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Total Pages: 82

ENTRANCE EXAMINATION, 2012

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) Calculators and Log Tables may be used.

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

(ix) 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.**

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1. Among the following statements, identify the number of correct statements :

(i) The function defined by

$$f(x) = \frac{ax+b}{cx+d}$$

always has maxima and minima for whatever values of the real numbers a, b, c and d.

(ii) $\log(x)$ is a convex function in the real line.

(iii) The function defined by $f(x) = x - \sin x$ is a decreasing function throughout in any interval of values of the variable x.

(a) 0

(b) 1

(c) 2

(d) 3

2. For arbitrary constants c_1 and c_2, the solution space of the differential equation $y'' - 8y' + 16y = 0$ will be

(a) $y(x) = c_1 e^{-4x} + c_2 x e^{-4x}$

(b) $y(x) = c_1 e^{4x} + c_2 e^{-4x}$

(c) $y(x) = c_1 e^{4x} + c_2 x e^{4x}$

(d) None of the above

3. Evaluate the integral

$$\int_{-1}^{1} |2x-1|\, dx$$

where $|\cdot|$ denotes the absolute value.

(a) $\frac{5}{2}$

(b) $\frac{3}{2}$

(c) 0

(d) None of the above

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4. How many committees of five people can be chosen from 20 men and 12 women if at least 4 women must be chosen on each committee?

(a) 9872

(b) 10012

(c) 10692

(d) None of the above

5. There are five different houses, A to E, in a row. A is to the right of B and E is to the left of C and right of A. Further, B is to the right of D. Which house will be in the middle?

(a) A

(b) B

(c) D

(d) None of the above

6. If a matrix A is invertible, then which property/properties of A remains/remain true?

(i) A is symmetric.

(ii) A is triangular.

(iii) All entries are integers.

(a) Only (i)

(b) Only (i) and (ii)

(c) All the properties (i), (ii) and (iii)

(d) None of the above

7. The number of diagonals that can be drawn by joining the vertices of an octagon is

(a) 28 (b) 20

(c) 24 (d) 48

8. Consider the function $(x+2)\cos^2 x$ for $x \geq 2$. Determine its order in terms of big-O notation.

(a) $O(x)$

(b) $O(x^2)$

(c) $O(\log(x))$

(d) None of the above

9. A particle acted by constant forces $4\mathbf{i}+\mathbf{j}-3\mathbf{k}$ and $3\mathbf{i}+\mathbf{j}-\mathbf{k}$ is displaced from the point (1, 2, 3) to the point (5, 4, 1), where $\mathbf{i}$, $\mathbf{j}$ and $\mathbf{k}$ are unit vectors along the X-, Y- and Z-axis respectively. Then the total work done by the forces is

(a) 20 units

(b) 30 units

(c) 40 units

(d) None of the above

10. The maximum value of the function defined by

$$f(x) = 2\sin x + \sin 2x$$

in the interval $\left[0, \frac{3\pi}{2}\right]$ is

(a) $\frac{5}{2}$

(b) $\frac{3\sqrt{5}}{2}$

(c) $\frac{3\sqrt{3}}{2}$

(d) None of the above

11. In how many ways can the letters of the word 'attention' be rearranged?

(a) 28220

(b) 30240

(c) 32120

(d) None of the above

12. In a certain code language

(i) 'mxy das zci' means 'good little frock'

(ii) 'jmx cos zci' means 'girl behaves good'

(iii) 'nug drs cos' means 'girl makes mischief'

(iv) 'das ajp cos' means 'little girl fell'

Which word in that language stands for 'frock'?

(a) zci

(b) das

(c) mxy

(d) Insufficient information

13. The number of solutions of the equation $\sqrt{3x^2 + x + 5} = x - 3$ is

(a) ∞

(b) 1

(c) 0

(d) None of the above

14. The radius of the circle in which the sphere $x^2 + y^2 + z^2 = 5$ is cut by the plane $x + y + z = 3\sqrt{3}$ is

(a) $\sqrt{3}$

(b) $3\sqrt{3}$

(c) $\frac{1}{\sqrt{3}}$

(d) None of the above

15. Suppose A, B and C are sets. Consider the following statements :

(i) $A \in B$, $B \subseteq C$. Then $A \subseteq C$ is true.

(ii) $A \not\subset B$. Then $B \subset C$ is true.

(iii) $C \in \wp(A)$ if and only if $C \subseteq A$, where $\wp(A)$ denotes the power set of A.

The number of correct statements among (i)–(iii) is

(a) 1

(b) 2

(c) 3

(d) None of the above

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16. Of 30 personal computers (PCs) owned by faculty members in a university department, 20 run Windows, 8 have 21 inch monitors, 25 have CD-ROM drives, 20 have at least two of these features and 6 have all the three features. How many PCs have at least one of these features?

(a) 22

(b) 24

(c) 27

(d) None of the above

17. In the complex plane, consider the following statements :

(i) If $\left|e^{z}\right| = 1$, then z is a pure imaginary number.

(ii) There are complex numbers z such that $\left|\sin z\right| > 1$.

(iii) The function $\sin\bar{z}$ is nowhere analytic, where $\bar{z}$ is the complex conjugate of the number z.

Identify the number of correct statements.

(a) 0 (b) 1

(c) 2 (d) 3

18. Among the six students A, B, C, D, E and F, it is given that—

(i) D and F are tall, while the others are short

(ii) A, C and D are wearing glasses, while the others are not

Identify the short students who are not wearing glass.

(a) B, E, F

(b) B, E

(c) B, C

(d) None of the above

19. For the matrix $A = \begin{pmatrix} 2 & c & c \\ c & c & c \\ 8 & 7 & c \end{pmatrix}$, find the number of c values in which the matrix A is not invertible.

(a) 0 (b) 1

(c) 2 (d) 3

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20. Transform the well-formed formula $P \rightarrow Q \wedge R$ into a disjunction normal form (DNF) and conjunction normal form (CNF) respectively.

(a) $\neg P \vee (Q \wedge R)$ and $(\neg P \vee Q) \wedge (\neg P \vee R)$

(b) $P \vee \neg(Q \wedge R)$ and $(P \wedge \neg Q) \wedge (\neg P \vee R)$

(c) $\neg P \wedge (Q \vee R)$ and $(P \vee \neg Q) \wedge (\neg P \vee R)$

(d) None of the above

21. What is the probability that the sum of two numbers x and y randomly chosen on the interval (0, 1) is greater than 1, while the sum of their squares is less than 1?

(a) $\frac{\pi}{2} - \frac{1}{4}$

(b) $\frac{\pi}{4} - \frac{1}{2}$

(c) $\frac{\pi}{6} - \frac{1}{3}$

(d) None of the above

22. The subtraction of $2A_{16}$ from 84_{16} results in

(a) 68_{16} (b) $A6_{16}$

(c) $5A_{16}$ (d) $5B_{16}$

23. 'Joule' is related to energy and in the same way 'Pascal' is related to

(a) volume

(b) pressure

(c) purity

(d) beauty

24. If $x = \dfrac{2\sin\alpha}{1+\cos\alpha+\sin\alpha}$, then the value of $\dfrac{\cos\alpha}{1+\sin\alpha}$ is equal to

(a) $1-x$

(b) $1+x$

(c) $\dfrac{1}{x}$

(d) None of the above

25. Suppose a matrix A of order 3 has eigenvalues 1, – 1, 3. What is the determinant of A^{-1}, where A^{-1} is the inverse of the matrix A?

(a) -3

(b) 3

(c) $2/3$

(d) None of the above

26. If $P(x, y)$ is a point on the line $y = -3x$ such that P and the point (3, 4) are the opposite sides of the line $3x - 4y = 8$, then

(a) $x > \dfrac{8}{15},\ y < -\left(\dfrac{8}{5}\right)$

(b) $x > \dfrac{8}{5},\ y < -\left(\dfrac{8}{15}\right)$

(c) $x = \dfrac{8}{15},\ y = -\left(\dfrac{8}{5}\right)$

(d) None of the above

27. The value of the integral

$$\int_0^\infty \frac{x\log x}{(1+x^2)^2}\,dx$$

is

(a) 0 (b) $\log 2$

(c) $2\log 5$ (d) ∞

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28. Find the global minimizers of the following function :

$$f(x, y) = e^{x-y} + e^{y-x}$$

(a) All points along the X-axis

(b) All points along the Y-axis

(c) Global minimum of the function $f(\cdot)$ does not exist

(d) None of the above

29. From the two statements—

(i) some cubs are tigers

(ii) some tigers are goats

we can conclude that

(a) some cubs are goats

(b) no cub is a goat

(c) all cubs are goats

(d) None of the above

30. Let X equal -1, 0 or 1 with equal probability and let $Y = |X|$. A simple calculation shows $\text{cov}(X, Y)$ equals

(a) 1

(b) -1

(c) 0

(d) None of the above

31. Let A and B be the matrices of the same order. Consider the following statements :

(i) The eigenvalues of A are equal to the eigenvalues of A^t, where A^t is the transpose of A.

(ii) The eigenvalues of AB are the product of the eigenvalues of A and B.

(iii) The eigenvalues of $(A + B)$ are the sum of the individual eigenvalues of A and B.

Identify the correct statements.

(a) Only (i) and (ii)

(b) Only (i) and (iii)

(c) (i), (ii) and (iii)

(d) None of the above

32. If $f(x) = x^2 + 2bx + 2c^2$ and $g(x) = -x^2 - 2cx + b^2$ are such that

$$\min f(x) > \max g(x)$$

then we will have

(a) $c^2 > 2b^2$

(b) $2c^2 < b^2$

(c) $b^2 + c^2 < 2$

(d) None of the above

33. Find the matrix A^{50}, when the matrix A is

$$A = \begin{pmatrix} 2 & -1 \\ 0 & 1 \end{pmatrix}$$

(a) $\begin{pmatrix} 2^{50} & (-1)^{50-1} \\ 0 & 1 \end{pmatrix}$

(b) $\begin{pmatrix} 2^{50} & -3+2^{50} \\ 0 & 1 \end{pmatrix}$

(c) $\begin{pmatrix} 2^{50} & -1 \\ 0 & 1 \end{pmatrix}$

(d) None of the above

34. If the function $f : [1, \infty) \to [1, \infty)$ is defined by $f(x) = 2^{x(x-1)}$, then its inverse is

(a) $\frac{1}{2}(1 + \sqrt{1 - 2\log_2 x})$

(b) $\frac{1}{2}(1 + \sqrt{1 + 2\log_2 x})$

(c) $\frac{1}{2}(1 + \sqrt{1 + 4\log_2 x})$

(d) None of the above

35. For a given real-valued function $h(t)$, $t \geq 0$, the Laplace transform denoted by $\bar{h}(s)$ is defined by

$$\bar{h}(s) = \int_0^\infty e^{-st} h(t)\, dt$$

The Laplace transform of $e^{-at} h(t)$ is

(a) $\bar{h}(s+a)$

(b) $\dfrac{\bar{h}(s)}{s+a}$

(c) $a\bar{h}(s)$

(d) None of the above

36. Among the four groups of letters from (a) to (d) given, three of them are alike in a certain way, while one is different. Identify the one that is different.

