

Assignment 3: Excel Pivot Tables and Excel Functions

Date Due: February 5, 2023.

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

ID	StateNumber	RestStopName	Highway	MilePost	Municipality	County	State	Latitude_deg	Longitude_deg	Spots
1	1	Grand Bay Welcome Center	I-10 EB	0.485	Grand Bay	Mobile	AL	30.477238	-88.393032	90
2	1	Baldwin County Welcome Center	I-10 WB	65.8	Seminole	Baldwin	AL	30.575718	-87.418285	27
3	1	Houston County Welcome Center	US-231 NB / SB	0.706	Cottonwood	Houston	AL	31.006808	-85.407686	8
4	1	Covington County Rest Area	US-331 NB / SB	8.002	Floral	Covington	AL	31.090454	-86.296196	5
5	1	Conecuh County Rest Area (NB)	I-65 NB	84.208	Evergreen	Conecuh	AL	31.336613	-87.114501	22

Truck Rest Stop Data.

Use the truck rest stop data provided to answer the following questions.

- Use a Pivot Table to summarize the number of truck stops by state. Show a screen capture of the Pivot Table.
- Use another Pivot Table to summarize the total number of truck stops by state. Show a screen capture of the Pivot Table.
- List the five states with the highest total number of truck stops.
- Use the LEN command in Excel to find the number of characters contained in the Highway field. Just show me a sample of the first 20 entries (rows).
- Find the longest Highway name using the information on part (d).

Problem 2

	A	B	C	D	E	F	G
1	Length_ofRoadSegment_mi	State_Province	RoadNumber	RoadName	Surface	NoLanes	SpeedLimit_kmhr
2	1.57	Alaska		AHMOAGAK AVE	Paved	2	88
3	1.41	Alaska		AHMOAGAK AVE	Paved	2	88
4	30.48	Alaska	S11	JAMES DALTON HWY	Unpaved	2	80
5	0.13	Alaska	S11	JAMES DALTON HWY	Unpaved	2	80
6	21.61	Alaska	S11	JAMES DALTON HWY	Unpaved	2	80
7	13.91	Alaska	S11	JAMES DALTON HWY	Unpaved	2	80
8	20.51	Alaska	S11	JAMES DALTON HWY	Unpaved	2	80
9	38.64	Alaska	S11	JAMES DALTON HWY	Unpaved	2	80
10	1.82	Alaska	S11	JAMES DALTON HWY	Unpaved	2	80
11	25.94	Alaska	S11	JAMES DALTON HWY	Unpaved	2	80

Use the highway segment file provided to answer the following questions. This problem requires that you use Excel Pivot Tables.

- Summarize the number of road/highway segments by state. Show a screen capture of the Pivot Table.
- Find the average number of lanes for all road segments belonging to each state. Show a screen capture of the Pivot Table.
- Find the top ten states with the highest average speed limit for their road/highway segments.
- Find the average speed limit (km/hr) for all the road/highway segments in every state. Show a screen capture of the Pivot Table.

e) Create a Pivot Table to quickly find the total number of miles of unpaved roads and ferry segments. Show a screen capture of the Pivot Table.

Problem 3

Use the car data file provided in class (week 1) to answer the following questions. This problem requires that you use Excel database functions explained in class. **Using IF statements to classify the data is not allowed.**

Show all your work and provide screen captures of your work and **include the actual database commands** used to make each query.

- Calculate the average gas tank size for cars produced in the US with weight > 2,500 lbs.
- Calculate the average engine displacement for Japanese cars whose tank size > 14.7 gallons.
- Count the number of cars produced in the US with horsepower > 135 HP and turning circle > 36 feet.
- Count the number of cars produced in Japan with tank size > 14.8 feet and weight < 3200 lbs.

Problem 4

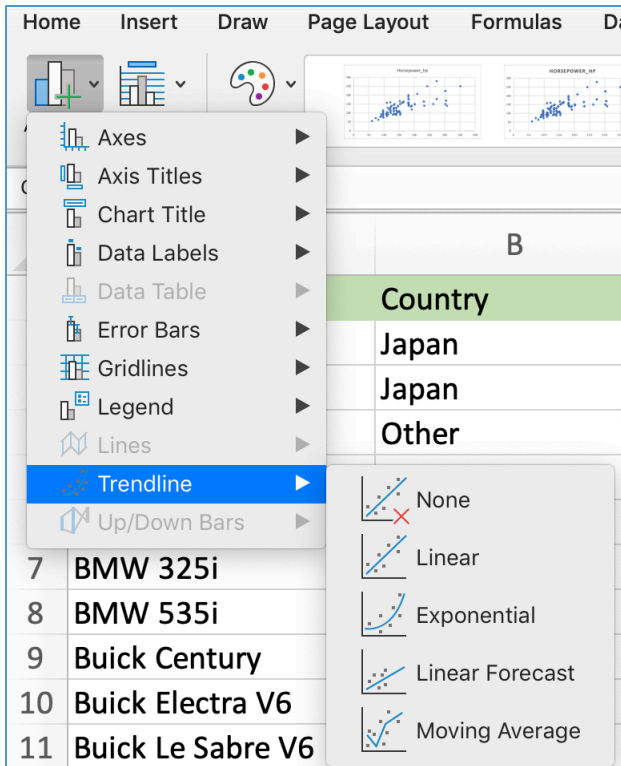
Use the car data file provided in class (week 1) to answer the following.

