NIMCET MCA
Solved Paper 2011

Mathematics

1. The value of $\sin 30^\circ \cos 45^\circ + \cos 30^\circ \sin 45^\circ$

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

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

2. The solution of ΔABC given that $B = 45^\circ$, $C = 105^\circ$ and $c = \sqrt{2}$ is

(a) $A = 30^\circ$, $a = \sqrt{3} - 1$, $b = \sqrt{2}(\sqrt{3} - 1)$

(b) $A = 30^\circ$, $a = \sqrt{3} + 1$, $b = \sqrt{2}(\sqrt{3} - 1)$

(c) $A = 30^\circ$, $a = 1 - \sqrt{3}$, $b = \sqrt{2}(\sqrt{3} + 1)$

(d) $A = 30^\circ$, $a = \sqrt{3} - 1$, $b = \sqrt{2}(\sqrt{3} + 1)$

3. If $\tan\theta = \frac{b}{a}$, then the value of $a\cos 2\theta + b \sin 2\theta$ is

(a) b (b) a

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

4. The general solution of $\sqrt{3}\cos x + \sin x = 3$ is

(a) $2n\pi \pm \frac{\pi}{6}$ (b) $2n\pi \pm \frac{\pi}{3}$

(c) no solution (d) $n\pi \pm \frac{\pi}{6}$

5. The value of $\frac{1 - \tan^2 15^\circ}{1 + \tan^2 15^\circ}$ is

(a) 1 (b) $\sqrt{3}$

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

6. A random variable X has the following probability distribution

x	0	1	2	3	4	5	6	7	8
$P(X = x)$	a	$3a$	$5a$	$7a$	$9a$	$11a$	$13a$	$15a$	$17a$

Then, the value of 'a' is

(a) 1/81 (b) 2/82

(c) 5/81 (d) 7/81

7. The sum of $11^2 + 12^2 + \ldots + 30^2$

(a) 8070 (b) 9070

(c) 1080 (d) 9700

8. If A and B are two square matrices such that $B = A^{-1}BA$, then $(A+B)^2$ will be equal to

(a) 0 (b) $A^2 + 2AB + B^2$

(c) $A^2 + B^2$ (d) $A + B$

9. Consider the system of linear equations

$$3x_1 + 7x_2 + x_3 = 2$$
$$x_1 + 2x_2 + x_3 = 3$$
$$2x_1 + 3x_2 + 4x_3 = 13$$

The system has

(a) infinitely many solutions

(b) exactly 3 solutions

(c) a unique solution

(d) no solution

10. If α, β are the roots of the equation $x^2 - 2x + 4 = 0$, then the value of $\alpha^6 + \beta^6$ is

(a) 64 (b) 128

(c) 256 (d) 132

11. If θ is the angle between $\mathbf{a}$ and $\mathbf{b}$ and $|\mathbf{a} \times \mathbf{b}| = |\mathbf{a} \cdot \mathbf{b}|$, then θ is equal to

(a) 0 (b) π

(c) $\pi/2$ (d) $\pi/4$

12. ABCD is a parallelogram with **AC** and **BD** as diagonals. Then, **AC** · **BD** is equal to

(a) 4AB (b) 3AB

(c) 2AB (d) AB

13. If $\sin x, \cos x$ and $\tan x$ are in GP, then $\cot^6 x - \cot^2 x$ will be equal to

(a) 2 (b) -1

(c) 1 (d) 0

14. The greatest angle of the triangle whose sides are $x^2 + x + 1, 2x + 1, x^2 - 1$, is

(a) 150° (b) 90°

(c) 135° (d) 120°

15. The general value of θ satisfying the equation $2\sin^2\theta - 3\sin\theta - 2 = 0$, is

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

(c) $n\pi + (-1)^n \frac{5\pi}{6}$ (d) $n\pi + (-1)^n \frac{7\pi}{6}$

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16. If $2x + 3y - 6 = 0$ and $9x + 6y - 18 = 0$ cuts the axes in concylic points, then the centre of the circle is
(a) (2, 3) (b) (3, 2)
(c) (5, 5) (d) (5/2, 5/2)

17. The number of distinct solutions (x, y) of the system of equations $x^2 = y^2$ and $(x - a)^2 + y^2 = 1$, where 'a' is any real number, can only be
(a) 0, 1, 2, 3, 4 or 5 (b) 0, 1 or 3
(c) 0, 1, 2 or 4 (d) 0, 2, 3 or 4

