**PGDM / PGDM (IB), 2020-22**
**Statistics for Decision Making in Python**
**DM-372/IB-372**
**Trimester – III, End-Term Examination: April 2021**

Time allowed: 2 Hrs 30 Min
Max Marks: 50

Roll No: _____

**Instruction:** Students are required to write Roll No on every page of the Answer Sheet. All other instructions on the question paper / notifications should be followed meticulously.
All problems have to be solved in Python and the code has to be submitted in .ipnyb format.

Where not mentioned use alpha of 0.05.

Detailed commentary along with stating of the null and alternative hypothesis is required.

Even when not explicitly mentioned make the confidence interval and state the p-values.

Save the file with your name and roll_number.

**Section A: 30 Marks**

A 1: 5 Marks - CLO1 & CLO4

Last month, the mean waiting time, at the drive-through window of McDonald's in Vasant Kunj, as measured from the time a customer places an order until the time the customer receives the order, was 3.5 minutes. You select a random sample of 49 orders. The sample mean waiting time is 2.5 minutes, with a sample standard deviation of 0.6 minute. (Use a 0.05 level of significance.)

Is the population mean waiting time different from 3.5 minutes?

A 2: 5 Marks - CLO1 & CLO4

Chips packets are labeled as 80 ounces, the company wants the packages to contain a mean of 80.5 ounces so that virtually none of the packages contain less than 80 ounces. A sample of 25 packages is selected periodically, and the packaging process is stopped if there is evidence that the mean amount packaged is different from 80.5 ounces. Suppose that in a particular sample of 25 packages, the mean amount dispensed is 80.12 ounces, with a sample standard deviation of 0.51 ounce. Is there evidence that the population mean amount is different from 80.5 ounces? (Use a 0.05 level of significance.)

A 3: 5 Marks - CLO1 & CLO4

A company that manufactures chocolate bars is particularly concerned that the mean weight of a chocolate bar is not greater than 6.03 ounces. A sample of 50 chocolate bars is selected; the sample mean is 6.034 ounces, and the sample. standard deviation is 0.02 ounce. Using the $\alpha = 0.01$ level of significance, is there evidence that the population mean weight of the chocolate bars is greater than 6.03 ounces?

A 4: 5 Marks - CLO2 & CLO4

| DISPLAY LOCATION | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Beverage End-Cap | | | | | Produce End-Cap | | | | |
| 22 | 34 | 52 | 62 | 30 | 52 | 71 | 76 | 54 | 67 |
| 40 | 64 | 84 | 56 | 59 | 83 | 66 | 90 | 77 | 84 |

Compare the sales between the two locations. Develop a confidence interval at alpha = 0.1. State the null hypothesis, alternative hypothesis and your results.

A 5: 5 Marks CLO2 & CLO4

You and some friends have decided to test the validity of an advertisement by a local pizza restaurant, which says it delivers to the dormitories faster than a local branch of a national chain. Both the local pizza restaurant and national chain are located across the street from your college campus. You define the variable of interest as the delivery time, in minutes, from the time the pizza is ordered to when it is delivered. You collect the data by ordering 10 pizzas from the local pizza restaurant and 10 pizzas from the national chain at different times. You organize and store the data in PizzaTime.

| Local | | Chain | |
|---|---|---|---|
| 16.8 | 18.1 | 22.0 | 19.5 |
| 11.7 | 14.1 | 15.2 | 17.0 |
| 15.6 | 21.8 | 18.7 | 19.5 |
| 16.7 | 13.9 | 15.6 | 16.5 |
| 17.5 | 20.8 | 20.8 | 24.0 |

At the 0.1 level of significance, is there evidence that the mean delivery time for the local pizza restaurant is less than the mean delivery time for the national pizza chain? What is the confidence interval?

A 6: 5 Marks CLO2 & CLO3
Using ANOVA check statistically if the returns of three stocks are same or different. Use alpha of 0.05 (see attached ANOVA1.csv)

**Section B: 20 Marks**

B1: 10 Marks CLO2 & CLO4

Perform a linear regression of the data. X is gestation and Y is birthweight

| Mammal | Birthweight | Gestation |
|---|---|---|
| Goat | 2.75 | 155 |
| Sheep | 4 | 175 |
| Deer | 0.48 | 190 |
| Porcupine | 1.5 | 210 |
| Bear | 0.37 | 213 |
| Hippo | 50 | 243 |
| Horse | 30 | 340 |
| Camel | 40 | 380 |
| Zebra | 40 | 390 |
| Giraffe | 98 | 457 |
| Elephant | 113 | 670 |

Explain your model with respect to the following:

a) Linearity
b) Normality
c) Variance and
d)R-squared

B2: 10 Marks CLO2 & CLO4

Develop the capital asset pricing model using beta data(CAPM.csv file). The “Market” represents excess premium over the risk free rate. The stock price of Merck is the excess over the risk free rate. Use Y: Merck and X: Market for your regression equation. Explain your assumptions and findings.

