

**DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE ASKED TO DO SO**

**T.B.C. : B-GSE-P-TUA**

**Test Booklet Series**

1006597

**Serial**



**TEST BOOKLET  
STATISTICS**

**Paper I**

**Time Allowed : Two Hours**

**Maximum Marks : 200**

**INSTRUCTIONS**

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET **DOES NOT** HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS, ETC. IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET.
2. Please note that it is the candidate's responsibility to encode and fill in the Roll Number and Test Booklet Series Code A, B, C or D carefully and without any omission or discrepancy at the appropriate places in the OMR Answer Sheet. Any omission/discrepancy will render the Answer Sheet liable for rejection.
3. You have to enter your Roll Number on the Test Booklet in the Box provided alongside.  
**DO NOT** write *anything else* on the Test Booklet.
4. This Test Booklet contains **80** items (questions). Each item comprises four responses (answers). You will select the response which you want to mark on the Answer Sheet. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose **ONLY ONE** response for each item.
5. You have to mark all your responses **ONLY** on the separate Answer Sheet provided. See directions in the Answer Sheet.
6. All items carry equal marks.
7. Before you proceed to mark in the Answer Sheet the response to various items in the Test Booklet, you have to fill in some particulars in the Answer Sheet as per instructions sent to you with your Admission Certificate.
8. After you have completed filling in all your responses on the Answer Sheet and the examination has concluded, you should hand over to the Invigilator **only the Answer Sheet**. You are permitted to take away with you the Test Booklet.
9. Sheets for rough work are appended in the Test Booklet at the end.
10. **Penalty for wrong answers :**  
**THERE WILL BE PENALTY FOR WRONG ANSWERS MARKED BY A CANDIDATE IN THE OBJECTIVE TYPE QUESTION PAPERS.**
  - (i) There are four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, **one-third (0-33)** of the marks assigned to that question will be deducted as penalty.
  - (ii) If a candidate gives more than one answer, it will be treated as a **wrong answer** even if one of the given answers happens to be correct and there will be same penalty as above to that question.
  - (iii) If a question is left blank, i.e., no answer is given by the candidate, there will be **no penalty** for that question.

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1. Let  $(X, Y)$  be jointly distributed with density

$$f(x, y) = \begin{cases} e^{-y}, & 0 < x < y < \infty \\ 0, & \text{otherwise} \end{cases}$$

Consider the following :

1.  $E(X) = 1$
2.  $E(Y) = 2$
3.  $E(XY) = 2$

Which of the above are correct ?

- (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

2. Let  $X$  have a Bernoulli distribution with mean 0.4. What is the variance of  $(2X - 3)$  ?

- (a) 0.24
- (b) 0.48
- (c) 0.6
- (d) 0.96

3. If in 6 trials,  $X$  is a binomial variate which follows the relation  $9P(X = 4) = P(X = 2)$ , then what is the probability of success ?

- (a)  $1/8$
- (b)  $1/4$
- (c)  $3/8$
- (d)  $3/4$

4.  $X_1$  and  $X_2$  are independent Poisson variables such that  $P(X_1 = 2) = P(X_1 = 1)$  and  $P(X_2 = 2) = P(X_2 = 3)$ . What is the variance of  $(X_1 - 2X_2)$  ?

- (a) 14
- (b) 4
- (c) 3
- (d) 2

5. For the distribution

$$f(x) = \frac{1}{\beta(p, q)} \frac{x^{p-1}}{(1+x)^{p+q}}, \quad 0 < x < \infty, p > 0,$$

$q > 0$ ; what is the harmonic mean ?

- (a)  $\frac{p}{p+q}$
- (b)  $\frac{1}{p}$
- (c)  $\frac{p-1}{q}$
- (d)  $\frac{p+1}{q-1}$

6. A Poisson variable  $X$  has mean equal to  $\frac{1}{2}$ .

Consider the following for  $Y = 2X$  :

1.  $E(Y) = 1$
2.  $\text{Var}(Y) = 4$
3.  $\mu_3(Y) = 4$
4.  $\mu_4(Y) = 28$

Which of the above is/are correct ?

- (a) 1 only
- (b) 2 and 4 only
- (c) 1 and 3 only
- (d) 1, 2 and 3 only

7. Let the random variable  $X$  have the distribution  $P(X = 0) = P(X = 3) = p$ ,  $P(X = 1) = 1 - 3p$  for  $0 \leq p \leq 1/2$ . What is the maximum value of  $V(X)$  ?

