

CEE 3804: Computer Applications in Civil Engineering Spring 2026

Assignment 2: Excel Pivot Tables and Excel Functions

Date Due: February 9, 2026 (Midnight).

Instructor: Trani

Show all your work including screen captures of Excel pivot tables, VBA code, etc. Create a single PDF file for the complete homework and submit a single file.

Problem 1

Use the California Transit Company file provided to answer the following questions. Figure 1 shows a sample view of the file.

	A	B	C	D
1	City	Bus Type	Odometer (Miles)	Route length (miles)
2	Los Angeles	Gillig Hybrid 40	110,498	35.6
3	San Diego	Van Hool AG500	260,756	10.9
4	Los Angeles	Van Hool AG500	71,010	17.0
5	San Diego	New Flyer Xcelsior	132,532	22.2
6	San Luis Obispo	Van Hool AG500	200,620	17.4
7	San Jose	New Flyer Xcelsior	208,128	15.0
8	San Diego	New Flyer Xcelsior	49,451	35.8
9	Los Angeles	Gillig Hybrid 40	148,989	27.2
10	San Jose	New Flyer Xcelsior	91,645	13.0

Figure 1. Sample View of Transit Company Buses.

- Create a Pivot Table to summarize the number of buses of each type owned by the company. Show a screen capture of the Pivot Table. Create the Pivot Tables in the assignment in separate tabs to help you organize your answers.
- Create another Pivot Table to summarize the number of buses owned by the company by type and by city (show a matrix). Show a screen capture of the Pivot Table.
- Create another Pivot Table to calculate the average route lengths at each city. Show a screen capture of the Pivot Table. Name the cities with the shortest and longest average route length.
- Use Excel to create a histogram of the the odometer readings for all buses operating in San Luis Obispo. Label your axes accordingly.
- Find the mean odometer reading for buses operated in San Diego.

f) Create a Pivot Chart showing the average odometer readings by city. Label accordingly.

Problem 2

Civil engineers design and maintain the US airport infrastructure. According to Federal Aviation Administration (FAA) records, there are 19,520 landing facilities (airports, heliports, seaplane bases, etc.) in the United States. A file containing US landing facilities is provided. Figure 2 partially illustrates the landing facility data as of January 20, 2026. With the file provided, answer the following questions:

	A	B	C	D	E	F
1	Facility Type	Identifier	State Id	State Name	County	County State
2	AIRPORT	18AA	AK	ALASKA	HAINES	AK
3	HELIPORT	AA35	AK	ALASKA	HAINES	AK
4	AIRPORT	AK46	AK	ALASKA	MATANUSKA-SUSITNA	AK
5	AIRPORT	ADK	AK	ALASKA	ALEUTIANS WEST	AK
6	AIRPORT	9AA9	AK	ALASKA	HAINES	AK
7	AIRPORT	5AK3	AK	ALASKA	FAIRBANKS NORTH STAR	AK
8	AIRPORT	AK10	AK	ALASKA	MATANUSKA-SUSITNA	AK
9	AIRPORT	AKK	AK	ALASKA	KODIAK ISLAND	AK
10	SEAPLANE BASE	KKI	AK	ALASKA	BETHEL	AK
11	AIRPORT	Z13	AK	ALASKA	BETHEL	AK
12	AIRPORT	AKI	AK	ALASKA	BETHEL	AK

Figure 2. Sample View of United States Airport Database.

- Use a Pivot Table to find the number of landing facilities **by state**. Landing facilities can be airports, heliports, sea plane bases, etc. Show me the first few rows of the Pivot Table.
- Use another Pivot Table to find the number of airports (label in column A is airport) by state. Show me the first few rows of the Pivot Table.
- Using a Pivot Table, find the number of **public use airports** in California. Public airports are identified by the letters PU in column (J). Highlight in yellow the answer to help grading.
- Create a new Pivot Table to find the number of airports that have paved runways in Texas and Virginia. Highlight in yellow the answers to help grading.
- Use a **CountIF** statement to find the number of airports located at elevations greater than 3,000 feet.
- Make a scatter plot of the landing facility Longitude (column N) and landing facility Latitude (column M). Label your axes. Comment on the location of the landing facilities contained in the file.

Problem 3

Use the car data file provided in class (week 1) to answer the following.

Model	Country	Type	Weight_lbs	Turning Circle_ft	Displacement_clnch	Horsepower_hp	Gas Tank Size_gallons
Acura Integra	Japan	Small	2700	37	112	130	13.2
Acura Legend V6	Japan	Medium	3265	42	163	160	18
Audi 100	Other	Medium	2935	39	141	130	21.1
Audi 80	Other	Compact	2670	35	121	108	15.9
Audi 90	Other	Compact	2790	35	141	130	15.9
BMW 325i	Other	Compact	2895	35	152	168	16.4
BMW 535i	Other	Medium	3640	39	209	208	21.1
Buick Century	USA	Medium	2880	41	151	110	15.7

- a) Perform a polynomial regression using Excel to estimate the best regression model that relates vehicle the engine horsepower plotted in the x-axis, and the gas tank size (plotted in the y-axis). Use the **trend analysis function** in Excel to estimate the polynomial coefficients A , B , C of the curve that fits the data best. The second-order polynomial equation is of the type:

$$GT = A(HP^2) + B(HP) + C$$

Where:

