940	4.865	6.737	9.342
11	2.603	3.053	3.816	4.575	5.578	7.584	10.341
12	3.074	3.571	4.404	5.226	6.304	8.438	11.340
13	3.565	4.107	5.009	5.892	7.042	9.299	12.340
14	4.075	4.660	5.629	6.571	7.790	10.165	13.339
15	4.601	5.229	6.262	7.261	8.547	11.036	14.339
16	5.142	5.812	6.908	7.962	9.312	11.912	15.338
17	5.697	6.408	7.564	8.672	10.085	12.792	16.338
18	6.265	7.015	8.231	9.390	10.865	13.675	17.338
19	6.844	7.633	8.907	10.117	11.651	14.562	18.338
20	7.434	8.260	9.591	10.851	12.443	15.452	19.337
21	8.034	8.897	10.283	11.591	13.240	16.344	20.337
22	8.643	9.542	10.982	12.338	14.041	17.240	21.337
23	9.260	10.196	11.688	13.091	14.848	18.137	22.337
24	9.886	10.856	12.401	13.848	15.659	19.037	22.337
25	10.520	11.524	13.120	14.611	16.473	19.939	24.337
26	11.160	12.198	13.844	15.379	17.292	20.843	25.336
27	11.808	12.879	14.573	16.151	18.114	21.749	26.336
28	12.461	13.565	15.308	16.928	18.939	22.657	27.336
29	13.121	14.256	16.047	17.708	19.768	23.567	28.336
30	13.787	14.953	16.791	18.493	20.599	24.478	29.336
40	20.707	22.164	24.433	26.509	29.051	33.660	39.335
50	27.991	29.707	32.357	34.764	37.689	42.942	49.335
60	35.535	37.485	40.482	43.188	46.459	52.294	59.335
70	43.275	45.442	48.758	51.739	55.329	61.698	69.334
80	51.172	53.540	57.153	60.391	64.278	71.145	79.334
90	59.196	61.754	65.647	69.126	73.291	80.625	89.334
100	67.328	70.065	74.222	77.929	82.358	90.133	99.334
K_α	−2.576	−2.326	−1.960	−1.645	−1.282	−0.6745	0.000

.25	.10	.05	.025	.01	.005	.001	α / ν
1.323	2.706	3.841	5.024	6.635	7.879	10.828	1
2.773	4.605	5.991	7.378	9.210	10.597	13.816	2
4.108	6.251	7.815	9.348	11.345	12.838	16.266	3
5.385	7.779	9.488	11.143	13.277	14.860	18.467	4
6.626	9.236	11.070	12.832	15.086	16.750	20.515	5
7.841	10.645	12.592	14.449	16.812	18.548	22.458	6
9.037	12.017	14.067	16.013	18.475	20.278	24.322	7
10.219	13.362	15.507	17.535	20.090	21.955	26.125	8
11.389	14.684	16.919	19.023	21.666	23.589	27.877	9
12.549	15.987	18.307	20.483	23.209	25.188	29.588	10
13.701	17.275	19.675	21.920	24.725	26.757	31.264	11
14.845	18.549	21.026	23.337	26.217	28.300	32.909	12
15.984	19.812	22.362	24.736	27.688	29.819	34.528	13
17.117	21.064	23.685	26.119	29.141	31.319	36.123	14
18.245	22.307	24.996	27.488	30.578	32.801	37.697	15
19.369	23.542	26.296	28.845	32.000	34.267	39.252	16
20.489	24.769	27.587	30.191	33.409	35.718	40.790	17
21.605	25.989	28.869	31.526	34.805	37.156	43.312	18
22.718	27.204	30.144	32.852	36.191	38.582	43.820	19
23.828	28.412	31.410	34.170	37.566	39.997	45.315	20
24.935	29.615	32.671	35.479	38.932	41.401	46.797	21
26.039	30.813	33.924	36.781	40.289	42.796	48.268	22
27.141	32.007	35.172	38.076	41.638	44.181	49.728	23
28.241	33.196	36.415	39.364	42.980	45.558	51.179	24
29.339	34.382	37.652	40.646	44.314	46.928	52.620	25
30.434	35.563	38.885	41.923	45.642	48.290	54.052	26
31.528	36.741	40.113	43.194	46.963	49.645	55.476	27
32.620	37.916	41.337	44.461	48.278	50.993	56.892	28
33.711	39.087	42.557	45.722	49.588	52.336	58.302	29
34.800	40.256	43.773	46.979	50.892	53.672	59.703	30
45.616	51.805	55.758	59.342	63.691	66.766	73.402	40
56.334	63.167	67.505	71.420	76.154	79.490	86.661	50
66.981	74.397	79.082	83.298	88.379	91.952	99.607	60
77.577	85.527	90.531	95.023	100.425	104.215	112.317	70
88.130	96.578	101.879	106.629	112.329	116.321	124.839	80
98.650	107.565	113.145	118.136	124.116	128.299	137.208	90
109.141	118.498	124.342	129.561	135.807	140.169	149.449	100
+0.6745	+1.282	+1.645	+1.960	+2.326	+2.576	+3.090	K_α

<u>หมายเหตุ</u> กรณีที่ $\nu > 100$ จะได้ว่า

$$\chi^2 = \nu \{1 - \frac{2}{9\nu} + K_\alpha \sqrt{\frac{2}{9\nu}}\}^3$$

หรือ $$\frac{1}{2}\{K_\alpha + \sqrt{(2\nu - 1)}\}^2$$

โดย ν คือระดับชั้นอิสระที่เป็นจริง และ K_α คือจุด 100α % ของการแจกแจงแบบปกติมาตรฐานดังแสดงในบรรทัดล่างของตาราง

