JNUEE - 2012

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

   i) The function defined by $f(x) = \dfrac{ax + b}{cx + d}$

   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 thrugout in any interval of values of the variable x.
   (a) 0 (b) 1
   (c) 2 (d) 3.   **B (JNU-2012)**

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 these.

3. Evaluate the integral

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

   where | . | denotes the absolute value :
   (a) 5/2 (2) 3/2
   (c) 0 (d) none of the above.

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?   C(JNU-2012)
   (a) 9872 (b) 10012
   (c) 10692 (4) 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 :   B(JNU-2012)
   (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 4i + j - 3k and 3i + j - k is displaced from the point (1, 2, 3) to the point (5, 4, 1), where i, j and 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 $\left[0, \dfrac{3\pi}{2}\right]$ is :   **C(JNU-2012)**

    (a) $\dfrac{5}{2}$ (b) $\dfrac{3\sqrt{5}}{2}$

    (c) $\dfrac{3\sqrt{3}}{2}$ (d) none of the above.

11. In how many ways can the letters of the word 'attention' be rearranged?   **B(JNU-2012)**
    (a) 28220 (b) 30240
    (c) 32120 (d) none of the above.

12. In a certain code language :
    i) 'mxy das zci' 'good little frock'
    ii) 'jmx cos zci' means 'girld behaves good'
    iii) 'nug drs cos' means 'girl makes mischief'
    iv) 'das ajp cos' means 'little girl fell'
    Which word in that language strands for 'frock'?
    (a) zci (b) das
    (c) mxy (d) insufficient information.

13. The number of solutions of the equations
    $$\sqrt{3x^2 + x + 5} = x - 3 \text{ is :}$$
    (a) ∞ (b) 1 (c) 0 (d) none.

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) √3 (b) 3√3 (c) 1/√3 (d) none.

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.   **A(JNU-2012)**

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?   **C(JNU-2012)**
    (a) 22 (b) 24 (c) 27 (d) none.

17. In the complex plane, consider the following statements:
    i) If $|e^z| = 1$, then z is a pure imaginary number.
    ii) There are complex numbers z such that |sin z| > 1.
    iii) The function sin $\bar{z}$ 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.

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 inversible :

(a) 0   (b) 1   (c) 2   (d) 3.

20. Transform the well-formed $P \rightarrow Q \wedge R$ into a disjunction normal form (DNF) and conjuction 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 $(P \vee \neg Q) \wedge (\neg P \vee R)$.

(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.**B(JNU-2012)**

22. The subtraction of $2A_{10}$ 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 $x = \frac{2 \sin \alpha}{1 + \cos \alpha + \sin \alpha}$, then the value of $\frac{\cos \alpha}{1 + \sin \alpha}$ is equal to :

(a) 1 - x   (b) 1 + x   (c) 1/x   (d) none.

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.

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

(c) $x = \frac{8}{15}, y = -\left(\frac{8}{5}\right)$ (d) none of the above.

27. The value of the integral

28. $\int_0^\infty \frac{x \log x}{(1 + x^2)} dx$ is :

(a) 0   (b) log 2   (c) 2 log 5   (d) ∞.

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(.) does not exist.

(d) none of the above.

29. From the two statements :

i) some cubs are tigers.

ii) some tigers are goats

iii) 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 cov (X, Y) equals :

(a) 1 (b) -1 (c) 0 (d) none of the above.**C(JNU-2012)**

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

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 eigvenvalues of A and B.

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

Identify the correct statement :

(a) only (i) and (ii)   (2) only (i) and (iii)

(3) (i), (ii) and (iii)   (4) 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(JNU-2012)**

(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 $f : [1, \infty) \rightarrow [1, \infty)$ 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.   **C(JNU-2012)**

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

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

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

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

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

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

(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. Idntify 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) $\dfrac{k!}{(k_1 + k_2 + ... + k_n)!}$

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

(c) $k_1! k_2! ... k_n!$ (d) none of the above.**D(JNU-2012)**

38. $\lim\limits_{n\to\infty}\left(\dfrac{1+i}{\sqrt{\pi}}\right)^n$ is equal to :   **(JNU-2012)**

(a) 0   (b) t   (c) ∞   (d) none.

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 perpendicular to AB meeting the axis of the parabola at C. The projection of BC on the axis is :
    (a) a   (b) 2a   (c) 4a   (d) none.

40. The probability that a number selected at random between 100 and 999 (both inclusive) will not contain the digit 7 is :   **A(JNU-2012)**
    (a) 18/25   (b) 16/25
    (c) 729/1000   (d) 27/75.

41. If the product of the roots of the equation $x^2 - 5kx + 2e^4 - 1 = 0$ is 31, then the sum of the roots is :
    (a) 10   (b) 8   (c) 5   (d) none.

42. Let f : Z → 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.
    A(JNU-2012)

43. An equation of a tangent to the hyperbola
    $16x^2 - 25y^2 - 96x + 100y - 356 = 0$
    which makes an angle π/4 with the transverse axis is :
    (a) y = x + 2   (b) y = 2x - 3
    (c) y = x + 6   (d) x = 2y - 3.