18. The vertex of parabola $y^2 - 8y - x + 19 = 0$ is
(a) (3, 4) (b) (4, 3)
(c) (1, 3) (d) (3, 1)

19. The eccentricity of ellipse $9x^2 + 5y^2 - 30y = 0$ is
(a) 1/3 (b) 2/3
(c) 3/4 (d) 1/4

20. If the function $f : [1, \infty) \to [1, \infty)$ is defined by $f(x) = 2^{x(x-1)}$, then $f^{-1}(x)$ is
(a) $(1/2)^{x(x-1)}$ (b) $\frac{1}{2}\{1 + \sqrt{1 + 4\log_2 x}\}$
(c) $\frac{1}{2}\{1 - \sqrt{1 + 4\log_2 x}\}$ (d) not defined

21. A polygon has 44 diagonals, the number of its sides is
(a) 9 (b) 10
(c) 11 (d) 12

22. Let X be the universal set for sets A and B. If $n(A) = 200$, $n(B) = 300$ and $n(A \cap B) = 100$, then $n(A' \cap B')$ is equal to 300 provided $n(X)$ is equal to
(a) 600 (b) 700
(c) 800 (d) 900

23. In a college of 300 students, every student reads 5 newspapers and every newspaper is read by 60 students. The number of newspaper is
(a) atleast 30 (b) atmost 20
(c) exactly 25 (d) exactly 28

24. The number of ways of forming different nine digit numbers from the number 223355888 by rearranging its digit, so that the odd digits occupy even positions is
(a) 16 (b) 36
(c) 60 (d) 180

25. An anti-aircraft gun can take a maximum of four slots at an enemy plane moving away from it. The probabilities of hitting the plane at the first, second, third and fourth slots are 0.4, 0.3, 0.2 and 0.1 respectively. The probability that the gun hits the plane, then is
(a) 0.5 (b) 0.7235
(c) 0.6976 (d) 1.0

26. The least integral value of k for which $(k-2)x^2 + 8x + k + 4 > 0$ for all $x \in R$, is
(a) 5 (b) 4 (c) 3 (d) 6

27. If for $n \in N$, $\sum_{k=0}^{2n} (-1)^k \left[\binom{2n}{k}\right]^2 = A$, then the value of $\sum (-1)^k (k - 2n)\left[\binom{2n}{k}\right]^2$ is
(a) nA (b) $-nA$
(c) 0 (d) A

28. Solution set of the inequality $\log_3 (x+2)(x+4) + \log_{1/3}(x+2) < \frac{1}{2}\log_{\sqrt{3}} 7$ is
(a) $(-2, -1)$ (b) $(-2, 3)$
(c) $(-1, 3)$ (d) $(3, \infty)$

29. If three positive real numbers a, b, c $(c > a)$ are in HP, then $\log(a + c) + \log(a - 2b + c)$ is
(a) 2 log $(c - b)$ (b) 2 log $(a + c)$
(c) 2 log $(c - a)$ (d) log a + log b − log c

30. The area enclosed within the lines $|x| + |y| = 1$ is
(a) 1 (b) 2
(c) 3 (d) 4

31. If the mean of the squares of first n natural numbers be 11, then n is equal to
(a) $-\frac{13}{2}$ (b) 11
(c) 5 (d) 4

32. The probability of a razor blade to be defective is 0.002. The blades are in packet of 10. The number of packets containing no defective blades in a stock of 10000 packets is
(a) 2000 (b) 9802
(c) 9950 (d) 8000

33. Two variables have least square regression lines $3x + 2y = 26$ and $6x + y = 31$, then correlation between x and y is
(a) 0.5 (b) 0.7 (c) −0.7 (d) −0.5

34. A car completes the first half of its journey with a velocity v_1 and the rest half with a velocity v_2. Then, the average velocity of the car for the whole journey is
(a) $\frac{v_1 + v_2}{2}$ (b) $\sqrt{v_1 v_2}$
(c) $\frac{2v_1v_2}{v_1 + v_2}$ (d) None of these

35. The mean of first n natural numbers is equal to $\frac{n+7}{3}$, then 'n' is equal to
(a) 9 (b) 10 (c) 11 (d) 12

36. $\int_0^{1/2} \frac{dx}{\sqrt{x - x^2}}$ will be equal to
(a) $\pi/2$ (b) π (c) $\pi/3$ (d) $\pi/4$

