

SCHOOL OF MATHEMATICS & STATISTICS

-CAT MODEL QUESTIONS

M.Sc. Mathematics & M.Sc. Statistics

(Select the Correct Answer from among the four choices given)

1. The vectors $X_1 = (1, 1, 0)$, $X_2 = (1, 3, 2)$ and $X_3 = (4, 9, k)$ are linearly dependent. Then the value of k is

[A] 7 [B] 5 [C] 3 [D] 1

2. The area enclosed by the curves $y = 2x^2$, $y = 3x$, $y = 0$ and $x = 0.5$, $x=1$ is equal to

[A] $\frac{15}{32}$ [B] $\frac{7}{8}$ [C] $\frac{13}{24}$ [D] $\frac{9}{23}$

3. $\lim_{n \rightarrow \infty} \frac{3+2\sqrt{n}}{\sqrt{n}}$

[A] 3 [B] 2 [C] 1 [D] 0

4. Which of the following sequence is not convergent

[A] $\left\{ \frac{n}{n+1} \right\}$ [B] $\left\{ \frac{(-1)^n}{n} \right\}$ [C] $\left\{ \frac{1}{n} \right\}$ [D] $\left\{ \frac{1}{n!} \right\}$

5. $\int_0^1 |x| dx$ is

[A] -1 [B] 0 [C] 1 [D] None of the

6. The solution of the differential equation $dy = y dx$ is

[A] $\log x$ [B] e^x [C] $1/x$ [D] xy

7. If $y = a \sin(bx+c)$, a and c are the parameters then solution y satisfies the differential equation

[A] $y'' + b^2 y = 0$ [B] $y'' - b^2 y = 0$ [C] $y'' + y' + y = 0$ [D] $y'' - y' = 0$

8. Binary equivalent of the decimal number 156 is

[A] 11001010
[C] 11100010

[B] 10011100
[D] 10010101

9. The average of first n natural numbers is
(a) $n(n+1)/2$ (b) $(n+1)/2$ (c) $(n^2-1)/2$ (d) $n(n+1)(2n+1)/6$

10. Which of the following represents a circle?
(a) $x^2-y^2=25$ (b) $x^2+y^2+2xy=25$ (c) $x^2+y^2+2x+3y=25$ (d) $x^2+y^2=25$

11. If A is an orthogonal matrix, which of the following is true?
[A] $A=A^T$ [B] $AA^T=I$ [C] $A^T=I$ [D] $AA^T A=I$

12. Which of the following matrix is invertible

[A] $\begin{bmatrix} 1 & 2 & 2 \\ 1 & 2 & 2 \\ 1 & 2 & 2 \end{bmatrix}$ [B] $\begin{bmatrix} 1 & 2 & 2 \\ 0 & 2 & 2 \\ 0 & 0 & 2 \end{bmatrix}$ [C] $\begin{bmatrix} 1 & 2 & 2 \\ 1 & 0 & 2 \\ 1 & 0 & 2 \end{bmatrix}$ [D] $\begin{bmatrix} 1 & 0 & 0 \\ 1 & 2 & 2 \\ 1 & 2 & 2 \end{bmatrix}$

13. The solution of system of equations

$$3y+2x = z+1$$

$$3x+2z = 8-5y$$

$$3z-1 = x-2y$$

[A] (3,-1,3) [B] (-5,2,3) [C] (3,-1,2) [D] (1,-3,5)

14. Let $A = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 2 & 3 & 4 & 1 \\ 3 & 4 & 2 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 6 \\ 2 & 3 & 1 \end{bmatrix}$. Which of the following exist?

[A] AB [B] $A+B$ [C] BA [D] A^T+B

15. If A and B are two matrices such that $A^2 - B^2 = (A - B)(A + B)$, then:

[A] Either A or B is a zero matrix
[C] $AB = BA$

[B] $A = B$
[D] $A^2 = B^2$

24. A factory uses 3 machines X,Y,Z to produce certain items. Suppose
1. Machine X produces 50% of the items of which 3% are defective
 2. Machine Y produces 30% of the items of which 4 % are defective
 3. Machine Z produces 20% of the items of which 5 % are defective

Suppose a defective item is found among the output. Find the probability that it came from machine Y

[A] 4/10 [B] 12/36 [C] 1/3 [D] 12/37.