(a) ALMZ

(b) BTUY

(c) CPQX

(d) DEFY

37. How many ways can k distinguishable balls be distributed into n urns so that there are k_i balls in urn i?

(a) $\dfrac{k!}{(k_1 + k_2 + \ldots + k_n)!}$

(b) $\dfrac{k!}{k_1!k_2!\ldots k_n!}$

(c) $k_1!k_2!\ldots k_n!$

(d) None of the above

38. $\lim\limits_{n \to \infty} \left(\dfrac{1+i}{\sqrt{\pi}}\right)^n$ is equal to

(a) 0

(b) i

(c) ∞

(d) None of the above

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39. AB is a chord of the parabola $y^2 = 4ax$ with the end A at the vertex of the given parabola. BC is drawn perpendicular to AB meeting the axis of the parabola at C. The projection of BC on this axis is

(a) a

(b) $2a$

(c) $4a$

(d) None of the above

40. The probability that a number selected at random between 100 and 999 (both inclusive) will not contain the digit 7 is

(a) 18/25 (b) 16/25

(c) 729/1000 (d) 27/75

41. If the product of the roots of the equation $x^2 - 5kx + 2e^{4\quad 8} - 1 = 0$ is 31, then the sum of the roots is

(a) 10

(b) 8

(c) 5

(d) None of the above

42. Let $f : Z \to Z$ be a function defined by $f(x) = 3x^3 - x$, where Z is the set of integers. Then the function f is

(a) injective only

(b) surjective only

(c) bijective

(d) None of the above

43. An equation of a tangent to the hyperbola

$$16x^2 - 25y^2 - 96x + 100y - 356 = 0$$

which makes an angle $\pi/4$ with the transverse axis is

(a) $y = x + 2$

(b) $y = 2x - 3$

(c) $y = x + 6$

(d) $x = 2y - 3$

44. If $s_n = \frac{1}{2}(1-(-1)^n)$ for $n \geq 1$, then as $n \to \infty$

$$\frac{s_1 + s_2 + \ldots + s_n}{n}$$

converges to

(a) 0

(b) 1

(c) $\frac{1}{2}$

(d) None of the above

45. A triangle PQR is inscribed in the circle $x^2 + y^2 = 25$. If Q and R have coordinates (3, 4) and (–4, 3) respectively, then $\angle QPR$ is equal to

(a) $\frac{\pi}{2}$

(b) $\frac{\pi}{3}$

(c) $\frac{\pi}{4}$

(d) $\frac{\pi}{6}$

46. If $y = \int_1^{t^3} \sqrt[3]{z} \log z \, dz$ and $x = \int_{\sqrt{t}}^{3} z^2 \log z \, dz$, then $\frac{dy}{dx}$ is

(a) $-4t^{5/2}$

(b) $35t^{5/2}$

(c) $-36t^{5/2}$

(d) None of the above

47. February 29, 1952 occurred on which day of the week?

(a) Sunday

(b) Wednesday

(c) Friday

(d) None of the above

48. Let $f(x)$ be a polynomial function and satisfy the conditions

$$f(x)f(1/x) = f(x) + f(1/x) \text{ and } f(3) = 28$$

Then the value of $f(4)$ is given by

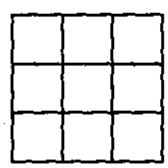
(a) 65

(b) 62

(c) 60

(d) None of the above

49. How many squares are there in the given figure?



(a) 12

(b) 14

(c) 16

(d) None of the above

50. For any three vectors **a**, **b**, **c** if $\mathbf{a}+\mathbf{b}+\mathbf{c}=0$ and $|\mathbf{a}|=3$, $|\mathbf{b}|=5$ and $|\mathbf{c}|=7$, then the angle between **a** and **b** is

(a) $\frac{5\pi}{3}$

(b) $\frac{2\pi}{3}$

(c) $\frac{\pi}{3}$

(d) $\frac{\pi}{6}$

51. Ganesh appeared for mathematics examination. He tried to solve correctly all the 100 problems given but some of them went wrong and scored 85. The score was calculated by subtracting two times the number of wrong answers from the correct answers. Then the number of problems solved correctly is

(a) 95

(b) 92

(c) 90

(d) None of the above

52. If the sum of the lengths of the hypotenuse and another side of a right-angled triangle is given, then the area of the triangle is maximum when the angle between those sides is

(a) 30 degrees

(b) 60 degrees

(c) 90 degrees

(d) None of the above

53. Determine the probability that after $2n$ tosses of a fair coin, there have been the same number of heads as tails.

(a) $\binom{2n}{n}\frac{1}{2^{2n}}$

(b) $\binom{2n}{n}\frac{1}{2^{n}}$

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

(d) None of the above

54. Let a, b be positive integers and let p be a prime number such that $\gcd(a, p^2) = p$ and $\gcd(b, p^3) = p^2$ are satisfied, where gcd (. , .) denotes the greatest common divisor. Then $\gcd(ab, p^4)$ will be equal to

(a) p

(b) p^2

(c) p^3

(d) None of the above

55. Let n be a positive integer such that $(1+i)^n = 4096$ is true, where $i^2 = -1$. Then the value of n is

(a) 20

(b) 24

(c) 28

(d) None of the above

56. Identify the correct statements from the following :

(i) The diagonal entries of a skew-symmetric matrix are zero.

(ii) The determinant of a skew-symmetric matrix of order 3 will be always equal to zero.

(iii) The determinant of an orthogonal matrix of order 3 will be always equal to zero.

(a) (i) and (ii) only

(b) (ii) and (iii) only

(c) (i) and (iii) only

(d) None of the above

57. By the transformation

$$u = x - ct, \quad v = x + ct$$

the partial differential equation

$$\frac{\partial^2 z(x, t)}{\partial t^2} = c\frac{\partial^2 z(x, t)}{\partial x^2}$$

will reduce to

(a) $\dfrac{\partial^2 z(u, v)}{\partial u \partial v} = u^2 + v^2$

(b) $\dfrac{\partial^2 z(u, v)}{\partial u \partial v} = uv$

(c) $\dfrac{\partial^2 z(u, v)}{\partial u \partial v} = 0$

(d) None of the above

58. Imagine that you have two empty stacks of integers, s1 and s2. Draw a picture of each stack after the execution of the following pseudocode :

```
pushStack(s1, 3);
pushStack(s1, 5);
pushStack(s1, 7);
pushStack(s1, 9);
pushStack(s1, 11);
while(!emptyStack(s1))
{
      popStack(s1, x);
      x = x + 1;
      pushStack(s2, x);
}
```

(a)

s1	s2
3	4
5	6
7	8
9	10

(b)

s1	s2
3	
5	
7	
9	

(c)

s1	s2
	4
	6
	8
	10

(d) None of the above

59. Let X denote a random variable that takes on any of the values -1, 0, 1 with respective probabilities

$$P\{X=-1\}=0\cdot 2,\ \ P\{X=0\}=0\cdot 5 \ \text{and} \ \ P\{X=1\}=0\cdot 3$$

Compute the expected value of $E(X^2)$.

(a) 0·35

(b) 0·5

(c) 0·625

(d) None of the above

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60. Suppose a matrix A of order 3 has eigenvalues 1, 2, 4. What is the trace of A^2?

(a) 8

(b) 7

(c) 21

(d) 64

61. If $\sin^{-1} x + \sin^{-1} y = \frac{2\pi}{3}$, then we have $\cos^{-1} x + \cos^{-1} y =$

(a) $\frac{\pi}{3}$

(b) $\frac{\pi}{6}$

(c) $\frac{\pi}{8}$

(d) None of the above

62. Find a third equation that can be solved if $x + y + z = 0$ and $x - 2y - z = 1$.

(a) $3x + z = 2$

(b) $3y + 2z = 4$

(c) $2x - y = 1$

(d) None of the above

63. For any real number a, $\lim_{x \to \infty} \sqrt{x}\{\sqrt{x+a} - \sqrt{x}\}$ is equal to

(a) ∞

(b) 0

(c) a

(d) None of the above

64. In a group of cows and hens, the number of legs are 14 more than twice the number of heads. Then the number of cows will be

(a) 5

(b) 7

(c) 10

(d) None of the above

65. Evaluate the following integral :

$$\int_0^\infty \frac{dx}{(1+x)^2}$$

(a) 0

(b) 1

(c) Integral does not exist

(d) None of the above

66. With a 100 kHz clock frequency, eight bits can be serially entered into a shift register in

(a) 8 ms

(b) 80 ms

(c) 8 μs

(d) 80 μs

67. The probability that a man who is 85 years old will die before attaining the age of 90 is 1/3. Four persons A_1, A_2, A_3 and A_4 are 85 years old. The probability that A_1 will die before attaining the age of 90 and will be the first to die is

(a) $\frac{31}{228}$

(b) $\frac{13}{282}$

(c) $\frac{65}{324}$

(d) None of the above

68. Which one of the following formats of a digital image is odd-one-out?

(a) BMP (b) JPEG

(c) RLE (d) TIFF

69. In a triangle ABC, line BP is drawn perpendicular to BC to meet CA in P such that $CA = AP$. Then $\frac{BP}{AB}$ is equal to

(a) $2 \sin A$

(b) $2 \sin B$

(c) $2 \sin C$

(d) None of the above

70. Suppose a matrix A is invertible and by exchanging its first two rows, you get the matrix B. Then B is invertible and is obtained from the inverse of A by

(a) exchanging the first two rows of the inverse of A and keeping its remaining entries fixed

(b) exchanging the first two columns of the inverse of A and keeping its remaining entries fixed

(c) exchanging the first two rows and columns of the inverse of A and keeping its remaining entries fixed

(d) None of the above

71. What is the decimal representation of the octal number $(51735)_8$?

(a) 21469

(b) 21220

(c) 21008

(d) None of the above

72. Find the shortest distance from the origin to the surface defined by

$$x^2 + 8xy + 7y^2 = 225$$

(a) 0

(b) 12

(c) 22

(d) None of the above

73. A and B are brothers. C and D are sisters. A's son is D's brother. How is B related to C?

(a) Father

(b) Brother

(c) Grandfather

(d) Uncle

74. If A and B are two events such that

$$P(A \cup B) = \frac{3}{4}, \quad P(A \cap B) = \frac{1}{4} \quad \text{and} \quad P(A^c) = \frac{2}{3}$$

where $P(A^c)$ denotes the probability of the complement of A, then $P(A^c \cup B)$ is

(a) $\frac{5}{12}$

(b) $\frac{5}{9}$

(c) $\frac{8}{11}$

(d) None of the above

75. In a 4-variable Karnaugh map, a 2-variable product term is produced by

(a) a 2-cell group of 1^s

(b) an 8-cell group of 1^s

(c) a 4-cell group of 1^s

(d) a 4-cell group of 0^s

76. If z is a complex number and lies in the second quadrant, then in which quadrant of the complex plane, the complex number $i\bar{z}$ lies, where $\bar{z}$ is the complex conjugate of z and $i^2 = -1$?

(a) First quadrant

(b) Second quadrant

(c) Third quadrant

(d) Fourth quadrant

77. The sum of the roots of the equation $4^x - 3(2^{x+3}) + 128 = 0$ is

(a) 0

(b) 5

(c) 8

(d) None of the above

78. In Gauss elimination method, the coefficient matrix is reduced into a

(a) diagonal matrix

(b) triangular matrix

(c) unit matrix

(d) null matrix

79. Suppose $f : A \rightarrow B$ and $g : B \rightarrow C$ are functions. Consider the following statements :

(i) If $(g \circ f)$ is one-to-one and the function f is onto, then the function g is one-to-one.

(ii) If $(g \circ f)$ is one-to-one, then the function f is one-to-one.

(iii) If $(g \circ f)$ is onto and the function g is one-to-one, then the function f is onto.

Among the above statements, identify the correct statements.

(a) (i) and (ii) only

(b) (ii) and (iii) only

(c) (i), (ii) and (iii)

(d) None of the above

80. Arrange the following numbers in ascending order :

$$\log(2+4),\ \log 2+\log 4,\ \log(6-3),\ \log 6-\log 3$$

(a) $\log(2+4),\ \log 2+\log 4,\ \log 6-\log 3,\ \log(6-3)$

(b) $\log 2+\log 4,\ \log(2+4),\ \log(6-3),\ \log 6-\log 3$

(c) $\log 6-\log 3,\ \log(6-3),\ \log 2+\log 4,\ \log(2+4)$

(d) None of the above

81. Consider the limit $\lim_{z\to 0}\left(\frac{z}{\bar{z}}\right)^2$ in the complex plane, where $\bar{z}$ is the complex conjugate of z.

Then the values of the limit as z approaches zero along the real axis, along the imaginary axis and along the line $y = x$ will be

(a) 1, 1, − 1

(b) 1, 1, 0

(c) −1, − 1, 1

(d) None of the above

82. A computer science class consists of 13 females and 12 males. Six class members are to be chosen at random to plan a picnic. What is the probability that exactly 4 females and 2 males are chosen?

