CEE 5614: Analysis of Air Transportation Systems   Fall 2015

Final Project (Individual Assignment)

Date Due: December 14, 2015   Instructor: Trani

Deliverables:

a) Final report (10-15 pages includes figures and tables) with clear explanations of the solution to the problem. Include sample calculations and any supporting materials in your paper.

b) A one page description of the use of optimization in aviation.

Problem 1

A new airline wants to operate in the markets shown in Table 1. The table shows the forecast demands between each O-D pair. Table 1 shows the aircraft characteristics of the three aircraft considered in the analysis. The airline would be based in Charlotte, NC.

Table 1. OD Markets for the Proposed New Airline.

Origin-Destination Airports	Daily Demand (passengers)
CLT-ATL	424
ATL-CLT	502
CLT-LAS	190
LAS-CLT	176
CLT-BOS	320
BOS-CLT	310
LAS-ATL	165
ATL-LAS	173

Table 2. Aircraft characteristics for three possible aircraft considered by the new airline.

Aircraft	Seats	Hourly Cost ($/hr)	Utilization (hours/day)	Block Speed (knots)
Embraer 190	98	3,950	12.5	410
Airbus A320	160	4,875	12.5	440
Boeing 737-800	164	5,920	13.0	442

a) Find the number of flights needed on a daily basis to satisfy the demand function stated in Table 1 and minimize the cost to the airline.

b) Find the number of aircraft needed in the fleet to satisfy the demand and at the same satisfying the airline constraints.

c) Calculate the fares to be charged in each O-D pair if the airline wants to recover its full cost for service plus a 5% profit. In your calculation assume the hourly operating cost of the aircraft shown in Table 1 is 80% of the total operating cost of the carrier. That is, 20% of the cost of running is due to administrative and other costs not related to operation of the aircraft.

    d) Select the best aircraft (or aircraft - plural) for the airline considering the airports operated. In your analysis check that the aircraft considered are able to provide service from the airports shown in Table 1 at maximum takeoff weight. The aircraft performance including payload-range diagrams for the Embraer 190 can be found at : http://www.embraercommercialaviation.com/AMPS/APM_190.pdf.

Problem 2

An airline would like to schedule four flights between ATL and JFK to minimize the passenger schedule delay. Surveys done in Atlanta show that travelers would like to travel at times indicated by the demand function curve shown in Figure 1.

Time = [0 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24];

Demand = [0 0 42 64 60 41 10 8 8 15 20 32 35 45 62 54 31 23 16 5 0];
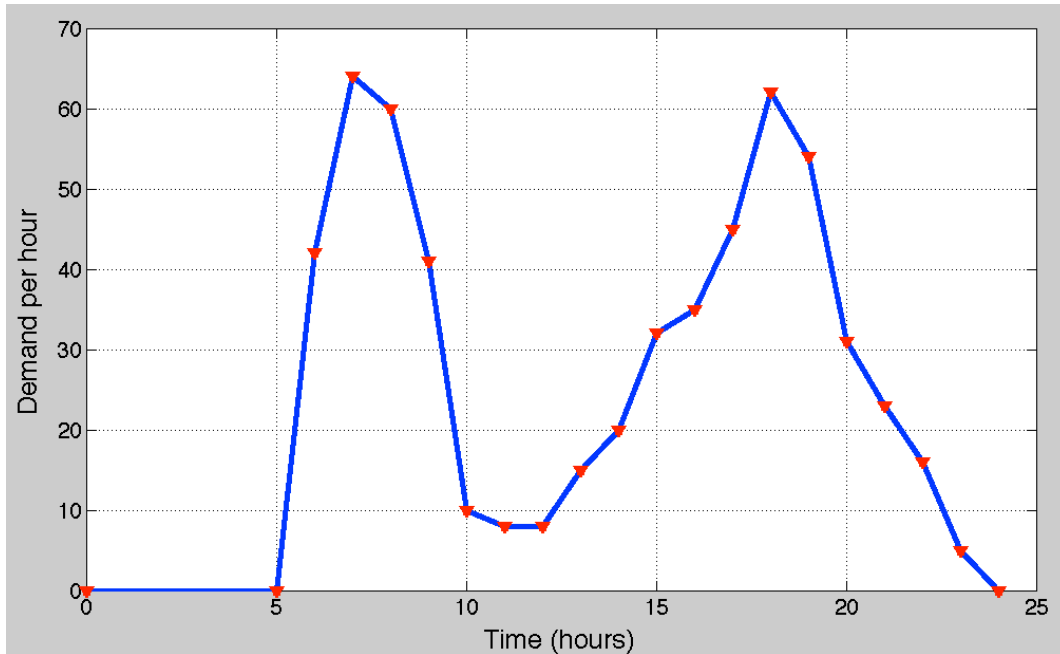

Figure 1. Demand function for Problem 1.

The airline would like to use Boeing 737-700 aircraft configured with 140 seats to satisfy the demand in this route.

a) Find the optimal departure times for four flights to minimize the schedule delay. The schedule delay is defined as the time difference between each traveler's departure time and the time when the airline offers a flight.

Show all your calculations.

b) Calculate the total delay for all passengers flying between ATL and JFK.

c) Will the solution change if the airline uses Boeing 767-200 aircraft instead with 204 seats? Explain.