- (a) 3
- (b) 4
- (c) 5
- (d) 6

8. Let  $X$  be a Poisson variate with parameter  $\lambda$  such that  $P(X = 2) = 2P(X = 4) + 20P(X = 6)$ . What is the coefficient of skewness?

- (a)  $\frac{1}{\sqrt{3}}$   
 (b) 1  
 (c)  $\frac{1}{2}$   
 (d)  $-\frac{1}{\sqrt{3}}$

9. Let  $X$  be a random variable with probability generating function  $P(s) = \sum_k p_k s^k$ . What is the probability generating function of  $Y = 2X$ ?

- (a)  $P(\sqrt{s}) + P(-\sqrt{s})$   
 (b)  $\frac{P(\sqrt{s}) - P(-\sqrt{s})}{2}$   
 (c)  $P(\sqrt{s}) - P(-\sqrt{s})$   
 (d)  $\frac{P(\sqrt{s}) + P(-\sqrt{s})}{2}$

10. A simple random sample of size 10 is selected with replacement from a population of size 100. What is the expected number of unique elements in the sample?

- (a)  $100 \times \left(\frac{99}{100}\right)^{10}$   
 (b)  $100 \times \left[1 - \left(\frac{99}{100}\right)^{10}\right]$   
 (c)  $100 \times \left(\frac{9}{10}\right)^{10}$   
 (d)  $100 \times \left(1 - \frac{99}{100}\right)^{10}$

11. 10 balls are placed in 10 boxes independently at random. Assuming that all 10 boxes were initially empty, what is the expected number of boxes that remain empty?

- (a)  $\left(\frac{9}{10}\right)^9$   
 (b)  $\frac{9^9}{10^{10}}$   
 (c)  $\frac{9^{10}}{10^9}$   
 (d)  $\left(\frac{9}{10}\right)^{10}$

12. To compare the lifetimes of bulbs produced by two companies, A and B, one bulb of each company was selected at random and their lifetimes were observed. Assume that the bulbs have exponentially distributed lifetimes with mean 1000 days and 800 days for company A and company B, respectively. What is the probability that the bulb from company B fails first?

- (a)  $\frac{4}{9}$   
 (b)  $\frac{5}{9}$   
 (c)  $\frac{25}{81}$   
 (d)  $\frac{25}{41}$

13. The lifetime of a bulb is exponentially distributed with mean 100 hours. The bulb remains switched on for exactly 4 hours every day and remains switched off the remaining time. What is the probability that the bulb stops working on or before the 25<sup>th</sup> day ?

- (a)  $\frac{1 - e^{-1}}{1 - e^{-\frac{1}{25}}}$   
 (b)  $1 - e^{-\frac{1}{25}}$   
 (c)  $1 - e^{-1}$   
 (d)  $e^{-1}$

14. Suppose  $X$  follows the  $N(0, \sigma^2)$  distribution and conditional on  $X = x$ ,  $Y$  has the  $N(\rho x, \sigma^2)$  distribution. What is  $\text{Cov}(X, Y)$  equal to ?

- (a)  $\rho$   
 (b)  $\rho^2$   
 (c)  $\rho \sigma^2$   
 (d)  $\rho^2 \sigma^2$

15. Suppose  $X_1, X_2, X_3, \dots, X_n$  are independent standard normal random variables and

$$T_n = \sum_{i=1}^n X_i^2. \text{ Consider the following :}$$

- The distribution of  $T_n$  is  $\chi_n^2$ .
- The asymptotic distribution of  $\sqrt{n} \left( \frac{T_n}{n} - 1 \right)$  is  $N(0, \sigma^2)$  for some  $\sigma^2 > 0$ .

Which of the above is/are correct ?

- (a) 1 only  
 (b) 2 only  
 (c) Both 1 and 2  
 (d) Neither 1 nor 2

16. Consider the following statements :

*Statement I* : For a Laplace distribution

$$f(x) = \frac{1}{2} e^{-|x|}, \quad -\infty < x < \infty,$$

$$f(x) = \frac{1}{2\pi} \int_{-\infty}^{\infty} e^{-itx} \psi(t) dt \text{ for all } x \in \mathbb{R}',$$

where  $\psi(t)$  is the characteristic function.

*Statement II* :  $\psi(t)$  is absolutely integrable.

Which one of the following is correct in respect of the above statements ?

- (a) Both Statement I and Statement II are true and Statement II is the correct explanation of Statement I.  
 (b) Both Statement I and Statement II are true but Statement II is **not** the correct explanation of Statement I.  
 (c) Statement I is true but Statement II is false.  
 (d) Statement I is false but Statement II is true.

