Course STA301: Statistics and Probability

Practice Questions For MID-TERM (Lec # 1 to 22)

Lecture No 1 to 5

Multiple Choice Questions:

(Sample questions)

1. Statistics deals with:

a) Observations
b) Aggregates of facts
c) Individuals
d) Isolated items

2. A number of students in a class is an example of:

a) Finite Population
b) Infinite Population
c) Hypothetical Population
d) None of these

3. A component bar chart in which

a) Each bar is divided into two or more sections
b) The value of a common variable in the form of grouped bars
c) The horizontal or vertical bars of equal with and length proportional to the values
d) None of these

4. What is the value of class mark for the given class 20-25?

a) 24
b) 22.5
c) 22
d) 15

5. The extremely positive skewed curve is also known as::

a) Frequency curve
b) U-shaped curve
c) J-shaped curve
d) Reverse J-shaped curve

Numerical Questions

(Sample questions)

Q1: Differentiate between Qualitative and Quantitative Variables.

Q2: Differentiate between Primary data and Secondary data.

Q3: Define Multiple Bar Chart.

Q4: Arrange the data given below in an array and construct a frequency distribution, using a class interval of 13, number of classes is 5 and the smallest observation is 09. Indicate the class boundaries and class limits clearly.

62, 73, 85, 42, 68, 54, 38, 27, 32, 63, 68, 69, 75, 59, 52, 58, 36, 85, 88, 72, 52, 52, 63, 68, 29, 73, 29, 76, 29, 57, 46, 43, 28, 32, 09, 66, 72, 68, 42, 76

Q5: Draw a Histogram and a Frequency Polygon for the following distribution.

Daily wages (Rs.)	4 – 6	6 – 8	8 – 10	10 – 12	12 – 14	14 – 16
No. of employees	13	111	182	105	19	7

ANSWERS / SOLUTION

Course STA301: Statistics and Probability

Practice Questions

Lecture No 1 to 5

Multiple Choice Questions:

6. Statistics deals with:

e) Observations
f) Aggregates of facts***
g) Individuals
h) Isolated items

7. A number of students in a class is an example of:

e) Finite Population***
f) Infinite Population
g) Hypothetical Population
h) None of these

8. A component bar chart in which

e) Each bar is divided into two or more sections***
f) The value of a common variable in the form of grouped bars
g) The horizontal or vertical bars of equal with and length proportional to the values
h) None of these

9. What is the value of class mark for the given class 20-25?

e) 24
f) 22.5***
g) 22
h) 15

10. The extremely positive skewed curve is also known as::

e) Frequency curve
f) U-shaped curve
g) J-shaped curve
h) Reverse J-shaped curve***

Numerical Questions

Q1: Differentiate between Qualitative and Quantitative Variables.

A variable whose characteristics can be measured numerically is called Quantitative Variable for example age, weight, income or number of children.

A variable whose characteristics cannot be measured numerically is called Qualitative Variable for example gender, education, intelligence or eye-color.

Q2: Differentiate between Primary data and Secondary data.

Data that have been originally collected (raw data) and have not undergone any statistical treatment are called Primary data.

Data that have undergone any statistical treatment at least once i.e. the data have been collected, classified, tabulated or presented in some form for a certain purpose are called Secondary data.

Q3: Define Multiple Bar Chart.

A multiple bar chart consists of two or more characteristics corresponding to the values of the common variable in form of grouped bars, whose lengths are proportional to the values where each bar is shaded with different colors to show their identification.

Q4: Arrange the data given below in an array and construct a frequency distribution, using a class interval of 13, number of classes is 5 and the smallest observation is 09. Indicate the class boundaries and class limits clearly.

62, 73, 85, 42, 68, 54, 38, 27, 32, 63, 68, 69, 75, 59, 52, 58, 36, 85, 88, 72, 52, 52, 63, 68, 29, 73, 29, 76, 29, 57, 46, 43, 28, 32, 09, 66, 72, 68, 42, 76.

Solution:

Class Limits	Frequency	Class Boundaries
9 – 21	1	8.5 – 21.5
22 – 34	7	21.5 – 34.5
35 – 47	6	34.5 – 47.5

48 – 60	7	47.5 – 60.5
61 – 73	13	60.5 – 73.5
74 – 86	5	73.5 – 86.5
87 – 99	1	86.5 – 99.5
	40	

