22

QUESTION PAPER SERIES CODE
D

Registration No. :

Centre of Exam. : ____________________

Name of Candidate : ____________________

Signature of Invigilator

ENTRANCE EXAMINATION, 2016

MASTER OF COMPUTER APPLICATIONS

[Field of Study Code : MCAM (224)]

Time Allowed : 3 hours

Maximum Marks : 480
Weightage : 100

INSTRUCTIONS FOR CANDIDATES

Candidates must read carefully the following instructions before attempting the Question Paper :

(i) Write your Name and Registration Number in the space provided for the purpose on the top of this Question Paper and in the Answer Sheet.

(ii) **Please darken the appropriate Circle of Question Paper Series Code on the Answer Sheet.**

(iii) All questions are compulsory.

(iv) Answer all the 120 questions in the Answer Sheet provided for the purpose by darkening the correct choice, i.e., (a) or (b) or (c) or (d) with BALLPOINT PEN only against the corresponding circle. Any overwriting or alteration will be treated as wrong answer.

(v) Each correct answer carries **4** marks. **There will be negative marking and 1 mark will be deducted for each wrong answer.**

(vi) Answer written by the candidates inside the Question Paper will not be evaluated.

(vii) Pages at the end have been provided for Rough Work.

(viii) Return the Question Paper and Answer Sheet to the Invigilator at the end of the Entrance Examination. **DO NOT FOLD THE ANSWER SHEET.**

INSTRUCTIONS FOR MARKING ANSWERS

1. Use only Blue/Black Ballpoint Pen (do not use pencil) to darken the appropriate Circle.
2. Please darken the whole Circle.
3. Darken ONLY ONE CIRCLE for each question as shown in the example below :

Wrong	Wrong	Wrong	Wrong	Correct
● ⓑ ⓒ ●	ⓐ̸ ⓑ ⓒ ⓓ	ⓐ̸ ⓑ ⓒ ⓓ̸	⊙ ⓑ ⓒ ●	ⓐ ⓑ ⓒ ●

4. Once marked, no change in the answer is allowed.
5. Please do not make any stray marks on the Answer Sheet.
6. Please do not do any rough work on the Answer Sheet.
7. Mark your answer only in the appropriate space against the number corresponding to the question.
8. **Ensure that you have darkened the appropriate Circle of Question Paper Series Code on the Answer Sheet.**

1. The probability that a coin lands on heads is 3/5. The coin is flipped 150 times. The variance of the number of heads will be

(a) 90

(b) 60

(c) 36

(d) None of the above

2. Ravi and Kunal are good in hockey and volleyball. Sachin and Ravi are good in hockey and baseball. Gaurav and Kunal are good in cricket and volleyball. Sachin, Gaurav and Michael are good in football and baseball. Who is good in baseball, volleyball and hockey?

(a) Ravi

(b) Sachin

(c) Kunal

(d) Gaurav

3. If a, b, c are distinct positive real numbers and $a^2+b^2+c^2=1$, then $ab+bc+ca$ is

(a) less than 1

(b) equal to 1

(c) greater than 1

(d) any real number

4. The resultant of two forces $3P$ and $2P$ is R. If the first force is doubled, then the resultant is also doubled. The angle formed between the two forces is

(a) 30°

(b) 60°

(c) 120°

(d) 150°

5. What will be the value of k for which the function given by $f(x, y) = kxy$, for $x = 1, 2, 3, \ldots$, $y = 1, 2, 3, \ldots$ can serve as joint probability distribution?

(a) 1/9

(b) 1/18

(c) 1/36

(d) 1

6. Which of the following indicates similar relationship as LOWER has with WORLE?

(a) GLAZE : AGELZ

(b) AMONG : OMNAG

(c) WORDS : ROSWD

(d) ENTRY : RNYET

7. If a, b, c, d are in GP, then $(a^2 + b^2 + c^2)(b^2 + c^2 + d^2)$ is equal to

(a) $(ab + ac + bc)^2$

(b) $(ac + cd + ad)^2$

(c) $(ab + bc + cd)^2$

(d) None of the above

8. The remainder, when 2^{2000} is divided by 17, is

(a) 1

(b) 2

(c) 8

(d) None of the above

9. If SYSTEM is coded as SYSMET and NEARER is coded as AENRER, then what will be the code for FRACTION?

(a) CAFNOIT

(b) NOITFRAC

(c) FRACNOIT

(d) CARFTION

10. Two friends decide to meet at a certain location. If each person independently arrives at a time uniformly distributed between 10 a.m. and 11 a.m., what is the probability that the first to arrive has to wait longer than 10 minutes?