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

- Perform a **linear regression** using Excel to estimate the best regression model that relates vehicle the engine displacement (in cubic inches) and plotted in the x-axis, and engine horsepower (in the y-axis). Use the **trend analysis function in Excel** to estimate the equation of the line that fits the data best.

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

- Select the chart.
 - Click the + button on the right side of the chart or select the Add Chart Element in the Chart Design Tab.
 - Select the Trendline and make your selection of Options.
- Create a function in Excel (using VBA) to calculate the vehicle horsepower (dependent variable) given the engine displacement.
 - Test the function created in part (c) to estimate the engine horsepower expected for engine displacements ranging from 100 to 300 cubic inches. Make a plot to check your solution.



Problem 5

Figure 1 shows the typical dimensions of an oil tanker in meters.

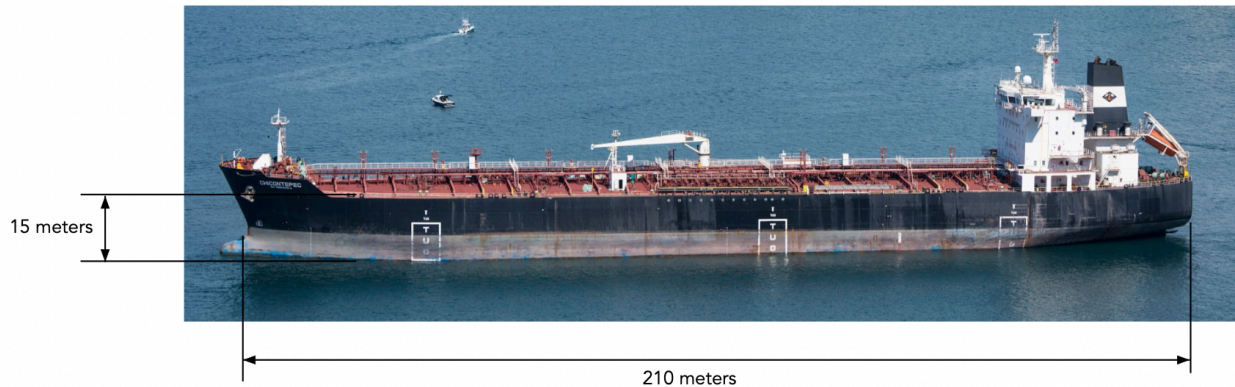


Figure 1. Dimensions of an Oil Tanker.

The equations to estimate the sail drag (lateral force acting on the tanker when subjected to crosswinds) and the power required to overcome the "sail" drag force are presented below:

$$D_{sail} = \frac{1}{2} \rho V_c^2 S_a C_d$$

D_{sail} = sail drag (Newtons)

V_c = crosswind speed (m/s)

ρ = air density (kg/cu. meter)

S_a = sail area (square meters)

C_d = drag coefficient (dimensionless)

$$P_{sail} = D_{sail} V_c$$

P_{sail} = power to overcome sail drag (Watts)

The air density at sea level conditions is 1.225 kg/cu.meter. The ship's sides act as flat plates that generate resistance force with a drag coefficient (C_d) value of 0.95. The ship's sail area is the lateral area of the ship above the water line exposed to crosswinds. You can estimate the sail area using Figure 1.

- a) Create an Excel function (Public Function) to calculate the ship's sail drag with a crosswind speed of 20 m/s. The function should take the ship's parameters (including the ship's dimensions) and estimate the sail drag (Newtons). Note that all units in the equations above are consistent.
- b) Perform a sensitivity analysis to estimate the sail drag (force) as a function of wind speed. Create a table in Excel with wind speeds ranging from 0 to 25 m/s at steps of 2.5 m/s and calculate the sail drag force.
- c) Plot sail drag (y-axis) versus wind speed (m/s).