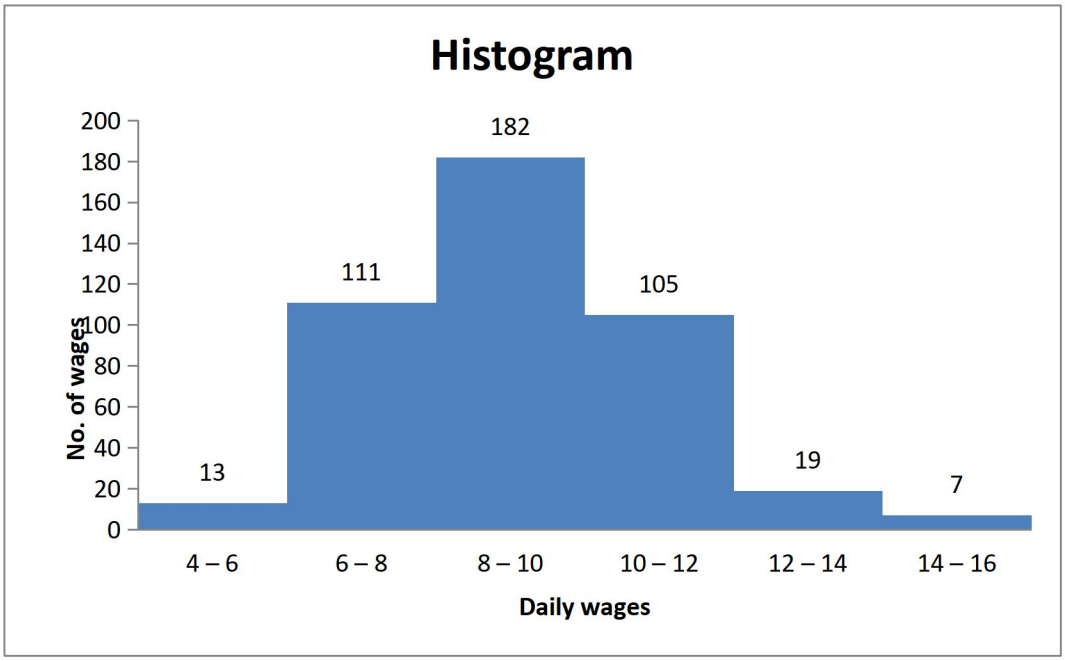
Q5: Draw a Histogram and a Frequency Polygon for the following distribution.

Daily wages (Rs.)	4 – 6	6 – 8	8 – 10	10 – 12	12 – 14	14 – 16
No. of employees	13	111	182	105	19	7

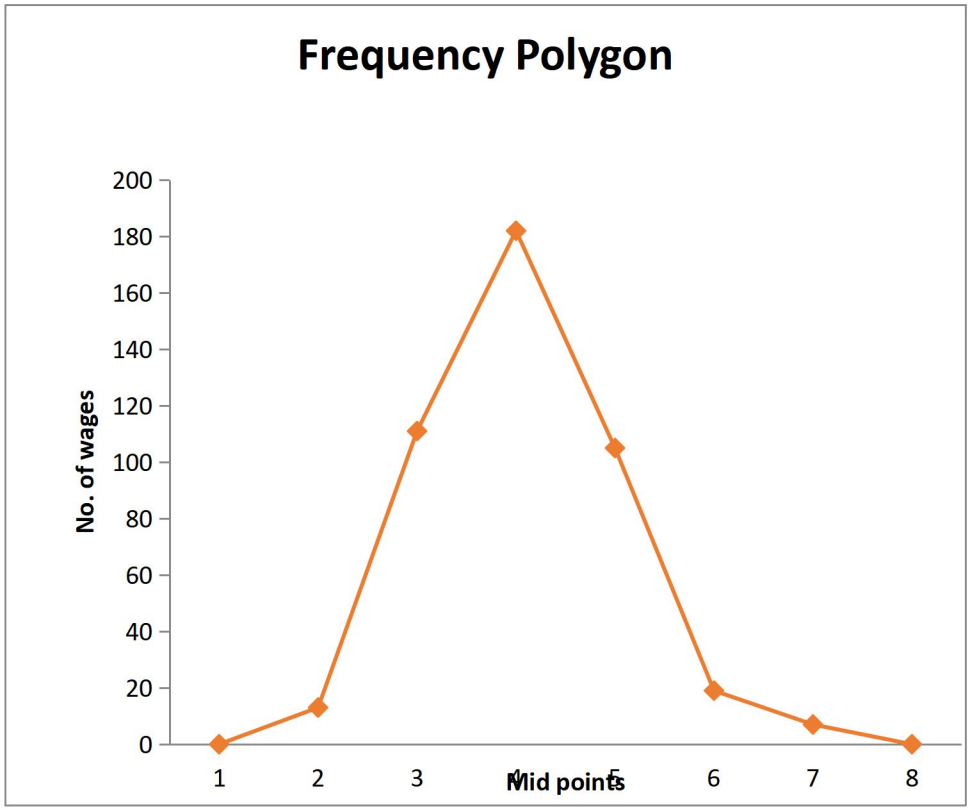
Solution:

Daily wages	**No. of wages**	**Mid points**
4 – 6	13	5
6 – 8	111	7
8 – 10	182	9
10 – 12	105	11
12 – 14	19	13
14 – 16	7	15

Histogram:



Frequency Polygon:



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and I'll do the same, In Sha Allah.

— Qalb-e-Momin

Course STA301: Statistics and Probability

Practice Questions

Lecture No 6 to 10

MCQs

1. The value that occurs most often in a set of data is called the:
   a) Mean
   b) Mode
   c) Geometric mean
   d) Harmonic mean

2. Find the mean of the following sample of distances of stars from the earth:

18.2, 56.9, 24.6, 13.5

a) $\bar{X} = 28.30$

b) $\bar{X} = 43.30$

c) $\bar{X} = 38.30$

d) $\bar{X} = 43.30$

3. Which of the following is a true statement about the median?

   a) It is always one of the data values.
   b) It is influenced by extreme values.
   c) Fifty percent of the observations are larger than the median.
   d) It is the middle value of the data values.