(a) 1/36

(b) 35/36

(c) 11/36

(d) 25/36

11. The expansion of $[x^2 + (x^6 - 1)^{1/2}]^5 + [x^2 - (x^6 - 1)^{1/2}]^5$ is a polynomial of degree

(a) 8

(b) 10

(c) 13

(d) None of the above

12. Let A be a matrix defined by

$$A = \begin{bmatrix} 2 & 5 & 8 \\ 0 & -1 & 9 \\ 0 & 0 & 6 \end{bmatrix}$$

Which of the following is true?

(a) All the eigenvalues of A are complex

(b) All the eigenvalues of A are real and are distinct from each other

(c) All the eigenvalues of A are real and exactly two of the eigenvalues are the same

(d) All the eigenvalues of A are real and are equal

13. The foci of the ellipse $\frac{x^2}{16}+\frac{y^2}{b^2}=1$ and the hyperbola $\frac{x^2}{144}-\frac{y^2}{81}=\frac{1}{25}$ coincide. The value of b^2 is

(a) 9

(b) 1

(c) 5

(d) 7

14. If Q means 'add to', J means 'multiply by', T means 'subtract from', and K means 'divide by', then the value of $30\,K\,2\,Q\,3\,J\,6\,T\,5$ will be

(a) 28

(b) 31

(c) 39

(d) 103

15. If $a+b+c=0$ and a, b, c are rational, then the roots of the equation

$$(b+c-a)x^2+(c+a-b)x+(a+b-c)=0$$

are

(a) rational

(b) irrational

(c) imaginary

(d) equal

16. The coefficient of x in the expansion of $(1+4x+x^2)^{1/2}$ is

(a) -1

(b) 0

(c) 1

(d) 2

17. If $a, b, c \in R$ and the equations $ax^2 + bx + c = 0$ and $x^3 + 3x^2 + 3x + 2 = 0$ have two roots in common, then

(a) $a = b \neq c$

(b) $a = b = -c$

(c) $a = b = c$

(d) None of the above

18. Some students in MCA are supposed to take at most the following three courses :

CS1, CS2 and CS3

Let 20 students take CS1, 30 take CS2, 25 take CS3, 10 take both CS1 and CS2, 15 take both CS2 and CS3, 20 take both CS2 and CS3 and 7 take all three courses. How many students are there in the class?

(a) 40

(b) 37

(c) 35

(d) 30

19. Let $Z_n^* = \{[a]_n \in Z_n \mid \gcd(a, n) = 1\}$

S_1 : If p is prime, then $a^p \equiv 1 (\text{mod}\, p)$ for all $a \in Z_p^*$

S_2 : If Z_n^* possesses a primitive root, then the group Z_n^* is cyclic

Which of the following is correct?

(a) S_1 is correct and S_2 is not correct

(b) S_1 is not correct and S_2 is correct

(c) Both S_1 and S_2 are correct

(d) Both S_1 and S_2 are not correct

20. If $A+B$ means 'A is the daughter of B', $A-B$ means 'A is the husband of B', $A \times B$ means 'A is the brother of B', then what is the meaning of $P \times Q + R$?

(a) P is the brother of R

(b) P is the father of R

(c) P is the uncle of R

(d) P is the son of R

21. If t_1 and t_2 are the flight times of two particles having the same initial velocity u and range R on the horizontal, then $t_1^2 + t_2^2$ is equal to

(a) $\frac{u^2}{g}$

(b) $\frac{4u^2}{g^2}$

(c) $\frac{u^2}{2g}$

(d) 1

22. Let A be a lower triangular matrix and further let it be non-singular. Then what will be A^{-1}?

(a) An upper triangular matrix

(b) A lower triangular matrix

(c) A diagonal matrix

(d) None of the above

23. In the English alphabet, which letter is sixteenth to the right of the letter which is fourth to the left of I?

(a) S

(b) T

(c) U

(d) V

24. Which of the following is/are correct for the two vectors to be equal?

(I) Same length

(II) Same direction

(III) Same support

(a) Only (I)

(b) Only (I) and (II)

(c) Only (I) and (III)

(d) All (I), (II) and (III)

25. The equation $e^{\sin x} - e^{-\sin x} - 4 = 0$ has

(a) infinite number of roots

(b) no real roots

(c) exactly one real root

(d) exactly four real roots

26. Which of the following sets of vectors $\mathbf{u} = (u_1, u_2, u_3)$ in R^3 are subspaces of R^3?

(a) All $\mathbf{u}$ such that $u_1 \geq 0$

(b) All $\mathbf{u}$ such that $u_1 u_2 = 0$

(c) All $\mathbf{u}$ such that u_1 is rational

(d) None of the above

27. X has the binomial distribution with the parameters n and θ. The unbiased estimator of θ is

(a) $E[X/n]$

(b) $E[nX]$

(c) median

(d) None of the above

28. The domain of the function $f(x) = \sin^{-1}\left\{\log_2\left(\frac{1}{2}x^2\right)\right\}$ is

(a) $[-2, -1) \cup [1, 2]$

(b) $(-2, -1] \cup [1, 2]$

(c) $[-2, -1] \cup [1, 2]$

(d) $(-2, -1) \cup (1, 2)$

29. If the seventh day of a month is three days earlier than Friday, then what day it will be on the nineteenth day of the month?

