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Course :Bsc(Hons.)Computer Science
Semester 2

Probability For Computing Practicals

#1. Plotting and fitting of Binomial distribution and graphical representation of probabilities.

Step 1: Set up your data

Create a column for the number of successes (x) and a column for the corresponding probabilities (P(x)). Start with x = 0 and increment by 1 until you reach the desired number of successes.

Step 2: Calculate the probabilities

In the cell next to each x value, use the binomial distribution formula to calculate the corresponding probability. The formula is:

=BINOM.DIST(x, n, p, FALSE)

where:

- *x: The number of successes*
- *n: The total number of trials*
- *p: The probability of success in each trial*
- *FALSE: Set cumulative parameter to FALSE*

Step 3: Create a scatter plot

Select both columns of data (x and P(x)), including the headers. Then, go to the "Insert" tab in Excel and choose the scatter plot option. Select the scatter plot with only markers (without lines) for simplicity.

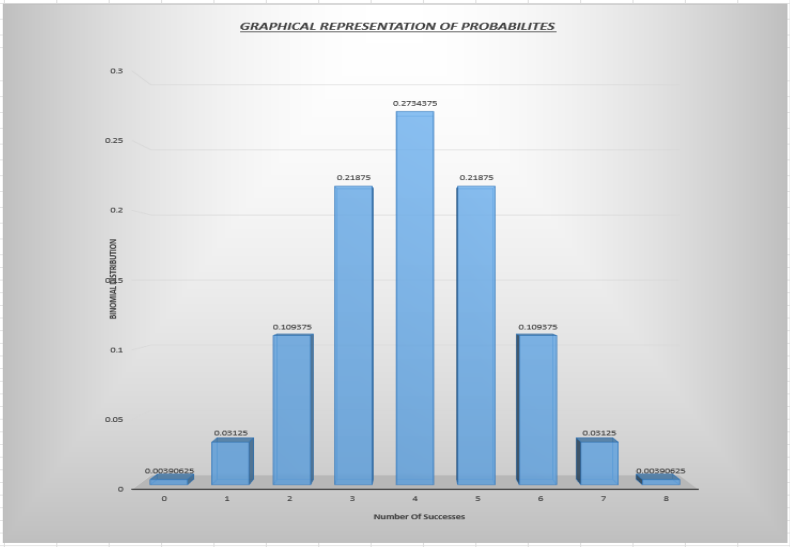
PROBABILITY FOR COMPUTING

PRACTICAL QUESTION 1

PLOTTING AND FITTING OF BINOMIAL DISTRIBUTION AND GRAPHICAL REPRESENTATION OF PROBABILITIES

Value Of n (Number Of Trails)	8
Success In A Given Trail	0.5

k : Number Of Successes	BINOMIAL DISTRIBUTION
0	0.00390625
1	0.03125
2	0.109375
3	0.21875
4	0.2734375
5	0.21875
6	0.109375
7	0.03125
8	0.00390625
9	Err:502
10	Err:502



#2. Plotting and fitting of Multinomial distribution and graphical representation of probabilities.

Step 1: Set up your data

Create a column for the categories (C) and a column for the corresponding probabilities (P(C)). List all the possible categories and assign their respective probabilities.

Step 2: Calculate the probabilities

In the cell next to each category, use the multinomial distribution formula to calculate the corresponding probability. The formula is:

=Multinomial(x1, x2, ..., xn, p1, p2, ..., pn)

where:

- ***x1, x2, ..., xn: The number of occurrences of each category.***
-
- ***p1, p2, ..., pn: The probabilities of each category.***
-

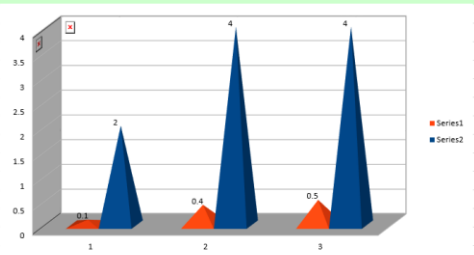
Step 3: Create a bar chart

Select both columns of data (categories and P(C)), including the headers. Then, go to the "Insert" tab in Excel and choose the bar chart option. Select the clustered bar chart for simplicity.

