

Pabna Cadet College  
Second Term-End Exam - 2021  
Subject: Statistics  
Class: XI

Time: 3 hours

Full Marks: 80

Answer all the questions.

**Creative Questions**

1. **A researcher has determined the first four central moments about 3, and the values are -1, 5, 20, and 90.**
  - a. Write one use of moments. 1
  - b. Find the relationship between first raw moment and arithmetic mean. 2
  - c. Find the second and third central moments using information from the stem. 3  
*[You are free to use techniques from **this link-click to open**]*
  - d. Estimate the skewness of the distribution and explain. 4
2. **Height and Weight of 10 people are:**

Table 1: Height and weight of 10 random people

height	weight
142	50
150	48
152	49
155	52
157	56
160	61
165	56
167	65
172	58
175	67

- a. Which variable should be the dependent one?
  - b. Is the regression coefficient always unit-free? Briefly explain.
  - c. Fit a regression line from the above data (i.e., find the regression coefficients and write the fitted model)
  - d. If the regression model with the above data is  $Y = \alpha + \beta X + \epsilon$ , what is the value of  $\alpha$ ? Explain
3. Export amount of a product followed the pattern:

Table 2: Time-series data

year	amount
2001	112
2002	115
2003	120
2004	125
2005	132
2006	144

year	amount
2007	150
2008	160
2009	162
2010	165

- What is time series data?
- What does a negative trend imply?
- From the stem, find the trend using semi-average method.
- Does moving average method look better for finding trend of this data? Explain.

## MCQ

- Who invented Stem and Leaf display?
  - Karl Pearson
  - R.A. Fisher
  - W.I. King
  - John Tukey
- H.G. Sturges rule for determining number of classes (k)-
  - $K = 1 + 3.322 \log N$
  - $K = 1 + 2.322 \log N$
  - $K = 1 + 3.222 \log N$
  - $K = 1 - 3.322 \log N$
- Formula to measure angles for a pie-chart-
  - $\theta_i = \frac{f_i}{N} \times 360^\circ$
  - $\theta_i = \frac{N}{f_i} \times 360^\circ$
  - $\theta_i = \frac{f_i}{N-1} \times 360^\circ$
  - $\theta_i = \frac{N-1}{f_i} \times 360^\circ$
- If there are numerous categories in a data, which graph would be perfect?
  - Histogram
  - Pie chart
  - Bar Diagram
  - Frequency polygon
- Which graph requires cumulative frequencies?
  - Histogram
  - Ogive
  - Frequency polygon
  - Pie chart
- “50 students scored less than or equal to 60 marks”- which of the following can directly give such information?
  - Histogram
  - Pie chart
  - Bar diagram
  - Ogive
- Which diagram shows times series data?
  - Histogram

- b. Frequency curve
  - c. Bar diagram
  - d. Histogram
8. Which diagram is suitable for displaying the data?

District	Rajshahi	Chapainawabganj	Rangpur	Pabna	Natore
Mango Production	750	800	500	450	380

- i. Histogram
  - ii. Pie chart
  - iii. Bar chart
- a. i
  - b. i & ii
  - c. ii & iii
  - d. i, ii, & iii
9. Which of the following is NOT an attribute of a good classification?
- a. Stability
  - b. Unambiguity
  - c. Flexibility
  - d. Attractiveness
10. Which is a characteristic of secondary data?
- a. It is very reliable
  - b. It provides data in the form the researcher desires
  - c. It is less costly
  - d. It does not require precautions by the user.
11. Which one is correct for positive skewness
- a. Mean > Median < Mode
  - b. Mean = Median = Mode
  - c. Mean < Median < Mode
  - d. Mean > Median > Mode
12. Skewness of a symmetrical distribution is -
- a. 1
  - b. 0
  - c. -1
  - d. Infinity
13. The first raw moment about 2 is 6. What is value of the arithmetic mean? (2 marks)
- a. 4
  - b. 12
  - c. 8
  - d. 2
14. Karl Pearson's method of coefficient of skewness- (2 marks)
- a.  $SK_p = \frac{\bar{X} - Mo}{\sigma}$
  - b.  $SK_p = \frac{Q_3 + Q_1 - 2Me}{Q_3 - Q_1}$
  - c.  $SK_p = \frac{D_9 + D_1 - 2Me}{D_9 - D_1}$
  - d.  $SK_p = \frac{\bar{X} - \sigma}{Mo}$