37. If the area bounded by $y = x^2$ and $y = x$ is A sq units, then the area bounded by $y = x^2$ and $y = 1$ is
(a) $(2A + 1)$ sq units (b) $2A$ sq units
(c) $(2A + 2)$ sq units (d) $(A + 2)$ sq units

38. If $\mathbf{a}$, $\mathbf{b}$ and $\mathbf{c}$ are unit coplanar vectors, then the scalar triple product $[2\mathbf{a} - \mathbf{b}, 2\mathbf{b} - \mathbf{c}, 2\mathbf{c} - \mathbf{a}]$ will be equal to
(a) 0 (b) 1 (c) $-\sqrt{3}$ (d) $\sqrt{3}$

39. Let $\mathbf{a} = x\,\mathbf{i} - 3\,\mathbf{j} - \mathbf{k}$ and $\mathbf{b} = 2x\,\mathbf{i} + x\,\mathbf{j} - \mathbf{k}$. Suppose that the angle between $\mathbf{a}$ and $\mathbf{b}$ is acute and the angle between $\mathbf{b}$ and the positive direction of the y-axis lies between $\frac{\pi}{2}$ and π. Then, the set of all possible values of x is
(a) $\{1, 2\}$ (b) $\{-2, -3\}$
(c) $\{x : x < 0\}$ (d) $\{x : x > 0\}$

40. Let $\mathbf{v} = 2\mathbf{i} + \mathbf{j} - \mathbf{k}$ and $\mathbf{w} = \mathbf{i} + 3\mathbf{k}$. If $\mathbf{u}$ is a unit vector, then the maximum value of the scalar triple product $[\mathbf{u}\ \mathbf{v}\ \mathbf{w}]$ is

(a) -1 (b) $-\sqrt{10} - \sqrt{6}$
(c) $\sqrt{59}$ (d) $\sqrt{10} + \sqrt{6}$

41. The minimum value of $px + qy$, when $xy = r^2$ is

(a) $2r\sqrt{pq}$ (b) $2pq\sqrt{r}$
(c) $-2r\sqrt{pq}$ (d) $\sqrt{pqr}$

42. If 'a' is a positive integer, then the number of values satisfying

$$\int_0^{\pi/2} \left\{ a^2\left(\frac{\cos 3x}{4} + \frac{3}{4}\cos x\right) + a\sin x - 20\cos x \right\} dx \le \frac{-a^2}{3} \text{ is}$$

(a) only one (b) two
(c) three (d) four

43. Find $\frac{d}{dx}\left(\sqrt{x} - \frac{5}{\sqrt{x}}\right)$.

(a) $\frac{1}{2\sqrt{x}} + \frac{3}{2}x^{-3/2}$ (b) $2x - \frac{5}{2}x^{3/2}$
(c) $2x + \frac{5}{2}x^{-3/2}$ (d) None of these

44. $\lim_{x\to\infty} \sqrt{\frac{(x+\sin x)}{(x-\cos x)}}$ is equal to

(a) 0 (b) 1
(c) -1 (d) None of these

45. If $f(x) = \int_0^x t\sin t\, dt$, then $f'(x)$ is

(a) $\cos x + x\sin x$ (b) $x\sin x$
(c) $x\cos x$ (d) $x^2/2$

Analytical Ability & Logical Reasoning

Directions (Q. Nos. 46-48) *Read the information given below and answer the questions that follow.*

Four persons A, B, C and D play a cards game. They put ₹ 500 as stake money. When the game is over 'C' receives ₹ 19 more that 'D' and 'B' receives ₹ 21 less than 'A' whose amount was ₹ 2 less than the quarter of ₹ 500.

46. How much money did 'C' get?

(a) ₹ 147 (b) ₹ 136
(c) ₹ 144 (d) ₹ 159

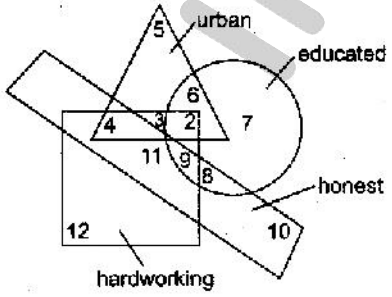
47. How much money did 'B' get?