PLOTTING AND FITTING OF MULTINOMIAL DISTRIBUTION AND GRAPHICAL REPRESENTATION OF PROBABILITIES.

IN A THREE-WAY ELECTION FOR MAYOR, CANDIDATE A RECIEVES 10% OF THE VOTES , CANDIDATE B RECIEVES 40% OF THE VOTES AND CANDIDATE C RECIEVES 50% OF THE VOTES.IF WE SELECT A RANDOM SAMPLE 10 VOTERS, WHAT IS THE PROBABILITY THAT 2 VOTED FOR CANDIDATE A, 4 VOTED FOR CANDIDATE B, AND 4 VOTED FOR CANDIDATE C ?

OUTCOME1	2
OUTCOME 2	4
OUTCOME 3	4
PROBABILITY 1	0.1
PROBABILITY 2	0.4
PROBABILTY 3	0.5
MULTINOMIAL	3150
PROB1^OUTCOME 1	0.01
PROB2^OUTCOME 2	0.0256
PROB3^OUTCOME 3	0.0625
PROBABILITY	0.0504



#3. Plotting and fitting of Poisson distribution and graphical representation of probabilities.

Step 1: Set up your data

Create a column for the number of events (x) and a column for the corresponding probabilities (P(x)). Start with x = 0 and increment by 1 until you reach a suitable range for your Poisson distribution.

Step 2: Calculate the probabilities

In the cell next to each x value, use the Poisson distribution formula to calculate the corresponding probability. The formula is:

=POISSON.DIST(x, λ, FALSE)

where:

- ***x: The number of events***
- ***λ: The average rate of events occurring (also known as the Poisson parameter)***
- ***FALSE: Set cumulative parameter to FALSE***

Step 3: Create a scatter plot or column chart

Select both columns of data (x and P(x)), including the headers. Then, go to the "Insert" tab in Excel and choose either the scatter plot option or the column chart option.

For a scatter plot:

- ***Select the scatter plot with only markers (without lines) for simplicity.***

For a column chart:

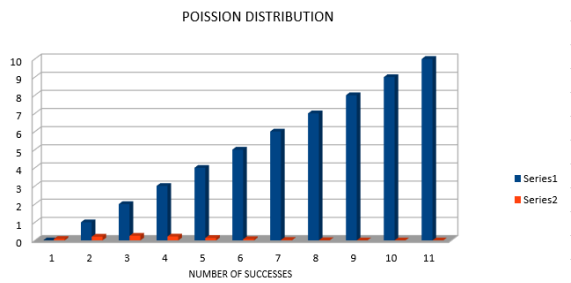
- ***Choose the clustered column chart for simplicity.***

PLOTTING AND FITTING OF POISSON DISTRIBUTION AND GRAPHICAL REPRESENTATION OF PROBABILITIES

λ(MEAN NUMBER OF SUCCESSES) 2.5

A=POISSON(G7,H3,FALSE())

K(NUMBER OF SUCCESSES)	
0	0.0821
1	0.2052
2	0.2565
3	0.2138
4	0.1336
5	0.0668
6	0.0278
7	0.0099
8	0.0031
9	0.0009
10	0.0002



#4. Plotting and fitting of Geometric distribution and graphical representation of probabilities.

Step 1: Set up your data

Create a column for the number of trials (x) and a column for the corresponding probabilities (P(x)). Start with x = 1 and increment by 1 until you reach a suitable range for your geometric distribution.