4. The G.M of 2, 4 and 8 is

   a) 3.67
   b) 4
   c) 3.43
   d) 5

5. One of the main disadvantages of the range is:

   a) It does not use all the observations in its calculations
   b) It cannot be influenced by an extreme value
   c) It does not involve negative values
   d) It deals with open ended classes

Question 1:

Find the mode, for the distribution of examination marks given below:

Marks	30-39	40-49	50-59	60-69	70-79	80-89	90-99
Number of Students	8	87	190	304	211	85	20

Question 2:

Find the mean weight of 120 students at the Punjab University from the frequency distribution:

Weight (pounds)	Number of students
110-119	1

120-129	4
130-139	17
140-149	28
150-159	25
160-169	18
170-179	13
180-189	6
190-199	5
200-209	2
210-219	1

Question 3

If mode =25 and median = 30, then find approximate value of mean

Question 4:

Find the harmonic mean from the following frequency distribution of weights:

Weights (grams)	65-84	85-104	105-124	125-144	145-164	165-184	185-204
f	9	10	17	10	5	4	5

Question 5

Find semi-inter quartile range, if Q_1= 1423.36 and Q_3 = 167.83

Practice Question with SOLUTION

Course STA301: Statistics and Probability

Lecture No 6 to 10

2. The value that occurs most often in a set of data is called the:
   a) Mean
   b) Mode
   c) Geometric mean
   d) Harmonic mean

Answer key: b)

2. Find the mean of the following sample of distances of stars from the earth:

18.2, 56.9, 24.6, 13.5

a) $\bar{X} = 28.30$

b) $\bar{X} = 43.30$

c) $\bar{X} = 38.30$

d) $\bar{X} = 43.30$

Answer Key= a)

3. Which of the following is a true statement about the median?

a) It is always one of the data values.
b) It is influenced by extreme values.
c) Fifty percent of the observations are larger than the median.
d) It is the middle value of the data values.

Answer Key= d)

4. The G.M of 2, 4 and 8 is

a) 3.67
b) 4
c) 3.43
d) 5

Answer Key= b)

5. One of the main disadvantages of the range is:

a) It does not use all the observations in its calculations
b) It cannot be influenced by an extreme value
c) It does not involve negative values
d) It deals with open ended classes

Answer key = a)

Question 1:

Find the mode, for the distribution of examination marks given below:

Marks	30-39	40-49	50-59	60-69	70-79	80-89	90-99
Number of Students	8	87	190	304	211	85	20

Solution:

The class that carries the highest frequency is 59.5-69.5 which the modal class is thus

Also

$l = 59.5, f_1 = 190, f_2 = 211, f_m = 304$ and $h = 10$

Hence

$$\text{Mode} = l + \frac{f_m - f_1}{(f_m - f_1) + (f_m - f_2)} \times h$$

$$\text{Mode} = 59.5 + \frac{304\text{-}190}{(304\text{-}190) + (304\text{-}211)} \times 10$$

$$= 59.5 + 5.8 = 65.3 = 65 \text{ Marks}$$

Question 2:

Find the mean weight of 120 students at the Punjab University from the frequency distribution:

Weight (pounds)	Number of students
110-119	1
120-129	4
130-139	17
140-149	28
150-159	25
160-169	18
170-179	13
180-189	6
190-199	5
200-209	2
210-219	1

Solution:

Weight (pounds)	Number of students(f)	Class Mark (X)	fX
110-119	1	114.5	114.5
120-129	4	124.5	498.0
130-139	17	134.5	2286.5
140-149	28	144.5	4046.0
150-159	25	154.5	3862.5
160-169	18	164.5	2961.0
170-179	13	174.5	2268.5
180-189	6	184.5	1107.0

190-199	5	194.5	972.5
200-209	2	204.5	409.0
210-219	1	214.5	214.5
	n=∑f=120		∑fX=18740

$$\bar{X} = \frac{\sum fX}{\sum f}$$
$$= \frac{18740}{120} = 156.17 \; pounds$$

Question 3

If mode =25 and median = 30, then find approximate value of mean

Solution:

Mode= 3 Median-2 Mean

25=3(30)-2(Mean)

25=90-2(Mean)

2(Mean) =90-25

2(Mean) =65

Mean=32.5

Question 4:

Find the harmonic mean from the following frequency distribution of weights:

Weights (grams)	65-84	85-104	105-124	125-144	145-164	165-184	185-204
f	9	10	17	10	5	4	5

Solution:

We calculate the harmonic mean as below

Weights (grams)	f	X	f(1/X)
65-84	9	74.5	0.12081
85-104	10	94.5	0.10582
105-124	17	114.5	0.14847
125-144	10	134.5	0.07435
145-164	5	154.5	0.03236
165-184	4	174.5	0.02292
185-204	5	194.5	0.02571
	60		0.53044