(a) ₹ 102 (b) ₹ 107
(c) ₹ 108 (d) ₹ 110

48. Who get the highest amount?

(a) A (b) B (c) C (d) D

Directions (Q. Nos. 49-51) *In the following diagram circle stands for 'educated', square for 'hardworking', triangle for 'urban people', and rectangle for 'honest'. Different regions in the diagram are numbered from 2 to 12. Study the diagram carefully and answer.*



49. Educated, hardworking and urban people are indicated by

(a) 7 (b) 2
(c) 3 (d) 4

50. Non-urban educated people who are neither hardworking nor honest are indicated by

(a) 5 (b) 7
(c) 10 (d) 12

51. Honest, educated and hardworking non-urban people are indicated by

(a) 3 (b) 4 (c) 6 (d) 9

52. Mr X left his entire estate to his wife, his daughter, his son and the cook, his daughter and son got half the estate, sharing in the ratio of 4 to 3. His wife got twice as much as the son. If the cook received a bequest of ₹ 500, then the entire estate was

(a) ₹ 3500 (b) ₹ 5500
(c) ₹ 6500 (d) ₹ 7000

53. At a dance party a group of girls and boys exchange dances as follows.

One boy dances with 5 girls, second boy dances with 6 girls, and so on last boy dances with all girls. If b represents the number of boys and g represents the number of girls, then

(a) $b = g$ (b) $b = g/5$
(c) $b = g - 4$ (d) $b = g - 5$

54. The average age of husband and wife was 22 yr when they were married five years back. What is the present average age of the family, if they have a three year old child?

(a) 19 yr (b) 25 yr
(c) 27 yr (d) $28\frac{1}{2}$ yr

55. Which of the following will be acceptable for establishing a fact?

(a) Opinion of large number of people
(b) Traditionally in practice over a long period of time
(c) Availability of observable evidences
(d) References in the ancient literature

Directions (Q. Nos. 56-59) *Six scientists A, B, C, D, E and F are to present at 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.*

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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.

56. In case *C* is to be the fifth scientist to present his paper, then *B* must be
(a) first (b) second
(c) third (d) fourth

57. *B* could be placed for any of the following places in the order of presenters EXCEPT
(a) second (b) third
(c) fourth (d) fifth

58. In case *F* is to present his paper immediately after *D* presents his paper, *C*'s could be scheduled for which of the following places in the order of presenters?
(a) Second (b) Third
(c) Fourth (d) Fifth

59. In case *F* and *E* are the fifth and sixth presenters respectively, then which of the following must be true?
(a) *A* is first in the order of presenters
(b) *A* is third in the order of presenters
(c) *A* is fourth in the order of presenters
(d) *B* is first in the order of presenters

Directions (Q. Nos. 60-63) *Study the following information to answer the given questions .*
(i) In a family of 6 persons, there are two couples.
(ii) The lawyer is the head of the family and has only two sons-Mukesh and Rakesh both teachers.
(iii) Mrs Reena and her mother-in-law both are lawyers.
(iv) Mukesh's wife is a doctor and they have a son, Ajay.

60. What is the profession of Rakesh's wife?
(a) Teacher (b) Doctor
(c) Lawyer (d) None of these

61. How many male members are there in the family?
(a) Two (b) Three
(c) Four (d) None of these

62. What is/was Ajay's grandfather's occupation?
(a) Teacher (b) Lawyer
(c) Doctor (d) Cannot be determined

63. What is the profession of Ajay?
(a) Teacher (b) Lawyer
(c) Doctor (d) Cannot be determined

Directions (Q. Nos. 64-66) *Mrs Thomas received a large order for stitching school uniforms from May flower school and Little flower school. She has two cutters who will cut the fabric, five tailors who will do the stitching and two assistants to stitch the buttons and button holes. Each of these nine persons will work for exactly* 10 *h a day. Each of the May flower uniforms requires* 20 *min for cutting the fabric, one hour for stitching, and* 15 *min for stitching buttons and button holes, whereas the Little flower uniform requires* 30 *min,* 1 *h and* 30 *min respectively for these activities.*

64. What is the number of Little flower uniforms that Mrs Thomas can complete in a day?
(a) 50 (b) 20
(c) 40 (d) 30

65. On a particular day, Mrs Thomas decided to complete 20 Little flower uniforms. How many May flower uniforms can she complete on that day?
(a) 30 (b) 40
(c) 20 (d) 0

66. If she hires one more assistant, what is the maximum number of May flower uniforms that she can complete in a day?
(a) 40 (b) 50
(c) 60 (d) 30

67. In a certain code, RIPPLE is written as 613382 and LIFE is written as 8192. How is PILLER written in that code?
(a) 318826 (b) 318286
(c) 618826 (d) 328816