25. A box contains three red marbles and seven white marbles. A marble is drawn from the box and the marble is replaced by a marble of the other colour. A second marble is drawn from the box. Find the probability that the second marble is red.

[A] 17/50 [B] 8/25 [C] 21/50 [D] 1/5

26. A fair coin is tossed twice giving the equi-probable space S. Let X and Y be random variables on S defined as follows.

- i) $X=1$ if the first toss is head and $X=0$ otherwise
- ii) $Y=1$ if both tosses are head and $Y=0$ otherwise

Let $Z=X+Y$. Find variance of Z.

[A] 7/16 [B] 15/16 [C] 9/16 [D] 11/16

27. Let X_1 follows $N(2, 1)$ and X_2 follows $N(3, 2)$ and X_1 and X_2 are independent. Then the distribution of $3X_1 - 2X_2$ is:

[A] $N(12, 17)$ [C] $N(12, 1)$ [B] $N(0,1)$ [D] $N(0, 17)$.

28. Let X_1, X_2, X_3, X_4 be independent random variable that are identically distributed with

mean 100 and standard deviation 4. Let $Y = \frac{X_1 + X_2 + X_3 + X_4}{4}$. Find standard deviation of Y.

[A] 2 [B] 4 [C] 12 [D] 16

29. Find the expected number of correct answers obtained by guessing in a 30 question true –false test.

[A] 25 [B] 15 [C] 20 [D] 10

30. The variable X and Y are connected by the equation $aX+bY+c=0$. If the signs of a and b are different. What is the correlation between them?

- [A] +1 [B] 0
[C] -1 [D] 0.5

31. Given two lines of regression as $8x-10y+66=0$, $40x-18y=214$. What is the correlation coefficient between x and y

- [A] $\pm \frac{1}{5}$ [B] $\pm \frac{2}{5}$ [C] $\pm \frac{3}{5}$ [D] $\pm \frac{4}{5}$

32. When the correlation coefficient $r=\pm 1$, then the two regression lines are

- [A] Perpendicular to each other [C] Coincide [D] Parallel to each other [B] Do not exist

33. The two lines of regression are given as $x+2y-5=0$ and $2x+3y=8$, then the average value of x and y respectively are

- [A] 1, 2 [B] 2, 1 [C] 3, 2 [D] 1, 3

34. The mode of geometric distribution with pmf $f(x)=\frac{1}{2^x}$, $x=1,2,\dots$ is

- [A] 1 [B] 0 [C] $\frac{1}{2}$ [D] Does not exist

35. If $X \sim N(2,1)$. The point of inflection of the normal curve are

- [A] (0,1) [B] (-1,1) [C] (1,3) [D] (3,1)

36. If $f(x, y)=4xy$; $0 < x < 1$; $0 < y < 1$, then $E(Y/X=x)$ is,

- [A] $\frac{1}{2}$ [B] $\frac{1}{3}$ [C] $\frac{2}{3}$ [D] $\frac{3}{2}$

37. The range of the multiple correlation coefficient is

- [A] (-1,1) [B] (0,1)
[C] (-1,0) [D] (-2,2)

38. Let X_1, X_2, \dots, X_n be a random sample from $B(1, p)$. Then a consistent estimator of p^2 is

[A] $\sum X_i$ [B] $\sum X_i^2$ [C] \bar{X} [D] \bar{X}^2

39. Convert the binary number 1001.0010_2 to decimal

[A] 90.125 [B] 9.125 [C] 125 [D] 12.5

40. The simplified SOP (Sum Of Product) form of the Boolean expression

$(P + Q' + R') \cdot (P + Q' + R) \cdot (P + Q + R')$ is

a) $(P' \cdot Q + R')$ b) $(P + Q' \cdot R')$ c) $(P' \cdot Q + R)$ d) $(P \cdot Q + R)$

41. When two asynchronous active low inputs PRESET and CLEAR are applied to a J-K Flip flop the output will be

a) 0 b) Undefined c) Previous state d) 1

42. A shift register that will accept a parallel input or a bidirectional serial load and internal shift features is called as?