(a) Sunday

(b) Monday

(c) Tuesday

(d) Wednesday

30. How many numbers from 1 to 100 are there, each of which is not only exactly divisible by 4 but also has 4 as a digit?

(a) 7

(b) 10

(c) 20

(d) 21

31. The determinant of the following matrix

$$\begin{bmatrix} -2 & 6 & 7 & -1 \\ 3 & -9 & 2 & -2 \\ 0 & 0 & 4 & -3 \\ 0 & 0 & -1 & 5 \end{bmatrix}$$

is

(a) 1

(b) 2

(c) −1

(d) None of the above

32. Navya ranked ninth from the top and thirty-eighth from the bottom in a class. How many students are there in the class?

(a) 45

(b) 46

(c) 47

(d) 48

33. Let $y = f(x)$ be a function such that $(x_1, y_1) = (0, 1)$ and $(x_2, y_2) = (1, 1)$. Then the first-order divided difference for the given data will be equal to

(a) 0

(b) 1

(c) $-\infty$

(d) None of the above

34. Let y be an element of the set $A = \{1, 2, 3, 5, 6, 10, 15, 30\}$ and x_1, x_2, x_3 be integers such that $x_1 x_2 x_3 = y$. Then the number of positive integral solutions of $x_1 x_2 x_3 = y$ is

(a) 64

(b) 27

(c) 81

(d) None of the above

35. Six scientists *A*, *B*, *C*, *D*, *E* and *F* are to present a paper each at a one-day conference. Three of them will present their papers in the morning session before the lunch break whereas the other three will be presented in the afternoon session. The lectures have to be scheduled in such a way that they comply with the following restrictions :

B should present his paper immediately before *C*'s presentation; their presentations cannot be separated by the lunch break.

D must be either the first or the last scientist to present his paper.

In case *C* is to be the fifth scientist to present his paper, then *B* must be

(a) first

(b) second

(c) third

(d) fourth

36. X is the number of heads in four tosses of a balanced coin. What is the probability distribution of $Z = (X-2)^2$?

(a)

Z	0	1	4
$P(Z)$	1/4	1/2	1/4

(b)

Z	0	1	4
$P(Z)$	1/8	3/8	4/8

(c)

Z	0	1	4
$P(Z)$	3/8	4/8	1/8

(d)

Z	0	1	4
$P(Z)$	1/2	0	1/2

37. Everybody in a room shakes hands with everybody else. The total number of handshakes is 66. The total number of persons in the room is

(a) 11

(b) 12

(c) 13

(d) 14

38. In how many ways seven students attending a meeting be assigned to one triple and two double hotel rooms?

(a) 190

(b) 210

(c) 3200

(d) 5040

39. In a group of boys, two are brothers and in this group 6 more boys are there. In how many ways they can sit if the brothers are not to sit along with each other?

(a) 4820

(b) 1410

(c) 2830

(d) None of the above

40. Let $\sigma = 681235947$ and $\tau = 627184593$ be permutations on $\{1, 2, 3, 4, 5, 6, 7, 8, 9\}$ in one-line notation (based on the usual order on integers). Which of the following is a correct cycle notation for $\tau \circ \sigma$?

(a) 124957368

(b) 142597368

(c) 142953768

(d) 142957368

41. If A and B are two sets, then $A \cap (A \cup B)'$ is equal to

(a) A

(b) B

(c) $A' \cap B$

(d) None of the above

42. A random variable X takes on one of the values $x_1, x_2, \ldots, x_n$ with respective probabilities $p_1, p_2, \ldots, p_n$. The entropy $H(x)$ is defined as $H(x) = -\sum_{i=1}^{n} p_i \ln(p_i)$, (take $0 \ln(0) = 0$). What is the maximum value of $H(x)$?

(a) $\ln(n)$

(b) $n \ln(n)$

(c) n

(d) None of the above

43. Suppose the resistance in a single-circuit varies randomly in response to environmental conditions. An experiment was performed in which resistance R was varied at random in the interval $0 < R \leq A$ and the ensuing voltage $E = IR$ was measured. What is the distribution of the random variable I (the current flowing through the circuit)?

(a) E / A

(b) E / AR^2

(c) A / R

(d) Ae^{-AR}

44. Which of the following functions is an odd function?

(a) $f(x) = \sin x + \cos x$

(b) $f(x) = 1 + x + x^2$

(c) $f(x) = x + \sin x$

(d) None of the above

45. If $A(1, 0, -1)$, $B(2, 0, -3)$, $C(-1, 2, 0)$ and $D(3, -2, -1)$ are four points and p is projection of AB on CD, then which of the following is true?