68. A doctor said to his compounder "I go to see the patients at their residence after every 3:30 h. I have already gone to the patient 1:20 h ago and next time I shall go at 1:40 pm". At what time this information was given to the compounder by the doctor?
(a) 10:10 am (b) 11:30 am
(c) 11:20 am (d) None of these

Direction (Q. No. 69) *In the following question, three statements are followed by a conclusion. Study the statements and the conclusion and point out which statement studied together will bring to the conclusion.*

69. Statements
(i) Price rise is natural phenomenon.
(ii) If production increases prices fall.
(iii) High prices affect the poor.
Conclusion If production rises the poor feel relieved.
Answer choices
(a) Only (i) and (ii) (b) Only (i) and (iii)
(c) Only (ii) and (iii) (d) Data insufficient

70. In how many different ways can the letters of the word "DETAIL" be arranged in such a way that the vowels occupy only the odd positions?
(a) 32 (b) 36
(c) 48 (d) 60

71. If from 4 to 55 the numbers which are divisible by 3 and the numbers which contain 3 as one of the digits, are removed, then how many numbers will be left?
(a) 24 (b) 23
(c) 22 (d) 25

72. In the following number-series, one term is wrong. Which term is wrong?
5, 12, 19, 33, 47, 75, 104
(a) 33 (b) 47
(c) 75 (d) 104

73. The positions of *A* in a class is 5th from the top and position of *B* is 7th from the bottom. If *C* is at 6th place after *A* and 6th place before *B*, how many students are there in the class?
(a) 25 (b) 23
(c) 21 (d) 22

74. Suppose $X = 2^{100}, Y = 3^{100}$ and $Z = 4^{100}$. Exactly one of the following is true. Which is it?
(a) $X + Y = Z$ (b) $X + Y < Z$
(c) $X + Y > Z$ (d) $XY = Z$

75. Assume that the following three statements are true.
A. All freshmen are human.
B. All students are human.
C. Some students think.
Given the following four statements.
I. All freshmen are students.
II. Some humans think.
III. No freshmen think.
IV. Some humans who think are not students.
Those Which are logical consequences of I, II and III are
(a) II (b) IV
(c) II, III (d) I, II

76. Five persons A, B, C, D and E were travelling in a car. There were two ladies in the group. Two new car driving, of them one was a lady. A is brother of D. B wife of D drove at the beginning. E drove at the end. Who was the other lady in the group?
(a) D (b) B (c) C (d) E

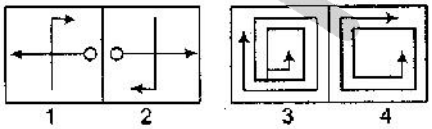
77. Choose which pair of numbers carries next in the following sequence.
61, 57, 50, 61, 43, 36, 61
(a) 29, 61 (b) 27, 20 (c) 31, 61 (d) 29, 22

78. Correct the following equation by inter-changing two signs.
$3 - 9 \times 27 + 9 \div 3 = 3$
(a) + and − (b) × and +
(c) × and ÷ (d) × and −

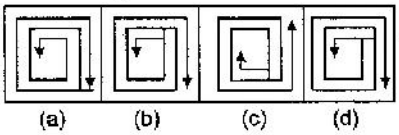
79. Pushpa is twice as old as Rita was two years age. If the difference between their ages be 2 yr, how old is Pushpa today?
(a) 6 yr (b) 8 yr
(c) 10 yr (d) 12 yr

80. A clock is set right at 8 am. The clock gains 10 min in 24 h. What will be the right time when the clock indicates 1 pm on the following day?
(a) 11:40 pm (b) 12:48 pm
(c) 12 noon (d) 10 pm

81. Choose the best answer figure to substitute element 4 in the problem figures so that element 3 is related to element 4 in the same way as element 1 is related to element 2.
Problem Figures



Answer Figures



Direction (Q. No. 82) *In the following question, below are given two statements followed by four conclusions numbered I, II, III, IV. You have to take the two given statements to be true, even if they seem to be at variance from commonly known facts. Read all the conclusions and then decide which of the given conclusions logically follows from the two given statements, disregarding commonly known facts.*

82. Statements
A. Some green are blue.
B. No blue in white.
Conclusions
I. Some blue are green.
II. Some white are green.
III. Some green are not white.
IV. All white are green.
(a) Only I follows
(b) Only II and III follow
(c) Only I and III follow
(d) Only I and II follow