(a) 0·1 (b) 0·2

(c) 0·3 (d) 0·4

83. Suppose a random variable X is uniformly distributed between 0 and 1 whose pdf (probability density function) is

$$f(x)=\begin{cases}1, & 0\le x\le 1\\ 0, & \text{else}\end{cases}$$

Then its mean and variance become

(a) 1/2, 1/12

(b) 1/4, 1/16

(c) 1/6, 1/17

(d) None of the above

84. If a circle passes through the point (3, 4) and cuts the circle $x^2 + y^2 = a^2$ orthogonally, the equation of the locus of its centre is

(a) $3x + 4y = a^2 + 25$

(b) $x + 8y = a^2 + 25$

(c) $6x + 8y = a^2 + 25$

(d) None of the above

85. A vector $\mathbf{c}$ perpendicular to the vectors $2\mathbf{i} + 3\mathbf{j} - \mathbf{k}$ and $\mathbf{i} - 2\mathbf{j} + \mathbf{k}$ satisfying the condition $\mathbf{c} \cdot (2\mathbf{i} - \mathbf{j} + \mathbf{k}) = -6$, where $\mathbf{i}$, $\mathbf{j}$ and $\mathbf{k}$ are unit vectors along the X-, Y- and Z-axis respectively, is

(a) $-2\mathbf{i} + \mathbf{j} - \mathbf{k}$

(b) $2\mathbf{i} - 3\mathbf{j} + 4\mathbf{k}$

(c) $-3\mathbf{i} + 3\mathbf{j} + 3\mathbf{k}$

(d) None of the above

86. Let $R = \{(x, y) : x, y \in A, \; x + y = 4\}$ be a relation, where $A = \{1, 2, 3, 4, 5\}$. Then R is

(a) reflexive, symmetric but not transitive

(b) symmetric but not reflexive and not transitive

(c) not reflexive, not symmetric and not transitive

(d) None of the above

87. Which of the following operators in C++ can be overloaded?

(a) Conditional operator (? :)

(b) Scope resolution operator (::)

(c) Member access operator (.*)

(d) Relational operator (<=)

88. Let $r \neq 0$ be a real number. Then the sum of the series

$$r^2 + \frac{r^2}{1+r^2} + \frac{r^2}{(1+r^2)^2} + \ldots$$

is equal to

(a) ∞

(b) $1+r^2$

(c) $\frac{1}{1+r^2}$

(d) None of the above

89. How many even numbers in the range of 100–999 have no repeated digits?

(a) 298

(b) 328

(c) 368

(d) None of the above

90. A frog starts climbing a 30 ft wall. Each hour it climbs 3 ft and slips back 2 ft. How many hours does it take to reach the top and get out?

(a) 30

(b) 29

(c) 28

(d) None of the above

91. A continuous random variate X has the probability density function (pdf)

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

Then the value of c is

(a) 1

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

(c) $\frac{1}{\pi}$

(d) None of the above

92. If an integer needs two bytes of storage, then the maximum value of an unsigned integer is

(a) $2^{16} - 1$ (b) $2^{15} - 1$

(c) 2^{16} (d) 2^{15}

93. The expression $X = (A + B + C)(A + B + C')(A + B' + C)(A + B' + C')(A' + B' + C)$ is equivalent to

(a) $A(B + C) + BC$ (b) $A(B' + C)$

(c) $AB' + BC'$ (d) None of the above

94. The output of the program

```
main( )
{int i=5; i=(++i)/(i++); printf("% d",i);}
```

is

(a) 5 (b) 1

(c) 6 (d) 2

95. Two finite sets have m and n elements respectively. The total number of subsets of the first set is 12 more than the total number of subsets of the second set. Then the values of m and n respectively are

(a) 5, 3

(b) 6, 4

(c) 4, 2

(d) None of the above

96. Among the following statements, identify the number of correct statements :

(i) Let A be a set and suppose that $x \in A$. Then $x \subseteq A$ is possible.

(ii) $\phi \in \{x, y, \phi\}$ and $\phi \subseteq \{x, y, \phi\}$, where ϕ is the empty set.

(iii) The number of elements of the power set of the power set of the empty set is 2.

(a) 1

(b) 2

(c) 3

(d) None of the above

97. Consider the matrix $A = \begin{pmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & \frac{1}{2} \end{pmatrix}$. Then the matrix A is

(a) positive definite

(b) positive semi-definite only

(c) negative definite

(d) indefinite

98. Suppose u_n and v_n are sequences defined recursively by

$$u_1 = 0,\ v_1 = 1 \text{ and for } n > 1,\ u_{n+1} = (u_n + v_n)/2,\ v_{n+1} = (u_n + 3v_n)/4$$

Then the sequences $\{u_n\}$ and $\{v_n\}$ will become

(a) both increasing

(b) both decreasing

(c) one increasing and the other decreasing

(d) None of the above

99. Consider the function $f(x) = \dfrac{e^{1/x}}{1+e^{1/x}}$ for $x \neq 0$. Then the values of the limit of the function $f(x)$ when $x \to 0^+$ and $x \to 0^-$ will be

(a) Both the limits do not exist

(b) 0, 0 respectively

(c) 0, 1 respectively

(d) None of the above

100. If $u = \arctan x$, then

$$(1+x^2)\frac{d^2u}{dx^2} + 2x\frac{du}{dx}$$

will be equal to

(a) x

(b) u

(c) 1

(d) None of the above

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101. The period of the function $f(x) = \cos^2 3x + \tan 4x$ is

(a) π

(b) $\pi/3$

(c) $\pi/6$

(d) None of the above

102. Find the binary representation of the number 2159.

(a) 100 001 101 101

(b) 110 011 101 111

(c) 101 101 001 100

(d) None of the above

103. The error quantity which must be added to the true representation of the quantity in order that the result is exactly equal to the quantity we are seeking to generate is called

(a) truncation error

(b) round-off error

(c) relative error

(d) absolute error

104. Identify the types of singularity of the following complex functions, both at $z = 0$:

(i) $f(z) = \dfrac{e^{2z} - 1}{z}$

(ii) $g(z) = z^3 \sin\left(\dfrac{1}{z}\right)$

(a) Both are removable singularities

(b) Both are essential singularities

(c) Essential and removable singularities

(d) Removable and essential singularities

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105. Find the sum of all the numbers between 100 and 1000 which are divisible by 14.

(a) 32388

(b) 35392

(c) 38396

(d) None of the above

106. Let $n > 3$ be an integer and let $A = \{1, 2, 3, \ldots, n\}$. How many subsets B of A have the property that $B \cup \{1, 2\} = A$?

(a) 1 (b) 2

(c) 3 (d) 4

107. Let $\{s_n\}$ be a sequence defined by the recurrence relation

$$s_n = \sqrt{\frac{ab^2 + s_n^2}{a+1}}, \text{ for } n \geq 1$$

where $b > a$ and $s_1 = a > 0$.

Then $\lim\limits_{n \to \infty} s_n$ is equal to

(a) ∞

(b) b

(c) $a + b$

(d) None of the above

108. The age of a father is twice that of the elder son. Ten years hence the age of the father will be three times that of the younger son. If the difference of ages of the two sons is 15 years, the age of the father will be

(a) 50 years

(b) 60 years

(c) 65 years

(d) None of the above

109. A five-figure number is formed by the digits 0, 1, 2, 3, 4 without repetition. The probability that the number formed is divisible by 4 is

(a) 9/16 (b) 5/16

(c) 7/16 (d) None of the above

110. Consider the following statements :

(i) Suppose A is a matrix such that $\det(A) = 0$. Then at least one of the cofactors must be zero.

(ii) Suppose A is a matrix in which all its entries are either 0 or 1. Then $\det(A)$ will be equal to 1, 0 or -1.

(iii) Suppose A is a matrix in which $\det(A) = 0$. Then all its principal minors will be zero.

Identify the wrong statements.

(a) Only (i) and (ii)

(b) Only (i) and (iii)

(c) (i), (ii) and (iii)

(d) None of the above

111. One of the disadvantages of raster scan display is

(a) it cannot display colour images

(b) lines may appear jaggy

(c) it cannot take advantages of technological research and mass production of the television industry

(d) None of the above

112. What are the next two terms in the sequence 17, 15, 26, 22, 35, 29, ..., ...?

(a) 42, 50

(b) 48, 40

(c) 46, 38

(d) None of the above

113. A ball is drawn from an urn containing three white and three black balls. After the ball is drawn, it is then replaced and another ball is drawn. This goes on indefinitely. What is the probability that of the first four balls drawn, exactly two are white?

(a) $\frac{3}{8}$

(b) $\frac{2}{9}$

(c) $\frac{5}{11}$

(d) None of the above

114. If $ab \neq 0$, the equation

$$ax^2 + 2xy + by^2 + 2ax + 2by = 0$$

represents a pair of straight lines, if

(a) $a^2 + b^2 = 2$

(b) $ab = 2$

(c) $a + b = 2$

(d) None of the above

115. Let $g(x) = \int_0^x f(t)\, dt$, where the function $f(\cdot)$ is such that

$$\frac{1}{2} \leq f(t) \leq 1 \text{ for } 0 \leq t \leq 1 \text{ and } 0 \leq f(t) \leq \frac{1}{2} \text{ for } 1 \leq t \leq 2$$

Then $g(2)$ satisfies the inequality

(a) $-\frac{1}{2} \leq g(2) < \frac{1}{2}$

(b) $0 \leq g(2) < 2$

(c) $\frac{3}{2} < g(2) \leq 3$

(d) None of the above

116. Bill and Gates go target shooting together. Both shoot at a target at the same time. Suppose, Bill hits the target with probability 0·7, whereas Gates, independently, hits the target with probability 0·4. Given that the target is hit, what is the probability that Gates hits it?

(a) $\frac{19}{45}$

(b) $\frac{11}{21}$

(c) $\frac{13}{27}$

(d) None of the above

117. If $\cos\theta = \cos\alpha\cos\beta$, then the product

$$\tan\left(\frac{\theta+\alpha}{2}\right)\tan\left(\frac{\theta-\alpha}{2}\right)$$

is equal to

(a) $\tan^2\left(\frac{\alpha}{2}\right)$

(b) $\tan^2\left(\frac{\beta}{2}\right)$

(c) $\tan^2\left(\frac{\theta}{2}\right)$

(d) None of the above

118. Suppose the roots of a quadratic equation are (8/5) and –(7/3). What is the value of the coefficient of the x-term, if the equation is written in the standard form $ax^2 + bx + c = 0$ with $a = 1$?

(a) 2/5

(b) 7/5

(c) 11/5

(d) None of the above

119. Find the number of ways a postman can deliver four letters, each to the wrong address.

(a) 7

(b) 8

(c) 9

(d) 10

120. Find the length of the 3-D curve defined in parametric form as

$$x = at^2,\ \ y = 2at \text{ and } z = at \text{ in } 0 \le t \le 1$$

(a) $\frac{a}{8}(5\log 5 + 12)$

(b) $a(5\log 7 + 8)$

(c) $\frac{a}{4}(2\log 5 + 7)$

(d) None of the above

***

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4. What will be printed from the following program block?

```
{
char s1[50] = "xyzt"
char *s2 = "xyat"
int dif;
dif = strcmp(s1,s2)
printf("\n %d", dif);
}
```

(a) 1

(b) 25

(c) 15

(d) −1

5. What will be the eigenvalues of the lower triangular matrix defined by

$$\begin{bmatrix} 1 & 0 & 0 \\ 5 & -1 & 0 \\ 8 & -2 & 2 \end{bmatrix}?$$

(a) 1, 2, −1

(b) 1, 5, 8

(c) 5, 8, −2

(d) None of the above

6. MPEG in multimedia system stands for

(a) Motion Phase Experts Group

(b) Motion Picture Experts Group

(c) Media Phase Experts Group

(d) Media Picture Experts Group

7. 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 [illegible] married?

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

(d) When the survey was conducted were the women as active as the [illegible]

8. Which of the graph traversals of an unweighted graph can be used to generate path in ascending order of length of the path?

(a) BFS

(b) DFS

(c) Any of the above

(d) None of the above

9. The inverse of a skew-symmetric matrix of odd order

(a) is a symmetric matrix

(b) is a skew-symmetric matrix

(c) is a diagonal matrix

(d) does not exist

10. Five educational films *A*, *B*, *C*, *D* and *E* are to be shown to a group of students. The films are to be shown in a particular order which conforms to the following conditions :

A must be shown earlier than *C*.

B must be shown earlier than *D*.

E should be the fifth film shown.

Which among the following is an acceptable order for showing the educational films?

(a) *A*, *C*, *B*, *D*, *E*

(b) *A*, *C*, *D*, *E*, *B*

(c) *B*, *D*, *C*, *A*, *E*

(d) *B*, *D*, *E*, *A*, *C*

11. Find the sum of the infinite series of complex numbers given by

$$\sum_{k=1}^{\infty} \frac{(1+2i)^k}{5^k}, \text{ where } i^2 = -1$$

(a) ∞

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

(c) $1-2i$

(d) $\frac{1}{2}i$

12. Consider the following assertions :

(i) Let A be a square matrix such that $A^{100} = I$ implies A is invertible.

(ii) When A, B are invertible matrices of same size, then $ABA^{-1} = B$ will be satisfied.