Step 2: Calculate the probabilities

In the cell next to each x value, use the geometric distribution formula to calculate the corresponding probability. The formula is:

=GEOME.DIST(x, p, FALSE)

where:

- ***x: The number of trials until the first success***
- ***p: The probability of success in each trial***
- ***FALSE: Set cumulative parameter to FALSE***

Step 3: Create a scatter plot or column chart

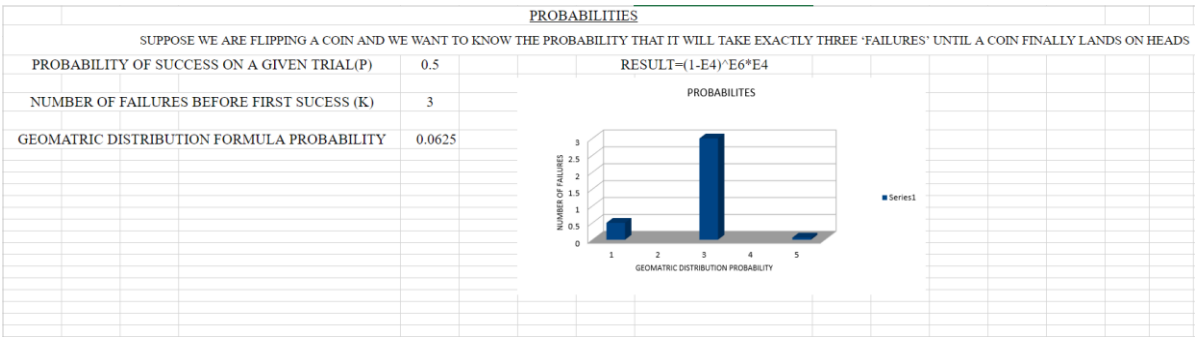
Select both columns of data (x and P(x)), including the headers. Then, go to the "Insert" tab in Excel and choose either the scatter plot option or the column chart option.

For a scatter plot:

- ***Select the scatter plot with only markers (without lines) for simplicity.***

For a column chart:

- ***Choose the clustered column chart for simplicity.***



PROBABILITIES

SUPPOSE WE ARE FLIPPING A COIN AND WE WANT TO KNOW THE PROBABILITY THAT IT WILL TAKE EXACTLY THREE 'FAILURES' UNTIL A COIN FINALLY LANDS ON HEADS

PROBABILITY OF SUCCESS ON A GIVEN TRIAL(P)	0.5
NUMBER OF FAILURES BEFORE FIRST SUCESS (K)	3
GEOMATRIC DISTRIBUTION FORMULA PROBABILITY	0.0625

RESULT=(1-E4)^E6*E4

#5. Plotting and fitting of Uniform distribution and graphical representation of probabilities

Step 1: Set up your data

Create a column for the values (x) and a column for the corresponding probabilities (P(x)). Start with x = the minimum value of the uniform distribution and increment by a suitable interval until you reach the maximum value.

Step 2: Calculate the probabilities

Since the uniform distribution has a constant probability for each value within the range, the probabilities will be the same for each value. Divide 1 by the total number of values to obtain the probability for each value. Enter this value in the P(x) column for all the corresponding values.

Step 3: Create a scatter plot or column chart

Select both columns of data (x and P(x)), including the headers. Then, go to the "Insert" tab in Excel and choose either the scatter plot option or the column chart option.

For a scatter plot:

- ***Select the scatter plot with only markers (without lines) for simplicity.***

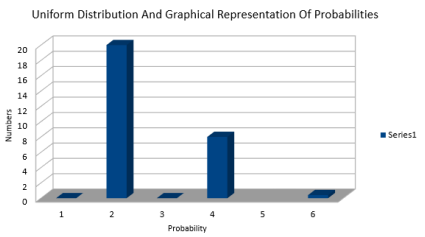
For a column chart:

- ***Choose the clustered column chart for simplicity.***

Plotting and Fitting Of Uniform Distribution and Graphical Represenattion of Probabilities

A Bus Shows Up At the Bus Stop Every 20 Minutes.If You Arrive At the Bus Stop,What is The Probability The bus Will Show Up in 8minutes Or Less?

a(minimum Value In Distribution)	0
b(Maximum Value In Distribution)	20
Minumum Value You Are Interested	0
Maximum Value You Are Interested	8
Probability	0.4



#6. Plotting and fitting of Exponential distribution and graphical representation of probabilities.