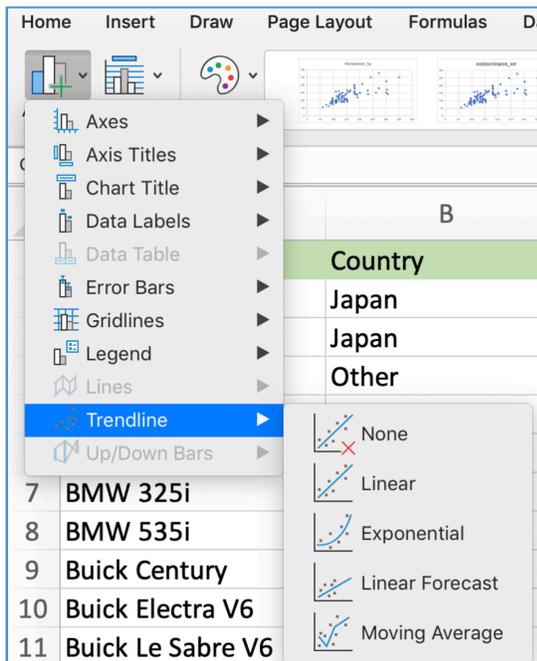
GT is the gas tank size (gallons)

HP is the engine horsepower (horsepower)

A , B , C are the polynomial coefficients of the trend line found by Excel.

The steps to make a trend line from a chart are:

- i) Select the chart.
- ii) Click the + button on the right side of the chart or select the Add Chart Element in the Chart Design Tab.
- iii) Select the Trendline and make your selection of Options (see figure below).



Making a Trend Line in Excel.

- b) Create a function using Visual Basic for Applications (VBA) to calculate the gas tank size (dependent variable) given the engine horsepower.
- c) Test the function created in part (b) to estimate the engine horsepower expected for engine horsepower ranging from 75 to 250 at steps of 5 HP. Make a plot to check your solution.
- d) A 2023 Toyota Camry has a four-cylinder, 203 horsepower engine. Use the function created in part (c) to estimate the gas tank size.

Problem 4

A simple formula used by Civil Engineers to predict **Storm Water Runoff** is shown below.

$$Q = C_f CIA$$

Where:

Q is the peak storm water runoff rate (ft³/second)

C_f is the runoff coefficient adjustment factor (dimensionless)

C is the runoff coefficient (dimensionless and depends on the surface)

I is the rainfall intensity (inches/hour)

A is the drainage area (acres)

Table 1 shows typical values of the runoff coefficient (C) for various surfaces.

Table 1. Typical Values of Runoff Coefficient for Various Surfaces.

Surface	Runoff Coefficient (dimensionless)
Forested	0.13
Asphalt	0.85
Concrete	0.88
Brick	0.75

- Create an Excel function to calculate the runoff (Q) given four inputs: C_f , C , I , A . The function takes four inputs and produces one output.
- Test the function created in part (b) to estimate the runoff generated by a large asphalt parking lot with a drainage area of 7.5 acres. Assume a 100-year storm rainfall rate of 8.2 inches/hr. For typical applications, the value of C_f is 1.0.
- Perform a sensitivity analysis to estimate the runoff (Q) as a function of drainage area (A). Create a table in Excel with drainage areas ranging from 1 to 20 acres at steps of one acre. For this part assume the drainage surface is asphalt. Assume a 100-year storm rainfall rate of 8.2 inches/hr.
- Plot the drainage area (independent variable) versus the runoff (dependent variable). Label accordingly.
- Repeat the analysis of part (c) but assume the drainage area is forested.

- f) Improve the plot created in part (d) by adding the new runoff values for a forested drainage area. Comment on the trends observed.

Problem 5

A simple formula used by Civil Engineers to Stopping Sight Distance (SSD) on level grade is shown below. The SSD is an important parameter in the design of highways.

$$SSD = 1.47Vt + 1.075V^2/a$$

Where:

SSD is the stopping sight distance (feet)

V is the highway design speed (miles per hour)

t is braking reaction time (seconds)

a is the vehicle design deceleration rate (ft/s²)

Table 1 shows typical values used in highway design for level grades (no slope).

Table 1. Typical Values of Runoff Coefficient for Various Surfaces.

Design Parameter	Value
Braking Reaction Time	2.5 seconds
Design deceleration rate	11.2 ft/s ²

- Create an Excel function to calculate the value of SSD given three inputs: V , a , t . The function takes three inputs and produces one output.
- Test the function created in part (a) to estimate the stopping sight distance (SSD) for design speeds ranging from 0 to 80 miles per hour at 5 mph intervals. Make a table with the results for SSD.
- Plot the value of SSD (independent variable) versus the highway design speed (dependent variable). Label accordingly.
- Compare the values obtained with your function and those published in the Texas DOT Roadway Design Manual (see <https://www.txdot.gov/manuals/des/rdw/chapter-4--basic-design-criteria/4-11-sight-distance.html#:~:text=SSD = 1.47Vt + 1.075 V,Table 4-24>).