(a) $p = \frac{6}{\sqrt{5}}$

(b) $p = \frac{6}{\sqrt{33}}$

(c) $p = \frac{6}{\sqrt{165}}$

(d) $p = \frac{8}{\sqrt{33}}$

46. The product function $f(x) = x \max\{x, 0\}$ is

(a) continuous nowhere

(b) differentiable nowhere

(c) continuous and differentiable everywhere

(d) None of the above

47. If $(1 + ax)^n = 1 + 8x + 24x^2 + \ldots$, then the values of a and n are equal to

(a) 1, 2

(b) 3, 6

(c) 2, 3

(d) 2, 4

48. Let z be a complex variable and let $|z| = 1$. Then the value of $\left(\frac{z-1}{z+1}\right)$ is

(a) purely real

(b) purely imaginary

(c) zero

(d) None of the above

49. Let $f : Z \to Z$ be a function defined by $f(n) = n/2 + (1-(-1)^n)/4$ for all $n \in Z$, where Z is the set of all integers. Identify the correct statement.

(a) f is a function and is onto and one-to-one

(b) f is a function and is not onto but one-to-one

(c) f is a function and is not onto and not one-to-one

(d) f is a function and is onto but not one-to-one

50. As Lava is related to Volcano, which of the following relations stands valid?

(a) Ice : Glass

(b) Cascade : Precipice

(c) Stream : Geyser

(d) Avalanche : Ice

51. A velocity $\frac{1}{4}$ m/s is resolved into two components along OA and OB making angles 30° and 45° respectively with the given velocity. Then the component along OB is

(a) $\frac{1}{8}$ m/s

(b) $\frac{1}{4}(\sqrt{3}-1)$ m/s

(c) $\frac{1}{4}$ m/s

(d) $\frac{1}{8}(\sqrt{6}-\sqrt{2})$ m/s

52. Which of the following words is most opposite in the meaning to the word Abate?

(a) Attach

(b) Alter

(c) Assist

(d) Augment

53. The number of points at which the function $f(x) = \frac{1}{\log|x|}$ is discontinuous, is

(a) 4

(b) 3

(c) 2

(d) 1

54. The value of $\lim_{n \to \infty} \frac{(n!)^{1/n}}{n}$ is

(a) e

(b) e^{-1}

(c) 0

(d) None of the above

55. A son is looking for his father. He went 90 metres in the east before turning to his right. He went 20 metres before turning to his right again to look for his father at his uncle's place 30 metres from this point. His father was not there. From there he went 100 metres to the north before meeting his father in a street. How far did the son meet his father from the starting point?

(a) 80 metres

(b) 100 metres

(c) 120 metres

(d) 140 metres

56. If $\vec{a}$ and $\vec{b}$ are two unit vectors such that $\vec{a}+2\vec{b}$ and $5\vec{a}-4\vec{b}$ are perpendicular to each other, what angle is formed between $\vec{a}$ and $\vec{b}$?

(a) 45°

(b) 60°

(c) $\cos^{-1}\left(\frac{1}{3}\right)$

(d) $\cos^{-1}\left(\frac{2}{7}\right)$

57. Let A be a square matrix of order n. Consider the following statements :

(I) If λ is an eigenvalue of the matrix A, then $A\mathbf{x} = \lambda\mathbf{x}$ for every vector $\mathbf{x}$ of size $n \times 1$.

(II) The characteristic polynomial of the matrix A always has degree n.

(III) The matrix A and its transpose A^T have the same characteristic polynomials.

Then, among the above statements

(a) only I is wrong

(b) only II is wrong

(c) only III is wrong

(d) All are true

58. The differential equation of the family of curves $y = e^x(A\cos x + B\sin x)$, where A and B are constants, is

(a) $y'' - 2y' + 2y = 0$

(b) $y'' + 2y' + 2y = 0$

(c) $y'' + (y')^2 + y = 0$

(d) $y'' - 7y' + 2y = 0$

59. If $f(x+y+z) = f(x)\cdot f(y)\cdot f(z)$ for all x, y, z and $f(2) = 4$, $f'(0) = 3$, then $f'(2)$ equals to

(a) 12

(b) 9

(c) 16

(d) 6

60. Let $h(x) = \min\{x, x^2\}$ for all $x \in R$. Then which of the following is not correct?

(a) h is not continuous for all x

(b) h is differential for all x

(c) $h'(x) = 1$ for all $x > 1$

(d) h is not a differential function for at least two points

61. If $f(x)$, $g(x)$, $h(x)$ are polynomials in x of degree 2 and

$$F(x) = \begin{vmatrix} f & g & h \\ f' & g' & h' \\ f'' & g'' & h'' \end{vmatrix}$$

then $F'(x)$ is equal to

(a) 1

(b) 0

(c) −1

(d) None of the above

62. Ram drives to Sajid's house at an average speed of 40 mph. If he can drive 2/3 of the way there in an hour, how far away is Sajid's house?