(iii) When A is invertible, then $(A + A^t)$ is invertible, where A^t is the transpose of A.

From the above, identify the assertion(s) which is/are not necessarily true.

(a) (i) only

(b) (i) and (ii) only

(c) (ii) and (iii) only

(d) None of the above

13. 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 the

(a) first

(b) second

(c) third

(d) fourth

14. Consider the following statement :

Let A, B be square matrices of same size.

Some conclusions may be derived as follows :

(i) If A, B are invertible, then $AB = BA$ will be satisfied.

(ii) If the matrix (AB) is invertible, then $(AB)^{-1} = ((B^t A^t)^{-1})^t$ will be satisfied, where t denotes the transpose.

(iii) If A, B are invertible, then $B^{-1} = A^{-1} - B^{-1}(B - A)A^{-1}$ will be satisfied.

From the above, identify which conclusion(s) is/are true.

(a) (i) only

(b) (i) and (ii) only

(c) (ii) and (iii) only

(d) None of the above

15. The following functions are defined on the real line :

$$f_1(x) = \begin{cases} 0, & \text{when } x \text{ is rational} \\ 1, & \text{when } x \text{ is irrational} \end{cases}$$

$$f_2(x) = \max\{0, x\}$$

Identify the correct statement.

(a) f_1, f_2 have uncountable number of points of non-differentiability

(b) f_1, f_2 have countable number of points of non-differentiability

(c) f_1, f_2 have finite number of points of non-differentiability

(d) None of the above

16. 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

17. End-around carry (EAC) generated in 1's complement arithmetic should be

(a) discarded

(b) added to the result

(c) subtracted from the result

(d) preserved for the next operation

18. Which of the following words is most opposite in meaning to the word ABATE?

(a) Attach

(b) Alter

(c) Assist

(d) Augment

19. Consider the following program segment :

```
for (i = 0, j = strlen(s) - 1; i ≤ j; i ++, j --)
{
    c = s[i];
    s[i] = s[j];
    s[j] = c;
    x = c* 5;
}
```

In the above, x = c* 5; is

(a) dead code

(b) loop invariant

(c) basic code

(d) None of the above

20. The equation of the plane passing through the point (1, 5, − 7) having normal vector $41i - 17j - 3k$, where i, j and k are unit vectors in the X-, Y- and Z-direction respectively, will be

(a) $41x - 17y - 3z - 39 = 0$

(b) $21x - 2y - 3z - 19 = 0$

(c) $x + 5y - z - 29 = 0$

(d) None of the above

21. OPTAB and SYMTAB are data structures used by

(a) assembler

(b) loader

(c) compiler

(d) parser

22. If $x^4 = 16$, then what will be the value of 4^x?

(a) 2 (b) 4

(c) 16 (d) 12

23. Let l be a set of letters, d the set of digits and o the set of other [illegible], then /.* (l|d|o)* *./ is

(a) comment string in Pascal or C language

(b) grammar of the comment string in Pascal or C language

(c) deterministic finite automata of the comment string in Pascal or C [illegible]

(d) regular expression of the comment string in Pascal or C language

24. For a function (sequence) defined by the rules $s(1) = 1$, $s(2) = 2$ and $s(n+1) = 2s(n) - s(n-1)$, the values of $s(4)$, $s(5)$ and $s(6)$ respectively are

(a) 4, 5, 6
(b) 4, 5, 11
(c) 5, 6, 11
(d) 5, 6, 7

25. The truth value of the formula $[(\neg(p \wedge q) \to r) \leftrightarrow \neg(r \to s)]$, if truth value of p be true, q be false, r be true and s be false, is

(a) tautology
(b) true
(c) false
(d) invalid

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

(a) 60 miles
(b) 20 miles
(c) 80 miles
(d) 50 miles

27. Consider the following statements and determine which of the options is valid :

(i) Compilers synthesise target programs.
(ii) Right recursion is preferred over left recursion for recursive descent parsing.
(iii) The LL(k) grammars enhance the efficiency of the bottom-up parsers.
(iv) Parse trees graphically exhibit the derivation of a word using the grammar of a language.

(a) Only (i) is true
(b) Only (i) and (ii) are true
(c) Only (i) and (iii) are true
(d) Only (i) and (iv) are true

28. The functions f and g are defined by $f(x) = |2x+1|$ and $g(x) = 3$ for all numbers x. What is the least value of c for which $f(c) = g(c)$?

(a) 1
(b) −1
(c) 2
(d) −2

29. If a file of size $n = 1000$ takes 5 ms for sorting using heap-sort algorithm, then approximately how much time would it take to sort a file of size $n = 1000000000000$? Assume that all data are available in the main memory.

(a) 20 ms

(b) 5000000000 ms

(c) 20000000 ms

(d) 20000000000 ms

30. Let z be a standard normal random variable and for a fixed x, set

$$X = \begin{cases} z, & \text{if } z > x \\ 0, & \text{otherwise} \end{cases}$$

What will be $E[X]$?

(a) 0

(b) 1

(c) $\frac{1}{\sqrt{2\pi}} e^{-\frac{x^2}{2}}$

(d) x

31. If $y = \sin(\sin x)$ and $\frac{d^2y}{dx^2} + \frac{dy}{dx}\tan x + f(x) = 0$, then $f(x)$ will be equal to

(a) $\sin^2 x \sin(\cos x)$

(b) $\sin^2 x \cos(\cos x)$

(c) $\cos^2 x(\sin(\cos x))$

(d) $\cos^2 x \sin(\sin x)$

32. What will be the value of the following computation?

$$^{20}C_1 + 2 \times {}^{20}C_2 + 3 \times {}^{20}C_3 + \ldots + 20 \times {}^{20}C_{20}$$

(a) 380×2^{20}

(b) 20×2^{19}

(c) 20×2^{38}

(d) None of the above

33. In a certain code, GIGANTIC is written as GIGTANCI. How will MIRACLES be written in that code?

(a) MIRLCAES

(b) MIRLACSE

(c) RIMCALSE

(d) RIMLCAES

34. If X_1 has mean 1 and variance 5 while X_2 has mean -2 and variance 5, and the two are independent, find the variance of $(X_1 + 2X_2 - 3)$.

(a) 25

(b) 15

(c) 36

(d) None of the above

35. What is critical section of a program?

(a) A part of OS not allowed to be accessed by any process

(b) A part of memory to be used by the OS only

(c) A set of instructions that access mutually exclusive shared resource

(d) None of the above

36. What will be the value of $\lim_{x \to \infty} \left(\frac{1+5x^2}{1+3x^2} \right)^{\frac{1}{x^2}}$?

(a) e^{-1}

(b) e

(c) e^2

(d) Limit does not exist

37. Choose the odd one.

(a) Potassium

(b) Silicon

(c) Gallium

(d) Zirconium

38. Consider the two complex-valued functions of complex variable defined by

$$f_1(z) = x^2 - y^2 + x + i(2x + y) \text{ and } f_2(z) = 2x^2 + y + i(y^2 - x)$$

where $z = x + iy$ is complex variable so that $i^2 = -1$.

Then, for any complex number z, identify the correct statement.

(a) Both f_1 and f_2 are analytic

(b) f_1 is analytic but not f_2

(c) f_2 is analytic but not f_1

(d) Both f_1 and f_2 are not analytic

39. Suppose three boxes contain a mixture of white and black balls. The first box contains 12 white and 3 black balls; the second contains 4 white and 16 black balls and the third contains 6 white and 4 black balls. A box is selected at random and a single ball is chosen from it. The choice of the box is made according to a throw of a fair die. If the number of spots on the die is 1, the first box is selected. If the number of spots is 2 or 3, the second box is selected; otherwise (the number of spots is equal to 4, 5 or 6) the third box is chosen. Find the probability that a white ball is chosen.

(a) 1/2
(b) 22/45
(c) 3/10
(d) 1/3

40. Let X and Y be two discrete random variables with joint probability mass function given by

	$X=-1$	$X=0$	$X=1$
$Y=-1$	1/12	3/12	1/12
$Y=0$	1/12	0/12	1/12
$Y=1$	1/12	3/12	1/12

The values of $E(X)$ and $E(XY)$ respectively are

(a) 1, 0
(b) 0, 0
(c) 0, 1
(d) 1, 1

41. Naphthalene is related to woollen in the same way as antibiotic is related to

(a) germ
(b) immunity
(c) disease
(d) body

42. If $f(x)$ is a polynomial of degree 8 and $f(x)f(1/x) = f(x) + f(1/x)$, then $f(x)$ is

(a) an odd function
(b) an even function
(c) neither even nor odd function
(d) None of the above

43. Suppose \$ 3993 is deposited in a savings account which earns 4·3% interest. [illegible] the approximate compound amount after two years if the interest is [illegible] continuously?

(a) \$ 6870
(b) \$ 5326
(c) \$ 4351
(d) \$ 6997

44. Given the following definition, which answer points to contents in x?

int x; int *p = &x; int *p = &p;

(a) p (b) &p

(c) **p (d) *p

45. The period of $|\sin x| - |\cos x|$ is

(a) 2π

(b) π

(c) $\pi/2$

(d) None of the above

46. DWH is related to WDS in the same way as FUL is related to

(a) UFO (b) OFU

(c) FOU (d) ELV

47. The derivative of $\sec^{-1}\left(\frac{1}{2x^2-1}\right)$ with respect to $\sqrt{1-x^2}$ at $x = 1/2$ is

(a) 2 (b) 4

(c) 1 (d) –2

48. The digit in the unit place of the number $183! + 3^{183}$ is

(a) 7 (b) 6

(c) 3 (d) 4

49. A self-complemented distributive lattice is called

(a) Boolean algebra

(b) self-dual lattice

(c) modular lattice

(d) complete lattice

50. If there is an error of $k\%$ in measuring the edge of a cube, then the percent error in estimating its volume is

(a) k

(b) $3k$

(c) $k/3$

(d) None of the above

51. What is the number that comes next in the following sequence?

4, 6, 12, 14, 28, 30, ...

(a) 32 (b) 60

(c) 62 (d) 64

52. The equation of a curve passing through $(2, 7/2)$ and having gradient $1-(1/x^2)$ at (x, y) is

(a) $y = x^2 + x + 1$

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

(c) $xy = x + 1$

(d) None of the above

53. What will be the value of the following expression in C language?

$6 < 7 > 5$

(a) True (b) False

(c) 1 (d) 2

54. The solution of the differential equation $(1-y)x\frac{dy}{dx} + (1+x)y = 0$ is

(a) $\log|xy| + x - y = c$

(b) $\log|xy| + x + y = c$

(c) $\log|xy| - x - y = c$

(d) None of the above

55. The highest normal form for a relation with two attributes is

(a) 1NF (b) 2NF

(c) 3NF (d) BCNF

56. Let X be a Poisson random variable with parameter λ. What will be the value of $P(X \text{ is even}) - P(X \text{ is odd})$?

(a) $\frac{1}{2}(1+e^{-2\lambda})$

(b) $\frac{1}{2}(1-e^{-2\lambda})$

(c) $e^{-2\lambda}$

(d) None of the above

57. Which of the following is not a DDL statement?

(a) ALTER

(b) DROP

(c) GRANT

(d) CREATE

58. If $f(x) = \cos(\log x)$, then $f(x)f(y) - \frac{1}{2}\{f(x/y) + f(xy)\}$ has the value

(a) -2

(b) -1

(c) $\frac{1}{2}$

(d) None of the above

59. Which of the following orderings, from most acceptable to least acceptable levels of cohesion, is correct?

(a) Sequential, Communicational, Procedural, Logical

(b) Procedural, Communicational, Temporal, Logical

(c) Functional, Procedural, Sequential, Logical

(d) None of the above

60. Ram walks 10 meters in front and 10 meters to the right. Then every time turning to his left, he walks 5 meters, 15 meters and 15 meters respectively. How far is he from his starting point?

(a) 5 meters

(b) 10 meters

(c) 15 meters

(d) 20 meters

61. If S_1, S_2 and S_3 be respectively the sum of n, $2n$ and $3n$ terms of a GP, then $\dfrac{S_1(S_3 - S_2)}{(S_2 - S_1)^2}$ is equal to

(a) 1 (b) 2

(c) 3 (d) 4

62. The equivalent of $(3124)_4$ to base 3 is

(a) 217 (b) 21000

(c) 22001 (d) 17010

63. If $\sin^{-1}\left(\dfrac{x^2 - y^2}{x^2 + y^2}\right) = \log a$, then $\dfrac{dy}{dx}$ equals

(a) $\dfrac{x}{y}$ (b) $\dfrac{y}{x^2}$

(c) $\dfrac{x^2 - y^2}{x^2 + y^2}$ (d) $\dfrac{y}{x}$

64. Let (h, k) be a fixed point, where $h > 0$, $k > 0$. A straight line passing through this point cuts the positive direction of the coordinate axes at the points P and Q. Which of the following is the minimum area of the triangle OPQ, O being the origin?