17. Let  $X_1$  and  $X_2$  be the number of eggs laid by two insects which follow independent Poisson distributions with parameters  $\lambda_1$  and  $\lambda_2$ , respectively. The conditional distribution of  $X_1$  given  $X_1 + X_2$  will be

- (a) Poisson  
 (b) Geometric  
 (c) Binomial  
 (d) Negative Binomial

18. Suppose 5 tickets are drawn at a time from a box containing  $n$  tickets numbered 1, 2, 3, ...,  $n$ . Let  $X$  be the sum of the numbers of the 5 tickets drawn.

Consider the following statements :

1.  $E(X) = \frac{5(n+1)}{2}$
2.  $V(X) = \frac{5(n+1)(n-5)}{12}$

Which of the above is/are correct ?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

19. If  $X$  and  $Y$  are two independent random variables with Binomial distributions having integer parameters  $m$  and  $n$  and the same probability parameter  $p$ , then consider the following statements :

1.  $m + n - X - Y$  has a Binomial distribution.
2. The conditional distribution of  $X$  given the sum  $X + Y$  is a hyper-geometric distribution.
3. The conditional distribution of  $X$  given the sum  $X + Y$  is again a Binomial distribution.

Which of the above statements is/are correct ?

- (a) 1 only
- (b) 2 only
- (c) 1 and 2 only
- (d) 1 and 3 only

20. If  $X$  has a uniform distribution over the interval  $(0, 1)$ , then for any real numbers  $a$  and  $b$ ,  $0 < a < b < 1$ , what is

$P\left[a < X < b \mid X > \frac{a+b}{2}\right]$  equal to ?

- (a)  $\frac{b-a}{2-a-b}$
- (b)  $\frac{2(b-a)}{b+a}$
- (c)  $\frac{2(b-a)}{2-a-b}$
- (d)  $\frac{b-a}{b+a}$

21. Let  $X$  be a random variable with density  $f(x) = \frac{1}{2}e^{-|x|}$ ,  $-\infty < x < \infty$ . What is the expected value of  $[X]$ , where  $[.]$  denotes the greatest integer function ?

- (a)  $\frac{1}{2}$
- (b) 0
- (c)  $-\frac{1}{2}$
- (d) -1

22. Let  $X$  and  $Y$  be independently and identically distributed as lognormal with parameters  $\mu$  and  $\sigma^2$ . What are the mean and variance of  $\log\left(\frac{X}{Y}\right)$  respectively ?

- (a) 0 and  $\sigma^2$
- (b) 0 and  $2\sigma^2$
- (c)  $2\mu$  and  $\sigma^2$
- (d)  $2\mu$  and  $2\sigma^2$

23. The joint probability density of  $X$  and  $Y$  is given as

$$f(x, y) = \begin{cases} \frac{x+2y}{3} & \text{for } 0 < x < 1, 0 < y < 1 \\ 0, & \text{otherwise} \end{cases}$$

What is the value of  $P\left(Y \leq \frac{1}{2} \mid X = \frac{1}{2}\right)$  ?

- (a)  $\frac{1}{6}$
- (b)  $\frac{1}{3}$
- (c)  $\frac{2}{3}$
- (d)  $\frac{5}{6}$

24. A and B are two events such that  $P(A) = P(A | B) = \frac{1}{4}$  and  $P(B | A) = \frac{1}{2}$ . Which of the following are correct ?

1. A and B are independent events.
2.  $P(A) < P(B)$
3.  $P(\bar{A} | B) = \frac{3}{4}$
4. A and B are mutually exclusive events.

Select the correct answer using the code given below :

- (a) 1, 2 and 3 only
- (b) 1, 2 and 4 only
- (c) 2, 3 and 4 only
- (d) 1, 3 and 4 only

25. A given lot of items has 2% defectives. A Quality Control (QC) procedure, which is not totally reliable, has the following features :

$P[\text{Testing QC procedure indicates an item tested as good} | \text{item is indeed good}] = 0.95$

$P[\text{Testing QC procedure indicates an item tested as defective} | \text{item is indeed defective}] = 0.94$

What is the probability that the item tested is defective given that the testing QC procedure indicates it to be defective ?

- (a) 0.028
- (b) 0.062
- (c) 0.28
- (d) 0.62

26. Which of the following tests should be employed for deciding whether or not two samples come from the same skewed parent population ?

1. Paired t-test
2. Unpaired t-test
3. Run test
4. Sign test

Which of the above statements are correct ?