Step 1: Set up your data

Create a column for the values (x) and a column for the corresponding probabilities (P(x)). Start with x = 0 and increment by a suitable interval until you reach a desired range for your exponential distribution.

Step 2: Calculate the probabilities

In the cell next to each x value, use the exponential distribution formula to calculate the corresponding probability. The formula is:

=EXPON.DIST(x, λ, TRUE)

where:

- ***x: The value at which to evaluate the exponential distribution***
- ***λ: The rate parameter of the exponential distribution***
- ***TRUE: Set cumulative parameter to TRUE***

Step 3: Create a scatter plot or line chart

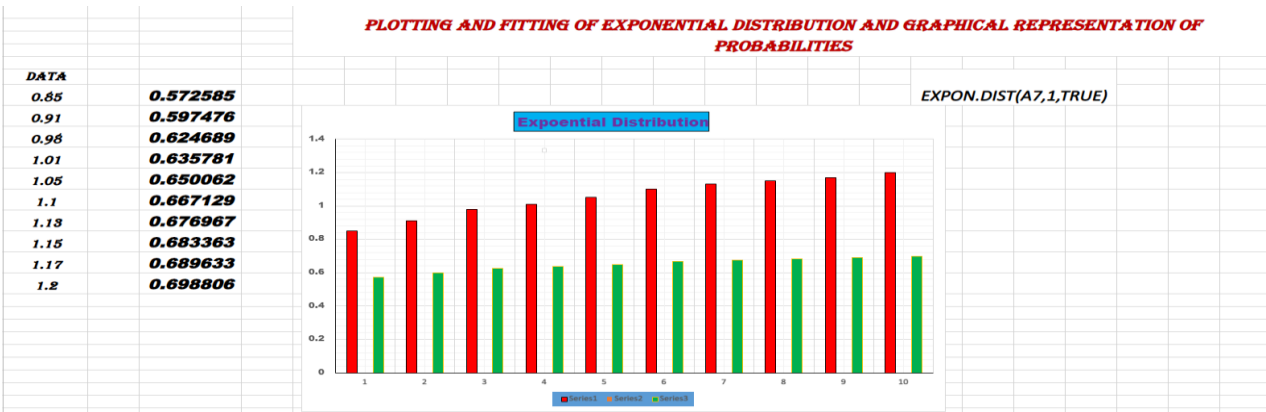
Select both columns of data (x and P(x)), including the headers. Then, go to the "Insert" tab in Excel and choose either the scatter plot option or the line chart option.

For a scatter plot:

- ***Select the scatter plot with only markers (without lines) for simplicity.***

For a line chart:

- ***Choose the line chart option.***



#7. Plotting and fitting of Normal distribution and graphical representation of probabilities.

Step 1: Set up your data

Create a column for the values (x) and a column for the corresponding probabilities (P(x)). Start with x = the desired minimum value and increment by a suitable interval until you reach the maximum value.

Step 2: Calculate the probabilities

In the cell next to each x value, use the normal distribution formula to calculate the corresponding probability. The formula is:

=NORM.DIST(x, mean, standard_deviation, FALSE)

where:

- ***x: The value at which to evaluate the normal distribution***
- ***mean: The mean or average value of the normal distribution***
- ***standard_deviation: The standard deviation of the normal distribution***
- ***FALSE: Set cumulative parameter to FALSE***