ภาคผนวก ช

โปรแกรมคอมพิวเตอร์สำหรับการโปรแกรมเชิงเส้นตรง

```
PAGE  1
*

    1:       COMMON B(140),C(350),CODE(140),KP1,MP1,N,K,M,NGET,NLET,NET,NTYPE,
    2:      *NP1,NC,NC1,INDEXG,INDEXL,INDEXE,NFLAG,BASICS,OPTSOL,SUM,NOPT
    3:       INTEGER CODE,XB,BASICS,OPTSOL
    4:       DIMENSION A(140,350),XB(350)
    5:       REAL*4 TITLE(20)
    6:    50 READ(1,10,END=2000)TITLE
    7:    10 FORMAT(20A4)
    8:       WRITE(3,15)TITLE
    9:    15 FORMAT('1',20A4,//)
   10:       READ(1,20)M,K,NLET,NGET,NET,NTYPE
   11:    20 FORMAT(6I5)
   12:       DO 25 I=1,M
   13:       READ(1,30)CODE(I),B(I)
   14:    30 FORMAT(I1,1X,F5.2)
   15:       READ(1,29) (A(I,J),J=1,K)
   16:    29 FORMAT(8(F1.0,1X))
   17:    25 CONTINUE
   18:       READ(1,49)(C(J),J=1,K)
   19:    49 FORMAT (8F2.0)
   20:       WRITE(3,40)
   21:    40 FORMAT(5X,'THE ORIGINAL OF THE COEFFICIENTS OF THE CONSTRAINTS',//
   22:      *15X,'CODE 0 ==>  <OR= CONSTRAINT',/15X,'CODE 1 ==>  >OR= CONSTRAIN
   23:      *T',/15X,'CODE 2 ==>  = CONSTRAINT',//)
   24:       WRITE(3,55)
   25:    55 FORMAT('   I CODE CONSTANT  A(I,1)  A(I,2)  (A(I,3)  A(I,4)  A(I,5
   26:      *)  A(I,6)  A(I,7)  A(I,8)',/)
   27:       DO 45 I=1,M
   28:       WRITE(3,51)I,CODE(I),B(I)
   29:    51 FORMAT(I4,I4,F10.2)
   30:       WRITE(3,52)(A(I,J),J=1,K)
   31:    52 FORMAT('+',15X,8F8.2,/(16X,8F8.2))
   32:    45 CONTINUE
   33:       IF(NTYPE.NE.0) GOTO 35
   34:       WRITE(3,36)
   35:    36 FORMAT(//5X,'THE COEFFICIENTS IN THE ORIGINAL OBJECTIVE FUNCTION
   36:      * TO BE MINIMIZED ARE : ',/)
   37:       GOTO 37
   38:    35 WRITE(3,38)
   39:    38 FORMAT(//5X,'THE COEFFICIENTS IN THE ORIGINAL OBJECTIVE FUNCTION
   40:      * TO BE MAXIMIZED ARE : ',/)
   41:    37 WRITE(3,39)(C(J),J=1,K)
   42:    39 FORMAT(16X,8F8.2/16X,8F8.2)
   43:       READ(1,20) NOPT
   44:   150 CALL SSARTV(A,XB)
   45:       IF (IFLAG.EQ.1) GOTO 50
   46:       BASICS=0
   47:       OPTSOL=0
   48:       WRITE(3,160)
   49:   160 FORMAT(//)
   50:       CALL SIMPLX(A,XB)
   51:       IF(NFLAG.EQ.1.OR.NFLAG.EQ.2) GOTO 50
   52:       IF (NTYPE.EQ.1) GOTO 220
   53:       SUM=-SUM
```

```
PAGE  2
*
   54:   220 WRITE(3,230)SUM
   55:   230 FORMAT(10X,'OPTIMAL VALUE OF THE ORIGINAL OBJECTIVE FUNCTION IS',
   56:      *F12.2)
   57:       GOTO 50
   58:  2000 STOP
   59:       END
   60:       SUBROUTINE SSARTV(A,XB)
   61:       COMMON B(140),C(350),CODE(140),KP1,MP1,N,K,M,NGET,NLET,NET,NTYPE,
   62:      *NP1,NC,NC1,INDEXG,INDEXL,INDEXE,NFLAG,BASICS,OPTSOL,SUM,NOPT
   63:       INTEGER CODE,XB,BASICS,OPTSOL
   64:       DIMENSION A(140,350),XB(350),ARTV(280)
   65: C INITIALIZE VARIABLES
   66:       IFLAG=0
   67:       IA=1
   68:       KP1=K+1
   69:       MP1=M+1
   70:       N=K+2*NGET+NLET+NET
   71:       NP1=N+1
   72:       NC=K+NGET+1
   73:       NC1=NC+NLET
   74:       INDEXG=K+1
   75:       INDEXL=K+NGET+1
   76:       INDEXE=K+NGET+NLET+1
   77:       DO 69 I=1,MP1
   78:       DO 69 J=KP1,NP1
   79:    69 A(I,J)=0.
   80:   150 DO 5 I=1,M
   81:     5 A(I,NP1)=B(I)
   82:       DO 4 I=1,M
   83:       IF(CODE(I).EQ.0) GOTO 6
   84:       IF (CODE(I).EQ.1) GOTO 8
   85:       ARTV(IA)=I
   86:       IA=IA+1
   87:       XB(I)=INDEXE
   88:       A(I,INDEXE)=1
   89:       INDEXE=INDEXE+1
   90:       GOTO 4
   91:     8 XB(I)=INDEXE
   92:       ARTV(IA)=I
   93:       IA=IA+1
   94:       INDEXE=INDEXE+1
   95:       A(I,INDEXG)=-1.
   96:       INDEXG=INDEXG+1
   97:       GOTO 4
   98:     6 XB(I)=INDEXL
   99:       A(I,INDEXL)=1.
  100:       INDEXL=INDEXL+1
  101:     4 CONTINUE
  102: C CHECK FOR CORRECT DATA
  103:       IF (INDEXG.NE.NC) GOTO 100
  104:       IF (INDEXL.NE.NC1) GOTO 110
  105:       IF (INDEXE.NE.NP1) GOTO 120
  106:       GOTO 151
```

PAGE 3

```
  100 WRITE(3,101)
  101 FORMAT(///' NUMBER OF >OR= CONSTRAINTS DOES NOT MATCH VALUE READ I
     . *N')
      IFLAG=1
      RETURN
  110 WRITE(3,111)
  111 FORMAT(///' NUMBER OF <OR= CONSTRAINTS DOES NOT MATCH VALUE READ I
     *N')
      IFLAG=1
      RETURN
  120 WRITE(3,121)
  121 FORMAT(///' NUMBER OF = CONSTRAINTS DOES NOT MATCH VALUE READ IN')
      IFLAG=1
      RETURN
C CHECK FOR MAXIMIZATION
  151 CONTINUE
      IF (NTYPE.EQ.0) GOTO 12
      DO 60 J=1,K
   60 A(MP1,J)=-C(J)
      GOTO 50
   12 DO 55 J=1,K
   55 A(MP1,J)=C(J)
   50 DO 61 J=KP1,NP1
      A(MP1,J)=0.
   61 C(J)=0.
      DO 62 J=1,K
   62 C(J)=-A(MP1,J)
      DO 63 J=NC1,N
   63 C(J)=-10.E2
      IF (NGET+NET.EQ.0) RETURN
      IA=IA-1
      KPGTE=K+NGET
      DO 64 J=1,KPGTE
      SUM=0.
      DO 65 I=1,IA
      IARTV=ARTV(I)
   65 SUM=SUM+A(IARTV,J)
   64 A(MP1,J)=A(MP1,J)-10.E2*SUM
      SUM=0.
      DO 66 I=1,IA
      IARTV=ARTV(I)
   66 SUM=SUM+A(IARTV,NP1)
      A(MP1,NP1)=A(MP1,NP1)-10.E2*SUM
      RETURN
      END
      SUBROUTINE SIMPLX(A,XB)
      COMMON B(140),C(350),CODE(140),KP1,MP1,N,K,M,NGET,NLET,NET,NTYPE,
     *NP1,NC,NC1,INDEXG,INDEXL,INDEXE,NFLAG,BASICS,OPTSOL,SUM,NOPT
      INTEGER CODE,XB,BASICS,OPTSOL
      DIMENSION A(140,350),XB(350)
      NFLAG=0
  100 BASICS=BASICS+1
      IF(NOPT.EQ.0) GOTO 200
```

PAGE 4

```
*
  160:   105 WRITE(3,104) BASICS
  161:   104 FORMAT(5X,'BASICS SOLUTION ',I4,/)
  162:       DO 110 I=1,M
  163:   110 WRITE(3,106)I,XB(I),A(I,NP1)
  164:   106 FORMAT(7X,'XB(',I3,')=  X(',I3,')=',F12.2)
  165:       SUM=0.
  166:       DO 111 I=1,M
  167:   111 SUM=SUM+C(XB(I))*A(I,NP1)
  168:       WRITE(3,130)SUM
  169:   130 FORMAT(/7X,'CURRENT VALUE OF THE OBJECTIVE FUNCTION IS',E18.8//)
  170:       IF (OPTSOL.EQ.1) GOTO 920
  171:   200 NEG=0
  172:       GNEG=0.
  173:       DO 21 J=1,N
  174:       IF(A(MP1,J).GE.GNEG) GOTO 21
  175:       GNEG=A(MP1,J)
  176:       NEG=J
  177:    21 CONTINUE
  178:       IF (NEG.EQ.0) GOTO 900
  179:   400 SPR=10.E10
  180:       DO 410 I=1,M
  181:       IF(A(I,NEG).LE..00001) GOTO 410
  182:       IF(A(I,NP1)/A(I,NEG).GE.SPR) GOTO 410
  183:       SPR=A(I,NP1)/A(I,NEG)
  184:       NSPR=I
  185:   410 CONTINUE
  186:       IF (SPR.LE.10.E8) GOTO 510
  187:       WRITE(3,420)
  188:   420 FORMAT(///' OBJECTIVE FUNCTION IS NOT BOUNDED BY CONSTRAINTS')
  189:       NFLAG=1
  190:       RETURN
  191:   510 PELE=A(NSPR,NEG)
  192:       DO 500 J=1,NP1
  193:   500 A(NSPR,J)=A(NSPR,J)/PELE
  194:       XB(NSPR)=NEG
  195:   600 DO 610 I=1,MP1
  196:       IF(I.EQ.NSPR) GOTO 610
  197:       HOLD=A(I,NEG)
  198:       DO 620 J=1,NP1
  199:   620 A(I,J)=A(I,J)-HOLD*A(NSPR,J)
  200:   610 CONTINUE
  201:       GOTO 100
  202:   900 OPTSOL=1
  203:       IF(NOPT.EQ.1) GOTO 920
  204:       GOTO 105
  205:   920 DO 930 I=1,M
  206:       IF(XB(I).LT.NC1) GOTO 930
  207:       IF(A(I,NP1).LE.0) GOTO 930
  208:       WRITE(3,940)
  209:   940 FORMAT(///' A FEASIBLE SOLUTION DOES NOT EXIST')
  210:       NFLAG=2
  211:       RETURN
  212:   930 CONTINUE
```

```
PAGE   5
+

  213:       WRITE(3,950)
  214:   950 FORMAT(10X,'THE LAST BASIC FEASIBLE SOLUTION IS OPTIMAL')
  215:       RETURN
  216:       END
```

