Quiz 1 (Take Home)

Date: Solution Instructor: Trani

Open book and notes, use of computer is allowed

Honor Code Pledge

The information provided in this exam is my own work. I have not received information from another person while doing this exam.

Your Name : _____

Problem 1 (30 Points)

Show all your work and screen captures with formulas (if applicable) to receive credit.

The data provided in the spreadsheet (see Table 1) contains the aircraft fleet information for four airlines. A sample table is shown below.

	A	B	C	D	E	F
1	Airline Name	Manufacturer	Aircraft Type	Engine Type	Age (years)	Flight Hours (hrs)
2	Piedmont Airlines	Boeing	737-800	CFM56-7B26	15	49,395
3	Piedmont Airlines	Boeing	737-800	CFM56-7B26	15	50,645
4	Piedmont Airlines	Boeing	737-800	CFM56-7B26	15	52,307
5	Piedmont Airlines	Boeing	737-800	CFM56-7B26	15	51,355
6	Piedmont Airlines	Boeing	737-800	CFM56-7B26	15	51,007
7	Piedmont Airlines	Boeing	737-800	CFM56-7B26	15	52,181
8	Piedmont Airlines	Boeing	737-800	CFM56-7B26	15	52,759
9	Piedmont Airlines	Boeing	737-800	CFM56-7B26	15	51,672
10	Piedmont Airlines	Boeing	737-800	CFM56-7B26	15	52,188
11	Piedmont Airlines	Boeing	737-800	CFM56-7B26	15	49,545

a) Create a Pivot table that shows a summary the aircraft types own by each airline.

Count of Age (years)	Column Labels				
Row Labels	Blue Sky Airlines	Jet Fly Airlines	Piedmont Airlines	Rocky Mountain Airlines	Grand Total
190-100AR	20	20		20	60
737-300		1		1	2
737-400		29		29	58
737-800			221		221
757-200		23	104	23	150
757-200ER		1	6	1	8
767-200ER		10	14	10	34
767-300ER			59		59
777-200ER			47		47
777-300ER			9		9
A319-112		54	4	54	112
A319-115			6		6
A319-132	3	39		39	81
A320-214		23		23	46
A320-231		14		14	28
A320-232	4	35		35	74
A321-211	9	43		39	91
A321-231	47	59		49	155
A330-243	20	20		10	50
A330-323	9	9		9	27
DC-9-82 (MD-82)			113		113
DC-9-83 (MD-83)			79		79
Grand Total	**112**	**380**	**662**	**356**	**1510**

b) Create a second Pivot Table to display in one column, the average age of each aircraft group by company and in another column or row (your choice) the average number of hours flown by each aircraft type.

Average of Flight Hours (hrs)	Column Labels				
Row Labels	Blue Sky Airlines	Jet Fly Airlines	Piedmont Airlines	Rocky Mountain Airlines	Grand Total
190-100AR	23,402	23,344		22,959	23,235
737-300		69,212		84,049	76,631
737-400		68,314		81,616	74,965
737-800			24,021		24,021
757-200		69,065	65,230	71,320	66,752
757-200ER		72,299	70,069	42,257	66,871
767-200ER		84,658	93,016	84,440	88,036
767-300ER			67,606		67,606
777-200ER			45,790		45,790
777-300ER			4,386		4,386
A319-112		49,249	4,757	49,740	47,897
A319-115			4,075		4,075
A319-132	41,451	44,705		44,541	44,505
A320-214		43,710		43,794	43,752
A320-231		83,374		83,111	83,242
A320-232	42,090	45,931		46,055	45,782
A321-211	4,089	32,017		34,877	30,480
A321-231	11,415	10,899		11,830	11,350
A330-243	12,859	12,621		13,438	12,879
A330-323	46,892	46,233		47,228	46,784
DC-9-82 (MD-82)			83,331		83,331
DC-9-83 (MD-83)			67,012		67,012
Grand Total	**17,976**	**41,832**	**52,491**	**45,343**	**45,563**

Pivot table with number of flight hours for each aircraft type and airline.

c) Find the average age and the number of Boeing 737-800 and the DC-9-83 (MD-83) in the fleet of Piedmont Airlines.

Using the first pivot table, the Boeing 737-800 count with Piedmont is 221 aircraft. the table below shows the average age and distribution of aircraft by airline. Piedmont's Airlines average 6.9 years.

Average of Age (years)	Column Labels				
Row Labels	Blue Sky Airlines	Jet Fly Airlines	Piedmont Airlines	Rocky Mountain Airlines	Grand Total
190-100AR	6.7	6.7		6.7	6.7
737-300		20.0		25.0	22.5
737-400		20.2		24.2	22.2
737-800			6.9		6.9
757-200		20.5	19.3	21.4	19.8
757-200ER		21.0	21.0	13.0	20.0
767-200ER		24.9	27.6	24.9	26.0
767-300ER			20.1		20.1
777-200ER			13.4		13.4
777-300ER			1.2		1.2
A319-112		14.5	1.0	14.5	14.0
A319-115			1.0		1.0
A319-132	12.3	13.1		13.1	13.0
A320-214		12.8		12.8	12.8
A320-231		24.7		24.7	24.7
A320-232	12.5	13.5		13.5	13.4
A321-211	1.0	9.2		10.1	8.8
A321-231	3.1	3.0		3.2	3.1
A330-243	3.6	3.6		3.6	3.6
A330-323	13.7	13.7		13.7	13.7
DC-9-82 (MD-82)			24.8		24.8
DC-9-83 (MD-83)			19.8		19.8
Grand Total	**5.1**	**12.2**	**15.5**	**13.3**	**13.4**

d) Using another Pivot Table, find the average number of hours flown by Airbus A320-232 aircraft with engines of the type V2527-A5.

