**CEE 3804 Exam1 (Spring 2024)**

**Computer Applications in Civil Engineering**

**In-Class Exam: Open Book and Notes**

Your Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Your Signature \* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* The answers in this exam are the product of my own work. I certify that I have not received, nor I have provided help to others while taking this examination.

**Directions:**

Solve the problems. Copy and paste the VBA code and solutions such as graphs in a Word Document and convert to a single PDF file. **Make sure your code is not too small for me to be able to read it.** Minimum font size 12 is acceptable.

**Problem 1 (30 points)**

Figure 1 shows a file containing marine dock facilities in the United States and US Territories. The file is provided in the assignments website.

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| Figure 1. Docks in the United States and US Territories. |

The fields in the file are explained below.

**Name** - name of the facility.

**Facility** - type of facility (docks, anchorages, junctions, etc.)

**State** - the State or US territory.

**Waterway name** - name of the waterway where the facility is located.

**Port name** - name of the port where the facility is located.

1. Create a Pivot Table (a matrix) to **count the number of facilities** (in columns) for each state (in rows).
2. Tell me the **number of docks** in the state of Florida (FL) and in Guam (GU).
3. Create a **Pivot Chart to count the number each type of facility**. Make sure the Pivot Chart has labels.

**Show me the upper left portion of the Pivot Table and the full Pivot Chart. Highlight the numbers with your answers.**

**Problem 2 (30 points)**

Engineers test a new commuter train and measure the noise level generated at different speeds. One of the civil engineers in the team, proposes a quadratic regression equation to approximate the noise level produced as a function of speed.

$$L\_{eq}=A+BV+CV^{2}$$

where:

$L\_{eq}$ is the equivalent noise level produced by the train (in decibels - dBA)

$V$ is the train speed (in miles per hour)

$A,B,C$ are the regression constants of the model.

After numerous tests, the numerical values of the constants $A,B,C$ are:

*A* = 40.486

*B* = 1.2984

*C* = -0.0086

All constants are dimensionally correct to produce a value of $L\_{eq}$ in decibels (a unit of noise level).

1. Write a **Public Function in VBA** to estimate the equivalent noise level ($L\_{eq}$) as a function of train speed ($V$). Use the equation provided in your function. Use **Option Explicit in your code.**
2. Test the function created in part (a) to estimate the value of $L\_{eq}$ for speed values ranging from 10 to 60 miles per hour at intervals of 10 mph. Show the value of $L\_{eq}$ for each speed tested. To test the function, use Excel and create a two-column table with values of speed (in column A) and the calculated values of $L\_{eq}$ in column B. **You do not have to create the table in VBA code.**

S**how me all your code in screen captures.** **Unreadable font size will not be accepted. Please make sure the equivalent font size of the screen capture is at least 12.**

**Problem 3 (40 points)**

A common problem in Civil Engineering is to estimate the deflection of a cantilever beam at different stations (see Figure 3).

$y=\frac{Px^{2}}{6EI}(3l-x)$ **(Equation 1)**

Where:

$y$ is the deflection at any point in the beam (inches)

$x$ is the distance from the wall to any point on the beam (inches)

$P$ is the load applied (lbs.)

$l$ is the length of the beam (inches)

$E$ is the modulus of elasticity (lb/in2)

$I$ is the moment of inertia (in4)

The units in this model are all consistent.

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| Figure 3. Cantilever Beam Subject to a Single Load (P). |

Table 1 shows the values of $E$ (Modulus of Elasticity) for three materials.

Table 1. Values of Modulus of Elasticity for Two Materials.

| **Material** | **E (lb/in2)** |
| --- | --- |
| **Steel** | 2.9E+07 |
| **Titanium** | 1.65E+07 |

1. **Create a Visual Basic Subroutine** to estimate the beam deflection ($y$) given the parameters on the right-hand side of Equation 1. The values of $x$ , $P$ , $l$ , and $I$ are defined in the Excel spreadsheet and then read by the VBA code. The VBA code reads the beam **material property as a list with the names** of the two materials in Table 1. The value of $E$ (modulus of elasticity) is assigned in the VBA code once the beam material has been selected from the spreadsheet. The value of deflection ($y$) is shown in the spreadsheet. Use **Option Explicit in your code.**
2. Test the function created in part (a) with the following values:

$x$ = 174 inches

$P$ = 2000 lbs.

$l$ =250 inches

Material = Steel

$I$ = 200 in4

S**how me all your code in screen captures.** **Unreadable font size will not be accepted. Please make sure the equivalent font size of the screen capture is at least 12.**