หมายเหตุ

โปรแกรมคอมพิวเตอร์ข้างบนนี้ใช้ได้กับระบบปัญหาที่มีจำนวนขอบข่ายไม่เกิน 349 ขอบข่าย และมีตัวแปรไม่เกิน 139 ตัวแปร ซึ่งถ้าหากต้องการใช้กับระบบปัญหาที่มีจำนวนขอบข่ายและจำนวนตัวแปรมากกว่าข้อกำหนดนี้ สามารถกระทำได้ด้วยการแก้ขนาด DIMENSION และ COMMON ใน MAIN PROGRAM และ SUB-PROGRAM SSARTV และ SIMPLEX

ภาคผนวก ซ

คำตอบที่เหมาะสมที่สุดสำหรับตัวแบบวางแผนการผลิต

BASIC SOLUTION 64

XB(1)	=X(135)=	331549.70
XB(2)	=X(137)=	283655.10
XB(3)	=X(138)=	346966.00
XB(4)	=X(139)=	283157.00
XB(5)	=X(140)=	273526.00
XB(6)	=X(141)=	380012.00
XB(7)	=X(142)=	332800.00
XB(8)	=X(143)=	315185.00
XB(9)	=X(144)=	368656.00
XB(10)	=X(145)=	305105.00
XB(11)	=X(146)=	295957.00
XB(12)	=X(147)=	398761.00
XB(13)	=X(148)=	312000.00
XB(14)	=X(149)=	312000.00
XB(15)	=X(150)=	385872.00
XB(16)	=X(151)=	307210.00
XB(17)	=X(152)=	305798.00
XB(18)	=X(153)=	390000.00
XB(19)	=X(154)=	210097.00
XB(20)	=X(155)=	212754.00
XB(21)	=X(156)=	263445.00
XB(22)	=X(157)=	223839.00
XB(23)	=X(158)=	223589.00
XB(24)	=X(159)=	273518.00
XB(25)	=X(160)=	128800.00
XB(26)	=X(161)=	128800.00
XB(27)	=X(162)=	155947.00
XB(28)	=X(163)=	121828.00
XB(29)	=X(164)=	119821.00
XB(30)	=X(165)=	148262.00
XB(31)	=X(166)=	252000.00
XB(32)	=X(167)=	252000.00
XB(33)	=X(168)=	302937.00
XB(34)	=X(169)=	245511.00
XB(35)	=X(170)=	239211.00
XB(36)	=X(171)=	308305.00
XB(37)	=X(172)=	226800.00
XB(38)	=X(173)=	208694.00
XB(39)	=X(174)=	265272.00
XB(40)	=X(175)=	214922.00
XB(41)	=X(176)=	213699.00
XB(42)	=X(177)=	261022.00
XB(43)	=X(178)=	235200.00
XB(44)	=X(179)=	230359.00
XB(45)	=X(180)=	275699.00
XB(46)	=X(181)=	227862.00
XB(47)	=X(182)=	223887.00
XB(48)	=X(183)=	281655.00
XB(49)	=X(184)=	187857.00
XB(50)	=X(185)=	188131.00
XB(51)	=X(186)=	234166.00
XB(52)	=X(187)=	188096.00

XB(53)=X(188)= 188501.00
XB(54)=X(189)= 234252.00
XB(55)=X(190)= 283800.00
XB(56)=X(191)= 283431.00
XB(57)=X(192)= 344825.00
XB(58)=X(193)= 281520.00
XB(59)=X(194)= 276535.00
XB(60)=X(195)= 351552.00
XB(61)=X(196)= 283800.00
XB(62)=X(197)= 282894.00
XB(63)=X(198)= 344847.00
XB(64)=X(199)= 280087.00
XB(65)=X(200)= 277101.00
XB(66)=X(201)= 351324.00
XB(67)=X(202)= 195000.00
XB(68)=X(203)= 195626.00
XB(69)=X(204)= 239411.00
XB(70)=X(205)= 194665.00
XB(71)=X(206)= 195956.80
XB(72)=X(207)= 242204.00
XB(73)=X(1)= 1250.22
XB(74)=X(2)= 49144.78
XB(75)=X(3)= 69033.94
XB(76)=X(4)= 49643.00
XB(77)=X(84)= 95262.00
XB(78)=X(6)= 35988.00
XB(79)=X(8)= 17615.00
XB(80)=X(9)= 47344.00
XB(81)=X(10)= 27695.00
XB(82)=X(11)= 36843.00
XB(83)=X(12)= 17239.00
XB(84)=X(5)= 59274.00
XB(85)=X(15)= 4128.00
XB(86)=X(16)= 4790.00
XB(87)=X(17)= 6202.00
XB(88)=X(21)= 20055.00
XB(89)=X(19)= 16703.00
XB(90)=X(20)= 14046.00
XB(91)=X(83)= 17027.00
XB(92)=X(22)= 2961.00
XB(93)=X(23)= 3211.00
XB(94)=X(24)= 9982.00
XB(95)=X(26)= -0.00
XB(96)=X(27)= 5053.00
XB(97)=X(28)= 6972.00
XB(98)=X(29)= 8979.00
XB(99)=X(30)= 12738.00
XB(100)=X(32)= -0.00
XB(101)=X(33)= 12063.00
XB(102)=X(34)= 6489.00
XB(103)=X(35)= 12789.00
XB(104)=X(36)= 6695.00
XB(105)=X(38)= 18106.00
XB(106)=X(39)= 18228.00
XB(107)=X(40)= 11873.00

```
XB( 108)=X(  41)=     13101.00
XB( 109)=X(  42)=     22478.00
XB( 110)=X(  44)=      4841.00
XB( 111)=X(  45)=     18301.00
XB( 112)=X(  46)=      7338.00
XB( 113)=X(  47)=     11313.00
XB( 114)=X(  48)=     12345.00
XB( 115)=X(  49)=      1143.00
XB( 116)=X(  50)=       869.00
XB( 117)=X(  51)=      2084.00
XB( 118)=X(  52)=       904.00
XB( 119)=X(  53)=       499.00
XB( 120)=X(  54)=      1998.00
XB( 121)=X(  56)=       369.00
XB( 122)=X(  57)=      9925.00
XB( 123)=X(  58)=      2280.00
XB( 124)=X(  59)=      7265.00
XB( 125)=X(  60)=      3198.00
XB( 126)=X(  62)=       906.00
XB( 127)=X(  63)=      9903.00
XB( 128)=X(  64)=      3713.00
XB( 129)=X(  65)=      6699.00
XB( 130)=X(  66)=      3426.00
XB( 131)=X(  68)=       374.00
XB( 132)=X(  69)=      5589.00
XB( 133)=X(  70)=      1335.00
XB( 134)=X(  71)=      4316.00
XB( 135)=X(  72)=      2796.00

CURRENT VALUE OF THE OBJECTIVE FUNCTION IS   =0.86291050E 07


   THE LAST BASIC FEASIBLE SOLUTION IS OPTIMAL
   OPTIMAL VALUE OF THE ORIGINAL OBJECTIVE FUNCTINN IS  8629105.00
EXEC = 299.15 SU
```