Directions (Q. Nos. 83-85) *In each of the 3 questions below, are given four statements followed by four conclusions numbered I, II, III, IV. You have to take the given statements to be true even, if they seem to be at variance from commonly known facts. Read all the conclusions and then decide which of the given conclusions logically follows from the given statements disregarding commonly known facts.*

83. Statements Some doctors are lawyers. All teachers are lawyers. Some engineers are lawyers. All engineers are businessman.
Conclusions
I. Some teachers are doctors.
II. Some businessmen are lawyers.
III. Some businessmen are teachers.
IV. Some lawyers are teachers.
(a) None follows
(b) Only II follows
(c) Only III follows
(d) Only II and IV follow

84. Statements All plastics are glasses. Some sponges are glasses. All sponges are clothes. All clothes are liquids.
Conclusions
I. All liquids are sponges.
II. Some plastics are clothes.
III. All glasses are plastics.
IV. All liquids are clothes.
(a) None follows
(b) Only either II or IV follows
(c) Only III and IV follow
(d) Only I and IV follow

85. Statements All sands are beaches. All shores are beaches. Some beaches are trees. All trees are hotels.
Conclusions
I. Some shores are hotels.
II. All beaches are shores.
III. Some beaches are hotels.
IV. Some sands are trees.
(a) Only III follows
(b) Only II follows
(c) Only IV follows
(d) None of the above

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Computer Awareness

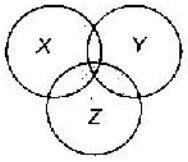
86. The ASCII code of A is
(a) 66D (b) 41H
(c) 01000010 (d) 01100011

87. An eight bit byte is capable of representing how many different characters?
(a) 64 (b) 128 (c) 256 (d) 512

88. The least significant bit of the binary number, which is equivalent to any odd decimal number is
(a) 0 (b) 1
(c) 1 or 0 (d) All of these

89. Which of the following Boolean expression represents the shaded portion of the Venn diagram?

Here, "." represents an AND operation and "+" denotes an OR operation.



(a) $Z' + (X \cdot Y)$ (b) $Z \cdot (X + Y)$
(c) $(Z \cdot X') + Y$ (d) $Z'(X + Y)$

90. Consider x and y be some Boolean variables, '+' denotes the OR operation and "." denotes the AND operation. What will be the simplified from of the Boolean expression $x \cdot (x + y)$?
(a) y (b) 1
(c) 0 (d) x

91. Which one of the following is not a valid rule of Boolean algebra?
(a) $A + 1 = 1$ (b) $A - A'$
(c) $AA = A$ (d) $A + 0 = A$

92. When two binary numbers are added, then an overflow will never occur, if
(a) both numbers of same sign
(b) the carry into the sign bit position and out of sign bit position are not equal
(c) the carry into the sign bit position and out of sign bit position are equal
(d) the carry into the sign bit position is 1

93. The sum of 11010 – 01111 equals to
(a) 101001 (b) 101010
(c) 110101 (d) 101000

94. Which protocol needs to be installed for Internet access on a network?
(a) TCP/IP (b) TELNET
(c) IPX/SPX (d) Not BEUI

95. A petabyte represents approximately
(a) 1000 gigabytes (b) 1000 kilobytes
(c) 1000 terabytes (d) 1000 yottabytes

General English

96. I have been working here _____ six months.
(a) since (b) by
(c) for (d) in

97. Defile
(a) Pollute (b) Disapprove
(c) Delay (d) Reveal

Directions (Q. Nos. 98 -101) *Each question consists of a word printed in capital letters, followed by four words or phrases. Choose the word or phrase that is most similar in meaning to the word in capital letters.*

98. POLEMIC
(a) black
(b) magnetic
(c) grimace
(d) controversial

99. The synonym for work FOOLHARDY is
(a) Erudite (b) Unwise
(c) Rusty (d) Roll

100. DEEP
(a) low (b) distracted
(c) flat (d) awake

101. Give the antonym for CRYPTIC.
(a) Futile (b) Candid
(c) Famous (d) Indifferent

Directions (Q. Nos. 102-111) *Answer the following four questions based on the given paragraph.*

