Assignment 4: Air Transportation Systems Analysis

Date Due: October 26, 2012 Instructor: Trani

Problem 1

The National Airspace System is a complex system with thousands of commercial flights each day. The file nasOperations_2011.xls contains a sample of the activities that happened in the NAS on December 20, 2008. The header and a few flights are illustrated in Table 1.

Table 1. Sample NAS Flights File.

Flight ID	Aircraft Type	Type of Aircaft	Origin Airport	Destination Airport	Cruise Flight Level (feet/100)	Cruise Speed (knots)	Departure Time (hrs)	Arrival Time (hrs)	Distance Flown (nm)
BSK641	B738	J	MUHA	MIA	230	346	1.70	3.40	235.17
CSDKC	GLF5	J	OMA	DAL	190	337	13.83	16.15	586.62
EJA931	C750	J	FLL	APF	60	249	23.50	0.12	100.82
TSU132	CVLT	T	MDSD	BQN	150	279	23.63	0.40	166.49
ABX2217	B762	J	MIA	SPIM	340	471	22.78	4.55	2621.49
ABX2250	DC86	J	NGU	MUGM	320	450	12.13	15.20	1178.55
ABX2251	DC86	J	MUGM	NGU	380	453	17.18	20.77	1178.55
ABX38	B762	J	ZBAA	ANC	390	462	19.28	3.25	3950.40
AIP511	B190	T	HNL	MUE	130	219	11.30	12.32	171.82
AIP512	B190	T	MUE	HNL	120	219	12.63	13.65	171.82

Examine operations in the NAS performed by the Boeing 757 family (models B752, B753 and B757)

a) Find cruise flight levels assigned to all the aircraft stated above and observe if there is any correlation between cruise altitude and distance flown. Explain the trends observed.

b) For the aircraft fund in Part (a), create a histogram representing the stage length flown by the aircraft vs frequency of operations flying a given range of distances. I suggest you partition the range of distances into 15-30 bins.

c) For the aircraft fund in Part (a), create a histogram representing the cruise flight levels (cruise altitude s used by the aircraft vs frequency of operations(number of operations). I suggest you partition the range of distances into 15-20 bins.

Problem 2

a) For the medium size transport aircraft provided in the class web site (http://128.173.204.63/courses/cee5614/cee5614_pub/Boeing737800Jet_class.m), estimate the rate of climb and true airspeed for each one of the following climb conditions:

Flight Condition (altitude above sea level) in meters	Indicated Airspeed (knots)
500	190
1000	200
3000	230
5000	260
7000	260
9000	270
10000	270

In this solution calculate all the aerodynamic parameters using the parabolic drag model discussed in class.

b) Using the rate of climb values estimated in part (a), estimate the time to climb from sea level to cruise altitude (i.e., 10,000 meters).