ตารางที่ ๔ ความสามารถในการผลิตของพนักงาน

ผลิตภัณฑ์ i \ พนักงาน j	0557	1130	1350	1358	1359	1361	1494	1497	1498	1658	1659	1740	1885	1988	2124	2291	3569	3575
2150001 (15^{O})	✓	✓	✓	✓	✓	✓	✓	✓	—	✓	✓	✓	✓	✓	✓	✓	✓	✓
2150001 (10^{O})	✓	✓	✓	✓	✓	✓	✓	✓	—	✓	✓	✓	✓	✓	✓	✓	✓	✓
2150001 (20^{O})	✓	✓	✓	✓	✓	✓	✓	✓	—	✓	✓	✓	✓	—	✓	✓	✓	✓
2150002	✓	✓	✓	✓	✓	✓	✓	✓	—	✓	✓	✓	✓	✓	—	✓	✓	✓
2150003	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	—	✓	✓	✓
2150021 (10^{O})	✓	✓	✓	✓	✓	✓	✓	—	—	✓	✓	✓	✓	—	—	✓	✓	✓
2150021 (15^{O})	—	✓	✓	✓	✓	✓	✓	—	—	✓	✓	✓	✓	—	—	✓	✓	✓
2150022	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	—	—	✓	✓	✓
2153027	✓	✓	✓	✓	✓	✓	✓	—	✓	✓	✓	✓	✓	✓	—	✓	✓	✓
2155011 (10^{O})	✓	✓	✓	✓	✓	✓	✓	✓	—	✓	✓	✓	✓	✓	✓	✓	✓	✓
2155011 (15^{O})	✓	✓	✓	✓	✓	✓	✓	✓	—	✓	✓	✓	✓	✓	✓	✓	✓	✓
2155032	✓	✓	✓	✓	✓	✓	✓	✓	—	✓	✓	✓	✓	—	—	✓	✓	✓

✓ หมายถึง สามารถผลิตได้

— หมายถึง ผลิตไม่ได้

ผลิตภัณฑ์ i \ พนักงาน j	3576	3579	3583	3584	3586	3588	3845	3876	6046	6094	6918	6942	7102	7240	7244	7245	7549	3573	4311
2150001 (15^{o})	✓	✓	–	✓	✓	✓	✓	✓	✓	–	✓	✓	✓	✓	✓	✓	✓	✓	✓
2150001 (10^{o})	✓	✓	–	✓	✓	✓	✓	✓	✓	–	✓	✓	✓	✓	✓	✓	✓	✓	✓
2150001 (20^{o})	✓	✓	–	✓	✓	✓	✓	✓	✓	–	–	✓	✓	–	–	✓	✓	✓	–
2150002	✓	✓	–	✓	✓	✓	✓	✓	✓	–	–	–	✓	–	–	✓	–	✓	–
2150003	✓	✓	–	✓	✓	✓	✓	✓	✓	–	–	–	✓	–	–	✓	–	✓	–
2150021 (10^{o})	✓	✓	–	✓	✓	✓	✓	✓	✓	✓	–	✓	✓	✓	✓	✓	✓	✓	✓
2150021 (15^{o})	✓	✓	–	✓	✓	✓	✓	✓	✓	✓	–	✓	✓	✓	✓	✓	✓	✓	✓
2150022	✓	✓	–	✓	✓	✓	✓	✓	✓	✓	–	–	✓	–	–	✓	–	✓	–
2153027	✓	✓	–	✓	✓	✓	–	✓	✓	✓	–	–	✓	–	–	✓	–	✓	–
2155011 (10^{o})	✓	✓	–	✓	✓	✓	✓	✓	✓	–	✓	✓	✓	✓	✓	✓	✓	✓	–
2155011 (15^{o})	✓	✓	–	✓	✓	✓	✓	✓	✓	–	✓	✓	✓	✓	✓	✓	✓	✓	–
2155032	✓	✓	–	✓	✓	✓	✓	✓	✓	–	–	–	✓	–	–	✓	–	✓	–

ภาคผนวก ญ

คำตอบที่เหมาะสมที่สุดสำหรับตัวแบบการมอบหมายงาน

XB(1)=	X(1)=	2.40
XB(2)=	X(35)=	0.00
XB(3)=	X(79)=	0.00
XB(4)=	X(100)=	19.80
XB(5)=	X(140)=	0.00
XB(6)=	X(169)=	0.00
XB(7)=	X(198)=	0.00
XB(8)=	X(226)=	3.27
XB(9)=	X(254)=	0.00
XB(10)=	X(287)=	0.00
XB(11)=	X(318)=	0.00
XB(12)=	X(331)=	17.60
XB(13)=	X(99)=	20.00
XB(14)=	X(333)=	0.20
XB(15)=	X(334)=	20.00
XB(16)=	X(335)=	20.00
XB(17)=	X(336)=	20.00
XB(18)=	X(337)=	20.00
XB(19)=	X(338)=	20.00
XB(20)=	X(339)=	20.00
XB(21)=	X(340)=	20.00
XB(22)=	X(341)=	20.00
XB(23)=	X(342)=	20.00
XB(24)=	X(343)=	20.00
XB(25)=	X(344)=	20.00
XB(26)=	X(345)=	20.00
XB(27)=	X(346)=	20.00
XB(28)=	X(347)=	16.73
XB(29)=	X(348)=	20.00
XB(30)=	X(349)=	20.00
XB(31)=	X(350)=	20.00
XB(32)=	X(351)=	20.00
XB(33)=	X(352)=	20.00
XB(34)=	X(353)=	20.00
XB(35)=	X(354)=	20.00
XB(36)=	X(355)=	20.00
XB(37)=	X(356)=	20.00
XB(38)=	X(357)=	20.00
XB(39)=	X(358)=	20.00
XB(40)=	X(359)=	20.00
XB(41)=	X(360)=	20.00
XB(42)=	X(361)=	20.00
XB(43)=	X(362)=	20.00
XB(44)=	X(363)=	20.00
XB(45)=	X(364)=	20.00
XB(46)=	X(365)=	20.00
XB(47)=	X(366)=	20.00

CURRENT VALUE OF THE OBJECTIVE FUNCTION IS -0.9576200OE+03

THE LAST BASIC FEASIBLE SOLUTION IS OPTIMAL
OPTIMAL VALUE OF THE ORIGINAL OBJECTIVE FUNCTION IS 957.62

ภาคผนวก ฎ

ราคา ขนาดและน้ำหนักของผลิตภัณฑ์ บกด.