- (a) 1 and 3 only
- (b) 3 and 4 only
- (c) 2, 3 and 4 only
- (d) 1, 3 and 4 only

27. Consider the following relations (with usual notations) where  $X \sim N(\mu, \sigma^2)$  :

$$1. \chi^2_{(2)} = \frac{(\bar{X} - \mu)^2}{\sigma^2}$$

$$2. t = \frac{(\bar{X} - \mu)\sqrt{n}}{s}$$

Which of the above is/are correct ?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

28. In a trivariate distribution, if  $r_{12} = r_{23} = r_{31} = \rho \neq 1$ , then what is the value of  $R_{1.23}$ ?

- (a)  $\frac{\rho}{\sqrt{1+\rho}}$   
 (b)  $\frac{1}{\sqrt{1+\rho}}$   
 (c)  $\frac{\sqrt{2}\rho}{\sqrt{1+\rho}}$   
 (d)  $\frac{1}{1+\rho}$

29. If  $Y = aX + 3$  and  $X = 2Y + 6$  are the regression lines of  $Y$  on  $X$  and  $X$  on  $Y$  respectively, then which one of the following is correct?

- (a)  $0.5 \leq a \leq 1$   
 (b)  $a > 1$   
 (c)  $0 \leq a \leq 0.5$   
 (d)  $-0.5 \leq a \leq 0$

30. Let the regression lines of  $Y$  on  $X$  and  $X$  on  $Y$  be  $Y = aX + b$  and  $X = cY + d$  respectively. Consider the following statements:

- The ratio of the variances of  $X$  and  $Y$  is  $\frac{c}{a}$ .
- The correlation coefficient between  $X$  and  $Y$  is  $\sqrt{ac}$ .
- The values of  $\bar{X}$  and  $\bar{Y}$  are  $\frac{cb+d}{1-ac}$  and  $\frac{ad+b}{1-ac}$  respectively.

Which of the above are correct?

- (a) 1 and 2 only  
 (b) 2 and 3 only  
 (c) 1 and 3 only  
 (d) 1, 2 and 3

31. If  $\bar{X}$  and  $S^2$  are the mean and variance of a random sample of size  $n$  from a normal population with mean  $\mu$  and standard deviation  $\sigma$ , then the random variable  $Y = \frac{(n-1)S^2}{\sigma^2}$  follows

- (a)  $\chi^2$  with  $(n-2)$  d.f.  
 (b)  $t$  with  $(n-1)$  d.f.  
 (c)  $\chi^2$  with  $(n-1)$  d.f.  
 (d)  $t$  with  $(n-2)$  d.f.

32. In measuring reaction time, an experimenter estimates that the standard deviation is 0.09 s. What should be the value of sample size  $n$  so that the experimenter is 95% confident that the error of his estimate of the mean reaction time will not exceed 0.02 s?

- (a)  $0 < n < 50$   
 (b)  $n \geq 78$   
 (c)  $50 \leq n \leq 77$   
 (d)  $n < 77$

33. Consider the  $2 \times 2$  contingency table on two attributes  $A$  and  $B$ :

|       | $A_1$ | $A_2$ |
|-------|-------|-------|
| $B_1$ | 10    | 20    |
| $B_2$ | 30    | 40    |

What is the value of  $\chi^2$  for testing the independence of the attributes  $A$  and  $B$ ?

- (a) 0.79  
 (b) 0.81  
 (c) 0.83  
 (d) 0.85

34. Consider the following statements :

1.  $X_1$  and  $X_2$  are independent  $\chi^2$  variates with  $n_1$  and  $n_2$  d.f. respectively, then  $Y = \frac{X_1}{X_2}$  follows  $\beta_2\left(\frac{n_1}{2}, \frac{n_2}{2}\right)$  distribution.
2.  $X_1$  and  $X_2$  are independent  $\chi^2$  variates with  $n_1$  and  $n_2$  d.f. respectively, then  $Z = \frac{X_1}{X_1 + X_2}$  follows  $\beta_1\left(\frac{n_1}{2}, \frac{n_2}{2}\right)$  distribution.
3.  $X_1$  and  $X_2$  are independent standard normal distribution, then  $W = X_1^2 + X_2^2$  follows  $\chi_{(2)}^2$  distribution.

Which of the above statements is/are correct ?

- (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 3 only
- (d) 1, 2 and 3

35. Which of the following are correct in respect of a frequency distribution ?

1. Arithmetic mean is less than harmonic mean.
2.  $\beta_2 > 1$
3.  $\beta_2 - \beta_1 - 1 \geq 0$
4. Karl Pearson's coefficient of skewness lies between -1 and +1.

Select the correct answer using the code given below :

- (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 3 and 4 only
- (d) 1 and 4 only

36. If  $r_{12.3}$  is the correlation coefficient between the variables  $X_1$  and  $X_2$  after eliminating the linear effect of  $X_3$ , then which of the following are correct ?