Hence H= $$H = \frac{n}{\sum f(1/X)}$$

$$H = \frac{60}{0.53044} = 113.11 grams$$

Question 5

Find semi-inter quartile range, if Q_1= 1423.36 and Q_3 = 167.83

Solution:

$$Q.D = \frac{Q_3 - Q_1}{2}$$

$$Q.D = \frac{167.83 - 142.36}{2} = 12.74$$

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— Qalb-e-Momin

Course STA 301: Statistics and Probability

Practice Questions

Lecture No 11 to 15

Multiple Choice Questions:

11. In a symmetrical distribution Q1=20, Median=30, then the value of Q3 is:

- **i)** 50
- **j)** 35
- **k)** 40
- **l)** 25

12. First two moments about 5 of a variable are 1 and 14, then variance

- **i)** 12
- **j)** 13
- **k)** 14
- **l)** 15

13. The lack of uniformity is called.

- **i)** Skewness
- **j)** Dispersion
- **k)** Symmetry
- **l)** Kurtosis

14. If variance of 12, 14, 16,18,20 is 8 , then variance of 10, 12, 14, 16, 18 is:

- **i)** 6
- **j)** 8
- **k)** 10
- **l)** Zero

15. The dependent variable is also called:

- **i)** Regressand variable
- **j)** Predictand variable
- **k)** Explained variable
- **l)** All of these

Numerical Questions

Q1: Calculate M.D from (i) mean (ii) median from the following frequency distribution. Also find the respective coefficients of M.D.

Classes	Frequency
10-14	1
15-19	4
20-24	8
25-29	11
30-34	15
35-39	9
40-44	2
Total	50

Q2: The weights of 10 boxes of a certain brand of cereal have a mean content of 278 gram, with a S.D of 9.64 gram. If these boxes were purchased at 10 different stores and the average price per box is $1.29 with a S.D $ 0.09. Can you conclude that the weights are relatively more homogeneous than the prices?

Q3: The following frequency distribution gives the number of houses and the number of persons per house

No. of Persons	No. of houses
1	5
2	17
3	25
4	33
5	14
6	6

Calculate first four moments about X=4. Convert these moments into moments about mean

Q4: Fit a regression line, $Y = a + bX$ from the following data.

X	Y
95	85
85	95
80	70
70	65
60	70

Q5: For a group of 10 values

$\sum X = 452$

$\sum X^2 = 24270,$

$Mode - 43.7$

Find the coefficient of Skewness?

ANSWERS / SOLUTION

Course STA 301: Statistics and Probability

Lecture No 11 to 15

1. In a symmetrical distribution Q1=20, Median=30, then the value of Q3 is:

   a) 50
   b) 35
   c) 40***
   d) 25

2. First two moments about 5 of a variable are 1 and 14, then variance

   a) 12
   b) 13***
   c) 14
   d) 15

3. The lack of uniformity is called.

   a) Skewness
   b) Dispersion***
   c) Symmetry
   d) Kurtosis

4. If variance of 12, 14, 16,18,20 is 8 , then variance of 10, 12, 14, 16, 18 is:

   a) 6
   b) 8***
   c) 10
   d) Zero

5. The dependent variable is also called:

   a) Regressand variable
   b) Predictand variable
   c) Explained variable
   d) All of these

Q1: Calculate M.D from (i) mean (ii) median from the following frequency distribution. Also find the respective coefficients of M.D.

Classes	Frequency
10-14	1
15-19	4
20-24	8
25-29	11
30-34	15
35-39	9
40-44	2
Total	50

Solution:

Classes	F	C.F	Class Boundaries	X	fX	$\lvert X-\bar{X}\rvert$	$f\lvert X-\bar{X}\rvert$	$\lvert X-\tilde{X}\rvert$	$f\lvert X-\tilde{X}\rvert$
10-14	1	1	9.5-14.5	12	12	17	17	17.83	17.83
15-19	4	5	14.5-19.5	17	68	12	48	12.83	51.32
20-24	8	13	19.5-24.5	22	176	7	56	7.83	62.64
25-29	11	24	24.5-29.5	27	297	2	22	2.83	31.13
30-34	15	39	29.5-34.5	32	480	3	45	2.17	32.55
35-39	9	48	34.5-39.5	37	333	8	72	7.17	64.53
40-44	2	50	39.5-44.5	42	84	13	26	12.17	24.32
Total	50	--	---	--		---	286	------	284.34