Airbus A320-232 with the V2527 engines average 45,782 hours.

e) Use Excel database function to find the number of A321-211 aircraft with CFM56-5B3/3B1 engines that are older than 8 years.

There are five Airbus A321-211 with the given engines. However, all the aircraft are younger than eight years old.
No matches found.

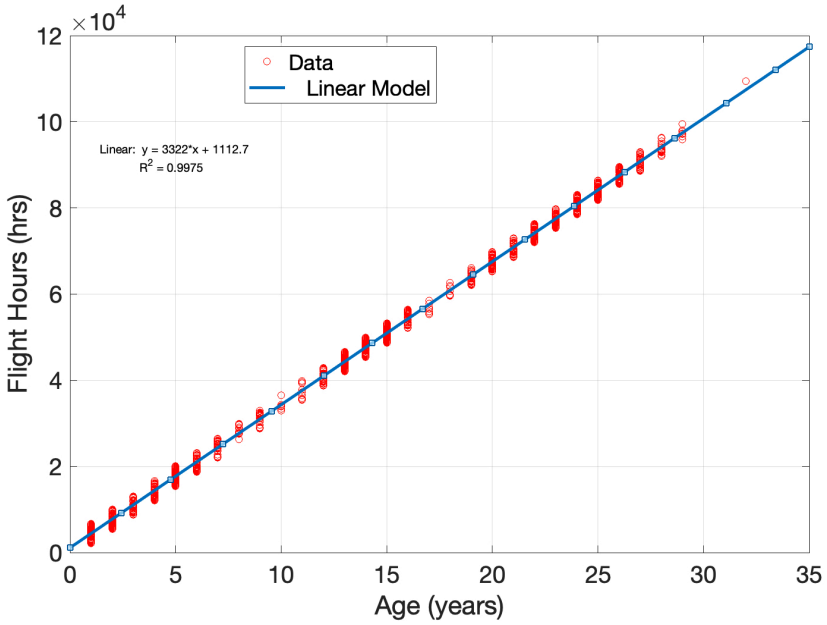
f) Use Excel database function to find the average flight hours of 767-200ER aircraft with CF6-80C2B2 engines.

There are 20 Boeing 767-200ER aircraft with CF6-80C2B2 engines.

g) Perform a linear regression using Excel or Matlab (your choice) to find the best equation of a line that relates flight hours vs. age for the entire fleet. Use the regression equation found to estimate the average flight hours of an aircraft that has been in service for 23.6 years.

A plot with the date trade is shown below.

The average number of flight hours is ~79510 for a 23.6 year-old aircraft.



Problem 2. (30 points)

Show all your work. Include screen captures the VBA code and the spreadsheet input and output data.

A formula to estimate the noise generated by a train is found to be:

Leq = SELref + 10 log(Ncars) + 20 log(S/50) + 10 log (V) – 31.6

where:

Leq = equivalent noise level (decibels - dBA)

SEL ref = reference sound exposure level (decibels - dBA)

Ncars = number of cars in the train

S = train speed (mph)

V = hourly average train volume (trains per hour)

log = natural log of the number

a) Write a **VBA subroutine (not a function)** without arguments in Visual Basic for Applications (VBA) to calculate the value of Leq given values of S (speed), SELref (sound exposure level), Ncars (train cars), and hourly train volume (V). The values of S, SELref, Ncars and V are entered in the worksheet and should be read by your Visual basic code. Write back the result from the Visual Basic code calculation obtained for Leq to the worksheet in cell B12.

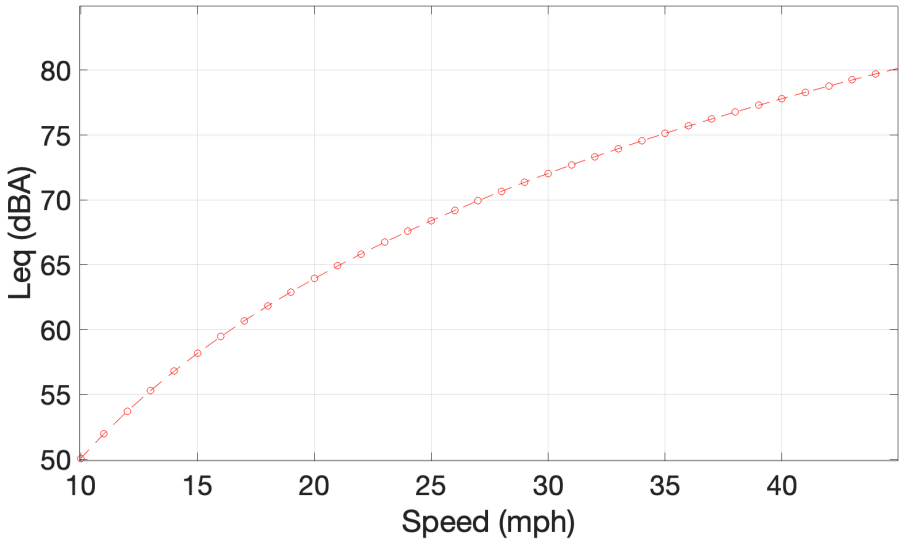
In your calculations assume the train has 12 cars, the hourly train volume is 30 trains/hr, Sref is 55, and the train travels at 45 mph.

