Quiz 1

Date: February 23, 2007   Instructor: Trani

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 _____

Your Signature _____

Write your solutions in a single MSWord file. Cut and Paste all your answers using screen captures. Show all your work. Label your file with your last name and CEE3804. Email your solutions to vuela@vt.edu and tao81@vt.edu. In the email header use the words CEE 3804 Quiz.

Problem 1 (40 Points)

An engineer formulates a linear programming problem as follows:

Maximize $Z = 50x_1 + 70x_2$

Subject to:

$x_2 \leq 125$

$x_1 + x_2 \leq 420$

and the non-negativity constraints $x_1 \geq 0$ and $x_2 \geq 0$.

a) Use **Excel Solver** to obtain the optimal solution. State the optimal value of Z.

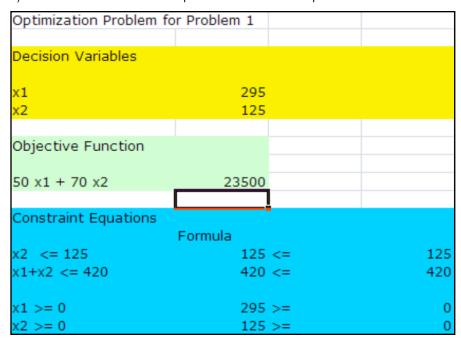| Optimization Problem for Problem 1			
Decision Variables			
x1	295		
x2	125		
Objective Function			
50 x1 + 70 x2	23500		
Constraint Equations	Formula		
x2 <= 125	125 <=		125
x1+x2 <= 420	420 <=		420
x1 >= 0	295 >=		0
x2 >= 0	125 >=		0

Figure 1. Solver Solution.

Optimal solution is x1 = 295 and x2 = 125. The value of Z is 23500.

b) Write down the first table to solve the problem using the Simplex method.

Transform the problem to canonical form by adding slack variables to change inequality constraints to equality constraints. Two slack variables are added in the problem.

Max. $Z - 50x_1 - 70x_2 = 0$

$x_2 + x_3 = 125$

$x_1 + x_2 + x_4 = 420$

Table 1. Initial Table of the Problem. Current Solution is: x_1, x_2, x_3, x_4 = [0 0 125 420]. Basic variables are x_3, x_4. Non-basic variables (i.e., those that are zero in the solution) are x_1, x_2.

Basic Variable	Z	x_1	x_2	x_3	x_4	RHS
	1	-50	-70	0	0	0
x_3	0	0	1	1	0	125
x_4	0	1	1	0	1	420

Problem 2 (30 Points)

A formula to estimate the noise generated by rail vehicles is,

$$L_{eq} = K_{ref} + 10\log(N_{cars}) + 20\log\left[\frac{v}{40}\right] + 10\log(q)$$

where:

L_{eq} = equivalent noise level (decibels in scale A - dBA)

K_{ref} = reference sound exposure level (decibels - dBA)

N_{cars} = number of cars in the train

v = train speed (mph)

q = hourly average train volume (trains per hour)

a) Write a simple **function** in Visual Basic for Applications (VBA) to calculate the value of L_{eq} given values of v (speed), K_{ref} (sound exposure level), N_{cars} (train cars), and hourly train volume (q). The function created takes four input values for v, K_{ref}, N_{cars} and q. The values of the four input variables are to be 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 L_{eq} to the worksheet.

```
Public Function Lequivalent(K, Ncars, v, q)
 ' Function to estimate the noise generated by a t

 '
 ' Programmer A.A. Trani
 ' Date : Feb/26/2012
 '
 ' Input parameters
 ' K = ref. sound (dBA)
 ' v = train speed (mph)
 ' Ncars = no. of cars
 ' q = volume of traffic (trains /hr)


|
    Lequivalent = K + 10 * Log(Ncars) + 20 * Log(v
End Function
```

Figure 2. Function Lequivalent.

b) Test your function using the following values: the train has 12 cars, the hourly train volume is 15 trains/hr and the train travels at 60 mph. The train studied is an electric locomotive with a reference sound exposure level value of 55 dBA.

Program to estimate the noise generated by a train

| Programmer | A.A. Trani |
| Date | feb/26/12 |

Formula   t = k + 10 * log(n) + 20*log(v/40)+10*log(q)

Inputs

Parameter		Units
K	55	dBA
Ncars	12	Cars per TU
v	60	mph
q	15	trains/hr

Output

| Lequivalent | 115.04 | dbA |

Figure 3. Testing the function Lequivalent.

Problem 3 (30 Points)

Short answers.

a) An engineer has developed two long formulas to estimate construction cost (C_c) and construction time (C_t) for a new bridge. These formulas require eleven parameter values to do the calculations. Should the engineer use a **function** or a **subroutine** to these calculations. Explain why.

Use a subroutine. The subroutine has the property to produce more than one output.

Examine the following VBA code.

```
  Sheets("sheet1").Select
  mass = Range("a8").Value

 If mass < 23000 Then
      aircraft = "Small"
 ElseIf mass > 115000 Then
      aircraft = "Heavy"
 Else
      aircraft = "Large"
 End If


  Sheets("sheet1").Select
  Range("b8").ClearContents
  Range("b8").Value = aircraft

End Sub
```

b) In three lines explain the purpose of the code.

- Select a value from the spreadsheet and assign to variable "mass"

- Given the mass, assign a string to variable "aircraft: to take one of three values: small heavy or large.

- Write down the "string" value assigned to aircraft into cell B8 (back to spreadsheet)

c) If the mass for an aircraft is 125000 kg what is the class assigned?

Heavy

2-Mar-10		
Check the VBA code behind		
Mass (kg)	Wake class	Calculate
125000	Heavy	