(a) hk

(b) $2hk$

(c) $\dfrac{1}{2}hk$

(d) None of the above

65. Alpha testing is a type of

(a) verification testing

(b) validation testing

(c) mutation testing

(d) regression testing

66. The area of the region bounded by the parabola $y = x^2 + 1$ and the straight line $x + y$ [illegible] is given by

(a) $\dfrac{45}{7}$ (b) $\dfrac{25}{4}$

(c) $\dfrac{\pi}{18}$ (d) $\dfrac{9}{2}$

67. A moving-arm disk storage with one head has 200 tracks per recording surface. Disk rotation speed is 2400 r.p.m. and track storage capacity is 62500 bits. What will be the transfer time?

(a) 3·75 Mbits/sec

(b) 4·25 Mbits/sec

(c) 2·5 Mbits/sec

(d) 1·5 Mbits/sec

68. The population of a country increases at a rate proportional to the number of inhabitants. If the population doubles in 30 years, then the population will triple in approximately how many years?

(a) 42

(b) 45

(c) 48

(d) 51

69. If it was Saturday on 17th December, 1982, what will be the day on 22nd December, 1984?

(a) Sunday

(b) Monday

(c) Friday

(d) Saturday

70. If a, b, c are in AP, then $ax + by + c = 0$ will always pass through a fixed point whose coordinates are

(a) $(1, -2)$ (b) $(-1, 2)$

(c) $(1, 2)$ (d) $(-1, -2)$

71. The value of $\lim_{x \to 0} \frac{\int_0^x (x + xt)\, dt}{\sin x \tan(\pi + x)}$ is

(a) 0 (b) 1

(c) 2 d) $\frac{1}{2}$

72. Which process model is appropriate for automating an existing manual system?

(a) Waterfall model

(b) Prototyping model

(c) Spiral model

(d) None of the above

73. If $y = \tan^{-1}\frac{x+1}{1-x} + \tan^{-1}\frac{1-x}{1+x}$, then dy/dx is given by

(a) $1/(1+x^2)$ (b) $1/(1-x^2)$

(c) $2x/(1+x^2)$ (d) 0

74. A circular queue is implemented as an array of five elements, say $q[5]$, with F (front) and R (rear) pointers initialized as $F = R = -1$. Assuming that F points one position below the actual front element, whereas R points to the actual rear element, what would be the values of F and R after the following sequence of operations (D: delete; I: insert)?

$I, I, I, D, I, D, I, I, I, D$

(a) $F = 2, R = 1$

(b) $F = 1, R = 2$

(c) $F = 1, R = 1$

(d) None of the above

75. What will be printed from the following C script?

```
if ("RAM" = = "RAM")
    printf ("TRUE")
else
    printf ("FALSE")
```

(a) True

(b) False

(c) Compilation Error

(d) Runtime Error

76. A relation $R(A, B, C, D)$ has the set of functional dependencies $\{B \to C, C \to A, B \to D\}$. Which of the following decompositions is dependency preserving?

(a) $R1(C, A)\, R2(C, B, D)$

(b) $R1(A, C, D)\, R2(B, D)$

(c) $R1(C, A)\, R2(A, B, D)$

(d) All of the above

77. The equations $x - y = 4$ and $x^2 + 4xy + y^2 = 0$ represent the sides of

(a) an equilateral triangle

(b) a right-angled triangle

(c) an isosceles triangle

(d) None of the above

78. If two relations have no attributes in common, then natural join

(a) is a cross product

(b) is a non-equijoin

(c) yields no result

(d) cannot be performed

79. The circles whose equations are $x^2 + y^2 + c^2 = 2ax$ and $x^2 + y^2 + c^2 = 2by$ will touch one other externally if

(a) $\frac{1}{b^2} + \frac{1}{c^2} = \frac{1}{a^2}$

(b) $\frac{1}{c^2} + \frac{1}{a^2} = \frac{1}{b^2}$

(c) $\frac{1}{a^2} + \frac{1}{b^2} = \frac{1}{c^2}$

(d) None of the above

80. Which of the following statements is false?

(a) Paging suffers from internal fragmentation

(b) Segmentation suffers from external fragmentation

(c) Segments can be paged

(d) Pages cannot be segmented

81. A constructor is invoked when

(a) a class is declared

(b) a class is used

(c) an object is declared

(d) an object is used

82. If the chord of contact of tangents from a point P to a given circle passes through Q, then the circle on PQ as diameter

(a) cuts the given circle orthogonally

(b) touches the given circle externally

(c) touches the given circle internally

(d) None of the above

83. If + means ÷, – means ×, ÷ means + and × means –, then what will be the value of the expression $36 \times 12 + 4 \div 6 + 2 - 3$?

(a) 2

(b) 18

(c) 42

(d) None of the above

84. The vertices of the hyperbola $9x^2 - 16y^2 - 36x + 96y - 252 = 0$ are

(a) (6, 3), (–2, 3)

(b) (6, 3), (–6, 3)

(c) (–6, 3), (–6, –3)

(d) None of the above

85. The simplified expression for the SOP expression $\Sigma(1, 3, 5, 7, 9, 11, 13, 15)$ corresponding to the inputs $ABCD$ is

(a) D'

(b) $A' + D'$

(c) $A'B + C'D$

(d) $A + B + C + D$

86. If $P(X, Y)$ be any point of ellipse $16x^2 + 25y^2 = 400$ and $F_1 = (3, 0)$, $F_2 = (-3, 0)$, then $PF_1 + PF_2$ equals

(a) 6

(b) 8

(c) 10

(d) 12

87. Which of the following is not a storage class supported by C++?

(a) Auto

(b) Register

(c) Dynamic

(d) Mutable

88. The equation of the plane containing the line $\frac{x+1}{-3} = \frac{y-3}{2} = \frac{z+2}{1}$ and the point (0, 7, – 7) is

(a) $x + y + z = 1$

(b) $x + y + z = 2$

(c) $x + y + z = 0$

(d) None of the above

89. Which of the following is true for linkage editor?

(a) It is used to edit programs which have to be later linked together

(b) It links object modules and resolves external references between them before loading

(c) It links object modules during compilation

(d) It resolves external references between object modules during execution

90. The angle between two diagonals of a cube is

(a) $\cos^{-1}\frac{1}{2}$ (b) $\cos^{-1}\frac{1}{3}$

(c) $\cos^{-1}\frac{1}{4}$ (d) $\frac{\pi}{2}$

91. The number of boys in a class is three times the number of girls. Which of the following numbers cannot represent the total number of students in the class?

(a) 40 (b) 42

(c) 44 (d) 48

92. In a complete graph of n vertices, how many Hamiltonian circuits are possible?

(a) $n!$

(b) n^2

(c) n^n

(d) None of the above

93. If the vectors $\hat{i}-2x\hat{j}-3y\hat{k}$ and $\hat{i}-3x\hat{j}-2y\hat{k}$ are orthogonal to each other, then the locus of the point (x, y) is

(a) a circle

(b) an ellipse

(c) a parabola

(d) a straight line

94. What is the data structure used by the macroprocessor to expand nested macrocalls?

(a) Multilist

(b) Tree

(c) Stack

(d) Heap

95. The angle between $\vec{a}$ and $\vec{b}$ is $\frac{5\pi}{6}$, and the projection of $\vec{a}$ in the direction of $\vec{b}$ is $-\frac{6}{\sqrt{3}}$, then $|\vec{a}|$ is equal to

(a) 6

(b) $\frac{\sqrt{3}}{2}$

(c) 12

(d) 4

96. The variance of the first n natural numbers is

(a) $\frac{n^2-1}{12}$

(b) $\frac{n^2-1}{6}$

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

(d) $\frac{n^2+1}{12}$

97. A dice is rolled three times. What is the probability of getting a large number than the previous number?

(a) $\frac{5}{216}$

(b) $\frac{5}{54}$

(c) $\frac{1}{6}$

(d) $\frac{5}{36}$

98. Consider the following statements :

Some camels are ships.

No ship is a boat.

Some conclusions may be derived as follows :

(i) Some ships are camels.

(ii) Some boats are camels.

(iii) Some camels are not boats.

(iv) All boats are camels.

Which of the above is/are followed from the above-given two statements?

(a) Only (i) follows

(b) Only (ii) and (iii) follow

(c) Only (i) and (iii) follow

(d) Only (i) and (iv) follow

99. If two events A and B are such that $P(A^c) = 0 \cdot 3$, $P(B) = 0 \cdot 4$, $P(A \cap B^c) = 0 \cdot 5$, then $P(B / A \cup B^c)$ is equal to

(a) 0·20

(b) 0·25

(c) 0·30

(d) 0·35

100. The angle between the minute hand and the hour hand of a clock when the time is 7 : 20 AM, is

(a) 100 degrees

(b) 104 degrees

(c) 108 degrees

(d) 112 degrees

101. If $\sin A = \sin B$ and $\cos A = \cos B$, then the value of A in terms of B is

(a) $n\pi + B$ (b) $n\pi + (-1)^n B$

(c) $2n\pi + B$ (d) $2n\pi - B$

102. An aeroplane flying horizontally 1 km above the ground is observed at an elevation of 60 degrees and after 10 seconds the elevation is observed to be 30 degrees. The uniform speed of the aeroplane in kilometers per hour is

(a) $60\sqrt{3}$

(b) 240

(c) $240\sqrt{3}$

(d) None of the above

103. In a class of 55 students, the number of students studying different subjects is 23 in Mathematics, 24 in Physics, 19 in Chemistry, 12 in Mathematics and Physics, 9 in Mathematics and Chemistry, 7 in Physics and Chemistry and 4 in all the three subjects. The number of students who have taken exactly one subject is

(a) 6 (b) 7

(c) 9 (d) 22

104. At the end of a conference, all the ten people present shake hands with each other once. How many handshakes will there be altogether?

(a) 20 (b) 45

(c) 55 (d) 90

105. If α and β are the roots of $x^2 - 2x + 4 = 0$, then $\alpha^n + \beta^n$ is equal to

(a) $2^n \cos\frac{n\pi}{3}$ (b) $2^n \cos\frac{(n+1)\pi}{3}$

(c) $2^{n+1} \cos\frac{n\pi}{3}$ (d) $2^{n+1} \cos\frac{(n+1)\pi}{3}$

106. $\dfrac{(-1+i\sqrt{3})^{15}}{(1-i)^{20}}+\dfrac{(-1-i\sqrt{3})^{15}}{(1+i)^{20}}$ is equal to

(a) -64 (b) -32

(c) -16 (d) $1/16$

107. If the roots of the equation $12x^2 - mx + 5 = 0$ are in the ratio 2 : 3, then m is equal to

(a) $2\sqrt{10}$

(b) $5\sqrt{10}$

(c) $3\sqrt{10}$

(d) None of the above

108. In a round-robin CPU scheduling algorithm, let s represent the time for context switch, q denote the time quantum and r denote the average time a process runs before blocking on I/O. What will be the CPU efficiency if $s < q < r$?

(a) $\dfrac{r}{r+s}$

(b) $\dfrac{s}{r+s}$

(c) $\dfrac{q}{q+s}$

(d) None of the above

109. If $\int f(x)\,dx = g(x)$, then $\int f^{-1}(x)\,dx$ is equal to

(a) $g^{-1}(x)$ (b) $xf^{-1}(x) - g(f^{-1}(x))$

(c) $xf^{-1}(x) - g^{-1}(x)$ (d) $f^{-1}(x)$

110. Consider a logical address space of 8 pages each of 1024 words mapped into memory of 32 frames. How many bits are there in the physical address?