| Date | Alphabet | Facebook | Twitter |
|---|---|---|---|
| May 25, 2018 | 1,081.35 | 185.6266 | 33.77 |
| May 23, 2018 | 1,079.69 | 186.9 | 33.42 |
| May 22, 2018 | 1,069.73 | 183.8 | 32.86 |
| May 21, 2018 | 1,079.58 | 184.49 | 33.63 |
| May 18, 2018 | 1,066.36 | 182.68 | 32.63 |
| May 17, 2018 | 1,078.59 | 183.76 | 32.58 |
| May 16, 2018 | 1,081.77 | 183.2 | 32.77 |
| May 15, 2018 | 1,079.23 | 184.32 | 32.75 |
| May 14, 2018 | 1,100.20 | 186.64 | 33.39 |
| May 11, 2018 | 1,098.26 | 186.99 | 32.75 |
| May 10, 2018 | 1,097.57 | 185.53 | 32.87 |
| May 09, 2018 | 1,082.76 | 182.66 | 32.46 |
| May 08, 2018 | 1,053.91 | 178.92 | 31.85 |
| May 07, 2018 | 1,054.79 | 177.97 | 31.33 |
| May 04, 2018 | 1,048.21 | 176.61 | 31.04 |
| May 03, 2018 | 1,023.72 | 174.02 | 30.67 |
| May 02, 2018 | 1,024.38 | 176.07 | 30.55 |
| May 01, 2018 | 1,037.31 | 173.86 | 30.3 |
| Apr 30, 2018 | 1,017.33 | 172 | 30.31 |
| Apr 27, 2018 | 1,030.05 | 173.59 | 29 |
| Apr 26, 2018 | 1,040.04 | 174.16 | 30.27 |
| Apr 25, 2018 | 1,021.18 | 159.69 | 29.75 |
| Apr 24, 2018 | 1,019.98 | 159.69 | 30.47 |
| Apr 23, 2018 | 1,067.45 | 165.84 | 31.22 |
| Apr 20, 2018 | 1,072.96 | 166.28 | 31.91 |
| Apr 19, 2018 | 1,087.70 | 168.1 | 31.54 |
| Apr 18, 2018 | 1,072.08 | 166.36 | 31.54 |
| Apr 17, 2018 | 1,074.16 | 168.66 | 31.84 |
| Apr 16, 2018 | 1,037.98 | 164.83 | 28.58 |
| Apr 13, 2018 | 1,029.27 | 164.52 | 28.76 |
| Apr 12, 2018 | 1,032.51 | 163.87 | 29 |
| Apr 11, 2018 | 1,019.97 | 166.32 | 29.39 |
| Apr 10, 2018 | 1,031.64 | 165.04 | 29.53 |
| Apr 09, 2018 | 1,015.45 | 157.93 | 28.01 |
| Apr 06, 2018 | 1,007.04 | 157.2 | 28.1 |
| Apr 05, 2018 | 1,027.81 | 159.34 | 28.64 |
| Apr 04, 2018 | 1,025.14 | 155.1 | 28.25 |
| Apr 03, 2018 | 1,013.41 | 156.11 | 27.54 |
| Apr 02, 2018 | 1,006.47 | 155.39 | 28.04 |
| Mar 29, 2018 | 1,031.79 | 159.79 | 29.01 |
| Mar 28, 2018 | 1,004.56 | 153.03 | 28.45 |
| Mar 27, 2018 | 1,005.10 | 152.22 | 28.07 |
| Mar 26, 2018 | 1,053.21 | 160.06 | 31.91 |
| Mar 23, 2018 | 1,021.57 | 159.39 | 31.03 |
| Mar 22, 2018 | 1,049.08 | 164.89 | 31.2 |
| Mar 21, 2018 | 1,090.88 | 169.39 | 32.73 |
| Mar 20, 2018 | 1,097.71 | 168.15 | 31.35 |
| Mar 19, 2018 | 1,099.82 | 172.56 | 34.98 |
| Mar 16, 2018 | 1,135.73 | 185.09 | 35.58 |