Step 3: Create a scatter plot or line chart

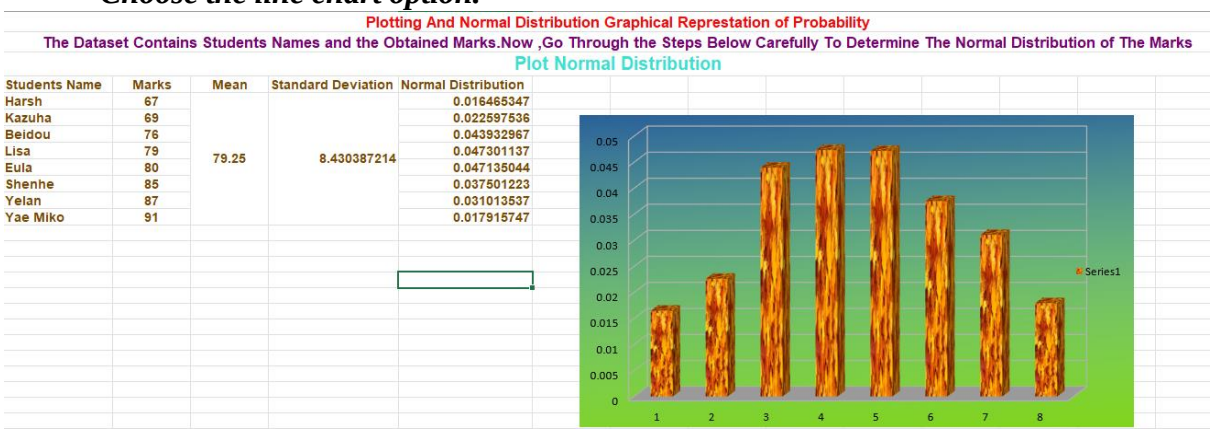
Select both columns of data (x and P(x)), including the headers. Then, go to the "Insert" tab in Excel and choose either the scatter plot option or the line chart option.

For a scatter plot:

- ***Select the scatter plot with only markers (without lines) for simplicity.***

For a line chart:

- ***Choose the line chart option.***



Students Name	Marks	Mean	Standard Deviation	Normal Distribution
Harsh	67			0.016465347
Kazuha	69			0.022597536
Beidou	76			0.043932967
Lisa	79	79.25	8.430387214	0.047301137
Eula	80			0.047135044
Shenhe	85			0.037501223
Yelan	87			0.031013537
Yae Miko	91			0.017915747

#8. Calculation of cumulative distribution functions for Exponential and Normal distribution.

- ***Exponential Distribution CDF: The CDF of the exponential distribution is given by the formula:***

=1 - EXPON.DIST(x, λ, TRUE)

where:

- ***x is the value at which you want to evaluate the CDF,***
- ***λ is the rate parameter of the exponential distribution,***
- ***TRUE indicates that you want to calculate the cumulative distribution.***

2.>Normal Distribution CDF: The CDF of the normal distribution is given by the formula:
=NORM.DIST(x, mean, standard_deviation, TRUE)

where:

- ***x is the value at which you want to evaluate the CDF,***
- ***mean is the mean or average value of the normal distribution,***
- ***standard_deviation is the standard deviation of the normal distribution,***
- ***TRUE indicates that you want to calculate the cumulative distribution.***
-

In both cases, you can enter the respective formula into an Excel cell and replace the parameters (x, λ, mean, standard_deviation) with the appropriate values.

PROBABILITY FOR COMPUTING

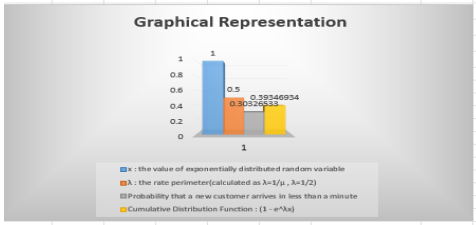
PRACTICAL QUESTION 6

Calculation of cumulative distribution functions for Exponential and Normal distribution.