(a) 15 (b) 13

(c) 11 (d) 9

111. The value of $(P \vee Q) \wedge (P \to R) \wedge (Q \to S)$ is equivalent to

(a) $S \to R$

(b) $R \to S$

(c) $S \wedge R$

(d) $S \vee R$

112. In a connected graph of n vertices, what will be the length of a Hamiltonian path (if it exists)?

(a) n

(b) $n+1$

(c) $n-1$

(d) $n/2$

113. A relation R on a set $A = \{1, 2, 3, 4, 5\}$ is defined by $xRy: x+1=y$. What is R^3?

(a) $\{(1, 3), (2, 4)\}$

(b) $\{(1, 3), (2, 5)\}$

(c) $\{(1, 4), (2, 5)\}$

(d) $\{(1, 4), (4, 5)\}$

114. Suppose X is a continuous random variable with density function f : $E[|X - A|]$ which is minimized when A is equal to

(a) median

(b) mode

(c) mean

(d) standard deviation

115. What will be the value of the integral $\int_C xy^2 dy$, where the path of integration C is the quarter circle defined by the parameter variable t as $x = 4\cos t$, $y = 4\sin t$ and $0 \le t \le \pi/2$?

(a) 4π

(b) 8π

(c) 16π

(d) None of the above

116. Sanjay has 7 friends. In how many ways can he invite one or more friends at dinner?

(a) 125 (b) 126

(c) 127 (d) 128

117. What will be the value of $4\tan^{-1}\frac{1}{5}+\tan^{-1}\frac{1}{239}$?

(a) π (b) $\pi/2$

(c) $\pi/3$ (d) $\pi/4$

118. What will be printed from the following block?

```
d = 0;
for (i = 1; i<31; ++i)
  for (j = 1; j<31; ++j)
    for (k = 1; k<31; ++k)
      if (((i+j+k)%3)==0)
        d = d+1;
printf("%d", d);
```

(a) 9000

(b) 27000

(c) 3000

(d) None of the above

119. The total number of ways in which three distinct numbers in AP can be selected from the set {1, 2, 3, ..., 24} is equal to

(a) 66

(b) 132

(c) 198

(d) None of the above

120. The minimum number of colors needed to color a graph having $n(>3)$ vertices and 2 edges is

(a) 4 (b) 3

(c) 2 (d) 1

22

QUESTION PAPER SERIES CODE

A

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ENTRANCE EXAMINATION, 2010

MASTER OF COMPUTER APPLICATIONS

[Field of Study Code : MCAM (225)]

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) Simple Calculators and Log Tables may be used.

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

(ix) 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 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. Given $f(x)$ is differentiable and $f'(4) = 5$, find

$$\lim_{x\to 2} \frac{f(4) - f(x^2)}{x - 2}$$

(a) ∞

(b) 0

(c) 5

(d) -20

2. $\lim_{x\to 0} \frac{1}{1 + e^{1/x}}$ is

(a) 0

(b) 1

(c) $\frac{1}{2}$

(d) Does not exist

3. The fourth power of $\sqrt{1+\sqrt{1+\sqrt{1}}}$ is

(a) $3+2\sqrt{3}$

(b) $3+2\sqrt{2}$

(c) $\frac{7+3\sqrt{5}}{2}$

(d) None of these

4. At what time between 3 and 4 o'clock are the hands of a clock together?

(a) $49\frac{1}{11}$ minutes past 3

(b) $16\frac{4}{11}$ minutes past 3

(c) $10\frac{10}{11}$ minutes past 3

(d) $43\frac{7}{11}$ minutes past 3

5. How many numbers from 1 to 1000 are not divisible by 2, 3 and 5?

(a) 266

(b) 500

(c) 333

(d) None of these

6. Express $(4312)_5$ as a number in base 10.

(a) 502

(b) 512

(c) 562

(d) 582

7. A and B can reap a field in 8 days, B and C in 12 days and C and A in 16 days. How long will they take to reap the field, if they work together?

(a) $\frac{77}{13}$ days

(b) $\frac{88}{13}$ days

(c) $\frac{96}{13}$ days

(d) 11 days

8. If α is a repeated root of $px^2 + qx + r = 0$, then

$$\lim_{x \to \alpha} \frac{\tan(px^2 + qx + r)}{(x - \alpha)^2}$$

is

(a) 0

(b) r

(c) p

(d) $\frac{\pi}{2}$

9. A triangle has two of its vertices at $P(1, 0)$ and $Q(0, 1)$. The third vertex $R(x, y)$ moves along the line $y = x$. Let A represent the area of the triangle. Find $\frac{dA}{dx}$.

(a) 0

(b) 1

(c) $\frac{1}{2}$

(d) $\frac{1}{4}$

10. If $0 < st < 1$, then which of the following can be true?

(a) $s < -1$ and $t > 0$

(b) $s < -1$ and $t < -1$

(c) $s > 1$ and $t > 1$

(d) $s > -1$ and $t < -1$

60/22

11. A certain cake recipe states that the cake should be baked in a pan of 8 cm diameter. If you want to make a cake of same depth but 12 cm in diameter, by what factor should you multiply the recipe ingredients?

(a) $2\frac{1}{4}$

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

(c) $1\frac{1}{4}$

(d) $1\frac{1}{3}$

12. X is normally distributed with mean -2 and variance 4, i.e., $X \sim N(-2, 4)$. Find $E[e^X]$.

(a) 1

(b) e^4

(c) e^2

(d) e^{-2}

13. For what value of x is $S = (x-1)^2 + (x-2)^2 + (x-5)^2 + (x-7)^2$ minimum?

(a) 4

(b) 6

(c) 7

(d) None of these

14. The density ρ of a uniform cylinder is determined by measuring its mass m, length l and diameter d. Calculate the approximate fractional error in ρ from the following data :

$$m = 47 \cdot 36 \pm 0 \cdot 01 \text{ g}, \; l = 15 \cdot 28 \pm 0 \cdot 05 \text{ mm}, \; d = 21 \cdot 37 \pm 0 \cdot 04 \text{ mm}.$$

(a) 0·01%

(b) 0·08%

(c) 0·50%

(d) 1·50%

15. $X_1, X_2, \cdots, X_n$ are independent random variables with respective means $\mu_1, \mu_2, \cdots, \mu_n$ and variances $\sigma_1^2, \sigma_2^2, \cdots, \sigma_n^2$. Obtain $\text{Var}(a_1X_1 + a_2X_2 + \cdots + a_nX_n)$.

(a) $\sigma_1^2 + \sigma_2^2 + \cdots + \sigma_n^2$

(b) $\sigma_1^2 \sigma_2^2 \cdots \sigma_n^2$

(c) $a_1^2\sigma_1^2 + a_2^2\sigma_2^2 + \cdots + a_n^2\sigma_n^2$

(d) $(a_1 a_2 \cdots a_n)$

61/22

16. X is a random variable with mean M and standard deviation σ. For small deviations compared to M, compute $E[\sqrt{X}]$.

(a) $M^{\frac{1}{2}}$

(b) $M^{\frac{1}{2}}\left(1-\frac{\sigma^2}{8M^2}\right)$

(c) $M^{\frac{1}{2}}\left(1-\frac{\sigma^2}{M^2}\right)$

(d) $M\left(1+\frac{\sigma^2}{M^2}\right)$

17. The incomes of A and B are in the ratio 3 : 2 and the expenditures in the ratio 5 : 3. If each of them saves Rs 1,000, find their incomes.

(a) Rs 3,000; Rs 2,000

(b) Rs 6,000; Rs 4,000

(c) Rs 12,000; Rs 8,000

(d) None of these

18. In a singles tennis tournament that has 125 entrants, a player is eliminated whenever she loses a match. How many matches are played in the entire tournament?

(a) 62

(b) 63

(c) 124

(d) 246

19. How many four-digit numbers have only even digits?

(a) 96

(b) 128

(c) 500

(d) 625

20. There are 27 students in a college debate team. Find the probability that at least 3 of them have their birthdays in the same month.

(a) $\frac{1}{27}$

(b) $\left(\frac{1}{27}\right)^3$

(c) $\frac{9}{27}$

(d) 1

21. Which of the operations is/are applicable on semaphore?

(a) UP and DOWN

(b) INTERRUPT

(c) BUSY WAITING

(d) SEND and RECEIVE

22. The time taken to move the arm from one track to another for R/W operation is called

(a) seek time

(b) rotational time

(c) latency time

(d) transmission time

23. Consider a relation R(P, Q, R) with set of functional dependencies $F = \{P \rightarrow QR, Q \rightarrow PR, R \rightarrow PQ\}$. The minimal cover of F is

(a) $\{P \rightarrow R, Q \rightarrow P, R \rightarrow Q\}$

(b) $\{P \rightarrow R, Q \rightarrow P, R \rightarrow P\}$

(c) $\{P \rightarrow Q, Q \rightarrow P, R \rightarrow Q\}$

(d) $\{P \rightarrow R, Q \rightarrow R, R \rightarrow Q\}$

24. Consider a relation R(P, Q, R, S, T) with set of functional dependencies $F = \{P \rightarrow Q, QR \rightarrow T, ST \rightarrow P\}$. The highest normal form for R is

(a) 2NF

(b) 3NF

(c) BCNF

(d) 4NF

25. Which of the following is a conflict serializable schedule?

(a) $R_1(X)$, $R_2(X)$, $W_1(X)$, $R_1(Y)$, $W_2(X)$, $W_1(Y)$

(b) $R_1(X)$, $R_2(X)$, $W_2(X)$, $W_1(X)$, $R_1(Y)$, $W_1(Y)$

(c) $R_1(X)$, $R_2(Y)$, $W_1(X)$, $R_1(Y)$, $W_1(Y)$, $W_2(Y)$

(d) $R_1(X)$, $W_1(X)$, $R_1(Y)$, $R_2(X)$, $W_1(Y)$, $W_2(X)$

where $R_T(A)$ refers to read operation on data A by transaction T and $W_T(A)$ refers to write operation on data A by transaction T.

26. The address lines required for 512 K word memory are

(a) 10

(b) 19

(c) 20

(d) None of these

27. Suppose the numbers a, b, c are in AP and $|a|$, $|b|$, $|c| < 1$. If

$$x = 1 + a + a^2 + \cdots \infty, \; y = 1 + b + b^2 + \cdots \infty, \; z = 1 + c + c^2 + \cdots \infty$$

then x, y, z are in

(a) AP

(b) GP

(c) HP

(d) None of these

28. The number of rectangles that one can find on a chessboard is

(a) 1082

(b) 1296

(c) 1128

(d) 1632

29. Let A be an orthogonal matrix. Consider the following statements :

I. The transpose of A is orthogonal.

II. The inverse of A is orthogonal.

III. aA is orthogonal, where a is any non-zero real number.

The number of true statements is

(a) 0

(b) 1

(c) 2

(d) 3

30. The greatest value of the positive integer n so that the sum to n terms of the series $1 + \frac{1}{2} + \frac{1}{2^2} + \cdots$ is less than $\left(2 - \frac{1}{1000}\right)$, is

(a) 5

(b) 7

(c) 8

(d) 10

31. The number of solutions of the system of equations

$$1 + x + x^2 + \cdots + x^{23} = 0$$
$$1 + x + x^2 + \cdots + x^{19} = 0$$

equals

(a) 3

(b) 4

(c) 19

(d) 23

32. A man of weight W is in an elevator of weight W. The elevator accelerates vertically up at a rate k and at a certain instant has a speed V. What is the apparent weight of the man?

(a) $W\left(1 - \frac{k}{g}\right)$

(b) $W\left(1 + \frac{k}{g}\right)$

(c) $2WV$

(d) Zero

33. Octal equivalent of the hexadecimal number B2F16 is

(a) 2627426

(b) 2625426

(c) 2826426

(d) 5457426

34. If a file of size $n = 1000$ takes on an average 4 ms for searching an item using binary search algorithm, then approximately how much time on an average would it take to search an item in a file of size $n = 1000000000000$?

(a) 1600 ms

(b) 16000 ms

(c) 160 ms

(d) 16 ms

35. Assume that a lower triangular matrix $A[0 \cdots n-1,\ 0 \cdots n-1]$ is stored in a linear array $B[0 \cdots \frac{1}{2} * n(n+1) - 1]$ in row by row order. For $n = 100$, if $A[0,\ 0]$ is stored in $B[0]$, where is $A[50,\ 40]$ stored?

(a) 1275

(b) 1300

(c) 1312

(d) 1315

36. The probability that a number chosen at random from the primes between 100 and 199 is odd, is

(a) 0

(b) 1

(c) $\frac{1}{2}$

(d) 0·6

37. Three identical balls fit exactly into a cylindrical can : the radius of the balls equals the radius of the can and the balls just touch the bottom and the top of the can. What fraction of the volume of can is taken up by the balls?