b) Create a table with solution for Leq as a function of train speed. Use speed values ranging from 10 to 50 mph. The table should be created in VBA code.

The values of the VBA table are shown in the Figure below.

c) A sensitive community next to the train tracks requires trains to be operated below 65 dBA equivalent noise level. Using the solutions found in part (b) estimate the maximum speed of the train near the noise sensitive community.

The speed to stay below the 65 Leq level is 21 miles per hour.



Problem 3 (40 Points)

Show all your work. Include screen captures the Excel file and Solver panel.

An engineer formulates a linear programming with two decision variables as follows:

Maximize $Z = 250x_1 + 730x_2$

Subject to:

$x_1 + 2.1x_2 \le 63$

$1.26x_1 + 1.1x_2 \le 56$

$0.95x_2 - 1.30x_1 \le 10$

and

$x_1 \ge 0,\ x_2 \ge 0$

Add slack variables

$Z - 250x_1 - 730x_2$

Subject to:

$x_1 + 2.1x_2 + x_3 = 63$

$1.26x_1 + 1.1x_2 + x_4 = 56$

$0.95x_2 - 1.30x_1 + x5_3 = 10$

a) Write down the problem in Standard (canonical) form (see solution above with slack variables)

b) Solve the problem by hand using the Simplex method. Clearly show each tableau and the types of algebraic operations used in every step.

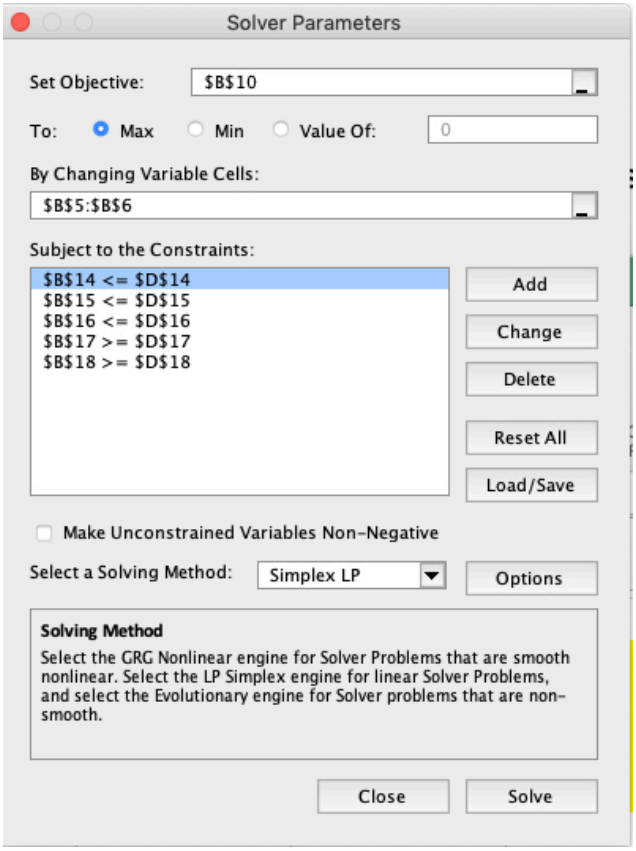
BV	Z	x1	x2	x3	x4	x5	RHS
	1	-250	-730	0	0	0	0
x3	0	1	2.1	1	0	0	63
x4	0	1.26	1.1	0	1	0	56
x5	0	-1.3	0.95	0	0	1	10

c) For each tableau indicate the current solution and the value of the objective function.

d) Find the optimal solution to the problem.

e) Solve the problem using Excel Solver to verify the manual answer. Show me the Solver panel and label accordingly.

Excel Solver solution including Solver Parameter Window. The optimal solution is x1= 10.557 and x2=24.973 with the value of the objective function Z at 20,869 units.



A	B	C	D	E
Optimization Problem for Q1				
Decision Variables				
x1	10.557		Decision variable 1	
x2	24.973		Decision variable 2	
Objective Function				
250 x1 + 730 x2	20869.43			
Constraint Equations				
	Formula			
x1 + 2.1 x2 <= 63	63.000	<=	63	
1.26 x1 + 1.1 x2 <= 56	40.772	<=	56	
0.95 x2 - 1.3 x1 <= 10	10.000	<=	10	
x1 >= 0	10.557	>=	0	
x2 >= 0	24.973	>=	0	