AMPLE QUESTION 1

A New customer enters a shop every two minutes,on average. After a customer arrives find the probability that the new customer arrives in less than 1 minute

x : the value of exponentially distributed random variable	1
λ : the rate perimeter(calculated as λ=1/μ , λ=1/2)	0.5
Probability that a new customer arrives in less than a minute	0.30326533
Cumulative Distribution Function : (1 - e^λx)	0.39346934

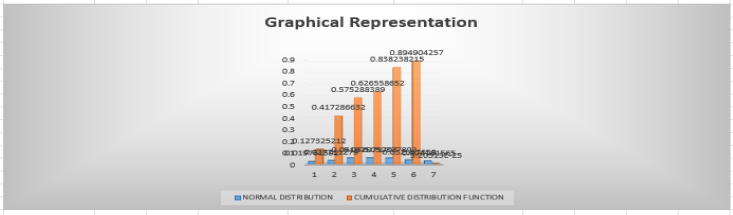


SAMPLE QUESTON 2.

The dataset contains Student Names and the obtained Marks. Now, go through the steps below carefully to determine the Normal Distribution of the marks.

PLOT NORMAL DISTRIBTION

STUDENT NAME	MARKS	MEAN	STANDARD DEVIATION	NORMAL DISTRIBUTION	CUMULATIVE DISTRIBUTION FUNCTION
SUMIT	67			0.019761592	0.127325212
MADHU	69			0.027711279	0.417286632
DEEPAK	76			0.051875	0.575288389
DIVYAM	79			0.052071703	0.626558652
KAPIL	80			0.050327892	0.838238215
AMIT	85			0.032567659	0.894904257
SEEMA	87	77.571	7.524562952	0.024181565	3.20513E-25



#9. Application problems based on the Binomial distribution.

Ques:

Suppose you play a game that you can only either win or lose. The probability that you win any game is 55%, and the probability that you lose is 45%. Each game you play is independent. If you play the game 20 times, write the function that describes the probability that you win 15 out of the 20 times.

In the cell next to each x value, use the binomial distribution formula to calculate the corresponding probability. The formula is:

=BINOM.DIST(x, n, p, FALSE)

PROBABILITY FOR COMPUTING

PRACTICAL QUESTION 10

APPLICATION PROBLEMS BASED ON BINOMIAL DISTRIBUTION USING EXCEL

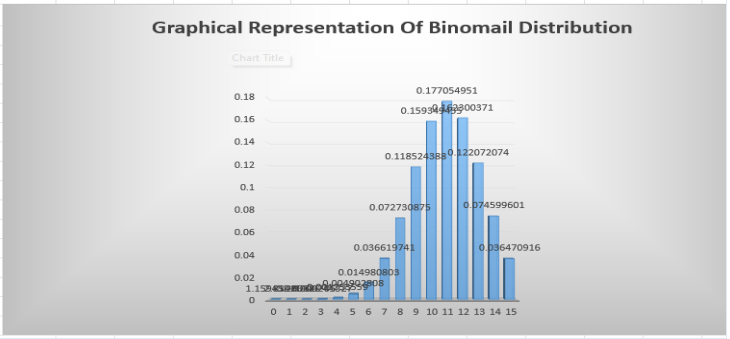
SAMPLE QUESTION

Suppose you play a game that you can only either win or lose. The proabability that you win any game is 55% , and the proabability that you lose
Each game you play is independent. If you play the game 20 times, write the function that describes the proababilty that you win 15 out of the 2

(number of trails) :	20
Success in a given trail :	0.55

p	q	Find P(X=15)
0.55	0.45	15

k: number of successes	Binomial Distribution
0	1.15945E-07
1	2.8342E-06
2	3.29082E-05
3	0.000241327
4	0.001253559
5	0.004902808
6	0.014980803
7	0.036619741
8	0.072730875
9	0.118524388
10	0.159349455
11	0.177054951
12	0.162300371
13	0.122072074
14	0.074599601
15	0.036470916



#10. Application problems based on the Poisson distribution.

Ques:

Calculate the probability that there will be 220 infected people by COVID-19 in a one day using the Excel function = POISSON.DIST() if a total of 2800 new cases are recorded in the last 14 days.