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

(b) $\frac{2}{3}$

(c) $\frac{3}{4}$

(d) 1

38. In quadrilateral *WXYZ*, the measure of angle *Z* is 10 more than twice the average of the measures of the other three angles. What is the measure of angle *Z*?

(a) 100

(b) 120

(c) 150

(d) 170

39. What is the arithmetic mean of 3^{30}, 3^{60}, 3^{90}?

(a) 3^{60}

(b) 3^{177}

(c) $3^{10}+3^{20}+3^{30}$

(d) None of these

40. If the sum of all the positive even integers less than 1000 is A, what is the sum of all the positive odd integers less than 1000?

(a) $A+500$

(b) $A+1$

(c) $\frac{A}{2}$

(d) $A-499$

41. Calculate $\int_1^2 \frac{\sin(\ln x)}{x} dx$,

(a) $1 - \sin 2$

(b) $1 - \cos(\ln 2)$

(c) $1 + \cos(\ln 2)$

(d) $1 + \ln 2$

42. There are three critical points of the function $g(x, y) = x^4 + 2x^2y + 2y^2 + 4$. Identify the point which is not critical.

(a) $\left(\frac{1}{\sqrt{2}}, \frac{1}{4}\right)$

(b) $\left(0, -\frac{1}{4}\right)$

(c) $\left(\frac{1}{\sqrt{2}}, -\frac{1}{2}\right)$

(d) $\left(-\frac{1}{\sqrt{2}}, -\frac{1}{2}\right)$

43. Find the area enclosed by the lines $t = 1$, $t = 2$, t-axis and the graph of the function $f(t) = e^t$.

(a) e^{2t}

(b) e

(c) $e^2 - e$

(d) e^2

44. Given the function $f(x, y) = 2y^3x + 5y^4 - (y^{\frac{3}{4}} - 2x^{\frac{3}{4}})^4 x$, then $x\frac{\partial f}{\partial x} + y\frac{\partial f}{\partial y}$ equals

(a) xy

(b) x^4y^4

(c) xyf

(d) $4f$

45. Suppose that $f(x) = \frac{1}{x}$, $g(x) = x^{3/2}$, $h(x) = x^2 + 2x + 3$. Compute $fgh(x)$ at $x = 2$.

(a) 11^3

(b) $11^{-3/2}$

(c) $11^{3/2}$

(d) None of these

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46. Let a_i, $q_i > 0$, $i = 1, 2, \cdots, n$; $\sum_{i=1}^{n} q_i = 1$ Then $\lim_{x \to 0} \ln(\Sigma q_i a_i^{x})^{\frac{1}{x}}$ equals

(a) $\ln(a_1 a_2 \cdots a_n)$

(b) $(q_1 + q_2 + \cdots + q_n)$

(c) $\sum_{i=1}^{n} q_i \ln a_i$

(d) Does not exist

47. Evaluate $\int_0^u \int_0^v \exp[\max(v^2 x^2, u^2 y^2)]\, dy\, dx$.

(a) $\dfrac{e^{u^2 v^2} - 1}{uv}$

(b) $\dfrac{e^{u^2 v^2}}{uv}$

(c) e^{uv}

(d) $\dfrac{uv}{e}$

48. Compute $\int_0^\infty x^{-\frac{1}{2}} e^{-x} dx$.

(a) e^{-1}

(b) $\sqrt{\pi}$

(c) $\sqrt{\pi / e}$

(d) ∞

49. Suppose that the lifetime X (in years) of a machine has an exponential distribution with parameter $\lambda = \frac{1}{3}$. What is the probability that a three-year-old machine will still work at the end of three additional years?

(a) $e^{-6} + e^{-3}$

(b) $e^{-3} - e^{-6}$

(c) e^{-1}

(d) $e^{-1/3}$

50. Let X be a non-negative continuous random variable. Then $E(X) = \int_0^\infty x f_X(x)\, dx$ in terms of c.d.f. $F_X(x)$ can be expressed as

(a) $\int_0^\infty F_X(x)\, dx$

(b) $\int_0^\infty (1 - F_X(x))\, dx$

(c) $F_X(\infty) - F_X(0)$

(d) $\int_0^\infty \dfrac{F_X(x)}{x} dx$

51. License plates are made up of three letters followed by four digits. We assume that letters I and O are never used and that no license plates end with 0000. How many distinct license plates can there be?

(a) $\binom{24}{3}\binom{10}{4}-1$

(b) $\binom{24}{3}\left[\binom{10}{4}-1\right]$

(c) $(24\times24\times24)10^4$

(d) $(24\times24\times24)(10^4-1)$

52. An amount of Rs 1,000 is invested and attracts interest at a rate equivalent 10% per annum. Find the total after one year, if the interest is compounded monthly.

(a) $1000(1+0\cdot1)^{12}$

(b) $1000(1+1\cdot2)$

(c) $1000\left(1+\frac{0\cdot1}{12}\right)^{12}$

(d) $1000\times0\cdot1\times12$

53. Determine the set $G\cap L$, where

$$G=\{(x,\ y)\mid y=x^2-5x+6\}$$
$$L=\{(x,\ y)\mid y=2x-6\}$$

$G\cap L$ consists of

(a) (4, 2), (3, 0)

(b) (2, 3)

(c) (2, 6), (3, 0)

(d) (4, 2), (6, 2)

54. The population of a country doubled every 10 years from 1960 to 1990. What was the percent increase in population during this time?

(a) 200%

(b) 300%

(c) 60%

(d) 70%

55. 8 is $\frac{1}{3}$% of what number?

(a) 24

(b) 240

(c) 2·4

(d) 2400

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56. Consider the identity $(1+x+x^2)^{25} = a_0 + a_1 x + a_2 x^2 + \cdots + a_{50} x^{50}$. We find $2(a_0 + a_2 + a_4 + \cdots)$ equals

(a) 3^{25}

(b) $3^{25}+1$

(c) 3^{26}

(d) $3^{26}-1$

57. The value of $f(0)$, for which $f(x) = \dfrac{512(\sqrt{x+4}-2)}{\sin 2x}$ is continuous, is

(a) 51

(b) 59

(c) 61

(d) None of these

58. If A is the area of a triangle whose vertices are (1, 2, 3), (−2, 1, −4), (3, 4, −2), then the value of $4A^2$ is

(a) $\dfrac{\sqrt{1218}}{2}$

(b) 1128

(c) 1218

(d) 2418

59. If $f(x) = (1+x)^n$, then the value of $f(0) + f'(0) + \dfrac{f''(0)}{2!} + \cdots + \dfrac{f^n(0)}{n!}$ is

(a) n

(b) 2^{n-1}

(c) 2^{n+1}

(d) 2^n

60. The curve which passes through the point (2, 0) and the slope of the tangent at any point (x, y) is $x^2 - 2x$ for all values of x, is

(a) $y = x^3$

(b) $y = \dfrac{x^3}{3} - x^2$

(c) $y = \dfrac{x^3}{3} - x^2 + \dfrac{4}{3}$

(d) $y = \dfrac{x^3}{3} - x^2 - \dfrac{4}{3}$

61. A straight line passes through $(2, -6)$ and the point of intersection of the lines $5x-2y+14=0$ and $2y=8-7x$. Any straight line concurrent with the given lines is $(5x-2y+14)+\lambda(2y-8+7x)=0$. The value of λ is

(a) 6

(b) 36

(c) 17

(d) 16

62. The Laplace transform of a real-valued function $f(t)$ is defined as $\bar{f}(s)=\int_0^\infty e^{-st}f(t)\,dt$. If $f(t)$ is a piecewise continuous function of exponential order α (i.e., $|f(t)|< Me^{\alpha t}$) the transform $\bar{f}(s)$ is defined for $\operatorname{Re} s>\alpha$. If $\bar{f}(s)=\frac{1}{s+1}+\frac{1}{s+2}$, then $f(t)$ is given by

(a) $t+t^2$

(b) $e^{-t}+2t$

(c) $e^{-t}+e^{-2t}$

(d) $\sin t+\sin 2t$

63. Given a 10×10 matrix. Each element of the matrix is a Boolean variable. How many different matrices can be formed?

(a) 2^{100}

(b) 100^2

(c) 2^{10}

(d) 10^2

64. Let $S \equiv x^2+y^2+2gx+2fy+c=0$ be the equation of a circle and $P\equiv ax+by+c'=0$ be the equation of a straight line. Then the equation $S+\lambda P=0$ represents

(a) circle

(b) ellipse

(c) hyperbola

(d) pair of straight lines

65. The ratio of the outer and the inner perimeters of a circular path is 23 : 22. If the path is 5 metres wide, the diameter of the inner circle is

(a) 55 m

(b) 65 m

(c) 215 m

(d) 220 m

66. Four circular cardboard pieces, each of radius 7 cm, are placed in such a way that each piece touches two other pieces. The area of the space enclosed by the four pieces is

(a) $22\ \text{cm}^2$

(b) $42\ \text{cm}^2$

(c) $84\ \text{cm}^2$

(d) $102\ \text{cm}^2$

67. The value of $e^{0\cdot001}$ correct up to one decimal place is

(a) 1·1

(b) 2·7

(c) 1·0

(d) None of these

68. Mr. *A*, Miss *B*, Mr. *C* and Miss *D* are sitting around a table and discussing their trades.

(i) Mr. *A* sits opposite to cook.

(ii) Miss *B* sits right to the barber.

(iii) Miss *D* sits opposite to Mr. *C*.

(iv) The washerman is on the left of the tailor.

What are the trades of *A* and *B*?

(a) Incomplete information

(b) Tailor and cook

(c) Washerman and cook

(d) Barber and cook

69. It is given that $f''(x) = -f(x)$, $f'(x) = g(x)$ and $h(x) = [f(x)]^2 + [g(x)]^2$. If $h(\frac{1}{2}) = 8$, then $h(\frac{3}{2})$ is equal to

(a) 0

(b) 2

(c) 4

(d) 8

70. Six roads lead to a country. They may be indicated by letters *X*, *Y*, *Z* and digits 1, 2, 3. When there is storm, *Y* is blocked. When there are floods, *X*, 1 and 2 will be affected. When road 1 is blocked, *Z* also is blocked. At a time when there are floods and a storm also blows, which road(s) can be used?

(a) Only *Y*

(b) Only *Z*

(c) Only 3

(d) *Z* and 2

71. Six persons *A*, *B*, *C*, *D*, *E* and *F* are standing in a circle. *B* is between *F* and *C*; *A* is between *E* and *D*; *F* is to the left of *D*. Who is between *A* and *F*?

(a) *B*

(b) *C*

(c) *D*

(d) *E*

72. Which one of the following diagrams correctly represents the relationship among the classes—Tennis fans, Cricket players and Students?

(a) 

(b) 

(c) 

(d) 

73. If sky is called sea, sea is called water, water is called air, air is called cloud and cloud is called river, then what do we drink when thirsty?

(a) River

(b) Sky

(c) Water

(d) Air

74. Grain : Stock :: Stick : ?

(a) Heap

(b) String

(c) Bundle

(d) Collection

75. What terms will fill the blank spaces?

Z, X, V, T, R, ——, ——

(a) M, N

(b) N, M

(c) P, N

(d) O, K

76. In a certain code, PAPER is written as SCTGW. How is MOTHER written in that code?

(a) ORVLGW

(b) PQRSXY

(c) PQVJGT

(d) None of these

77. A point moves in such a manner that the sum of its distances from fixed points $(-3, 0)$ and $(3, 0)$ is 6. Then the locus of the moving point must be

(a) an ellipse

(b) a parabola

(c) a line segment joining the fixed points

(d) a circle

78. Find the centre of mass for three weights located at points $(1, 3)$, $(2, -2)$ and $(3, 2)$, the weights being 5 kg, 6 kg and 2 kg respectively.

(a) $(23, 7)$

(b) $\left(\frac{23}{13}, \frac{7}{13}\right)$

(c) $\left(\frac{6}{13}, \frac{8}{13}\right)$

(d) $(6, 3)$

79. Select from the given diagrams the one that illustrates the relationship among the given three classes—Judge, Thief and Criminal.

