**Group #\_\_\_\_\_\_\_**

**Group Leader and ID\_\_\_\_\_\_\_\_**

**Member Names and IDs\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Sectional Written Homework #1**: (**25 points**):

1. (6 points; 2 points \* 3) Consider two random variables X (0 = male; 1 = female) and Y (0= low risk; 1= medium risk; 2 = high risk) with a joint pmf given in the Table below.

Table Joint pmf of X and Y

|  |  |  |  |
| --- | --- | --- | --- |
|  | Y=0 | Y=1 | Y=2 |
| X=0 | 1/25 | 1/10 | 1/5 |
| X=1 | 2/5 | 4/25 | 1/10 |

Compute:

1. p (X = female, Y= high risk) = ?
2. p( X = female ) = ?
3. p (Y= high risk|X=female) = ?

Your answer:

1. (3 points) Suppose a success of a medical trial, X (yes/no), follows a true binomial population distribution. We randomly draw samples of size, n=30, from this binomial population distribution, with the probability of success =0.2. Answer the following questions:
2. Given this sample size (n=30), will the CLT hold true? Show your steps to show if the CLT holds true.

Your answer:

For a binomial distribution, CLT holds true if the minimum of np and n(1-p) is greater than or equal to 5, i.e.

Since

And

Therefore, the minimum of np and n(1-p) = 6 and CLT holds true.

1. If the CLT holds true, what is the mean of these sample means? What is the standard deviation of these sample means?

Note: Show your solution steps and no scores are assigned if only answers are provided. Remember you can receive partial scores for your solution steps even if your answer is incorrect.

Your answer: For a binomial distribution, we know that the mean of the population is

And the variance () of the population is

Since CLT holds true,

1. (4 points) Let’s assume the number of spams follows the Poisson distribution and we randomly draw samples of size =40, with the mean of sample means of 6. Estimate the population mean and the population standard deviation based on CLT.

Note: Show your solution steps and no scores are assigned if only answers are provided. Remember you can receive partial scores for your solution steps even if your answer is incorrect.

Your Answer:

# (12 points; 4 points\*3) Use R to

1. Randomly generate 10 rows (n=10) for each of three random variables (RVs), x1, x2, and x3, using a random seed = **490**, from a multivariate **Gaussian** distribution, with a population mean vector of [2, 4, 6] (ie., mean of X1= 2, mean of X2= 4, mean of X3= 6) and a population covariance matrix of these RVs (shown below):

X1 X2 X3

X1 4 3 2

X2 3 9 5

X3 2 5 36

Note: **please use the exact random seed = 490 for reproducibility**;

Please past your R code and randomly generated data output below:

Solution.

Graphical user interface, text, application

Description automatically generated

Table

Description automatically generated

1. Use relevant R functions to compute Expected Value (ie., mean), Median, Skewness and Kurtosis using the data generated for x1, x2 and x3 in Problem (a), respectively. Please past your R code for computing each statistic, and corresponding R output below:

Solution:

Graphical user interface, application

Description automatically generated with medium confidence

A picture containing text

Description automatically generated

1. Use relevant R functions to compute the correlation and covariance matrix of x1, x2 and x3, with the data generated from Problem (a). Please paste your R code and output below:

Solution

Graphical user interface, application

Description automatically generated

Text

Description automatically generated

**Summary of your group meet time and duration**

* In person or Zoom:
* Group meet time and duration (e.g., 5pm-7pm, Feb 1st):
* Average time in communication and discussion regarding assigned group work (via email or other social media, e.g. What’s app.):
* Participants (Print and sign your names):

**Contribution** report:

* If your team members contribute equally to this project, please make this statement "Each member contributes equally" on your last page, so that each of you will receive the same score.
* If your team members do not contribute equally to this project, please note your team members' names, and mark the percentage of effort each member makes (e.g., Sukumar: 80%  then if your group receives a project score of 30, then this member with 80% effort will only get 24).
* Participants: Print and sign your names