$$\bar{X} = \frac{\sum fX}{\sum f}$$

$$\bar{X} = \frac{1450}{50}$$

$$\bar{X} = 29$$

$$\text{M.D(from mean)} = \frac{\sum f\left|X - \bar{X}\right|}{\sum f}$$

$$\text{M.D} = \frac{286}{50}$$

$$\text{M.D} = 5.72$$

$$\text{Coefficient of M.D} = \frac{M.D}{\bar{X}}$$

$$\text{Coefficient of M.D} = \frac{5.72}{29}$$

$$\text{Coefficient of M.D} = 0.1972$$

Median

$$\text{Median Group} = The\left(\frac{n}{2}\right)^{th} class$$

$$= \left(\frac{50}{2}\right)^{th} class$$

$$= 25^{th} class$$

$$\text{Median} = \tilde{X} = l + \frac{h}{f}\left(\frac{n}{2} - C\right)$$

$$\text{Median} = \tilde{X} = 29.5 + \frac{5}{15}(25 - 24)$$

$$\text{Median} = \tilde{X} = 29.5 + \frac{5}{15}(1)$$

$$\text{Median} = \tilde{X} = 29.5 + 0.33$$

$$\text{Median} = \tilde{X} = 29.83$$

$$\text{M.D(from median)} = \frac{\sum f\left|X - \tilde{X}\right|}{\sum f}$$

$$\text{M.D} = \frac{284.33}{50}$$

$$\text{M.D} = 5.6868$$

$$\text{Coefficient of M.D from median} = \frac{M.D}{\tilde{X}}$$

$$= \frac{5.6868}{29.83}$$

$$= 0.1906$$

Q2: The weights of 10 boxes of a certain brand of cereal have a mean content of 278 gram, with a S.D of 9.64 gram. If these boxes were purchased at 10 different stores and the average price per box is $1.29 with a S.D $ 0.09. Can you conclude that the weights are relatively more homogeneous than the prices?

Solution:

$$C.V_1 = \frac{S_1}{\bar{X}_1} \times 100$$

$$C.V_1 = \frac{9.64}{278} \times 100$$

$$C.V_1 = 0.347 \times 100$$

$$C.V_1 = 3.47$$

$$C.V_2 = \frac{S_2}{\bar{X}_2} \times 100$$

$$C.V_2 = \frac{0.09}{1.29} \times 100$$

$$C.V_2 = 0.698 \times 100$$

$$C.V_2 = 6.98$$

Weights are relatively more homogeneous than prices.

Q3: The following frequency distribution gives the number of houses and the number of persons per house

No. of Persons	No. of houses
1	5
2	17
3	25
4	33
5	14
6	6

Calculate first four moments about X=4. Convert these moments into moments about mean.

Solution:

X	f	$D = X - 4$	fD	fD^2	fD^3	fD^4
1	5	-3	-15	45	-135	405
2	17	-2	-34	68	-136	272
3	25	-1	-25	25	-25	25
4	33	0	0	0	0	0
5	14	1	14	14	14	14
6	6	2	12	24	48	96
Total	100	-	-48	176	-234	812

$$m_1' = \frac{\sum fD}{\sum f}$$
$$m_1' = \frac{-48}{100}$$
$$m_1' = -0.48$$

$$m_2' = \frac{\sum fD^2}{\sum f}$$
$$m_2' = \frac{176}{100}$$
$$m_2' = 1.76$$

$$m_3' = \frac{\sum fD^3}{\sum f}$$
$$m_3' = \frac{-234}{100}$$
$$m_3' = -2.34$$

$$m_4' = \frac{\sum fD^4}{\sum f}$$
$$m_4' = \frac{812}{100}$$
$$m_4' = 8.12$$

$$m_1 = m_1' - m_1'$$
$$m_1 = -0.48 - (-0.48)$$
$$m_1 = -0.48 + 0.48$$
$$m_1 = 0$$

$$m_2 = m_1' - \left(m_1'\right)^2$$
$$m_2 = 1.76 - \left(-0.48\right)^2$$
$$m_2 = 1.76 - 0.2304$$
$$m_2 = 1.5296$$

$$m_3 = m_3' - 3m_1'm_2' + 2\left(m_1'\right)^3$$
$$m_3 = 2.34 - 3(-0.48)(1.76) + 2\left(-0.48\right)^3$$
$$m_3 = -2.34 + 2.5344 - 0.2212$$
$$m_3 = 2.5344 - 2.5612$$
$$m_3 = -0.0268$$

$$m_4 = m_4' - 4m_1'm_3' + 6\left(m_1'\right)^2\left(m_2'\right) - 3\left(m_1'\right)^4$$
$$m_4 = 8.12 - 4(-0.48)(-2.34) + 6\left(-0.48\right)^2\left(1.76\right) - 3\left(-0.48\right)^4$$
$$m_4 = 8.1200 - 4.4928 + 2.4330 - 0.1593$$
$$m_4 = 10.5530 - 4.6521$$
$$m_4 = 5.9009$$

$$b_1 = \frac{m_3}{\sqrt{m_2^{\,3}}}$$
$$b_1 = \frac{-0.0268}{1.8918}$$
$$b_1 = -0.0142$$

$$b_2 = \frac{m_4}{m_2^{\,2}}$$
$$b_2 = \frac{5.9009}{(1.5296)^2}$$
$$b_2 = \frac{5.9009}{2.3397}$$
$$b_2 = 2.5221$$

Q: Fit a regression line, $Y = a + bX$ from the following data.