15. What is value of  $\beta_1$  for a symmetrical distribution?
- 1
  - 3
  - 1
  - 0
16. Second central moment of first n natural numbers
- $\frac{n^2+1}{12}$
  - $\frac{n^2-1}{12}$
  - $\frac{n^2}{n+1}$
  - $\frac{n^2-2}{12}$
17. First moment about 2 is -1. What is the moment about 5? (2 marks)
- 4
  - 4
  - 7
  - 6
18. In a distribution, Mean = 65, Median = 70 and coefficient of skewness = -0.5. What is coefficient of variation? (2 marks)
- 50%
  - 41.65%
  - 46.15%
  - 65.14%
19. Five number summary consist of-
- Arithmetic mean, three quartiles, and median
  - Range, three quartiles, and variance
  - Lowest value, mean, median, mode, and highest value
  - Lowest value, three quartiles, and highest value
20. Which is not true about this graph? (2 marks)

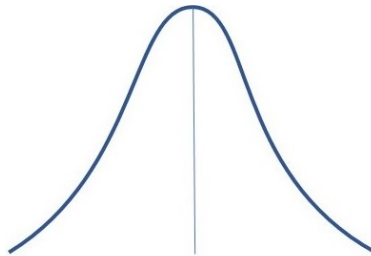


Figure 1: Example curve

- Most values have small frequencies
  - Most numbers lie around the average value
  - A representation of a symmetric distribution
  - Few values have small frequencies
21. What is the correct relationship?
- $\frac{b_{yx}+b_{xy}}{2} \leq r$
  - $\frac{b_{yx}+b_{xy}}{2} \geq r$
  - $\frac{b_{yx}+b_{xy}}{2} = r$

- d.  $\frac{b_{yx} \times b_{xy}}{2} \geq r$
22. Regression coefficient,  $\beta = 0.25$ ; What is not a correct interpretation? (2 marks)
- $\beta$  is equivalent to slope of a straight line
  - $\beta$  represents average increase in dependent variable due to independent variable.
  - If independent variable increases 1 unit, dependent variable increase 0.25 units, on average.
  - The relationship between dependent and independent variable is weak
23. Range of regression coefficient lies between -
- $(-1, 1)$
  - $(-\infty, +\infty)$
  - $(0, \infty)$
  - $[0, \infty)$
24. What is the value of  $r$  in the equation  $4x + 3y = 60$
- 1
  - 1
  - 0
  - 0.75
25. If  $b_{yx} = -2$  and  $b_{xy} = -0.4$ ,  $r =$
- 2.4
  - 2.4
  - 0.89
  - 0.89
26. Which graph shows the highest linear association?

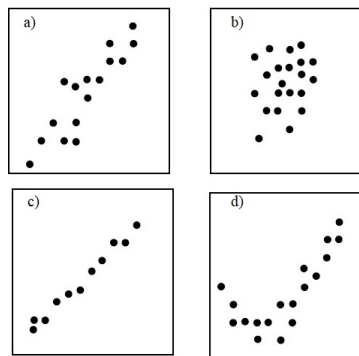


Figure 2: Scatter Plots

- a
- b
- c
- d

Answer questions 27-28 according to the following information.

$ax + by + c = 0$ , where  $a$  and  $b$  are non-zero values.