1.  $r_{12.3} = \frac{r_{12} - r_{13}r_{23}}{\sqrt{(1 - r_{13}^2)(1 - r_{23}^2)}}$
  2.  $r_{12}^2 + r_{23}^2 + r_{31}^2 - 2r_{12}r_{23}r_{31} \leq 1$
  3.  $r_{12.3}^2 = b_{12.3}b_{21.3}$ , where b's are partial regression coefficients
- (a) 1 and 2 only
  - (b) 2 and 3 only
  - (c) 1 and 3 only
  - (d) 1, 2 and 3

37. The following information was obtained in a survey of 100 workers of a factory :

All men workers were more than 20 years old. There were 50 women workers in the sample. Altogether 60 workers were over 20 years. 25 of the women workers were married, while 15 of the married workers were over 20 years old and 10 of the married women workers were over 20 years old.

From the above information, what is the number of married workers ?

- (a) 20
- (b) 25
- (c) 30
- (d) 40

38. To find out the mean yield per plant, 64 plants were selected at random from a field. The mean yield and standard deviation were found to be 10 and 2, respectively.

(For  $\alpha = 0.05$  and 63 degrees of freedom, the critical value of t is 2) What is the 95% confidence interval for the population mean ?

- (a) (9.5, 10.5)
- (b) (9.75, 10.25)
- (c) (6.0, 4.0)
- (d) (8.0, 12.0)

39. The burning time of a certain kind of rocket has a probability distribution with mean burning time 5 minutes, variance 0.5 square minutes and coefficient of kurtosis 4. What is the distribution of burning time of these kind of rockets ?

- (a) Uniform
- (b) Mesokurtic
- (c) Leptokurtic
- (d) Platykurtic

40. Consider the following statements :

*Statement I :*

It is not possible to determine the total number of birds in a forest by standard sampling technique.

*Statement II :*

It is not possible to construct the sampling frame for such populations.

Which one of the following is correct in respect of the above two statements ?

- (a) Both Statement I and Statement II are true and Statement II is the correct explanation for Statement I.
- (b) Both Statement I and Statement II are true but Statement II is **not** the correct explanation for Statement I.
- (c) Statement I is true but Statement II is false.
- (d) Statement I is false but Statement II is true.

41. A statistician mailed a survey questionnaire to a random sample of 100 teachers from each of 4 types of schools. The number of responses received is summarized in the following table :

| Type of School       | Number of responses | Number of non-responses |
|----------------------|---------------------|-------------------------|
| Government Primary   | 23                  | 77                      |
| Government Secondary | 30                  | 70                      |
| Private Primary      | 43                  | 57                      |
| Private Secondary    | 29                  | 71                      |

Before analysing the data collected, the statistician wants to test whether the probability of non-response was the same for all types of schools. What is the appropriate test for this purpose ?

- (a) Sign test
- (b) Goodness-of-fit test
- (c) Test for independence
- (d) ANOVA F-test

42. If X and Y are standard normal variates with correlation coefficient  $\rho$  between them, then what is the correlation coefficient between  $X^2$  and  $Y^2$  ?

- (a)  $2\rho - 1$
- (b)  $\rho^2$
- (c)  $\rho$
- (d)  $\sqrt{\rho}$

43. If  $X$  is a random variable having Poisson distribution with parameter  $\lambda$ , then what is the m.g.f. of  $Y = X - 2$ ?

(a)  $e^{\lambda e^t - 2t - \lambda}$

(b)  $e^{\lambda e^t - t - 1}$

(c)  $e^{\lambda(e^t - t - 1)}$

(d)  $e^{\lambda(e^t - 1)}$

44. If the random variables  $X$ ,  $Y$  and  $Z$  have the means  $\mu_x = 5$ ,  $\mu_y = 7$  and  $\mu_z = 4$ ; variances  $\sigma_x^2 = 10$ ,  $\sigma_y^2 = 14$  and  $\sigma_z^2 = 20$ ;  $\text{Cov}(XY) = 1$ ,  $\text{Cov}(XZ) = -3$  and  $\text{Cov}(YZ) = 2$ , then what is the covariance of  $U = X + 4Y + 2Z$  and  $V = 3X - Y - Z$ ?

(a)  $-76$

(b)  $82$

(c)  $-82$

(d)  $76$

45. Consider the following statements :

1. Mean and variance are equal for Poisson distribution.
2. Mean is less than variance for Binomial distribution.
3. Mean is less than variance for Chi-square distribution.

Which of the above statements are correct ?