X	Y
95	85
85	95
80	70
70	65
60	70

Solution:

Student	Xi	Yi	$\left(Xi - \bar{X}\right)$	$\left(Yi - \bar{Y}\right)$	$\left(Xi - \bar{X}\right)^2$	$\left(Yi - \bar{Y}\right)^2$	$\left(Xi - \bar{X}\right)\left(Yi - \bar{Y}\right)$
1	95	85	17	8	289	64	136
2	85	95	7	18	49	324	126
3	80	70	2	-7	4	49	-14
4	70	65	-8	-12	64	144	96
5	60	70	-18	-7	324	49	126
Sum	390	385			730	630	470
Mean	78	77					

Regression equation

$\hat{Y} = a + bX$

$$\bar{Y} = \frac{\sum Y}{n}$$
$$\bar{Y} = \frac{385}{5}$$
$$\bar{Y} = 77$$
$$\bar{X} = \frac{\sum X}{n}$$
$$\bar{X} = \frac{390}{5}$$
$$\bar{X} = 78$$

$$b = \frac{\sum \left(Xi - \bar{X} \right)\left(Yi - \bar{Y} \right)}{\sum \left(Xi - \bar{X} \right)^2}$$
$$b = \frac{470}{730}$$
$$b = 0.644$$
$$a = \bar{Y} - b\bar{X}$$
$$a = 77 - (0.644)(78)$$
$$a = 77 - 121.12$$
$$a = 26.768$$
$$\hat{Y} = 26.768 + 0.644X$$

Q: For a group of 10 values

$$\sum X = 452$$
$$\sum X^2 = 24270,$$
$$Mode - 43.7$$

Find the coefficient of Skewness?

Solution:

$$Mean = \bar{X} = \frac{\sum X}{n}$$

$$\bar{X} = \frac{452}{10}$$

$$\bar{X} = 45.2$$

$$S = \sqrt{\frac{\sum X^2}{n} - \left(\frac{\sum X}{n}\right)^2}$$

$$S = \sqrt{\frac{24270}{10} - \left(\frac{452}{10}\right)^2}$$

$$S = \sqrt{24270 - 2043.04}$$

$$S = \sqrt{383.96}$$

$$S = 19.59$$

Now

Skewness

$$SK = \frac{Mean - Mode}{S.D}$$

$$SK = \frac{45.2 - 43.7}{19.59}$$

$$SK = \frac{1.5}{19.59}$$

$$SK = 0.077$$

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— *Qalb-e-Momin*

Course STA301: Statistics and Probability

Practice Questions

Lecture No 16 to 18

Multiple Choice Questions:

(Sample questions)

16. Two events say A and B are said to be mutually exclusive events, when:

a) Two events cannot occur same time.
b) Two events can occur same time.
c) All of the above
d) None of the above

17. A four-person committee is to be formed from a list of six persons. How many sample points are associated with the experiment?

m) 360
n) 15
o) 250
p) 14

18. A club consists of four members. How many sample points are in the sample space when two officers: president and secretary are to be chosen?

m) 12
n) 6
o) 8
p) 20

19. In a throw of coin what is the probability of getting tails.

m) 1
n) 2.
o) 1/2
p) 0

20. If a card is drawn from an ordinary deck of 52 playing cards, find the probability that the card is a red card.

m) 1/2
n) 1/4
o) 1/13
p) 1/6

Numerical Questions

(Sample questions)

Q1: Define Equally Likely Events.

Q2: Define Exhaustive Events.

Q3: Differentiate between "Rule of Permutation" and "Rule of Combination".

Q4: In a box contains 4 red, 4 white and 5 green balls. In how many ways can 2 red balls, white balls and 2 green balls be chosen?

Q5: Two dice are rolled.

a) Make a sample space
b) Find the probability that the sum of the outcomes is equal to at least 8.
c) Find the probability of getting a same number on both die.

ANSWERS / SOLUTION

Course STA301: Statistics and Probability

Practice Questions

Lecture No 16 to 18

Multiple Choice Questions:

(Sample questions)

1. Two events say A and B are said to be mutually exclusive events, when:

a) Two events cannot occur same time. ***
b) Two events can occur same time.
c) All of the above
d) None of the above

2. A four-person committee is to be formed from a list of six persons. How many sample points are associated with the experiment?

a) 360
b) 15***
c) 250
d) 14

3. A club consists of four members. How many sample points are in the sample space when two officers: president and secretary are to be chosen?

a) 12***
b) 6
c) 8
d) 20

4. In a throw of coin what is the probability of getting tails.

a) 1
b) 2.
c) 1/2***
d) 0

5. If a card is drawn from an ordinary deck of 52 playing cards, find the probability that the card is a red card.

a) ½***
b) 1/4
c) 1/13
d) 1/6

Numerical Questions

(Sample questions)

Q1: Define Equally Likely Events.

Two events A and B are said to be equally likely events, when one event is as likely to occur as the other event. Or when the chance of occurrence of both events are same.

Q2: Define Exhaustive Events.

Events are said to be exhaustive events when the union of mutually exclusive events is the entire sample space.

Q3: Differentiate between "Rule of Permutation" and "Rule of Combination".

In rule of permutation, the order is important for the selection of r objects from the set of "n" distinct objects.

In rule of combination, the order is not important for the selection of r objects from the set of "n" distinct objects.