ราคาผลิตภัณฑ์กระเบื้องกระดาษ
Price List for Asbestos Cement Products

กระเบื้องลอนคู่ Roman Tiles

รายการสินค้า Description	ขนาด Size	นน. กก. Kgs.	ราคา List Price ยาว Uncoloured	แดง Red	เขียว Green
กระเบื้องลอนคู่ Roman Tile	50 x 120 cm.	6.0	32.50 (2110120)	45.00 (2113130)	45.00 (2115130)
	50 x 150 cm.	7.5	40.90 (2110150)	56.80 (2113160)	56.80 (2115160)

อุปกรณ์สำหรับกระเบื้องลอนคู่ Hand-mould Fittings for Roman Tiles

รายการสินค้า Description	ขนาด Size	นน. กก. Kgs.	ราคา List Price ยาว Uncoloured	แดง Red	เขียว Green
ครอบมุมลอนคู่ 10°15°20° Close Fitting Angle Ridge	50 x 45 cm.	2.0	20.25 (2150001)	27.75 (2153011)	27.75 (2155011)
ครอบปรับมุมลอนคู่ Two Piece Adjustable Ridge	ตัวบน 57 x 29 cm.	2.0	20.25 (2150002)	27.75 (2153012)	27.75 (2155012)
	ตัวล่าง57 x 27 cm.	2.0	20.25	27.75	27.75
ครอบตะเข้ลอนคู่ Hip Ridge	ตัวบน 30 x 78 cm.	2.9	20.25 (2150003)	27.75 (2153013)	27.75 (2155013)
	ตัวล่าง28 x 78 cm.	2.9	20.25	27.75	27.75
ปีนฝาลอนคู่ มุมจากซ้ายไปขวา Apron Flange มุมจากขวาไปซ้าย	50 x 20 x 10 cm.	1.2	20.25 (2150004)	27.75 (2153014)	27.75 (2155014)
ครอบเพิงแหงนลอนคู่ Eave Ridge	50 x 20 x 10 cm.	1.3	20.25 (2150005)	27.75 (2153015)	27.75 (2155015)

หมายเหตุ รายการที่ทำเครื่องหมายดอกจันทน์ไว้ เป็นสินค้านอกมาตรฐานการผลิต โปรดสอบถามไปยังบริษัทก่อน
Items with asterisks are non-standard products. Please inquire SCC.
ตัวเลขในวงเล็บคือรหัสสินค้า
Numbers in parentheses are product codes.
ราคาทั้งหมดนี้เป็นราคาสินค้าส่งมอบที่โรงงาน และราคาน้อาจเปลี่ยนแปลงได้
All prices quoted are for delivery ex-factory and are subject to changes without notice.

บปช. : เริ่มใช้ 18 กรกฎาคม 2526 SCC : Effective July 18,1983.

กระเบื้องลูกฟูกลอนเล็ก Small Corrugated Sheets

รายการสินค้า Description	ขนาด Size	นน. Kgs.	ราคา List Price ยาว Uncoloured	แดง Red	เขียว Green
กระเบื้องลูกฟูกลอนเล็ก Small Corrugated Sheet	54x120 cm.	5.3	29.50 (2120120)	39.50 (2123130)	39.50 (2125130)
	54x150 cm.	6.6	36.70 (2120150)	49.60 (2123160)	49.60 (2125160)

อุปกรณ์สำหรับกระเบื้องลูกฟูกลอนเล็ก Hand-Mould Fittings for Small Corrugated Sheet

รายการสินค้า Description	ขนาด Size	นน. Kgs.	ราคา List Price ยาว Uncoloured	แดง Red	เขียว Green
ครอบมุมลอนเล็ก 10°15°20° Close Fitting Angle Ridge	54x50 cm.	2.0	20.25 (2150021)	27.75 (2153031)	27.75 (2155031)
ครอบปรับมุมลอนเล็ก ตัวบน Two-Piece Adjustable Ridge ตัวล่าง	54x29 cm. 54x28 cm.	1.3	20.25 (2150022)	27.75 (2153032)	27.75 (2155032)
ครอบตะเข้ลอนเล็ก Hip Ridge	* 76x20 cm.	1.3	20.25 (2150023)	27.75 (2153033)	27.75 (2155033)
ครอบครึ่งวงกลมสำหรับตะเข้ Hip Ridge Cover	* 11x77 cm.	1.0	20.25 (2150026)	27.75 (2153036)	27.75 (2155036)
ชายฝาลอนเล็ก มุงจากซ้ายไปขวา Apron Flange มุงจากขวาไปซ้าย	* 54x20x10 cm.	1.3	20.25 (2150024)	27.75 (2153034)	27.75 (2155034)
ครอบเพิงแหงนลอนเล็ก Eave Ridge	* 15x15x54 cm.	1.5	20.25 (2150025)	27.75 (2153035)	27.75 (2155035)
ลูกฟูกลอนเล็กปลายงอน Eave Sheet	* 54x120 cm.	5.3	54.75 (2150017)	73.25 (2153027)	73.25 (2155027)

หมายเหตุ รายการที่ทำเครื่องหมายดอกจันทน์ไว้เป็นสินค้านอกมาตรฐานการผลิต โปรดสอบถามไปยังบริษัทก่อน
Items with asterisks are non-standard products. Please inquire SCC.
ตัวเลขในวงเล็บคือรหัสสินค้า
Numbers in parentheses are product codes.
ราคาทั้งหมดนี้เป็นราคาสินค้าส่งมอบที่โรงงาน และราคาน้อาจเปลี่ยนแปลงได้
All prices quoted are for delivery ex-factory and are subject to changes without notice.

บปช : เริ่มใช้ 18 กรกฎาคม 2526 SCC : Effective July 18, 1983

กระเบื้องลูกฟูกลอนใหญ่ Large Corrugated Sheet

รายการสินค้า Description	ขนาด Size	นน. กก. Kgs.	ราคา List Price ยาว Uncoloured
กระเบื้องลูกฟูกลอนใหญ่ Large Corrugated Sheet	* 102x120x0.6 cm.	15.7	100.00 (2130120)
	* 102x150x0.6 cm.	19.7	126.00 (2130150)
	* 102x180x0.6 cm.	23.6	151.00 (2130180)
	* 102x240x0.6 cm.	31.5	199.00 (2130240)

อุปกรณ์สำหรับกระเบื้องลูกฟูกลอนใหญ่ Hand-Mould fittings for Large Corrugated Sheets

รายการสินค้า Description		ขนาด Size	นน. กก. Kgs.	ราคา List Price ยาว Uncoloured
ครอบมุมลอนใหญ่ 10°15°20° Close Fitting Angle Ridge		* 102x45 cm.	4.5	46.00 (2150041)
ครอบปรับมุมลูกฟูกลอนใหญ่ Two-Piece Adjustable Ridge	ตัวบน	* 28x107 cm.	4.0	46.00 (2150042)
	ตัวล่าง	* 22x107 cm.	4.0	46.00
ชายฝาลอนใหญ่ Apron Flange	มุงจากซ้ายไปขวา มุงจากขวาไปซ้าย	* 10x15x120 cm.	2.7	46.00 (2150044)
ครอบเชิงชายลอนใหญ่ Eave Ridge		* 20x20x102 cm.	4.8	46.00 (2150045)

หมายเหตุ รายการที่ทำเครื่องหมายดอกจันหน้าไว้ เป็นสินค้านอกมาตรฐานการผลิต โปรดสอบถามไปยังบริษัทก่อน
Items with asterisks are non-standard products. Please inquire SCC.
ตัวเลขในวงเล็บคือรหัสสินค้า
Numbers in parentheses are product codes.
ราคาทั้งหมดนี้เป็นราคาสินค้าส่งมอบที่โรงงาน และราคาอาจเปลี่ยนแปลงได้
All prices quoted are for delivery ex-factory and are subject to changes without notice.

บปป : เริ่มใช้ 18 กรกฎาคม 2526 SCC : Effective July 18, 1983.

กระเบื้องแผ่นเรียบ Flat Sheet

รายการสินค้า Description	ขนาด Size	นน. กก. Kgs.	ราคา List Price ขาว Uncoloured
กระเบื้องแผ่นเรียบ Flat Sheet	120x120x0.4 cm.	10.1	56.00 (2140120)
	120x240x0.4 cm.	20.3	109.00 (2140240)
	120x240x0.6 cm.	30.5	158.50 (2140260)
	120x240x0.8 cm.	40.7	205.00 (2140280)

หมายเหตุ รายการที่ทำเครื่องหมายดอกจันหน้าไว้ เป็นสินค้านอกมาตรฐานการผลิต โปรดสอบถามไปยังบริษัทก่อน
Items with asterisks are non-standard products. Please inquire SCC.
ตัวเลขในวงเล็บคือรหัสสินค้า
Numbers in parentheses are product codes.
ราคาทั้งหมดนี้เป็นราคาสินค้าส่งมอบที่โรงงาน และราคาอาจเปลี่ยนแปลงได้
All prices quoted are for delivery ex-factory and are subject to changes without notice.