(a) 60 miles

(b) 20 miles

(c) 80 miles

(d) 50 miles

63. What are the order and degree of the differential equation

$$\left(1+3\frac{dy}{dx}\right)^{2/3} = 4\frac{d^3y}{dx^3} ?$$

(a) $1, \frac{2}{3}$

(b) 3, 1

(c) 3, 3

(d) 1, 2

64. For the differential equation $\frac{dy}{dx} = x - y$, $y(0) = 1$, the value of $y(0 \cdot 1)$ by taking the step-length $h = 0 \cdot 1$ using Runge-Kutta fourth-order method is

(a) 0·60372

(b) 0·83747

(c) 0·90968

(d) None of the above

65. A horizontal rod AB is suspended at its ends by two vertical strings. The rod is of length 0·6 metre and weight 3 units. Its centre of gravity G is at a distance 0·4 metre from A. What is the tension of the string at A in the same unit?

(a) 0·2

(b) 1·4

(c) 0·8

(d) 1·0

66. If $y = (1+x)(1+x^2)(1+x^4) \ldots (1+x^{2n})$, then $\frac{dy}{dx}$ at $x = 0$ is

(a) −1

(b) 1

(c) 0

(d) None of the above

67. Let $\phi(x)$ be the inverse of the function $f(x)$ and $f'(x) = \frac{1}{1+x^5}$. Then $\frac{d}{dx}\phi(x)$ is

(a) $\frac{1}{1+[\phi(x)]^5}$

(b) $\frac{1}{1+[f(x)]^5}$

(c) $1+[\phi(x)]^5$

(d) $1+[f(x)]^5$

68. Assume that A is an $n \times n$ matrix. Consider the following statements :

(I) A is singular if and only if Rank $(A) < n$.

(II) A is non-singular if and only if A is row equivalent to the identity matrix.

(III) $\det(A) = 0$ if and only if all the main diagonal elements of A are zero.

Identify the correct answer.

(a) Only I and II are true

(b) Only II and III are true

(c) Only I and III are true

(d) None of the above

69. $\tan^{-1}\left(\frac{1}{4}\right) + \tan^{-1}\left(\frac{2}{9}\right)$ is equal to

(a) $\frac{1}{2}\cos^{-1}\left(\frac{3}{5}\right)$

(b) $\cos^{-1}\left(\frac{1}{2}\right)$

(c) $\frac{1}{2}\tan^{-1}\left(\frac{3}{5}\right)$

(d) $\tan^{-1}\left(\frac{1}{2}\right)$

70. The equation of the straight line passing through (3, 4) and the intersecting point of the two lines $5x - y = 9$ and $x + 6y = 8$ is

(a) $3x - y - 5 = 0$

(b) $2x + y - 10 = 0$

(c) $2x - 3y + 6 = 0$

(d) None of the above

71. $\int_0^{100}(x-[x])\,dx$ is equal to

(a) 50

(b) 100

(c) 200

(d) None of the above

72. The speed of a swimmer in still water is 5 m/min. He crosses a river of width 24 metres flowing with a speed 4 m/min to reach the opposite point on the other bank. What is the time taken by the swimmer?

(a) 8 minutes

(b) 9 minutes

(c) 19 minutes

(d) 20 minutes

73. A particle moves from rest at a distance c from a fixed point O with an acceleration $\frac{\mu}{x^2}$ away from O at a distance x. The velocity of the particle at distance $2c$ from O is

(a) $\sqrt{\frac{\mu}{c}}$

(b) $\sqrt{\mu c}$

(c) $\frac{\mu}{\sqrt{c}}$

(d) $\sqrt{\frac{2}{\mu c}}$

74. If $f(x)$ is an odd function, then $\int_a^x f(t)\,dt$ is

(a) odd

(b) even

(c) neither even nor odd

(d) periodic

75. The value of the integral $\int_{1/2e}^{e/2} |\log 2x| dx$ is

(a) $1 + e^{-1}$

(b) $1 - e^{-1}$

(c) $e^{-1} - 1$

(d) None of the above

76. The point $(2t^2 + 2t + 4, t^2 + t + 1)$ lies on the line $x + 2y = 1$ for

(a) all real values of t

(b) some real values of t

(c) $t = \frac{-4 \pm \sqrt{7}}{8}$

(d) None of the above

77. If $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ represent the consecutive sides of a quadrilateral, then the necessary and sufficient condition that the quadrilateral to be a parallelogram is

(a) $\vec{a} + \vec{c} = 0$

(b) $\vec{a} + \vec{d} = 0$

(c) $\vec{a} = \vec{d}$

(d) Both (a) and (b)

78. The point (3, 2) is reflected in the y-axis and then moved a distance 5 units towards the negative side of y-axis. The coordinates of the point thus obtained are

(a) (3, − 3)

(b) (−3, 3)

(c) (3, 3)

