Contents

	Intro Prefa	duction to the Series ace	ix xi
1.	TRANS	SPORTATION DEMAND MODELS	1
	1.1.	Air Transport Demand	1
	1.2.	The Supply of Air Transportation Services	2
	1.3.	A Classification of Demand Estimation Models	5
	1.4.	Macroscopic Models of Transportation Demand When Demand is a Function of Time	12
	1.5.	Macroscopic Models of Transportation Demand When Demand is a Function of Socio-Economic Characteristics	21
	1.6.	Trip Distribution Models	27
		1.6.1. Entropy Trip Distribution Models	29
		1.6.2. The Gravity Trip Distribution Model	43
	1.7.	Multimode Models to Estimate Transportation Demand	48
	1.8.	The Abstract Mode Model to Estimate the Number of Passengers on Intercity Traffic	50
	1.9.	Choice Models	56
		1.9.1. LOGIT Model	62
		1.9.2. Calibrating the LOGIT Model	66
	1.10.	Concluding Remarks on Air Transportation Demand	79
2.	MATCH Deman	IING TRANSPORTATION FACILITIES AND PASSENGER	81
	2.1.	Matching Transportation Facilities and Passenger Demand in Air Traffic	81

2.2.	The Importance of Flight Frequency Determination	. 82
2.3.	The Concept of Passenger Flows and Changes in Their Intensity Over Time	85
2.4.	The Passenger Load Factor	88
2.5.	Calculating the Number of Refused Passengers	90
2.6.	Flight Frequency and Air Carrier Competition	97
2.7.	Flight Frequency and the Quality of Service	101
2.8.	Determining Flight Frequency on a Route That Maximizes Air Carrier Profit	104
2.9.	An Analysis of the Effects of Flight Frequency on Average Airline Schedule Delay	112
2.10.	Determining Flight Frequency on a Route With Competition	126
2.11.	Simultaneously Determining Departure Times and Flight Frequency on a Route	131
2.12.	Determining Flight Frequencies on a Network Tha Provide the Highest Quality of Transportation Services with Existing Transportation Capacities	nt 145
2.13.	Determining Flight Frequencies on a Network That Minimize the Carrier's Operating Costs	155
2.14.	Aircraft Assignment to the Network	160
2.15.	Planning Frequency and Traffic Assignment in the Network	165
3. AIRL	INE SCHEDULE DESIGN MODELS	172
3.1.	Factors That Influence Airline Schedule Design	172
3.2.	Types of Airline Schedules	178
3.3.	A Classification of Airline Schedule Design Models	180

vi

CONTENTS

3.4.	The Sequential Approach to Airline Schedule Design	184
3.5.	Determining the Least Number of Aircraft Needed on a Network with Known Departure Times	197
3.6.	Method to Determine the Least Number of Aircraft Needed to Service a Network When There are Departure Time Windows	214
3.7.	The Effects of Meterological Conditions on Airline Schedule Design	238
3.8.	Designing an Airline Schedule with Maximum Reliability in Relation to Meteorological Conditions	243
3.9.	The Influence of the Aircraft Maintenance System on Designing an Airline Schedule	257
3.10.	Daily Operational Aircraft Assignment to the Planned Route	261
3.11.	Airline Schedule Perturbations	270
3.12.	Designing a New Airline Schedule to Minimize Total Delay When an Aircraft Breaks Down	272
4. CREW	SCHEDULING PROBLEMS	282
4.1.	Crew Scheduling	282
4.2.	Formulating Crew Scheduling Problems	284
4.3.	Crew Scheduling for Long-Haul Flights	290
4.4.	Crew Assignments in Short-Haul and Medium- Haul Traffic as a Set Partitioning Problem	311
4.5.	Heuristic Set Covering Algorithms for Large Airline Crew Scheduling Problems	345
4.6.	Crew Scheduling as a Graph Partitioning Problem	348

vii

CON	TENTS	5	
cont	TENTO		
LUIN	I EINIS	•	

4.7.	Interactive Computer Programs for Crew Scheduling Problems	53
4.8.	Rostering Crew Members to Planned Work Duties 36	55
4.9.	The "Day-by-Day" Crew Assignment Method 37	70
4.10.	The "Pilot-by-Pilot" Crew Assignment Method 37	71
4.11.	A Combined Heuristic Crew Assignment Method 37	12
4.12.	Calculating the Costs of Assigning Cabin Crew to Planned Rotations	79
4.13.	Determining the Number of Reserve Crew 38	33
5. SEAT	RESERVATION SYSTEMS 39	91
5.1.	Characteristics of the Seat Reservation Process	91
5.2.	The Optimal Reservation Level for Nonstop Flights with One Type of Air Fare	94
5.3.	The Optimal Reservation Level as a Function of Time Before Takeoff for a Nonstop Flight and One Air Fare)9
5.4.	The Optimal Reservation Level as a Function of Time Before Departure for a Flight With Two Legs and One Type of Air Fare on Each Leg 41	17
5.5.	Seat Allocation on a Nonstop Flight With Two Air Fares 42	24
5.6.	Seat Allocation on Flights With Several Legs When There are Several Air Fares 43	85
Referenc	ces	41
Index	•••••••••••••••••••••••••••••••••••••••	57

viii