(a) 1 and 2 only

(b) 2 and 3 only

(c) 1 and 3 only

(d) 1, 2 and 3

46. The probability of a random variable  $X$  is given by

$$P(X = r) = \binom{n}{r} p^r q^{n-r}; \quad r = 0, 1, 2, \dots, n;$$

$$p + q = 1, p > 0.$$

What is the coefficient of skewness of the random variable  $X$ ?

(a)  $\frac{1 + 2p}{\sqrt{npq}}$

(b)  $\frac{1 - 2p}{\sqrt{npq}}$

(c)  $\frac{p}{\sqrt{nq}}$

(d)  $\frac{1 + p}{\sqrt{nq}}$

47. Consider the following pairs of equations :

$P : X + Y = 2, 2X + 3Y = 4$

$Q : X - 2Y = 3, 2X - 3Y = 5$

$R : X + 2Y = 5, 2X - 3Y = 3$

Which of the above is/are valid pair(s) of regression equations?

(a) P only

(b) Q only

(c) P and Q only

(d) P, Q and R

48. In a Chi-square test, the contingency table has 4 rows and 4 columns. What is the number of degrees of freedom?

(a) 3

(b) 4

(c) 8

(d) 9

49. Consider the following statements :

*Statement I :*

The correlation coefficient between two variables X and Y is the geometric mean of the two regression coefficients  $\beta_{YX}$  and  $\beta_{XY}$ .

*Statement II :*

The arithmetic mean of the two regression coefficients  $\beta_{YX}$  and  $\beta_{XY}$  is greater than or equal to the correlation coefficient between the variables X and Y.

Which one of the following is correct in respect of the above two statements ?

- Both Statement I and Statement II are true and Statement II is the correct explanation for Statement I.
- Both Statement I and Statement II are true but Statement II is **not** the correct explanation for Statement I.
- Statement I is true but Statement II is false.
- Statement I is false but Statement II is true.

50. For a given data  $(X_i, Y_i); i = 1, 2, 3, \dots, n$ ; using the principle of least-squares, two models, say  $M_1$  and  $M_2$  are fitted. Let  $M_1$  be  $Y = f_1(X)$  and let  $M_2$  be  $Y = f_2(X)$ . Suppose  $X_0$  is a value of X for which the predicted value of Y is to be determined.

Define  $E_1 = \sum_{i=1}^n [Y_i - f_1(X_i)]^2$  and

$E_2 = \sum_{i=1}^n [Y_i - f_2(X_i)]^2$ . Then which one of

the following is the criterion for choosing the estimated value of Y for  $X = X_0$  ?

- Put  $X = X_0$  in that model for which Y value obtained is the least.
- Put  $X = X_0$  in that model for which Y value obtained is the greatest.
- Put  $X = X_0$  in that model for which E value obtained is the least.
- Put  $X = X_0$  in that model for which E value obtained is the greatest.

51. Consider the following statements :

- Divided difference of  $k^{\text{th}}$  order involves k arguments.
- Divided difference is a symmetric function of its argument values.
- Divided difference can be expressed as the ratio of two determinants of  $(n + 1)$  order each.
- Divided difference is applicable even when arguments are not equispaced.

Which of the above statements are correct ?

- 2, 3 and 4 only
- 1, 3 and 4 only
- 1, 2 and 4 only
- 1, 2 and 3 only

52. What is the third order divided difference with arguments 2, 4, 9 and 10 of the function  $f(x) = x^3 - 2x$  ?

- 1
- 2
- 3
- 4

53. If  $\Delta^n 0^m = \Delta^n x^m |_{x=0}$ , then what is the value of  $\Delta^3 0^6$  ?

- 500
- 515
- 530
- 540

54. What is the function whose first difference is  $3x^2 + 7x + 10$  (assuming  $h = 1$ ) ?

- $3x^{(3)} + 7x^{(2)} + 10x + c$
- $x^{(3)} + 7x^{(2)} + 10x + c$
- $x^{(3)} + 5x^{(2)} + 10x + c$
- $3x^{(3)} + 5x^{(2)} + 10x + c$

55. It is given that  $u_1 = 1$ ,  $u_2 + u_3 = 6$  and  $u_4 + u_5 + u_6 + u_7 + u_8 = 30$ . What is the approximate value of  $u_4$  when computed by using Lagrange's interpolation formula ?

- (a) 7
- (b) 6
- (c) 5
- (d) 4

56. Let  $f(x) = 5x^3 - 13x^2 + 11x + 4$ . If the interval of differencing is 1, then consider the following statements :

- 1.  $\Delta^3 f(x) = 30$  for all  $x$
- 2.  $\Delta^2 f(x) = 34$  for  $x = 1$
- 3.  $\Delta f(x) = 4$  for  $x = 1$

Which of the above statements are correct ?