(d) (−3, − 3)

79. If two vertices of an equilateral triangle have integral coordinates, then the third vertex will have

(a) coordinates which are irrational

(b) at least one coordinate which is irrational

(c) coordinates which are rational

(d) coordinates which are integers

80. If θ is the angle between unit vectors $\vec{a}$ and $\vec{b}$, then the value of $\sin\left(\frac{\theta}{2}\right)$ is

(a) $\frac{1}{2}|\vec{a}+\vec{b}|$

(b) $\frac{1}{2}|\vec{a}\times\vec{b}|$

(c) $\frac{1}{2}|\vec{a}-\vec{b}|$

(d) $\sqrt{\frac{1}{2}(1-\vec{a}\cdot\vec{b})}$

81. The solution of $\frac{dy}{dx}=\frac{1}{x+y+1}$ is

(a) $y=\log(x+y+1)+1+c$

(b) $y+1=\log(x+y+2)+c$

(c) $y+\log(x+y+2)=c$

(d) $y+1+\log(x+y+2)=c$

82. If the centroid and vertex of an equilateral triangle are (2, 3) and (4, 3) respectively, then the other two vertices of the triangle are

(a) $(1, 3 \pm \sqrt{3})$

(b) $(2, 3 \pm \sqrt{3})$

(c) $(1, 2 \pm \sqrt{3})$

(d) $(2, 2 \pm \sqrt{3})$

83. Let E be the ellipse $\frac{x^2}{9} + \frac{y^2}{4} = 1$ and C be the circle $x^2 + y^2 = 9$ and let P and Q be the points (1, 2) and (2, 1) respectively. Then

(a) Q lies inside C but outside E

(b) Q lies outside both C and E

(c) P lies inside both C and E

(d) P lies inside C but outside E

84. If the coordinates of two vertices of a triangle are (4, 7) and (6, 1) and third vertex moves on the line $9x + 7y = 28$, then the locus of the centroid of the triangle has the equation

(a) $9x + 7y - 42 = 0$

(b) $7x + 9y - 58 = 0$

(c) $9x + 7y - 58 = 0$

(d) None of the above

85. Which of the following is not true?

(a) $Q - (P \cap R) = Q - (P \cap Q \cap R)$

(b) $Q \cap (P^c \cup R^c) = Q \cap (P^c \cup Q^c \cup R^c)$

(c) $(P - Q) - R = P - (Q \cup R)$

(d) All of the above

86. The points (0, − 1), (−2, 3), (6, 7) and (8, 3) are

(a) collinear

(b) vertices of a parallelogram which is not a rectangle

(c) vertices of a rectangle, which is not a square

(d) None of the above

87. A particle acted on by constant forces $4\hat{i} + \hat{j} - 3\hat{k}$ and $3\hat{i} + \hat{j} - \hat{k}$ to be displaced from the point $5\hat{i} + 4\hat{j} + \hat{k}$ to $\hat{i} + 2\hat{j} + 3\hat{k}$. The total work done by the forces is

(a) 20 units

(b) 30 units

(c) 40 units

(d) 50 units

88. The number of integral points (integral point means both the coordinates should be integers) exactly in the interior of the triangle with vertices (0, 0), (0, 21) and (21, 0) is

(a) 133

(b) 190

(c) 233

(d) 105

89. Let f, g and h be the permutations. Then which of the following is not true?

(a) $f \circ g = g \circ f$

(b) $f \circ (g \circ h) = (f \circ g) \circ h$

(c) $f \circ f^{-1} = 1 = f^{-1} \circ f$

(d) All of the above

90. Let A be a matrix such that $A = \begin{bmatrix} 3 & 0 \\ 0 & -2 \end{bmatrix}$. Then A^{12} will be equal to

(a) $\begin{bmatrix} 54123 & 5321 \\ 0 & 3058 \end{bmatrix}$

(b) $\begin{bmatrix} 534121 & 0 \\ 0 & 3058 \end{bmatrix}$

(c) $\begin{bmatrix} 531411 & 0 \\ 0 & 4096 \end{bmatrix}$

(d) None of the above

91. Consider three forces $\vec{P}$, $\vec{Q}$, $\vec{R}$ acting along IA, IB and IC, where I is the incenter of a ΔABC. If the forces are in equilibrium, then $\vec{P} : \vec{Q} : \vec{R}$ is

(a) $\cos\frac{A}{2} : \cos\frac{B}{2} : \cos\frac{C}{2}$

(b) $\sin\frac{A}{2} : \sin\frac{B}{2} : \sin\frac{C}{2}$

(c) $\sec\frac{A}{2} : \sec\frac{B}{2} : \sec\frac{C}{2}$

(d) $\operatorname{cosec}\frac{A}{2} : \operatorname{cosec}\frac{B}{2} : \operatorname{cosec}\frac{C}{2}$