Step 2: Calculate the probabilities

In the cell next to each x value, use the Poisson distribution formula to calculate the corresponding probability. The formula is:

=POISSON.DIST(x, λ, FALSE)

PRACTICAL QUESTION 11

APPLICATION PROBLEMS BASED ON POISSON DISTRIBUTION USING EXCEL

SAMPLE QUESTION

Calculate the probability that there will be 220 infected people by COVID-19 in a one day using the Excel function = POISSON.DIST() if a total of 2800 new cases are recorded in the last 14 days.

TOTAL CASE	INFECTED PER DAY	DAY	AVERAGE	POISSON DISTRIBUTION
2800	220	14	200	0.010210174

GRAPHICAL REPRESENTATION

#11. Application problems based on the Normal distribution.

Ques:

Suppose X is a normal random variable with mean 8 and standard deviation 5. Find the proabability P(X≤8.6)

Step 2: Calculate the probabilities

In the cell next to each x value, use the normal distribution formula to calculate the corresponding probability. The formula is:

=NORM.DIST(x, mean, standard_deviation, FALSE)

PROBABILITY FOR COMPUTING

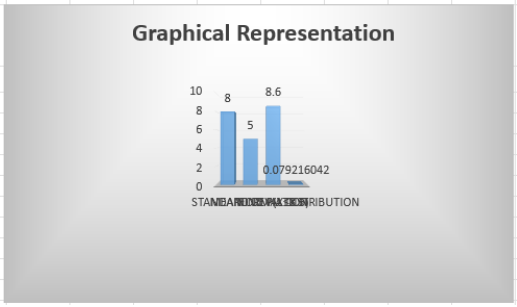
PRACTICAL QUESTION 12

APPLICATION PROBLEMS BASED ON NORMAL DISTRIBUTION USING EXCEL

SAMPLE QUESTION

Suppose X is a normal random variable with mean 8 and standard deviation 5. Find the proabability P(X≤8.6)

MEAN	STANDARD DEVIATION	FIND P(X≤8.6)	NORMAL DISTRIBUTION
8	5	8.6	0.079216042



#12. Presentation of bivariate data through scatter-plot diagrams and calculations of covariance.

Step 1: Set up your data

Create two columns, one for each variable, with corresponding data points. Each row should represent a pair of values for the two variables.

Step 2: Create a scatter plot

Select both columns of data, including the headers. Then, go to the "Insert" tab in Excel and choose the scatter plot option. Select the scatter plot with markers only (without lines) for a simple representation.

Step 3: Adjust the chart options

Customize the chart by adding axis labels, a title, and adjusting the chart's appearance to your preference.

Step 4: Calculate the covariance

In a blank cell, use the COVARIANCE.P function to calculate the covariance between the two variables. The formula is:

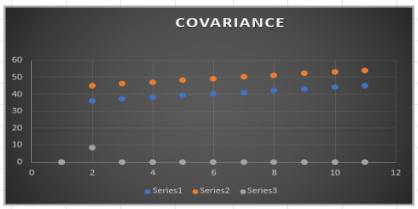
=COVARIANCE.P(range1, range2)

where:

- ***range1 and range2 are the ranges of the two variable columns in your data.***

Presentation of bivariate data through scatter-plot diagrams and calculations of covariance.

X	Y	
36	45	8.25
37	46	
38	47	
39	48	
40	49	
41	50	
42	51	
43	52	
44	53	
45	54	



COVARIANCE.P(A5:A14 , B5:B14)

#13. Calculation of Karl Pearson's correlation coefficients.

Step 1: Set up your data

Create two columns, one for each variable, with corresponding data points. Each row should represent a pair of values for the two variables.