(a) 

(b) 

(c) 

(d) 

80. In an (8×8) matrix whose elements are $a_{ij} = (-1)^{i+j}$, how many positive terms are there?

(a) 64

(b) 32

(c) 48

(d) 16

81. Which of these systems has no solution?

(a) $\begin{cases} 2x_1 - x_2 = 3 \\ x_1 + x_2 = 1 \end{cases}$

(b) $\begin{cases} 2x_1 - x_2 = 3 \\ 4x_1 - 2x_2 = 6 \end{cases}$

(c) $\begin{cases} x_1 + x_2 = 3 \\ 2x_1 - 2x_2 = 6 \end{cases}$

(d) $\begin{cases} 2x_1 - x_2 = 3 \\ 4x_1 - 2x_2 = 5 \end{cases}$

82. For what value of α is the vector $(2, 11, -3)$ in the span of the set $\{(2, 5, -3), (4, 8, \alpha)\}$?

(a) 4

(b) -6

(c) -8

(d) 2

83. Let A be (4×3) matrix whose columns form a linearly independent set. Which conclusion is justified?

(a) The equation $AX = b$ is consistent for every b in $\mathbb{R}^4$

(b) The set of rows in A is linearly dependent

(c) The equation $AX = 0$ has a non-trivial solution

(d) There is a matrix B such that $AB = I_4$

84. Let $\frac{1}{x^2-1} = \frac{A}{x+1} + \frac{B}{x-1}$. Find A and B.

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

(b) $\frac{1}{2}, -\frac{1}{2}$

(c) $-1, 1$

(d) $-1, -2$

85. Which of the these transformations is linear? In each case $X = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$.

(a) $T(X) = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$

(b) $T(X) = \begin{bmatrix} x_1 - x_2 \\ x_1 / x_2 \end{bmatrix}$

(c) $T(X) = \begin{bmatrix} x_1 x_2 \\ x_1 + x_2 \end{bmatrix}$

(d) $T(X) = \begin{bmatrix} 3x_1^2 \\ 4x_2^2 \end{bmatrix}$

86. What is the range of the function f that maps $\mathbb{R}$ to $\mathbb{R}^2$ by means of the formula $f(t) = \begin{bmatrix} \sin t \\ \cos t \end{bmatrix}$?

(a) A circle (circumference only)

(b) $\mathbb{R}^2$

(c) The set of all points $\{x, y\}$ satisfying $-1 \le x \le 1$ and $-1 \le y \le 1$

(d) A disk consisting of a circle together with all the points enclosed by the circle

87. Given an array of n elements. Each element can take three values -1, 0, 1. How many different arrays can be formed?

(a) $\binom{n}{3}$

(b) n^3

(c) 3^n

(d) $\left[\binom{n}{1}\right]^3$

88. The number of roots of $x^{2\cdot1} + x^{3\cdot01} + x^{4\cdot001} = 1$ is

(a) infinite

(b) two

(c) 3001

(d) 4001

89. The value of the sum $\sum_{n=1}^{13}(i^n + i^{n+1})$, $i = \sqrt{-1}$ is

(a) i

(b) $i - 1$

(c) $1 - i$

(d) 0

90. What is the area of a regular hexagon inscribed in a circle of radius of 10 cm?

(a) 180 cm^2

(b) $150\sqrt{3}$ cm^2

(c) $(150/\sqrt{3})$ cm^2

(d) $180\sqrt{3}$ cm^2

91. For what value of x is $S = |x-1| + |x-3| + |x-8| + |x-9| + |x-20|$ minimum?

(a) 7

(b) 6·8

(c) 8

(d) None of these

92. The Fibonacci sequence is governed by the difference equation $y_n = y_{n-1} + y_{n-2}$ with initial condition $y_0 = 0$, $y_1 = 1$. The general solution is $y_n = A\left(\frac{1+\sqrt{5}}{2}\right)^n + B\left(\frac{1-\sqrt{5}}{2}\right)^n$. Determine A and B.

(a) $-1, 1$

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

(c) $\frac{1}{\sqrt{5}}, \frac{1}{\sqrt{5}}$

(d) $\frac{1}{\sqrt{5}}, -\frac{1}{\sqrt{5}}$

93. Find z^4, if $z = 1 + \sqrt{3}i$, $i = \sqrt{-1}$.

(a) $4\cos\frac{4\pi}{3} + i\sin\frac{4\pi}{3}$

(b) $4\left(\cos\frac{4\pi}{3} + i\sin\frac{2\pi}{3}\right)$

(c) $16\left(\cos\frac{4\pi}{3} + i\sin\frac{4\pi}{3}\right)$

(d) $-16\left(\cos\frac{4\pi}{3} + i\sin\frac{4\pi}{3}\right)$

94. $\sinh ix$ equals

(a) $\cosh x$

(b) $i\sin x$

(c) $\cos x$

(d) 1

95. $S = 1 + \frac{1}{2^2} + \frac{1}{3^2} + \cdots$ equals

(a) $\frac{\pi^2}{6}$

(b) $\frac{\pi}{2}$

(c) 4

(d) ∞

96. The arc length of the parabola $y(x) = \frac{1}{2}x^2$ from $x = 0$ to $x = 1$ is given by

(a) $\ln(\sqrt{2}-1)$

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

(c) $\frac{\ln(\sqrt{2}+1)}{2}$

(d) $\frac{\ln\sqrt{2}}{2}$

97. The divergence of a vector field $\underline{u}$ is the dot product of del operator ∇ and $\underline{u}$, i.e.

$$\text{div } \underline{u} = \nabla \cdot \underline{u} = \frac{\partial u_1}{\partial x} + \frac{\partial u_2}{\partial y} + \frac{\partial u_3}{\partial z}$$

and the curl is the cross product of the del operator and the vector field $\underline{u}$, i.e.

$$\text{curl } \underline{u} = \nabla \times \underline{u} = \begin{vmatrix} i & j & k \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ u_1 & u_2 & u_3 \end{vmatrix}$$

Then $\nabla \cdot (\nabla \times \underline{u})$ is

(a) $\nabla(\nabla \cdot \underline{u}) - \nabla^2 \underline{u}$

(b) 0

(c) $\nabla^2 \underline{u}$

(d) 3

98. For $-1 \le x \le 1$, the infinite power series $x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \frac{x^5}{5} - \cdots$ converges to

(a) e^x

(b) $\sin x$

(c) $\ln x$

(d) $\ln(1+x)$

99. For cylindrical polar coordinates (r, ϕ, z), we have $x = r\cos\phi$, $y = r\sin\phi$, $z = z$. The Jacobian $J = \frac{\partial(x, y, z)}{\partial(r, \phi, z)}$ is

(a) r

(b) ϕ

(c) $r^2 \sin\phi \cos\phi$

(d) z

100. For large x, Stirling's asymptotic formula for $x!$ gives

(a) $e^{x \ln x}$

(b) $\sqrt{2\pi x}\, e^{x \ln x}$

(c) $\sqrt{2\pi x}\, e^{x \ln x - x}$

(d) $e^x \sqrt{x}$

101. $g(n) = O(f(n))$ denotes

(a) $g(n)$ has order at least $f(n)$

(b) $g(n)$ has the same order as $f(n)$

(c) $g(n)$ has order at most $f(n)$

(d) None of these

102. The object-oriented paradigm includes which of the following properties?

I. Encapsulation

II. Inheritance

III. Recursion

(a) I only

(b) I, II and III

(c) II only

(d) I and II only

103. Which of the following is the name of the data structure in a compiler that is responsible for managing information about variables and their attributes?

(a) Parse table

(b) Symbol table

(c) Attribute grammar

(d) Semantic stack

104. Which of the following statements about Ethernets is typically false?

(a) Ethernets use circuit switching to send messages

(b) Ethernets use buses with multiple masters

(c) Networks connected by Ethernets are limited in length to a few hundred metres

(d) Packets sent on Ethernets are limited in size

105. In the Internet Protocol (IP) suite of protocols, which of the following best describes the purpose of the Address Resolution Protocol?

(a) To determine the appropriate route for a datagram

(b) To translate Web addresses to host name

(c) To determine the hardware address of a given host name

(d) To determine the hardware address of a given IP address

106. Let k be an integer greater than 1. Which of the following represents the order of growth of the expression $\sum_{i=1}^{n} k^i$ as a function of n?

(a) $O(k^n)$

(b) $O(k^{n \log n})$

(c) $O(k^{n+k})$

(d) $O(k^n \log n)$

107. Consider the following program :

```
#include (stdio.h)
main( )
  {
        int i = 0, x = 0;
          do {
                if (i% 5 == 0) {
                              x++;
                              printf ("%d", x);
                             }
                           ++i;
              } while (i < 25);
        printf ("\nx = %d", x);
  }
```

The above program would produce output as

(a) 12345
x = 5

(b) 01234
x = 4

(c) 23456
x = 6

(d) None of these

108. Consider the following function :

```
int fun (int n)
{
  if (n ==1) return (1);
  else return (fun (n/2) + 1)
}
```

The value of fun (4000) is

(a) 10

(b) 9

(c) 12

(d) None of these

109. X is binomially distributed with parameters n and p. Then $E[(X-np)+(X-np)^2]$ equals

(a) np

(b) n^2p^2

(c) $n(n-1)p^2$

(d) $np(1-p)$

110. Let random variable X have m.g.f. $M(t) = \exp[3t + t^2]$. What is $E[X^2]$?

(a) 6

(b) 3

(c) 10

(d) 11

111. A uniform density function over an interval of unit length is such that $P\left(\frac{1}{4} < X < \frac{1}{2}\right) = \frac{1}{4}$. What is the left-hand end point of that interval of unit length?

(a) Cannot be determined

(b) 0

(c) $\frac{1}{8}$

(d) $\frac{1}{4}$

112. A company agrees to accept the highest of four sealed bids on a property. The four bids are regarded as four independent random variables with common cumulative distribution function $F(x) = \frac{1}{2}(1+\sin \pi x)$, $\frac{3}{2} \le x \le \frac{5}{2}$. Which of the following represents the expected value of the accepted bid?

(a) $\int_{3/2}^{5/2} x \cos \pi x \, dx$

(b) $\frac{\pi}{4}\int_{3/2}^{5/2} x \cos \pi x (1+\sin \pi x)^3 \, dx$

(c) $\frac{1}{16}\int_{3/2}^{5/2} x(1+\sin \pi x)^4 \, dx$

(d) $\pi\int_{3/2}^{5/2} x \cos \pi x \, dx$

113. The integrating factor of the differential equation $\frac{dy}{dx}(x \log x) + y = 2\log x$ is given by

(a) $\log\log x$

(b) x

(c) e^x

(d) $\log x$

114. For solving $\frac{dy}{dx} = (4x + y + 1)$, suitable substitution is

(a) $y = Vx$

(b) $y + 4x + 1 = V$

(c) $y = 4x + V$

(d) $y = 4x + V^2$

115. For a given data, the line of regression y on x is $y = 0{\cdot}4 + 1{\cdot}3x$ and x on y is $x = -0{\cdot}1 + 0{\cdot}7y$. Find $\bar{x}$ and $\bar{y}$.

(a) $0{\cdot}4, -0{\cdot}1$

(b) 3, 2

(c) 2, 3

(d) 3, 3

Let $X_1, X_2, \cdots, X_n$ be a random sample from exponential distribution with p.d.f.

$$f(x, \theta) = \frac{1}{\theta}\exp[-x/\theta], \quad x \geq 0, \theta \geq 0$$

The maximum likelihood estimator for θ is

(a) $\frac{1}{\overline{X}}$ (b) $(X_1 X_2 \cdots X_n)^{-1/n}$

(c) $\frac{\Sigma X_i}{n}$ (d) $(X_1 X_2 \cdots X_n)^{1/n}$

117. An Olympic diver of mass m begins his descent from a 10 metres high diving board with zero initial velocity. Calculate the velocity on impact with water.

(a) 14 m/s

(b) 28 m/s

(c) 9·8 m/s

(d) $\sqrt{20}$ m/s

118. Two coins are available, one unbiased and the other two-headed. Choose a coin at random and toss it once; assume that the unbiased coin is chosen with probability $\frac{3}{4}$. Given that the result is head, find the probability that the two-headed coin was chosen.

(a) $\frac{1}{5}$ (b) $\frac{2}{5}$

(c) $\frac{3}{8}$ (d) $\frac{3}{16}$

119. The maximum value of $z = 6x + 8y$ subject to constraints $2x + y \leq 30$, $x + 2y \leq 24$ and $x \geq 0$, $y \geq 0$ is

(a) 80

(b) 112

(c) 180

(d) 120

120. A particle executes random walk on a set of integers. Starting from origin, it takes a right step with probability p and a left step with probability $q = 1 - p$. Steps are independent and each step is of unit length. The probability that after 200 steps, particle is at 75 is

(a) p^{75}

(b) $p^{75}q^{125}$

(c) $\binom{200}{75} p^{75} q^{125}$

(d) 0

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