CS544 Module 2 Assignment

Part1) Probability - 25 points

Use the Bayes theorem to calculate the following probabilities. Show the **individual steps** of the Bayes theorem. You can use R for the calculations. Use the Word document for this part.

Suppose that in a particular state, among 10000 people surveyed, 4250 people are in the age group *18-34* years, 2850 people are in the age group *35-49* years, 1640 people are in the age group *50-64* years, and the remaining are *65 years & over*.

Out of those in the age group *18-34* years, 1062 people had a BMI of above 30. Of those in the age group *35-49* years, 1710 people had a BMI of above 30. Among those in the *50-64* years range, 656 people had a BMI of above 30. In the last age group, 189 people had a BMI of above 30.

a) What is the probability that a randomly selected person in this survey will have a BMI of above 30?

b) If a randomly selected person had a BMI of above 30, what is the probability of that person being in the age group 18-34 years?

c) If a randomly selected person had a BMI of above 30, what is the probability of that person being in the age group 35-49 years?

d) If a randomly selected person had a BMI of above 30, what is the probability of that person being in the age group 50-64 years?

e) If a randomly selected person had a BMI of above 30, what is the probability of that person being in the 65 years & over?

Part2) Random Variables - 25 points

Consider a game which involves rolling **three** dice. Write the **R code** for the following.

Using the **rollDie** function from the **prob** library, setup the sample space for this experiment with the probability space.
For each of the following scenarios from **a)** through **e)**, show the corresponding **outcomes** and the **probability** of that event. The sample outputs for **b)** are shown as example.

a) The sum of the rolls is greater than 6 but less than 10.

b) All the three rolls are identical.

Sample Output for outcomes:

```
    X1 X2 X3   probs
1    1  1  1 0.00463
44   2  2  2 0.00463
87   3  3  3 0.00463
130  4  4  4 0.00463
173  5  5  5 0.00463
216  6  6  6 0.00463
```

Sample Output for probability:

```
[1] 0.02778
```

c) Only two of the three rolls are identical.

d) None of the three rolls are identical.

e) Only two of the three rolls are identical given that the sum of the rolls is greater than 6 but less than 10.

Part3) Functions - 20 points

Using a **for** loop or a **while** loop, write your own **R function**,
sum_of_first_N_even_squares (***n***),
that returns the sum of the squares of the first **n** positive even numbers.

For example, if n = 5, the first five even numbers are 2, 4, 6, 8, 10 and the required result is $2^2 + 4^2 + 6^2 + 8^2 + 10^2 = 220$.

Test your function as follows:

```
> sum_of_first_N_even_squares(2)
[1] 20
> sum_of_first_N_even_squares(5)
[1] 220
> sum_of_first_N_even_squares(10)
[1] 1540
```

Now, **without** using any loop, write your own **R function**,
sum_of_first_N_even_squares_V2 (***n***),
that returns the sum of the squares of the first **n** even numbers.

Test your function as follows:

```
> sum_of_first_N_even_squares_V2(2)
[1] 20
> sum_of_first_N_even_squares_V2(5)
[1] 220
> sum_of_first_N_even_squares_V2(10)
[1] 1540
```

Part4) R - 30 points

Initialize the Tesla stock data for the year 2021 using the read.csv function as shown below:

tsla <- read.csv("https://people.bu.edu/kalathur/datasets/TSLA.csv")

The first 6 rows of the dataset are as shown below:

```
> head(tsla)
        Date Open High Low Close   Volume
1 2021-01-04  719  744 717   730 48638200
2 2021-01-05  724  741 719   735 32245200
3 2021-01-06  758  774 749   756 44700000
4 2021-01-07  778  817 775   816 51498900
5 2021-01-08  856  884 838   880 75055500
6 2021-01-11  849  854 804   811 59301600
```

Provide the simplest R code and corresponding outputs for the following.
The code should work for any given dataset.

a) Store the result of the **summary** function for the *Close* attribute as the variable *sm*. Change the *names* of this variable so that the output appears as shown below.

```
> sm
 Min   Q1   Q2 Mean   Q3  Max
 563  668  730  780  850 1230
```

b) Produce the output for the minimum price of the Tesla *closing* value in the dataset as shown below:

```
[1] "The minimum Tesla value of 563 is at row 44 on 2021-03-08"
[2] "The minimum Tesla value of 563 is at row 95 on 2021-05-19"
```

c) Produce the output for the maximum price of the Tesla *closing* value in the dataset as shown below:

```
[1] "The maximum Tesla value of 1230 is at row 213 on 2021-11-04"
```

d) Based on the dataset, what is the probability that on any given day, the Tesla *closing* price would be greater than the *opening* price?

e) Based on the dataset, what is the probability that on any given day, the Tesla trading *volume* would be greater than 20 million shares?

f) Based on the dataset, what is the probability that on any given day, the Tesla *closing* price would be higher than the *opening* price, given that the trading *volume* is greater than 20 million shares?

g) Suppose you bought 1 share of Tesla stock on each day in the dataset at its *open* price. How much net gain you would have using the last day closing price in the dataset as the reference?

h) Suppose you bought 1 share of Tesla stock on each day in the dataset at its *low* price. How much net gain you would have using the last day closing price in the dataset as the reference?

i) Suppose you bought 1 share of Tesla stock on each day in the dataset at its *high* price. How much net gain you would have using the last day closing price in the dataset as the reference?

Submission:

When the term *lastName* is referenced, please replace it with your last name.

Create a folder, **CS544_HW2_LastName** and place the following files in this folder.

Provide all R code in a single file, **CS544_HW2_LastName.R**. Clearly mark each subpart of each question.

Provide the corresponding outputs from the R console in a single Word document, **CS544_HW2_LastName**.doc.

Archive the folder (**CS544_HW2_LastName.zip**). Upload the zip file to the Assignments section of Blackboard.

Note: Only ONE submission is allowed. Please be sure that what you are submitting is your final submission.