Course: **CVE 593 – Special Topics in Civil Engr**
Task: **Homework #1**
Due Date: **Sep 25, 2022 at 11:59 PM**

Problem 1 (10 Points)

A table below gives the travel times and distances of a delivery truck. Use these data to write a python function to compute the average speed required to drive on each route and identify the route that has the highest average speed.

	1	2	3	4	5
Distance (mi)	560	440	490	530	370
Time (hr)	10.3	8.2	9.1	10.1	7.5

Hints: Your solution will look like the code below

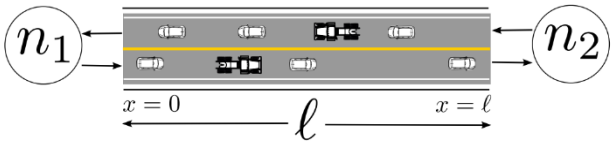
```
def truck_average_speed(....):

    write your code here

    return highest_speed_route
```

Problem 2 (10 Points)

A section of a freeway below, which start at n_1 and end at n_2 has a segment length of L. The calibrated speed-density relationships follow the equations below:



Greenshields model: $u = 65.1(1 - 0.0075k)$

Greenberg model: $u = 62.1 \ln(157/k)$

Where, u is speed, k is density

Task: Write **<u>one python function</u>** that return speeds at any given density value. The prepared function must return two speeds, one for Greenshields model and one for Greenberg model. Test the code using the following density: [43, 50, 8, 31] vehicle per miles.

```
def calculate_speed(....):

    write your code here

    return Greenshields_model_speed, Greenberg_model_speed
```

Problem 3

You are provided with the survey data that were collected from 327 people gathering information about the preference of using autonomous vehicles over the human driven cars. The data dictionary are as follows:

Column label	Question	Description
Gender	Are you?	1 = Female, 2 = Male
Home	Do you currently live in a household you consider home?	1 = Yes, 2 = No
Annual_household_income	What is the approximate annual household income ?	1 = no income, 2 = under $10K, 3 = 10K – 19K , 4 = $20K – 29K, 5 = $30K – 39K, 6 = $40K – 49K, 7 = $50,K – 74K, 8 = 75K – 99K, 9 $100K – 149K, and 10 = 150K or more
Use_of_autonomous_vehicles	How likely are you to adopt a fully autonomous vehicles?	1 = extremely unlikely, 2 = Unlikely, 3= Not sure, 4 = Likely, 5 Extremely likely.
Age	What is your age?	

Data: Copy and paste the following lines in a Jupyterlab or Jupyter Notebook and run the code

```
import pandas as pd
df = pd.read_csv("http://cee.eng.usf.edu/faculty/flm/CGN6933/TTE6307-MID(21).txt",
            delimiter = "\t",  header=None
            )
dxf = df.iloc[:,[24,22, 29, 30, 20]]
dxf.columns = ['Age', 'Gender', 'Home', 'household', 'Use_of_autonomous_vehicles']
```

```
import pandas as pd
df = pd.read_csv("http://cee.eng.usf.edu/faculty/flm/CGN6933/TTE6307-MID(21).txt",
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```

```
dxf
```

	Age	Gender	Home	household	Use_of_autonomous_vehicles
0	25	2	2	5	4
1	36	1	1	7	1
2	45	2	1	7	1
3	28	2	1	7	4
4	37	1	1	8	2
...	...	...	...	...	...
322	25	2	1	1	4
323	38	2	1	7	1
324	29	1	1	7	4
325	58	1	1	10	2
326	59	2	1	10	1

327 rows × 5 columns

Task: Prepare a descriptive statistics, crosstab, and figures of the given data **(Use python or R program).** Use the figure and cross tabulation results you prepared to answer the following questions:

a. Which gender group is extremely more likely to adopt the autonomous vehicle? (10 Points)
b. What is the relationship between adopting autonomous vehicles and income? (10 Points)
c. What is the relationship between adopting autonomous vehicles and age? (10 Points)

Submit your solution together with your code to receive full points