A recent experimental study showed for the first time that pulmonary exposure to the Particulate Matter (PM) within diesel exhaust enhances atherogenesis. The human blood vessel endothelium is a sensitive target for air pollutants. The interactions of the inflammation and coagulation systems are of the main mechanisms involved in impairment of endothelial function and eventually cardiovascular diseases. The effect of air pollution on inflammation, oxidative stress and cardiovascular risk factors has been demonstrated not only in older adults, but also in young adults as well as in children and adolescents. The inflammation process stimulates the coagulation system and result in increased secretion of Tissue Factor (TF). Endothelial function has key roles in anticoagulant and fibrinolytic systems. In vitro studies have demonstrated significant decrease in endogenous anticoagulation activity, Thrombo Modulin (TM), endothelial protein C receptor antigen and culture of endothelial cells during the inflammation process. A growing body of evidence suggests that the effects of air pollution on the inflammation and the coagulation systems may have a role in endothelial dysfunction and in turn in the progression of cardiovascular diseases. Findings of experimental studies suggest that exposure to

air pollution may result in increase in TF and decrease in TM. Atherogenesis starts from the fatal life through interrelations or traditional risk factors with inflammatory, immune and endothelial biomarkers. Air pollution has various harmful effects on this process from early life. Studying the effects of environmental factors on early stages of atherosclerosis in early life can help identify the underlying mechanisms.

102. Choose the option for the human system mechanisms whose interactions eventually result into cardiovascular diseases due to air pollution?
(a) Inflammation (b) Coagulation
(c) Antigen (d) Both (a) and (b)

103. Which is the central syndrome talked about in the paragraph?
(a) Inflammation
(b) Atherogenesis
(c) Secretions of tissue factors
(d) Thrombo Modulin

104. Which of the following is true?
(i) Exposure to air pollution may result in increase in TF and decrease in TM.
(ii) Effect of air pollution is severe on humans and occurs after adolescence.
(iii) Endothelial cells are sensitive target for air pollutants.
(a) All are true (b) Only (i) and (ii) are true
(c) Only (i) and (iii) are true (d) Only (ii) and (iii) are true

105. The *primary* cause of cardiovascular disease due to factors discussed in paragraph is
(a) lack of immunity (b) anticoagulation
(c) thrombo modulin (d) endothelial Dysfunction

106. RETROGRADE
(a) progressing (b) declining
(c) evaluating (d) directing

107. The people _____ you socialise are called friends.
(a) with whom (b) who
(c) with who (d) whom

108. Every one of them ____ to the music every day.
(a) listen (b) listening
(c) listens (d) None of these

109. I didn't work hard when I was ____ school.
(a) in (b) on
(c) at (d) by

110. Where are you ____ ?
(a) from (b) by
(c) of (d) to

111. Which of these is an adjective in "It is ____"
(a) hard (b) hardly
(c) hardship (d) harden

Directions (Q. Nos. 112-116) *For each numbered blank space in the paragraph given below, choose the correct response.*

Paragraph

Books are 112 the most 113 product of human effort. Temples 114 to ruin, pictures and statues 115; but books 116.

112. Answer choices
(a) decidedly (b) definitely
(c) by far (d) certainly

113. Answer choices
(a) lasting (b) everlasting
(c) temporary (d) permanent

114. Answer choices
(a) break down (b) fall
(c) broken (d) crumble

115. Answer choices
(a) die (b) decay
(c) fade (d) disappear

116. Answer choices
(a) live (b) survive
(c) last (d) are born

117. Profound
(a) Shallow (b) Sonorous
(c) Superficial (d) Lofty

118. Give the analogy for Elsusive : Capture ::
(a) Elastic : Stretch
(b) Headstrong : Control
(c) Sensible : Decide
(d) Persuasive : Convince

119. The meaning of work EGRESS is
(a) entrance (b) exit
(c) double (d) program

120. Choose the wrongly spelt word.
(a) Deficient (b) Efficient
(c) Magnificient (d) Reticent

Answers *with* Solutions

1. (b) $\therefore \sin 30^\circ \cos 45^\circ + \cos 30^\circ \sin 45^\circ$

$$= \frac{1}{2} \times \frac{1}{\sqrt{2}} + \frac{\sqrt{3}}{2} \times \frac{1}{\sqrt{2}}$$

$$= \frac{1+\sqrt{3}}{2\sqrt{2}}$$

2. (a) Since, $\angle A + \angle B + \angle C = 180^\circ$

$\therefore \quad \angle A = 180^\circ - 45^\circ - 105^\circ = 30^\circ$

Using sine rule, $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$

$$\Rightarrow \quad \frac{\sin 30^\circ}{a} = \frac{\sin 45^\circ}{b} = \frac{\sin 105^\circ}{\sqrt{2}}$$