- (a) 1 and 2 only
- (b) 1 and 3 only
- (c) 2 and 3 only
- (d) 1, 2 and 3

57. What is  $\frac{1}{(E^2 - 4)} (9x^2)$  equal to ?

- (a)  $-3x^2 - \frac{20x}{3} - 4$
- (b)  $-4x^2 - 3x + \frac{20}{3}$
- (c)  $-3x^2 - 4x - \frac{20}{3}$
- (d)  $-3x^2 - 4x + \frac{20}{3}$

58. Which of the following statements are correct ?

- 1. Weddle's rule requires at least six consecutive values of the function.
- 2. If  $f(x)$  is a polynomial of 4<sup>th</sup> degree, then Weddle's rule gives exact result.
- 3. In general, Weddle's rule is more accurate than Simpson's rule.

Select the correct answer using the code given below :

- (a) 2 and 3 only
- (b) 1 and 3 only
- (c) 1 and 2 only
- (d) 1, 2 and 3

59. The solution of the initial value problem  $y' = f(t, y)$ ,  $y(t_0) = y_0$  is to be obtained by the Euler's method with step length  $h$ . The truncation error of the Euler's method is bounded by

- (a)  $\frac{h^2}{2} \max |y''(x)|$
- (b)  $\frac{h^2}{2} \max |y'''(x)|$
- (c)  $h^2 \max |y''(x)|$
- (d)  $h \max |y''(x)|$

60. Consider the following data :

|        |     |    |    |    |   |
|--------|-----|----|----|----|---|
| $x$    | -2  | -1 | 0  | 1  | 2 |
| $f(x)$ | -11 | -8 | -5 | -2 | 1 |

What is the degree of the interpolation polynomial that represents the above data ?

- (a) 4
- (b) 3
- (c) 2
- (d) 1

61. Consider the following data :

|      |    |   |   |    |
|------|----|---|---|----|
| x    | 3  | 6 | 9 | 12 |
| y(x) | -1 | 1 | 2 | 3  |

What is the value of  $\int_3^{12} y(x) dx$ , when computed by Simpson's  $\frac{1}{3}$  rule ?

- (a) 10  
(b) 9  
(c) 6  
(d) 3
62. The error in fourth order Runge-Kutta formula for solving the differential equation  $\frac{dy}{dx} = f(x, y)$  is of the order
- (a) (equal interval)<sup>2</sup>  
(b) (equal interval)<sup>3</sup>  
(c) (equal interval)<sup>4</sup>  
(d) (equal interval)<sup>5</sup>
63. The values of the function  $f(x)$  for values of  $x$  are given as  $f(1) = 4$ ,  $f(2) = 5$ ,  $f(7) = 5$ ,  $f(8) = 4$ . Which one of the following is correct in respect of  $f(x)$  when it is computed by using Lagrange's formula ?
- (a)  $f(x)$  is maximum when  $x = 4.5$   
(b)  $f(x)$  is minimum when  $x = 4.5$   
(c)  $f(x)$  is maximum when  $x = 4$   
(d)  $f(x)$  is minimum when  $x = 4$

64. Consider the following data :

|               |        |        |        |        |
|---------------|--------|--------|--------|--------|
| x             | 1.35   | 1.36   | 1.37   | 1.38   |
| $\log_{10} x$ | 0.1303 | 0.1335 | 0.1367 | 0.1399 |

What is the value of  $x$  when  $x = 10^{\log_{10} x}$  and computed using Stirling's formula ?

- (a) 1.3609  
(b) 1.3709  
(c) 1.3809  
(d) 1.3909
65. If  $y = (a + bx)2^x$  with difference interval  $h = 1$ , then what is  $(\Delta^2 - 2\Delta + 1)y$  equal to ?
- (a) 4  
(b) 2  
(c) 1  
(d) 0
66. A computer linked to the Internet is identified by 'X', while a web page is identified by 'Y'. What are X and Y, respectively ?
- (a) IP address and Search Engine Google  
(b) IP address and URL  
(c) URL and Search Engine  
(d) Browser and IP address
67. Consider the following statements :
1. Intranet is a wide area network, using TCP/IP protocol like the Internet.
  2. Intranet is a private network of an organisation.
  3. Hackers are known to have logged on computers breaching password security.
- Which of the above statements are correct ?
- (a) 1 and 2 only  
(b) 2 and 3 only  
(c) 1 and 3 only  
(d) 1, 2 and 3

68. Computation of  $X > P + Q$  AND  $I = J$  is equivalent to

- (a)  $((X > P) + Q)$  AND  $(I = J)$
- (b)  $(X > P) + (Q$  AND  $I = J)$
- (c)  $(X > P) + (Q$  AND  $I) = J$
- (d)  $((X > (P + Q)))$  AND  $(I = J)$

69. Consider the following statements :

- 1. A function is a subroutine that may include one or more statements designed to perform a specific task.
- 2. A compiled and linked program is called executable code.