44. If $s_n = \dfrac{1}{2}(1 - (-1)^n)$ for n ≥ 1, then as n → ∞

$$\dfrac{s_1 + s_2 + ... + s_n}{n}$$

converges to : **D(JNU-2012)**

(a) 0   (b) 1   (c) 1/2   (d) none.

45. A triangle PQR inscribed in the circle $x^2 + y^2 = 25$. If Q and R have coordinates (3, 4) and (-4, 3) respectively, then ∠QPR is equal to :
    (a) π/2   (b) π/3   (c) π/4   (d) π/6.

46. If $y = \int_1^{t^3} 3\sqrt{z} \log z\, dz$ and $x = \int_{\sqrt{t}}^3 z^2 \log z\, dz$, then

$\dfrac{dy}{dx}$ is :

(a) $-4t^{5/2}$ (b) $35t^{5/2}$ (c) $-36t^{5/2}$ (d) none.

47. Febraury 29, 1952 occured 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(JNU-2012)**
    (a) 65   (b) 62   (c) 60   (d) none.

49. How many squares are there in the given figure?
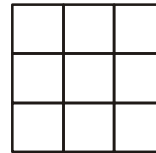
   C(JNU-2012)

(a) 12   (b) 14   (c) 16   (d) none.

50. For any three vectors a, b, c if a + b + c = 0 and |a| = 3, |b| = 5 and |c| = 7, then the angle between a and b is :

(a) $\dfrac{5\pi}{3}$ (b) $\dfrac{2\pi}{3}$ (c) $\dfrac{\pi}{3}$ (d) $\dfrac{\pi}{6}$.

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 answer. Then the number of problems solved correctly is :**A(JNU-2012)**
    (a) 95   (b) 92   (c) 90   (d) none.

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(JNU-2012)**

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

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

(c) $\dfrac{1}{2^{2n}}$ (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 comon divisor. Then

gcd(ab, p^4) will be equal to :
(a) p   (b) p^2 (c) p^3 (d) none.

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.

56. Identify the correct statements from the following :
i) The diagonal entries of a skew-symmetric matrix are zero.
ii) The determine of a skew-symmetric matrix of order 3 will be always equal to zero.
iii) The determine 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, 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 :

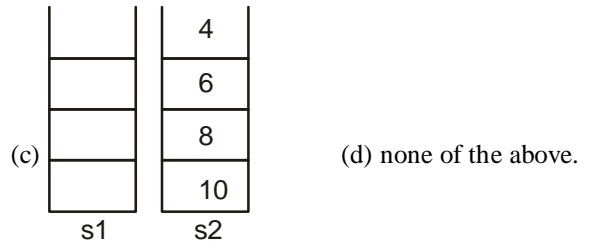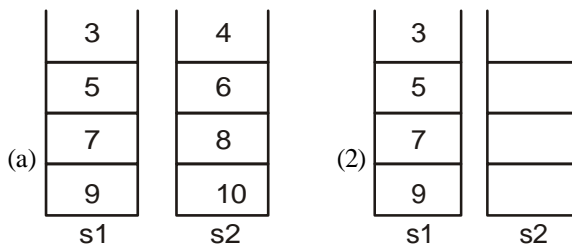(a) $\dfrac{\partial^2 z(u,v)}{\partial u \, \partial v} = u^2 + v^2$ (b) $\dfrac{\partial^2 z(u,v)}{\partial u \, \partial v} = uv$