Q4: In a box contains 4 red, 4 white and 5 green balls. In how many ways can 2 red balls, white balls and 2 green balls be chosen?

Numbers of ways of choosing 2 red balls from 4 red balls

$$= {}^4C_2 = \frac{4!}{2!(4-2)!} = \frac{4!}{2!\times 2!} = \frac{4\times 3\times 2!}{2!\times 2!} = \frac{4\times 3}{2\times 1} = 3\times 2 = 6.$$

Numbers of ways of choosing 2 white balls from 4 white balls

$$= {}^4C_2 = \frac{4!}{2!(4-2)!} = \frac{4!}{2!\times 2!} = \frac{4\times 3\times 2!}{2!\times 2!} = \frac{4\times 3}{2!} = 6$$

Numbers of ways of choosing 2 green balls from 5 green balls

$$= {}^5C_2 = \frac{5!}{2!(5-2)!} = \frac{5!}{2!\times 3!} = \frac{5\times 4\times 3!}{2!\times 3!} = \frac{5\times 4}{2!} = 10$$

By the counting principle 2 black, 2 white and 2 red balls can be chosen

$$6\times 6\times 10 = 360.$$

Q5: Two dice are rolled.

a) Make a sample space

b) Find the probability that the sum of the outcomes is equal to at least 8.

c) Find the probability of getting a same number on both die.

Solution:

a)

S = {(1, 1), (1, 2), (1, 3), (1, 4) (1, 5), (1, 6),
(2, 1), (2, 2), (2, 3), (2, 4), (2, 5), (2, 6),
(3, 1), (3, 2), (3, 3), (3, 4), (3, 5), (3, 6),
(4, 1), (4, 2), (4, 3), (4, 4), (4, 5), (4, 6),
(5, 1), (5, 2), (5, 3), (5, 4), (5, 5), (5, 6),
(6, 1), (6, 2), (6, 3), (6, 4), (6, 5), (6, 6)}

b)

n(S)=36,

Let A be the event that sum of at least 8

occurs.

$A = \{(2,6),(3,5),(3,6),(4,4),(4,5),(4,6),(5,3),(5,4),(5,5),(5,6),(6,2),(6,3),(6,4),(6,5),(6,6)\}$

n(A)= 15

$$P(A) = \frac{n(A)}{n(S)} = \frac{15}{36} = \frac{5}{12}.$$

b) Let B be the event that same number appears on the die.

$B = \{(1,1),(2,2),(3,3),(4,4),(5,5),(6,6)\}$

n(B)= 6

$$P(\mathrm{B}) = \frac{n(\mathrm{B})}{n(S)} = \frac{6}{36} = \frac{1}{6}.$$

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Best of luck for everything ahead!

May Allah bless you with success, strength, and peace.

Please **remember me in your precious prayers**

and I'll do the same, In Sha Allah.

— *Qalb-e-Momin*

Practice Question Lecture 19-22

1) A measure of the chance that an uncertain event will occur
    a) An experiment
    b) An event
    c) A probability
    d) A trial
2) For two mutually exclusive events A and B, P(A) =0.2 and P(B)=0.4, then P(AUB) is
    a) 0.8
    b) 0.2
    c) 0.6
    d) 0.5
3) The probability of drawing any one spade card is
    a) 1/32
    b) 1/13
    c) 4/13
    d) 1/4
4) If P(AUB)=P(A)+P(B), then A and B are
    a) Mutually exclusive
    b) Dependent
    c) Independent
    d) Not mutually exclusive
5) If P(B|A)=0.25 and $P(A \cap B)=0.20$, then P(A) is
    a) 0.05
    b) 0.8
    c) 0.95
    d) 0.75
6) A student solved 25 questions from first 50 questions of a book to be solved. The probability that he will solve the remaining all questions
    a) 0.25
    b) 0.50
    c) 1
    d) 0
7) If P(A)=1/3, P(B)=2/3 if A and B are independent then $P(A \cap B)$ is
    a) 2/6
    b) 2/9
    c) 0
    d) 1/9

8) A random variable is also called a
    a) Chance Variable
    b) Stochastic Variable
    c) Constant
    d) Both (a) and (b)
9) A discrete probability distribution may be represented by
    a) A table
    b) A graph
    c) A mathematical equation
    d) Both (b) and (c)
    e)
10) If the random variable X denotes the number of heads when three distinct coins are tossed, then X assumes the value
    a) 0,1,2,3
    b) 1,3,3,1
    c) 1,2,3
    d) 3,3,3,3
11) If X is a discrete random variable, then the function f(x) is
    a) A probability function
    b) A probability density function
    c) A density function
    d) A distribution function

12) What is the probability of getting at least one tail in three tosses of a coin?

13) Let A and B be two events associated with an experiment. Let P (A) =0.4, P (AUB) =0.7.Let P (B) =p. Find 'p' when (i) A and B are mutually exclusive (ii) A and B are independent.

14) A pair of dice is thrown twice. Find the probability of getting a total 7 and 11?

15) Obtain a probability distribution for the number of heads when three coins are tossed. ?