Which of the above statements is/are correct ?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

70. Consider the following statements :

*Statement I :*

Debugging is a three-stage process consisting of detection, isolation and correction of errors in a computer program.

*Statement II :*

Compiler can detect and isolate all errors in a computer program.

Which one of the following is correct in respect of the above two statements ?

- (a) Both Statement I and Statement II are true and Statement II is the correct explanation for Statement I.
- (b) Both Statement I and Statement II are true but Statement II is **not** the correct explanation for Statement I.
- (c) Statement I is true but Statement II is false.
- (d) Statement I is false but Statement II is true.

71. Consider the following statements :

- 1. Fixed point numbers are numbers in which the decimal point is assumed to be in a fixed position.
- 2. Integer arithmetic can be considered as special case of fixed point arithmetic.
- 3. Fixed point arithmetic tends to be more suitable for business data processing.
- 4. Floating point arithmetic tends to be important for scientific computing.

Which of the above statements are correct ?

- (a) 2 and 4 only
- (b) 1, 3 and 4 only
- (c) 1, 2 and 3 only
- (d) 1, 2, 3 and 4

72. Flash memory is a

- 1. slow-write and fast-read memory
- 2. fast-write and fast-read memory
- 3. non-volatile memory
- 4. removable and portable memory

Which of the above are correct ?

- (a) 1 and 3 only
- (b) 2 and 4 only
- (c) 1, 3 and 4 only
- (d) 2, 3 and 4 only

73. Consider the following in respect of scripting languages :

1. They assume availability of collection of programs.
2. They assume availability of high speed, efficient compiler.
3. They combine components to perform complex task.
4. They do not support strong data typing.

Which of the above statements are correct ?

- (a) 1, 2 and 3 only
- (b) 1, 2 and 4 only
- (c) 2, 3 and 4 only
- (d) 1, 3 and 4 only

74. Consider the following statements :

1. Browser, e-mail and ftp are parts of an operating system.
2. Wireless LAN can be established using CDMA or infrared as medium.
3. Optical fibre offers higher bandwidth and is cheaper than coaxial cables.
4. Server is a powerful computer that can be accessed over a computer network.

Which of the above statements are correct ?

- (a) 1 and 2 only
- (b) 2 and 4 only
- (c) 1 and 3 only
- (d) 1, 2 and 4 only

75. Consider the following statements :

1. Routers are special purpose computers which interconnect networks.
2. ISPs are dedicated, special service providers.
3. OSPs are operating service providers.

Which of the above statements is/are correct ?

- (a) 1 and 3 only
- (b) 1 only
- (c) 2 and 3 only
- (d) 1, 2 and 3

76. The primary purpose of a firewall in a network is to

- (a) execute antivirus program on each e-mail attachment and stop objectionable messages
- (b) permit any safe packets to the destination computer in the network
- (c) prevent operations of machine BOTS
- (d) stop excessive downloading of data by network users

77. Which of the following statements are correct ?

1. Scanner resolution is measured in dpi.
2. Processor speed is measured in GHz.
3. An LCD monitor uses less power than an LED monitor.
4. Laser printers use the same technology as photocopiers.

Select the correct answer using the code given below :

- (a) 1, 2 and 3 only
- (b) 1, 3 and 4 only
- (c) 1, 2 and 4 only
- (d) 2, 3 and 4 only

78. Which key is used to convert an ASCII code to the corresponding character (if displayable) ?

- (a) Alt key
- (b) Shift key
- (c) Ctrl key
- (d) Esc key

79. Which of the following are statistical softwares ?

- 1. Minitab
- 2. GIMP
- 3. R
- 4. SPSS

Select the correct answer using the code given below :

- (a) 1, 2 and 3 only
- (b) 1, 3 and 4 only
- (c) 1, 2 and 4 only
- (d) 2, 3 and 4 only

80. Which of the following statements are correct ?

- 1. SQL is used for database management.
- 2. Spreadsheets are good for manipulating huge tables.
- 3. Presentation softwares can handle text, tables, images and videos.

Select the correct answer using the code given below :

- (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

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