(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 picutre 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 (lemptyStack(s1))
(
    popStack(s1, x);
    x = x + 1;
    popStack(s2, x);
)
```

(a)

3	4
5	6
7	8
9	10
s1	s2

(2)

3	
5	
7	
9	
s1	s2

(c)

	4
	6
	8
	10
s1	s2

(d) none of the above.

59. Let X denote a random variable that takes on any of the values -1, 0, 1 with respective probabilites
$P\{X = -1\} = 0.2$, $P\{X = 0\} = 0.5$ and $P\{X = 1\} = 0.3$
Compute the expected value of $E(x^2)$ B(JNU-2012)
(a) 0.35   (b) 0.5   (c) 0.625   (d) none.

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 $\sin^{-1} x + \sin^{-1} y = \dfrac{2\pi}{3}$, then we have $\cos^{-1} x + \cos^{-1} y$
=:
(a) $\pi/3$ (b) $\pi/6$ (c) $\pi/8$ (d) none.

62. Find a third equation that can be solved if x + y + z = 0 ans x - 2y - z = 1 :
(a) 3x + z = 2   (b) 3y + z = 4
(c) 2x - y = 1   (d) none of the above.

63. For any real number a, $\lim\limits_{x \to \infty} \sqrt{x} \{\sqrt{x+1} - \sqrt{x}\}$ is equal to :   **D(JNU-2012)**
(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.

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 wil die before attaining the age of 90 and will the first to die is :   **C(JNU-2012)**

(a) $\dfrac{31}{228}$ (b) $\dfrac{13}{282}$ (c) $\dfrac{65}{324}$ (d) none.

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 $\dfrac{BP}{AB}$ is euqal

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

73. A and B 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
   $$P(A \cup B) = \frac{3}{4}, \quad P(A \cap B) = \frac{1}{4} \text{ and } P(A^C) = \frac{2}{3}$$
   where $P(A^C)$ denotes the probability of the complement of A, then $P(A^C \cup B)$ is :   **A(JNU-2012)**
   (a) 5/12   (b) 5/9   (c) 8/11   (d) none.

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
   $$4^x - 3(2^{x+3}) + 128 = 0$$
   (a) 0   (b) 5   (c) 8   (d) none.

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 end 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

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 :C**(JNU-2012)**
   (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 ascendng 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 $\lim_{z \to 0} \left(\dfrac{\bar{z}}{z} \right)^2$ 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?   C**(JNU-2012)**
   (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 whoose 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(JNU-2012)**
   (a) 1/2, 1/12   (b) 1/4, 1/16
   (c) 1/6, 1/7   (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 c perpendicular to the vectors 2i + 3j - k and i - 2j + k satisfying the condition c(2i - j + k) = - 6, where i, j and k are unit vectors along the X-, Y- and Z-axis respectively, is :
   (a) -2i + j - k   (b) 2i - 3j + 4k
   (c) -3i + 3j + 3k   (d) none of the above.

86. Let R = {(x, y) : x, y ∈ A, x + y = 4} be a relation, where A = {1, 2, 3, 4, 5}. Then R is :   B**(JNU-2012)**
   (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

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

is equal to :

(a) ∞ (b) $1 + r^2$ (c) $\frac{1}{1+r^2}$ (d) none.

89. How many even numbers in the range of 100-999 have no repeated digits?
(a) 298   (b) 328 (c) 368   (d) none.**B(JNU-2012)**

90. A frog starts climbing a 30 ft wall. Each hour it climbs 3 ft and slips and back 2 ft. How many hours does it take to reach the top and get out?
(a) 30   (b) 29   (c) 28   (d) none.

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

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

Then the value of c is :   **C(JNU-2012)**
(a) 1   (b) 1/2   (c) $1/\pi$ (d) none.

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 $X = (A + B + C)(A + B + C')(A + B' + C)(A' + B' + C)$ 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 ++); print ("% 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. Then the values of m and n respectively are :**C(JNU-2012)**
(a) 5, 3   (b) 6, 4   (c) 4, 2   (d) none.

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(JNU-2012)**

(a) 1   (b) 2   (c) 3   (d) none.

97. Consider the matrix $A = \begin{pmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1/2 \end{pmatrix}$. 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
$u_1 = O, v_1 = 1$ 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 $\{u_n\}$ will become :
(a) both increasing
(b) both decreasing
(c) one increasing and the other decreasing.
(d) none of the above.

99. Consider the function $f(x) = \frac{e^{1/x}}{1+e^{1/x}}$ 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.   C(JNU-2012)

100. If u = arctan x, then

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

will be equal to :   D **(JNU-2012)**
(a) x   (b) u   (c) 1   (d) none.

101. The period of the function $f(x) = \cos^2 3x + \tan 4x$ is :
(a) π (b) $\pi/3$ **A(JNU-2012)**
(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) $f(z) = \frac{e^{2z} - 1}{z}$

ii) $g(z) = z^3 \sin\left(\frac{1}{2}\right)$

(a) both are removal singularities.
(b) both are essential singularities.
(c) essential and removable singularities.
(d) removal and essential singularities.

105. Find the sum of all the numbers between 100 and 1000 which are divisible by 14 :
(a) 32388   (b) 25292   (c) 38396   (d) none.

106. Let n > 3 be an integer and let A = {1, 2, 3,...,n). How many subsets B of A have the property that $B \cup \{1, 2\} = A$?   **D(JNU-2012)**

(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 : **B(JNU-2012)**

(a) ∞ (b) b   (c) a + b   (d) none.

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.

109. A five-figure number is formed by the digits 0, 1, 2, 3, 4 without repetition. The probability that the number formed is divisilbe by 4 is :   **B(JNU-2012)**

(a) 9/16   (b) 5/16   (c) 7/16   (d) nne.

110. Consider the following statements :

i) Suppose A is a matrix such that det(A) = 0. Then at least one of th 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 technology 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....m...?

(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 identifinitely. What is the probability that of the first four balls drawn, exactly two are white?**A(JNU-2012)**

(a) 3/8   (b) 2/9   (c) 5/11   (d) none.

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.

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

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

Then g(2) satisfies the inequality :

(a) $-\frac{1}{2} \leq g(2) < \frac{1}{2}$ (b) $0 \leq g(2) < 2$

(c) $\frac{3}{2} \leq g(2) \leq 3$ (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, indepnedently, hits the target with probability O. Given that the target is hit, what is the probability that Gates hits it?

(a) 19/45   (b) 11/21   (c) 13/27   (d) none.

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

$$\tan\left(\frac{\theta+\alpha}{2}\right) \tan\left(\frac{\theta-\alpha}{2}\right) \text{ is equal to :}$$

(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.

119. Find the number of ways a postman can deliver four letters, each to the wrong address :   **C(JNU-2012)**

(a) 7   (b) 8   (c) 9   (d) 10.

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