27. If  $a = 2$  and  $b = 15$ ,  $r = ?$

- 1
- 0.8
- 0

- d. 1
28. If  $a = 20$  and  $b = -6$ ,  $r = ?$
- 1
  - 1
  - 0
  - 3.33
29. Which is true? (2 marks)
- Correlation can assess linear and non-linear relationships.
  - Regression analysis cannot make predictions.
  - Regression coefficient may or may not be unit-free.
  - Correlation coefficient depends on origin and scale.
30. The correct formula to measure rank correlation
- $\rho = 1 - \frac{6\sum d_i^2}{n(n^2-1)}$
  - $\rho = 1 - \frac{6\sum d_i^2}{(n^2-1)}$
  - $\rho = 1 - \frac{6\sum d_i^2}{n(n^2+1)}$
  - $\rho = 1 - \frac{\sum d_i^2}{n(n^2-1)}$
31. If there is an unpredictable/sudden effect in a time series data, it is called-
- Trend
  - Seasonal variation
  - Cyclic variation
  - Random variation
32. Which one is the correct additive model?
- $Y_t = T_t + S_t + C_t$
  - $Y_t = T_t + S_t + C_t + R_t$
  - $Y_t = T_t + S_t + C_t - R_t$
  - $Y_t = T_t - S_t + C_t - R_t$
33. The curve shows examples of- (2 marks)

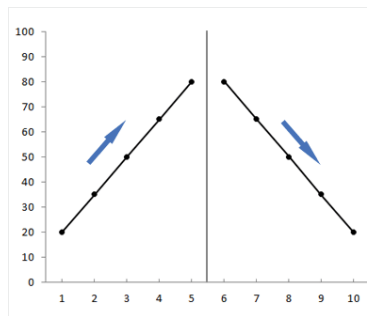


Figure 3: Example

- Trend
  - Seasonal variation
  - Cyclic variation
  - Irregular variation
34. Which is not true of graphical method to find trend? (2 marks)

- a. Easy and simple
  - b. Flexible for linear and non-linear trend
  - c. Subjective (depends on personal judgment)
  - d. Always measurable
35. As far as semi-average method of finding trend is concerned, when number of observations is odd, which is true?
- a. Middle-most value is omitted.
  - b. Middle-most value is divided into two parts and each part is added to semi-totals.
  - c. Middle-most value is added to both semi-totals.
  - d. None of the above

Answer the questions 36-38 according to the following table

Year	1992	1993	1994	1995	1996	1997	1998	1999	2000
Production (in m ton)	6.0	6.5	7.0	7.2	7.3	7.0	8.0	8.2	8.4

36. What is first semi-average?
- a. 6.665
  - b. 6.675
  - c. 6.776
  - d. 6.566
37. What is second semi-average?
- a. 7.912
  - b. 7.925
  - c. 7.900
  - d. 7.907
38. If two semi-averages are plotted on a graph paper, how many original points fall on the trend line? (2 marks)
- a. 1
  - b. 2
  - c. 3
  - d. 4
39. Which applies to the method of moving average?
- a. Simplicity
  - b. Flexibility
  - c. Biasness in non-linear trend
  - d. Suitable for future prediction
40. In the question 36, what is the first 3-yearly moving average?
- a. 6.67
  - b. 6
  - c. 6.5
  - d. 6.95

## Answers to Creative Questions

- a. Moments can be used to find characteristics of a distribution.
- b. Relationship between first raw moment and arithmetic mean.

First raw moment,  $\mu'_1 = \frac{\Sigma(x_i - a)}{n} = \frac{\Sigma x_i - na}{n} = \bar{X} - a$

Thus,  $\mu_1 = \bar{X} - a$

c. Second and third central moments from their raw counterparts

Using the techniques from here, We have to use the formulae  $a^2 + 2ab + b^2$  for the 2nd central moment and  $a^3 + 3a^2b + 3ab^2 + b^3$  for the 3rd central moment.

Here,  $b = a - k$  (since we are dealing with central moments,  $k = \bar{X}$ )

From (b),  $\bar{X} = \mu_1 + a = -1 + 3 = 2$

$\therefore b = 3 - 2 = 1$

$$\begin{aligned}
 \therefore \mu_2 &= \mu'_2(a) + 2\mu'_1b + b^2 \\
 &= 5 + 2(-1) \times 1 + 1^2 \quad (\#eq : cm2) \\
 &= 5 - 2 + 1 \\
 &= 4
 \end{aligned} \tag{1}$$

## MCQ Answers

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
d	a	a	c	b	d	d	c	d	c	d	b	c	a	d	b	a	c	d	a

21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
a	d	b	a	d	c	a	b	c	a	d	b	a	d	a	b	c	a	d	c