บปช : เริ่มใช้ 16 สิงหาคม 2525 SCC : Effective August 16, 1982

กระเบื้องโปร่งแสงตราช้าง

รายการสินค้า Description		น.น. กก. Kgs.	ราคา List Price ยาว Uncoloured	ยาวใส Clear	เหลือง Yellow	เขียว Green	น้ำเงิน Blue
แผ่นเรียบ Flat Sheet	120 x 100 cm.	2.1	230.00 (2340210)	230.00 (2340211)	230.00 (2344220)	230.00 (2345230)	230.00 (2346240)
ลอนคู่ Roman tile type sheet	50 x 120 cm.	1.2	130.00 (2310120)	130.00 (2310121)	130.00 (2314120)	130.00 (2315120)	130.00 (2316120)
	50 x 150 cm.	1.5	165.00 (2310150)	165.00 (2310151)	165.00 (2314150)	165.00 (2315150)	165.00 (2316150)
	* 50 x 180 cm.	1.8	200.00 (2310180)	200.00 (2310181)	200.00 (2314180)	200.00 (2315180)	200.00 (2316180)
ลูกฟูกลอนเล็ก Small Corrugated Sheet	54 x 150 cm.	1.6	175.00 (2320150)	175.00 (2320151)	175.00 (2324150)	175.00 (2325150)	175.00 (2326150)
	54 x 120 cm.	1.3	145.00 (2320120)	145.00 (2320121)	145.00 (2324120)	145.00 (2325120)	145.00 (2326120)
ลูกฟูกลอนใหญ่ Large Corrugated Sheet	*100 x 120 cm.	2.5	275.00 (2330120)	275.00 (2330121)	275.00 (2334120)	275.00 (2335120)	275.00 (2336120)
	*100 x 150 cm.	3.1	340.00 (2330150)	340.00 (2330151)	340.00 (2334150)	340.00 (2335150)	340.00 (2336150)
	*100 x 180 cm.	3.7	400.00 (2330180)	400.00 (2330181)	400.00 (2334180)	400.00 (2335180)	400.00 (2336180)
บานเกล็ด Louver sheet	60 x 120 cm.	1.3	145.00 (2350161)	145.00 (2350162)	145.00 (2354162)	145.00 (2355163)	145.00 (2356164)

หมายเหตุ รายการที่ทำเครื่องหมายดอกจันหน้าไว้ เป็นสินค้านอกมาตรฐาน โปรดสอบถามไปยังบริษัทก่อน
Items with asterisks are non-standard products. Please inquire SCC.
ราคาทั้งหมดนี้เป็นราคาสินค้าส่งมอบที่โรงงาน และราคานี้อาจเปลี่ยนแปลงได้
All prices quoted are for delivery ex-factory and are subject to changes without notice.

บปช : เริ่มใช้ 11 ตุลาคม 2525 SCC : Effective October 11, 1982.

สินค้าเบ็ดเตล็ด Miscellaneous Products

รายการสินค้า Description	ขนาด Size	รหัสสินค้า Code	นน. กก. Kgs.	ราคา List Prices ขาว Uncoloured	แดง Red	เขียว Green
กระเบื้องบานเกล็ด Vanetian Louver Sheet	* 40x120 cm.	2150061	4.8	49.00		
กระเบื้องบานเกล็ดพิเศษ Special Venetian Louver Sheet	60x120 cm.	2150108	6.6	71.00		
กระเบื้องราง Car Port Unit	* 84x500 cm. (แบบเก่า)	2150062	95.0	800.00		
	98x500 cm. (แบบใหม่)	2150067	82.0	700.00		
	* 98x400 cm.	2150077	65.6	550.00		
	* 98x380 cm.	2150068	62.3	530.00		
	* 98x300 cm.	2150078	49.2	430.00		
ครอบขันฝากระเบื้องราง Apron Flange	* 40x98 cm.	2150054	9.7	100.00		
ครอบคันกระเบื้องราง Cover For Apron Flange	* 8.4x120 cm.	2150050	5.0	53.00		
ครอบมุมกระเบื้องราง Closed Fitting Angle Ridges	*40x40x98 cm.	2150051	13.6	130.00		
กระเบื้องกันแล่ง Solar Screen	12x60 cm.	2150063	1.3	13.50		
พุกรองกระเบื้องบานเกล็ด Spacer Block for Venetian Sheet	-	2150064	0.2	5.25		
ปิดจั่ว Corner Piece	*24x24x120 cm.		4.4	47.00 (2150007)	61.75 (2153017)	61.75 (2155017
ครอบล่ามทั้ง วาย-ที Three Corner (Y and T)	*วาย 15°17°20°25°30° ที -		1.9	21.00 (2150006)	28.00 (2153016)	28.00 (2155016
กัมกรีต Gumcrete	0.5 Kg.	2790555	0.5	60.00		
	1.0 Kg.	2790556	1.0	100.00		
	5.0 Kg.	2790557	5.0	460.00		

หมายเหตุ * รายการที่ทำเครื่องหมายดอกจันทน้ำไว้เป็นสินค้านอกมาตรฐานการผลิต โปรดสอบถามไปยังบริษัทก่อน

* Items with asterisks are non-standard products. Please inquire SCC.

ตัวเลขในวงเล็บคือรหัสสินค้า

Numbers in parentheses are product codes.

ราคาทั้งหมดนี้เป็นราคาสินค้าส่งมอบที่โรงงาน และราคานี้อาจเปลี่ยนแปลงได้

All prices quoted are for delivery ex-factory and are subject to changes wihtout notice.

บปช : เริ่มใช้ 10 เมษายน 2525 SCC : Effective April 10, 1982.

รายการสินค้า Description		ขนาด Size	รหัสสินค้า Code	นน. Kgs.	หน่วย Unit	ราคาขายเร่รุ่ไป List Prices
กระเบื้องลอน 244	*	84x150 cm.	2150069	24.8	แผ่น	250.00
AC Corrugate 244	*	84x240 cm.	2150070	39.7	"	400.00
	*	84x300 cm.	2150071	49.6	"	500.00
กระเบื้องลอน 280	*	94x150 cm.	2150073	24.8	"	250.00
AC Corrugate 280	*	94x240 cm.	2150074	39.7	"	400.00
	*	94x300 cm.	2150075	49.6	"	500.00
ครอบทับหลัง AC Cap	*	15.5x120x0.8 cm.	2150072	5.06	อัน	53.00
*โต๊ะสนาม Table			2150101	8.3	ตัว	260.00
*เก้าอี้สนาม Stool			2150102	5.0	"	155.00
*สีทาหลังคากระเบื้อง ASBESTOS CEMENT ROOFING PAINT						
ขาว	White		2790100	4.00	กระป๋อง	250.00
เหลือง	Yellow		2790101	4.00	"	250.00
น้ำตาล	Brown		2790102	4.00	"	250.00
แดง	Red		2790103	4.00	"	250.00
ส้ม	Orange		2790104	4.00	"	250.00
เขียว	Green		2790105	4.00	"	250.00
เขียวไพร	Olive-Green		2790106	4.00	"	250.00
แสด	Terra-Cotta		2790107	4.00	"	250.00
ฟ้า	Light-Blue		2790108	4.00	"	250.00
เทา	Grey		2790109	4.00	"	250.00
*สีสำหรับทาภายในและภายนอกอาคาร INTERIOR AND EXTERIOR EMULSION PAINTS						
สีออฟไวท์	Off White		2790150	4.0	กระป๋อง	250.00
สีแมกโนเลีย	Magnolia		2790151	4.0	"	250.00
สีไวล์ดไรซ์	Wild Rice		2790152	4.0	"	250.00
สีซิลเวอร์มิสท์	Silver Mist		2790153	4.0	"	250.00
สีอาส์เกรย์	Ash Gray		2790154	4.0	"	250.00

หมายเหตุ รายการที่ทำเครื่องหมายดอกจันหน้าไว้เป็นสินค้านอกมาตรฐานการผลิต โปรดสอบถามไปยังบริษัทก่อน
Items with asterisks are non-standard products. Please inquire SCC.
ราคาทั้งหมดนี้เป็นราคาสินค้าส่งมอบที่โรงงาน และราคานี้อาจเปลี่ยนแปลงได้
All prices quoted are for delivery ex-factory and are subject to changes without notice.