| | | | |
|---|---|---|---|
| Mar 15, 2018 | 1,149.58 | 183.86 | 35.8 |
| Mar 14, 2018 | 1,149.49 | 184.19 | 36.6 |
| Mar 13, 2018 | 1,138.17 | 181.88 | 34.11 |
| Mar 12, 2018 | 1,164.50 | 184.76 | 35.5 |
| Mar 09, 2018 | 1,160.04 | 185.23 | 35.35 |
| Mar 08, 2018 | 1,126.00 | 182.34 | 34.85 |
| Mar 07, 2018 | 1,109.64 | 183.71 | 35.76 |
| Mar 06, 2018 | 1,095.06 | 179.78 | 34.43 |
| Mar 05, 2018 | 1,090.93 | 180.4 | 34.58 |
| Mar 02, 2018 | 1,078.92 | 176.62 | 33 |
| Mar 01, 2018 | 1,069.52 | 175.94 | 32.24 |
| Feb 28, 2018 | 1,104.73 | 178.32 | 31.86 |
| Feb 27, 2018 | 1,118.29 | 181.46 | 31.32 |
| Feb 26, 2018 | 1,143.75 | 184.93 | 32.16 |
| Feb 23, 2018 | 1,126.79 | 183.29 | 32.66 |
| Feb 22, 2018 | 1,106.63 | 178.99 | 32.11 |
| Feb 21, 2018 | 1,111.34 | 177.91 | 33.38 |
| Feb 20, 2018 | 1,102.46 | 176.01 | 32.84 |
| Feb 16, 2018 | 1,094.80 | 177.36 | 33.06 |
| Feb 15, 2018 | 1,089.52 | 179.96 | 33.61 |
| Feb 14, 2018 | 1,069.70 | 179.52 | 33.75 |
| Feb 13, 2018 | 1,052.10 | 173.15 | 33.44 |
| Feb 12, 2018 | 1,051.94 | 176.41 | 30.95 |
| Feb 09, 2018 | 1,037.78 | 176.11 | 31.51 |
| Feb 08, 2018 | 1,001.52 | 171.58 | 30.18 |
| Feb 07, 2018 | 1,048.58 | 180.18 | 26.91 |
| Feb 06, 2018 | 1,080.60 | 185.31 | 25.24 |
| Feb 05, 2018 | 1,055.80 | 181.26 | 25.13 |
| Feb 02, 2018 | 1,111.90 | 190.28 | 25.92 |
| Feb 01, 2018 | 1,167.70 | 193.09 | 27.14 |
| Jan 31, 2018 | 1,169.94 | 186.89 | 25.81 |
| Jan 30, 2018 | 1,163.69 | 187.12 | 25.62 |
| Jan 29, 2018 | 1,175.58 | 185.98 | 25.18 |
| Jan 26, 2018 | 1,175.84 | 190 | 24.27 |
| Jan 25, 2018 | 1,170.37 | 187.48 | 22.16 |
| Jan 24, 2018 | 1,164.24 | 186.55 | 22.37 |
| Jan 23, 2018 | 1,169.97 | 189.35 | 22.75 |
| Jan 22, 2018 | 1,155.81 | 185.37 | 23.32 |
| Jan 19, 2018 | 1,137.51 | 181.29 | 23.66 |
| Jan 18, 2018 | 1,129.79 | 179.8 | 24.04 |
| Jan 17, 2018 | 1,131.98 | 177.6 | 24.56 |
| Jan 16, 2018 | 1,121.76 | 178.39 | 24.66 |
| Jan 12, 2018 | 1,122.26 | 179.37 | 25.41 |
| Jan 11, 2018 | 1,105.52 | 187.77 | 24.35 |
| Jan 10, 2018 | 1,102.61 | 187.84 | 24.25 |
| Jan 09, 2018 | 1,106.26 | 187.87 | 24.17 |
| Jan 08, 2018 | 1,106.94 | 188.28 | 24.59 |
| Jan 05, 2018 | 1,102.23 | 186.85 | 24.32 |
| Jan 04, 2018 | 1,086.40 | 184.33 | 23.99 |
| Jan 03, 2018 | 1,082.48 | 184.67 | 24.45 |

| | | | |
|---|---|---|---|
| Jan 02, 2018 | 1,065.00 | 181.42 | 24.51 |

| Date | Annual Returns Excess of Risk Free | |
|---|---|---|
| (yyyymmdd) | Merck | Market |
| 19721229 | 0.46 | 0.18 |
| 19731231 | -0.08 | -0.17 |
| 19741231 | -0.16 | -0.27 |
| 19751231 | 0.06 | 0.38 |
| 19761231 | 0.00 | 0.26 |
| 19771230 | -0.16 | -0.05 |
| 19781229 | 0.26 | 0.07 |
| 19791231 | 0.10 | 0.22 |
| 19801231 | 0.21 | 0.33 |
| 19811231 | 0.03 | -0.04 |
| 19821231 | 0.04 | 0.21 |
| 19831230 | 0.10 | 0.23 |
| 19841231 | 0.08 | 0.06 |
| 19851231 | 0.50 | 0.32 |
| 19861231 | 0.85 | 0.17 |
| 19871231 | 0.30 | 0.03 |
| 19881230 | 0.12 | 0.18 |
| 19891229 | 0.37 | 0.30 |
| 19901231 | 0.19 | -0.04 |
| 19911231 | 0.89 | 0.31 |
| 19921231 | -0.20 | 0.08 |
| 19931231 | -0.18 | 0.11 |
| 19941230 | 0.15 | 0.00 |
| 19951229 | 0.76 | 0.35 |
| 19961231 | 0.24 | 0.21 |
| 19971231 | 0.36 | 0.32 |
| 19981231 | 0.41 | 0.19 |
| 19991231 | -0.07 | 0.10 |
| 20001229 | 0.42 | 0.04 |
| 20011231 | -0.36 | -0.08 |
| 20021231 | -0.01 | -0.18 |
| 20031231 | -0.11 | 0.29 |