92. If the equations of four circles are $(x \pm 4)^2 + (y \pm 4)^2 = 4^2$, then the radius of the smallest circle touching all the four circles is

(a) $4(\sqrt{2} + 1)$

(b) $4(\sqrt{2} - 1)$

(c) $2(\sqrt{2} - 1)$

(d) None of the above

93. In a triangle ABC, $a = 4$, $b = 3$, $\angle A = 60°$, then c is the root of the equation

(a) $c^2 - 3c - 7 = 0$

(b) $c^2 + 3c - 7 = 0$

(c) $c^2 - 3c + 7 = 0$

(d) $c^2 + 3c + 7 = 0$

94. The symmetric difference of sets A and B is defined as $A \oplus B = (A - B) \cup (B - A)$. Among the following statements, identify the false statement.

(a) $A \oplus (B \oplus C) = (A \oplus B) \oplus C$

(b) $A \oplus \phi = A$

(c) $A \oplus A = A$

(d) If $A \oplus C = B \oplus C$, then $A = B$

95. The distance from the centre of the circle $x^2 + y^2 = 2x$ to a straight line passing through the points of intersection of the two circles $x^2 + y^2 + 5x - 8y + 1 = 0$ and $x^2 + y^2 - 3x - 7y - 25 = 0$, is

(a) 1/3

(b) 2

(c) 3

(d) 1

96. If the parabolas $y^2 = 4a(x - c_1)$ and $x^2 = 4a(y - c_2)$ touch each other, then the locus of their point of contact is

(a) $xy = 4a^2$

(b) $xy = 2a^2$

(c) $xy = a^2$

(d) None of the above

97. $\int \frac{d^2}{dx^2}(\tan^{-1} x)\,dx$ is equal to

(a) $\frac{1}{1+x^2} + C$

(b) $\tan^{-1} x + C$

(c) $x\tan^{-1} x - \frac{1}{2}\log(1+x^2) + C$

(d) None of the above

98. A bus has exactly six stops on its route. The bus first stops at stop one and then at stops two, three, four, five and six respectively. After the bus leaves stop six, the bus turns and return to stop one and repeat the cycle. These stops are at six buildings that are in alphabetical order *L*, *M*, *N*, *O*, *P* and *Q*. Some other informations about the stops are as follows :

P is the third stop.
M is the sixth stop.
The stop *O* is the stop immediately before *Q*.
N is the stop immediately before *L*.

In case *N* is the fourth stop, which among the following must be the stop immediately before *P*?

(a) *O*

(b) *Q*

(c) *N*

(d) *L*

99. A bug starts at the origin and goes 1 unit up, 1/2 unit right, 1/4 unit down, 1/8 unit left, 1/16 unit up, and so on. Following the pattern up, right, down, left and infinitum, in what coordinates does it end up?

(a) (0, 0)

(b) (2/5, 4/5)

(c) (1/2, 1/4)

(d) (1/8, 1/2)

100. If $|z+4| \leq 3$, then what are the greatest and least values of $|z+1|$ respectively?

(a) 6, 0

(b) 4, 3

(c) 3, 0

(d) 0, 4

101. The sum of first n terms of the series $1 \cdot 1! + 2 \cdot 2! + 3 \cdot 3! + 4 \cdot 4! + \ldots$ is

(a) $(n+1)! - 1$

(b) $n! - 1$

(c) $(n-1)! - 1$

(d) None of the above

102. A survey recently conducted revealed that marriage is fattening. The survey found that on an average, women gained 23 pounds and men gained 18 pounds during 13 years of marriage. The answer to which among the following questions would be the most appropriate in evaluating the reasoning presented in the survey?

(a) Why is the time period of the survey 13 years, rather than 12 or 14?

(b) Did any of the men surveyed gain less than 18 pounds during the period they were married?

(c) How much weight is gained or lost in 13 years by a single-people of comparable age to those studied in the survey?

(d) When the survey was conducted, were the women as active as the men?

103. A random variable X is normally distributed with mean 2 and variance 16. Using

$$\frac{1}{\sqrt{2\pi}} \int_{-\infty}^{0 \cdot 25} e^{-x^2/2} dx = 0 \cdot 5987$$

the value of $P(X \le 3)$ will be

(a) 0·7734

(b) 0·4532

(c) 0·5987

(d) None of the above

104. $\sum_{i=1}^{n} \sum_{j=1}^{i} \sum_{k=1}^{j} 1$ is equal to

(a) $\frac{n(n+1)(2n+1)}{6}$

(b) $\frac{n(n+1)}{2}$

(c) $\left(\frac{n(n+1)}{2}\right)^2$

(d) $\frac{n(n+1)(n+2)}{6}$

105. A curve for which the tangent at each point makes a constant angle α with the radius vector satisfies which of the following differential equations?