สินค้าเบ็ดเตล็ด Miscellaneous Products

รายการสินค้า Description	ขนาด Size	รหัสสินค้า Code	นน. กก. Kgs.	ราคา List Price
กระเบื้องลูกฟูกลอนใหญ่โค้ง R232 Large Corrugated Curved Sheet	* 83x251.5 cm. (แบบเก่า)	2150140	27.0	273.00
กระเบื้องลูกฟูกลอนใหญ่โค้ง Large Corrugated Curved Sheet	* 83x226 cm. (แบบใหม่)	2150151	24.3	246.00
กระเบื้องแบบเซลล์ Large Corrugated Curved Sheet	* 102.5x220 cm.	2150145	28.9	292.00

อุปกรณ์สำหรับกระเบื้อง Accessories

รายการสินค้า Description	ขนาด Size	รหัสสินค้า Code	นน. กก. Kgs.	ราคา List Price
สลักเกลียว	12" (30 cm.)	2550501	0.08	1.75
Hook Bolt	16" (40 cm.)	2550502	0.10	2.25
สลักเกลียวยึดบานเกล็ด	9" (23 cm.)	2550511	0.06	2.25
Screw Bolt for Louver Sheet	10" (25 cm.)	2550512	0.07	2.50
ขอยึดสำหรับลูกฟูกลอนเล็ก	6" (15 cm.)	2520521	0.04	โรงงานขายเอง
Clip for Small corrugated Sheet	8" (20 cm.)	2520522	0.05	1.25
ขอยึดสำหรับลอนคู่	6" (15 cm.)	2510531	0.06	โรงงานขายเอง
Clip for Roman Tile	8" (20 cm.)	2510532	0.07	1.25
	10" (25 cm.)	2510533	0.10	1.50
ตะปูเกลียว	2.5" (6.25 cm.)	2550541	0.02	1.00
Coach Screw	3.0" (7.50 cm.)	2550542	0.02	1.25
	4.0" (10.0 cm.)	2550543	0.03	1.50

ราคาทั้งหมดนี้เป็นราคาสินค้าส่งมอบที่โรงงาน และราคานี้อาจเปลี่ยนแปลงได้
All prices quoted are for delivery ex-factory and are subject to changes without notice.

บปช : เริ่มใช้ 10 เมษายน 2525 SCC : Effective April 10, 1982.

ภาคผนวก ฏ

งวดบัญชีรายสัปดาห์ ประจำปี 2527

สัปดาห์ที่	วันที่/เดือน		เดือน	สัปดาห์ที่	วันที่/เดือน		เดือน
	จาก	ถึง			จาก	ถึง	
1	2/01	8/01	มกราคม	27	2/07	8/07	กรกฎาคม
2	9/01	15/01		28	9/07	15/07	
3	16/01	22/01		29	16/07	22/07	
4	23/01	29/01		30	23/07	29/07	
5	30/01	5/02	กุมภาพันธ์	31	30/07	5/08	สิงหาคม
6	6/02	12/02		32	6/08	12/08	
7	13/02	19/02		33	13/08	19/08	
8	20/02	26/02		34	20/08	26/08	
9	27/02	4/03	มีนาคม	35	27/08	2/09	กันยายน
10	5/03	11/03		36	3/09	9/09	
11	12/03	18/03		37	10/09	16/09	
12	19/03	25/03		38	17/09	23/09	
13	26/03	1/04		39	24/09	30/09	
14	2/04	8/04	เมษายน	40	1/10	7/10	ตุลาคม
15	9/04	15/04		41	8/10	14/10	
16	16/04	22/04		42	15/10	21/10	
17	23/04	29/04		43	22/10	28/10	
18	30/04	6/05	พฤษภาคม	44	29/10	4/11	พฤศจิกายน
19	7/05	13/05		45	5/11	11/11	
20	14/05	20/05		46	12/11	18/11	
21	21/05	27/05		47	19/11	25/11	
22	28/05	3/06	มิถุนายน	48	26/11	2/12	ธันวาคม
23	4/06	10/06		49	3/12	9/12	
24	11/06	17/06		50	10/12	16/12	
25	18/06	24/06		51	17/12	23/12	
26	25/06	1/07		52	24/12	30/12	

แผนกระบบบัญชีและรายงาน สำนักงบประมาณ

1 ตุลาคม 2526

ภาคผนวก ฐ

ตัวอย่างการคำนวณเพื่อการพยากรณ์ปริมาณความต้องการสินค้า

ในบทที่ 5 ได้แสดงถึงหลักการและผลสรุปของการพยากรณ์ปริมาณความต้องการสินค้าแต่ละชนิดไว้แล้ว ในภาคผนวก ฐ นี้จะแสดงถึงรายละเอียดของการพยากรณ์ดังกล่าว โดยในที่นี้จะแสดงตัวอย่างเฉพาะการพยากรณ์ปริมาณความต้องการผลิตภัณฑ์ 2150001(10^{o}) เท่านั้น เพื่อเป็นแนวทางแก่ผู้ที่ต้องการศึกษาถึงรายละเอียด

ในวิทยานิพนธ์ฉบับนี้ มีหลักการพยากรณ์ปริมาณความต้องการซึ่งจะแบ่งเป็นขั้นตอนได้ดังนี้

(1) ศึกษารูปแบบปริมาณความต้องการผลิตภัณฑ์ในอดีต ว่ามีรูปแบบประเภทใด เช่น ผลิตภัณฑ์ 2150001 (10^{o}) ดังรูปที่ 5.1 นั้นแสดงให้เห็นว่าปริมาณความต้องการผลิตภัณฑ์ดังกล่าวขึ้นกับอิทธิพลแนวโน้มและอิทธิพลด้านฤดูกาล จึงทำการพยากรณ์ด้วยวิธีการของวินเตอร์ส

(2) จากข้อมูลปี 2524-5 ทำการกะประมาณเส้นตรงด้วยวิธีการกำลังสองที่น้อยที่สุด และหาปัจจัยของฤดูกาลแบบผลคูณของแต่ละคาบ ซึ่งได้ผลดังนี้

ระยะตัดแกนที่ช่วงเริ่มต้น	=	33,143.7617	ชิ้น
ค่าความชันของเส้นแนวโน้ม	=	-389.7373	ชิ้น/เดือน
ปัจจัยของฤดูกาลแบบผลคูณเดือนมกราคม	=	0.6906	
ปัจจัยของฤดูกาลแบบผลคูณเดือนกุมภาพันธ์	=	0.9741	
ปัจจัยของฤดูกาลแบบผลคูณเดือนมีนาคม	=	1.8007	
ปัจจัยของฤดูกาลแบบผลคูณเดือนเมษายน	=	1.3149	
ปัจจัยของฤดูกาลแบบผลคูณเดือนพฤษภาคม	=	1.6225	
ปัจจัยของฤดูกาลแบบผลคูณเดือนมิถุนายน	=	0.9608	
ปัจจัยของฤดูกาลแบบผลคูณเดือนกรกฎาคม	=	0.7145	
ปัจจัยของฤดูกาลแบบผลคูณเดือนสิงหาคม	=	0.9432	
ปัจจัยของฤดูกาบแบบผลคูณเดือนกันยายน	=	0.7995	