Step 2: Calculate the correlation coefficient

In a blank cell, use the CORREL function to calculate the correlation coefficient between the two variables. The formula is:

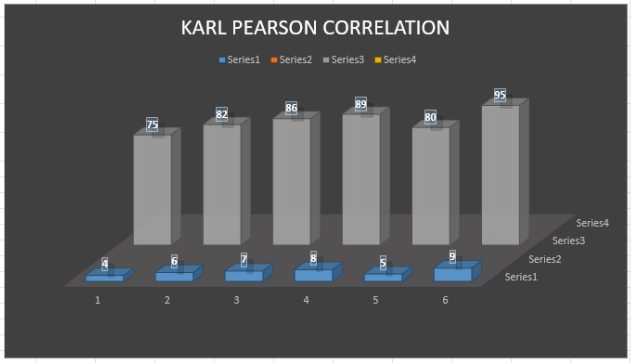
=CORREL(range1, range2)

where:

- ***range1 and range2 are the ranges of the two variable columns in your data.***

Calculation of Karl Pearson's correlation coefficients

Hours Studied	Total Marks	Karl Pearson	Correlation
4	75	0.991258674	0.991258674
6	82		
7	86		
8	89		
5	80		
9	95		



#14. To find the correlation coefficient for a bivariate frequency distribution.

Step 1: Set up your data

Create two columns, one for each variable, with corresponding frequency counts for each combination of values. Each row should represent a combination of values and its corresponding frequency count.

Step 2: Calculate the product of the two variables

In a new column, multiply each combination of values by their corresponding frequency count. This will give you the product of the two variables for each combination.

Step 3: Calculate the sum of the variables, the sum of the squared variables, and the sum of the products

Use Excel's SUM function to calculate the sum of the variables, the sum of the squared variables, and the sum of the products. Place the results in separate cells.

To find the correlation coefficient for a bivariate frequency distribution

HOURS	SCORE
1	55
1	65
2	35
3	87
4	57
5	76
3	87
2	46
5	97

CR RELATION COEFFICIENT= 0.58089344

CORREL(A6:A14,B6:B14)

Chart Area

#15. Generating Random numbers from discrete (Bernoulli, Binomial, Poisson) distributions.

- ***Generating random numbers from a Bernoulli distribution:***
- ***In an empty cell, enter the following formula:***
-
- ***=IF(BERNOULLI.DIST(1, p, FALSE), 1, 0)***

- ***Replace p with the probability of success for each trial (a value between 0 and 1).***
- ***Press Enter to generate a random number from the Bernoulli distribution with the specified probability.***

- ***Generating random numbers from a Binomial distribution:***
- ***In an empty cell, enter the following formula:***
- ***=BINOM.DIST(k, n, p, FALSE)***
- ***Replace k with the number of successful outcomes you want, n with the number of trials, and p with the probability of success for each trial (a value between 0 and 1).***
- ***Press Enter to generate a random number from the Binomial distribution with the specified parameters.***

- ***Generating random numbers from a Poisson distribution:***
- ***In an empty cell, enter the following formula:***
- ***=POISSON.DIST(x, lambda, FALSE)***

- ***Replace x with the number of events you want, and lambda with the average number of events (also known as the rate parameter) for the Poisson distribution.***
- ***Press Enter to generate a random number from the Poisson distribution with the specified parameters.***

Generating Random numbers from discrete (Bernoulli, Binomial, Poisson) distribution

k	n	p	Bionomial Distribution	X	Lambda	oission Distributio
5	10	0.3	0.102919345	3	2	0.180447044
2	5	0.6	0.2304	1	0.5	0.30326533
8	12	0.7	0.231139696	2	1.5	0.25102143
3	7	0.2	0.114688	5	3	0.100818813
1	4	0.4	0.3456	4	2.5	0.133601886
6	9	0.8	0.176160768	2	1	0.183939721
4	8	0.6	0.2322432	6	4	0.104195635
2	6	0.3	0.324135	3	1.8	0.160670519
7	11	0.1	2.16513E-05	1	0.7	0.347609713
4	10	0.2	0.088080384	4	2.2	0.108151269