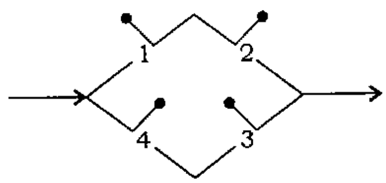
(a) $\frac{dr}{d\theta} = r\tan\alpha$

(b) $\frac{dr}{d\theta} = r\cot\alpha$

(c) $r\frac{dr}{d\theta} = \tan\alpha$

(d) $r\frac{dr}{d\theta} = \cot\alpha$

106. The following figure shows an electric circuit in which each of the switches located at 1, 2, 3 and 4 is independently closed or open with probabilities p and $1-p$ respectively :



If a signal is fed to the input, what is the probability that it is transmitted?

(a) $1-(1-p)^4$

(b) $1-(1-p^2)^2$

(c) $p^2(2-p^2)$

(d) $2p^2$

107. The sum of the series $1+2\cdot2+3\cdot2^2+4\cdot2^3+5\cdot2^4+\ldots+100\cdot2^{99}$ is

(a) $99\cdot2^{100}+1$

(b) $100\cdot2^{100}$

(c) $99\cdot2^{100}$

(d) $99\cdot2^{200}+1$

108. The value of $\int_{-\pi}^{\pi}\frac{\cos^2 x}{1+a^x}dx,\ a>0$ is

(a) $\pi/2$

(b) $a\pi$

(c) π

(d) 2π

109. There are four towns P, Q, R and S. Q is to the south-west of P, R is to the east of Q and south-east of P, S is to the north of R in line with QP. In which direction of P is S located?

(a) South-east

(b) North

(c) North-east

(d) East

110. Each element of the set {10, 11, 12, ..., 19, 20} is multiplied by each element of the set {21, 22, 23, ..., 29, 30}. The resulting sum by adding all these products will be

(a) 42075

(b) 27500

(c) 18000

(d) 40275

111. Let $y = y(x)$ be a function defined on the closed interval $[x_0, x_n]$. Let $x_0 \le x_1 \le \dots \le x_n$ be points such that $y_i = y(x_i)$ and further let $h = x_i - x_{i-1}$, where $i = 1, 2, \dots, n$. Then the numerical integration formula, defined by

$$\int_{x_0}^{x_n} y(x) \approx \frac{h}{2}(y_0 + 2y_1 + \dots + 2y_{n-1} + y_n)$$

is called

(a) trapezoidal rule

(b) Simpson's rule

(c) Gregory's formula

(d) None of the above

112. Let A and B be square matrices of order n. Consider the following three statements on determinants :

(I) $\det(AB) = \det(BA)$

(II) $\det(AB) = 0$ if and only if $\det(A) = 0$ or $\det(B) = 0$

(III) $\det(AB^T) = \det(A^T)\det(B)$ where A^T, B^T denote the transpose of A, B

Then

(a) exactly one of the above statements is true

(b) exactly two of the above statements is true

(c) all the above statements are true

(d) all the above statements are false

113. The sum of the radii of inscribed and circumscribed circles for an n-sided polygon of side a is

(a) $a\cot\left(\frac{\pi}{2}\right)$

(b) $\frac{a}{2}\cot\left(\frac{\pi}{2n}\right)$

(c) $a\cot\left(\frac{\pi}{2n}\right)$

(d) $\frac{a}{4}\cot\left(\frac{\pi}{2n}\right)$

114. The value of the limit $\lim_{x\to 0}\frac{x}{|x|}$ is

(a) 0

(b) 1

(c) −1

(d) None of the above

115. Which, among the following, is odd?

Guava, Litchi, Papaya, Watermelon, Jackfruit

(a) Jackfruit

(b) Litchi

(c) Papaya

(d) Watermelon

116. If $\sum_{j=1}^{21} a_j = 693$, where $a_1, a_2, \ldots, a_{21}$ are in AP, then $\sum_{i=0}^{10} a_{2i+1}$ is

(a) 361

(b) 396

(c) 363

(d) Data incomplete

117. The probability density of x is given by

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

Then the value of $E[(2x+1)^2]$ will be

(a) 5

(b) 18

(c) 3

(d) 1/6

118. The solution to the equations $x \equiv 2 \pmod 5$ and $x \equiv 3 \pmod{13}$ is

(a) 55

(b) 52

(c) 42

(d) 6

119. Find the correct alternatives by establishing the relationship as stated below :

Aeroplane : Cockpit :: Train : ?

(a) Wagon

(b) Coach

(c) Compartment

(d) Engine

120. If $\log_{2^{1/2}} a + \log_{2^{1/4}} a + \log_{2^{1/6}} a + \log_{2^{1/8}} a$ up to 20 terms is 840, then a is equal to

(a) 2

(b) 1

(c) 4

(d) $\sqrt{2}$

SPACE FOR ROUGH WORK

SPACE FOR ROUGH WORK

SPACE FOR ROUGH WORK

★ ★ ★