a) Tristate b) End around c) Universal d) Conversion

43. How is an array initialized in C language?

a) `Int a[3]={1,2,3};` b) `Int a={1,2,3};` c) `Int a=new int[3];` d) `Int a(3)=[1,2,3];`

44. Which of the following is an example for a postfix expression?

a) $a*b(c+d)$ b) $abc*+de-+$ c) $+ab$ d) $a+b-c$

45. What would be the asymptotic time complexity to add a node at the end of singly linked list, if the pointer is initially pointing to the head of the list?

a) $O(1)$ b) $O(n)$ c) $\theta(n)$ d) $\theta(1)$

46. Which of the following is not an in-place sorting algorithm?

a) Selection sort b) Heap sort c) Quick sort d) Merge sort

47. Identify the incorrect constructor type.

a) Friend constructor. b) Default constructor
c) Parameterized constructor d) Copy constructor

48. Which of the following is generally used for performing tasks like creating the structure of the relations, deleting relation?

a) DML(Data Manipulation Language) b) Query
c) Relational Schema d) DDL(Data Definition Language)

49. The ability to query data, as well as insert, delete, and alter tuples, is offered by

a) TCL (Transaction Control Language) b) DCL (Data Control Language)

- c) DDL (Data Definition Language) d) DML (Data Manipulation Language)
50. Let R be a relation schema, **R (A, B, C, D)** and **F = {A → B, B → C, C → A}** is the set of functional dependency. Determine the key of relation ?
 a) A b) B c) C d) D
51. Third normal form is inadequate in situations where the relation :
 a) has multiple candidate keys b) has candidate keys that are composite
 b) has overlapped candidate keys d) none of the above
52. Locks placed by command are called
 a) Implicit lock b) Explicit lock c) Exclusive lock d) Shared lock
53. What does SSL stand for?
 a) Secure Socket Layer b) System Socket Layer
 c) Superuser System Login d) Secure System Login
54. What do we call a collection of two or more computers that are located within a limited distance of each other and that are connected to each other directly or indirectly?
 a) Internet b) Intranet c) Local Area Network d) Wide Area Network
55. Find the odd one out from the set { 396, 462, 572, 427, 671, 264 }
 a) 671 b) 462 c) 427 d) 396
56. If selling price is doubled, the profit triples. Find the profit percent ?
 a) 100% b) 200% c) 300% d) 400%
57. A and B together can do a piece of work in 4 days. If A alone can do it in 6 days, i.e. In how many days B can alone complete the same piece of work?
 a) 12 b) 8 c) 9 d) 16
58. Find the next term in the series: 3, 6, 9, 18, 27, 54, ...
 a) 81 b) 69 c) 108 d) 72
59. In a class of 100 students, 50 students passed in Mathematics and 70 passed in English, 5 students failed in both Mathematics and English. How many students passed in both the subjects?
 a) 50 b) 45 c) 35 d) 25
60. Q, R, S, and T are sitting on a bench. P is sitting next to Q, R is sitting next to S, S is not sitting with T who is on the left end of the bench. R is in the second position from

the right. P is to the right of Q and T. P and R are sitting together. In which position P is sitting?

- a) Between Q and S
- b) Between Q and R
- c) Between T and S
- d) Between R and T

61. Statements: Some ships are boats. All boats are submarines. Some submarines are watches. Conclusion:

- I. Some watches are boats.
- II: Some submarines are boats.
- III: Some submarines are ships.
- IV: Some watches are ships.

- a) All follow
- b) Only II and III follow
- c) Only III follows
- d) Only IV follow

62. The missing number in the Series 114, 131, 165, 216, ?, 369

- a) 314
- b) 284
- c) 294
- d) 304

63. Pointing to a photograph, a man said, "I have no brother or sister but that man's father is my father's son." Whose photograph was it?

- a) His own
- b) His Son
- c) His Father
- d) His Grandfather

64. In one hour, a boat goes 11 km/hr along the stream and 5 km/hr against the stream. The speed of the boat in still water (in km/hr) is:

- a) 3 km/hr
- b) 5 km/hr
- c) 8 km/hr
- d) 9 km/hr