ปัจจัยของฤดูกาลแบบผลคูณเดือนตุลาคม = 0.6222

ปัจจัยของฤดูกาลแบบผลคูณเดือนพฤศจิกายน = 0.8189

ปัจจัยของฤดูกาลแบบผลคูณเดือนธันวาคม = 0.7379

(3) หาค่าดุลย์ถ่วง ซึ่งถือเป็นค่าคงที่ของตัวแบบการพยากรณ์ที่เหมาะสม (ในที่นี้คือ α, β และ γ) ด้วยหลักการแบบลองผิดลองถูก (Trial and Error) เพื่อให้ค่าผลรวมกำลังสองของความคลาดเคลื่อน (Residual Sum of Square) ต่ำที่สุดด้วย ความคลาดเคลื่อนดังกล่าวหาได้จากความแตกต่างระหว่างค่าพยากรณ์กับค่าความต้องการที่แท้จริงของปี 2526

ผลจากการคำนวณ (ดูภาคผนวก ค) ได้ว่า ค่าดุลย์ถ่วงที่เหมาะสมที่สุด คือ $\alpha = 0.25$, $\beta = 0.05$ และ $\gamma = 0.05$ เพราะจะทำให้มีค่าผลรวมกำลังสองของความคลาดเคลื่อนของค่าพยากรณ์ในปี 2526 มีค่าต่ำที่สุด คือ 0.6845584×10^8

(4) ผลจากค่าดุลย์ถ่วงที่ได้ในข้อ (3) จะนำมาปรับค่าระยะ ตัดแกนที่ช่วงเริ่มต้นค่าความชันของเส้นแนวโน้ม และปัจจัยของฤดูกาลแบบผลคูณของแต่ละเดือนเสียใหม่ โดยการควบคุมค่าเฉลี่ยและค่าความเบี่ยงเบนมาตรฐานของความคลาดเคลื่อนของค่าพยากรณ์ด้วยหลักการของแผน-ภูมิควบคุม ดังแสดงผลการคำนวณในหน้าที่ 167 ของภาคผนวก ค

โดยผลจากการปรับค่าดังกล่าว จะได้ค่าที่ทันสมัยสำหรับการพยากรณ์ปริมาณความต้องการสำหรับปี พ.ศ. 2527 ดังนี้

ระยะตัดแกนที่ช่วงเริ่มต้น	=	24,533.9883	ชิ้น
ค่าความชันของเส้นแนวโน้ม	=	-365.0374	ชิ้น/เดือน
ปัจจัยของฤดูกาลแบบผลคูณสำหรับเดือนมกราคม	=	0.6919	
ปัจจัยของฤดูกาลแบบผลคูณสำหรับเดือนกุมภาพันธ์	=	0.9745	
ปัจจัยของฤดูกาลแบบผลคูณสำหรับเดือนมีนาคม	=	1.8012	
ปัจจัยของฤดูกาลแบบผลคูณสำหรับเดือนเมษายน	=	1.3147	
ปัจจัยของฤดูกาลแบบผลคูณสำหรับเดือนพฤษภาคม	=	1.6228	
ปัจจัยของฤดูกาลแบบผลคูณสำหรับเดือนมิถุนายน	=	0.9609	
ปัจจัยของฤดูกาลแบบผลคูณสำหรับเดือนกรกฎาคม	=	0.7139	
ปัจจัยของฤดูกาลแบบผลคูณสำหรับเดือนสิงหาคม	=	0.9435	

ปัจจัยของฤดูกาลแบบผลคูณสำหรับเดือนกันยายน = 0.7994

ปัจจัยของฤดูกาลแบบผลคูณสำหรับเดือนตุลาคม = 0.6212

ปัจจัยของฤดูกาลแบบผลคูณสำหรับเดือนพฤศจิกายน = 0.8180

ปัจจัยของฤดูกาลแบบผลคูณสำหรับเดือนธันวาคม = 0.7382

ซึ่งผลจากการคำนวณดังกล่าวนี้ ได้ค่าเฉลี่ยของความคลาดเคลื่อน 317.7646 และค่าความเบี่ยงเบนมาตรฐานของความคลาดเคลื่อน 4,028.2371 และไม่มีค่าความคลาดเคลื่อนในคาบเวลาใดออกนอกพิกัดควบคุม ($\pm 3\sigma$) เลย จึงแสดงว่าค่าที่ใช้พยากรณ์ที่ปรับปรุงแล้วข้างบนนี้มีความเหมาะสมทุกค่า

(5) ทำการพยากรณ์ปริมาณความต้องการผลิตภัณฑ์แต่ละเดือนในปี พ.ศ. 2527 จากสมการที่ (5-5) ยกตัวอย่างเช่น

ปริมาณความต้องการเดือนมกราคม 2527 = [24,533.9883-(365.0374)(1)]0.6919

= 16,722.49 ชิ้น

ในทำนองเดียวกันสามารถหาค่าพยากรณ์ความต้องการในแต่ละเดือนที่เหลือได้ ด้วยการเปลี่ยนค่า τ ตามสมการ (5-5) เป็น 2,3,4,.....,12 โดยลำดับ ดังแสดงผลการพยากรณ์ในตอนล่างของหน้า 167 ตามที่สรุปผลไว้ในตารางที่ 5.2

(6) เมื่อมีข้อมูลปริมาณความต้องการที่แท้จริงของเดือนมกราคม 2527 เข้ามา การวิเคราะห์จะกลับไปที่ขั้นตอนที่ (4) เพื่อปรับค่าระยะตัดแกนที่ช่วงเริ่มต้น และค่าความชันของเส้นแนวโน้ม ณ เดือนมกราคม 2527 ตลอดจนการปรับค่าปัจจัยของฤดูกาลแบบผลคูณในแต่ละเดือน

โดยในขั้นตอนนี้ ถ้าหากว่าความคลาดเคลื่อนยังคงอยู่ในภาวะควบคุมเชิงสถิติการพยากรณ์คงดำเนินการต่อไป แต่ถ้าหากว่าความคลาดเคลื่อนในคาบเวลาใดเวลาหนึ่ง อยู่ในภาวะออกนอกการควบคุมเชิงสถิติ การวิเคราะห์จะต้องกลับไปที่ขั้นตอนที่ (1) หรือ (2) ใหม่ ทั้งนี้เพราะรูปแบบปริมาณความต้องการอาจเปลี่ยนไปแล้ว หรือควรจะต้องมีการปรับค่าดุลย์ถ่วงใหม่แล้ว โดยที่ผู้พยากรณ์จะต้องพิจารณาอย่างรอบคอบอีกขั้นหนึ่ง

ประวัติผู้เขียน

นายกิติศักดิ์ พลอยพานิชเจริญ เกิดเมื่อวันที่ 25 กันยายน 2498 ที่กรุงเทพมหานคร สำเร็จการศึกษาปริญญาวิศวกรรมศาสตรบัณฑิต (สาขาวิศวกรรมอุตสาหการ) จากสถาบันเทคโนโลยีพระจอมเกล้าธนบุรี เมื่อปี 2524 และได้เข้าศึกษาต่อขั้นปริญญามหาบัณฑิต สาขาวิศวกรรมอุตสาหการ ที่บัณฑิตวิทยาลัย จุฬาลงกรณ์มหาวิทยาลัย เมื่อปี 2525 ปัจจุบันรับราชการตำแหน่งอาจารย์ ประจำภาควิชาวิศวกรรมอุตสาหการ รวมทั้งปฏิบัติราชการในตำแหน่งเลขานุการคณะกรรมการประจำคณะวิศวกรรมศาสตร์ สถาบันเทคโนโลยีพระจอมเกล้าธนบุรี