Solution

1) A measure of the chance that an uncertain event will occur
    a) An experiment
    b) An event
    c) A probability****
    d) A trial
2) For two mutually exclusive events A and B, P(A) =0.2 and P(B)=0.4, then P(AUB) is
    a) 0.8
    b) 0.2
    c) 0.6****
    d) 0.5
3) The probability of drawing any one spade card is
    a) 1/32
    b) 1/13
    c) 4/13
    d) 1/4****
4) If P(AUB)=P(A)+P(B), then A and B are
    a) Mutually exclusive****
    b) Dependent
    c) Independent
    d) Not mutually exclusive
5) If P(B|A)=0.25 and $P(A \cap B)$=0.20, then P(A) is
    a) 0.05
    b) 0.8****
    c) 0.95
    d) 0.75
6) A student solved 25 questions from first 50 questions of a book to be solved. The probability that he will solve the remaining all questions
    a) 0.25
    b) 0.50****
    c) 1
    d) 0
7) If P(A)=1/3, P(B)=2/3 if A and B are independent then $P(A \cap B)$ is
    a) 2/6
    b) 2/9****
    c) 0
    d) 1/9

8) A random variable is also called a
    a) Chance Variable
    b) Stochastic Variable
    c) Constant
    d) Both (a) and (b)****

9) A discrete probability distribution may be represented by
   a) A table
   b) A graph
   c) A mathematical equation
   d) Both (b) and (c)****

10) If the random variable X denotes the number of heads when three distinct coins are tossed, then X assumes the value
   a) 0,1,2,3****
   b) 1,3,3,1
   c) 1,2,3
   d) 3,3,3,3

11) If X is a discrete random variable, then the function f(x) is
   e) A probability function****
   f) A probability density function
   g) A density function
   h) A distribution function

12) What is the probability of getting at least one tail in three tosses of a coin?

Solution:

If H and T respectively denote the occurrence of head and tail, then the sample space for the experiment of tossing three coins is

S={HHH,HHT,HTH,THH,HTT,THT,TTH,TTT}.

If we let A represent the event that at least one head occurs, then A will consist of MANY sample points, and the process of computing the probability of this event will become somewhat cumbersome! So, instead of denoting this particular event by A, let us denote its complement i.e. "No TAIL" by A.
Thus the event A consists of the SINGLE sample point {HHH}.
Therefore P(A) = 1/8.
Hence by the law of complementation, we have

$$P(\bar{A}) = 1 - P(A) = 1 - 1/8 = 3/8$$

13) Let A and B be two events associated with an experiment. Let P (A) =0.4, P (AUB) =0.7.Let P (B) =p. Find 'p' when (i) A and B are mutually exclusive (ii) A and B are independent.

Solution:

i. For mutually events A and B, we have
   P (AUB) =P (A) +P (B)

0.7=0.4+p

P=0.7-0.4=0.3

ii. For independent events A and B, we have

$P(A \cap B) = P(\mathrm{A})P(B) = 0.4\,\mathrm{p}$

$\mathrm{P(AUB)} = \mathrm{P(A)} + \mathrm{P(B)} - \mathrm{P(A} \cap \mathrm{B)}$

$0.7 = 0.4 + p - 0.4\,\mathrm{p}$

$0.6p = 0.3$

$\mathrm{p} = 0.5$

14) A pair of dice is thrown twice. Find the probability of getting a total 7 and 11?

Solution:

Let A_1 and A_2 denote the events "a 7 appears on the first throw" and "a 7 appear on the second throw" and B_1 and B_2 the events "an 11 appears on the first throw" and 11 appear on the second throw"

So

$n(A_1)=\{(1,6),(2,5),(3,4),(4,3),(5,2),(6,1)\}$

n (S)=36

$P(A_1) = n(A_1)/n(S) = 6/36 = 1/6$

$P(A_1) = P(A_2) = 1/6$

$n(B_1)=\{(5,6),(6,5\}$

n (S)=36

$P(B_1) = n(B_1)/n(S) = 2/36 = 1/18$

$P(B_1) = P(B_2) = 1/18$

P(total of 7 and 11)=P(total of 7 on first die and total of 11 on the second die)=P(total of 11 on first die and total of 7 on the second die)

$$P(A_1 \cap B_2) + P(B_1 \cap A_2) = P(\mathrm{A}_1)P(\mathrm{B}_2) + P(\mathrm{B}_1)P(\mathrm{A}_2)$$

$$= 1/6 \times 1/18 + 1/18 \times 1/6 = 1/108 + 1/108 = 1/54$$

15) Obtain a probability distribution for the number of heads when three coins are tossed. ?

Solution

If H and T respectively denote the occurrence of head and tail, then the sample space for the experiment of tossing three coins is

S= {HHH, HHT, HTH, THH, HTT, THT, TTH, TTT}.

If X denotes the number of heads when three coins are tossed, then the elements (sample points) of the sample space and the values of the random variable X are shown in the following table

Sample point	HHH	HHT	HTH	THH	HTT	THT	TTH	TTT
X	3	2	2	2	1	1	1	0

Thus the probability distribution of the random variable X is given in the following table.

x	0	1	2	3
P(x)	1/8	3/8	3/8	1/8

Best of Luck