$$\Rightarrow \quad \frac{1}{2a} = \frac{1}{\sqrt{2}b} = \frac{\sin 75^\circ}{\sqrt{2}} = \frac{1+\sqrt{3}}{2\sqrt{2} \times \sqrt{2}}$$

$$\Rightarrow \quad \frac{1}{2a} = \frac{1}{\sqrt{2}b} = \frac{2}{4(\sqrt{3}-1)} = \frac{1}{2(\sqrt{3}-1)}$$

$$\Rightarrow \quad a = \sqrt{3} - 1, \; b = \sqrt{2}(\sqrt{3}-1)$$

3. (b) Given, $\tan\theta = \frac{b}{a}$

$\therefore \quad a\cos 2\theta + b \sin 2\theta$

$$= a\left(\frac{1-\tan^2\theta}{1+\tan^2\theta}\right) + b\left(\frac{2\tan\theta}{1+\tan^2\theta}\right)$$

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$$= a\left(\frac{1 - b^2/a^2}{1 + b^2/a^2}\right) + b\left(\frac{2b/a}{1 + b^2/a^2}\right)$$
$$= a\left(\frac{a^2 - b^2}{a^2 + b^2}\right) + b\left(\frac{2ab}{a^2 + b^2}\right)$$
$$= \frac{a(a^2 + b^2)}{a^2 + b^2} = a$$

4. (c) Given, $\sqrt{3}\cos x + \sin x = 3$

LHS $= \sqrt{3+1} \le \sqrt{3}\cos x + \sin x \le \sqrt{3+1}$

$\Rightarrow \quad -2 \le \sqrt{3}\cos x + \sin x \le 2$

Here, maximum value is 2, but right hand side is 3, hence no solution exists.

Alternate method

$$\sqrt{3}\cos x + \sin x = 3$$
$$\frac{\sqrt{3}}{2}\cos x + \frac{1}{2}\sin x = \frac{3}{2}$$
$$\sin\pi/3 \cdot \cos x + \cos\pi/3 \cdot \sin x = 3/2$$
$$\sin(\pi/3 + x) = 3/2$$

But $\quad \sin\left(\frac{\pi}{3} + x\right) \ne \frac{3}{2}$

$\because -1 \le \sin x \le 1$

So, no solution exist.

5. (c) $\therefore \dfrac{1 - \tan^2 15^\circ}{1 + \tan^2 15} = \dfrac{\cos^2 15^\circ - \sin^2 15^\circ}{\cos^2 15^\circ + \sin^2 15^\circ}$

$$= \frac{\cos 30^\circ}{1} = \frac{\sqrt{3}}{2}$$

6. (a) $\therefore$ Sum of probabilities = 1

$\therefore a + 3a + 5a + 7a + 9a + 11a + 13a + 15a + 17a = 1$

$\Rightarrow \quad 81a = 1 \quad \Rightarrow \quad a = \dfrac{1}{81}$

7. (b) $\therefore \ 11^2 + 12^2 + \ldots + 30^2$

$$= (1^2 + 2^2 + \ldots + 30^2) - (1^2 + 2^2 + \ldots + 10^2)$$

$$\left[\because \Sigma n^2 = \frac{n(n+1)(2n+1)}{6}\right]$$

$$= \frac{30(30+1)(60+1)}{6} - \left[\frac{10 \times (10+1)(20+1)}{6}\right]$$
$$= \frac{56730}{6} - \frac{2310}{6} = \frac{54420}{6} = 9070$$

8. (c) Given, $B = -A^{-1}BA$

$\Rightarrow \quad AB = -BA$

$\Rightarrow \quad AB + BA = 0 \qquad \ldots(i)$

$\therefore \quad (A + B)^2 = A^2 + B^2 + AB + BA$

$= A^2 + B^2$ [from Eq. (i)]

9. (a) Given system of equations is

$$3x_1 + 7x_2 + x_3 = 2$$
$$x_1 + 2x_2 + x_3 = 3$$
$$2x_1 + 3x_2 + 4x_3 = 13$$

$\therefore$ The coefficient matrix $A = \begin{vmatrix} 3 & 7 & 1 \\ 1 & 2 & 1 \\ 2 & 3 & 4 \end{vmatrix}$; $|A| = \begin{vmatrix} 3 & 7 & 1 \\ 1 & 2 & 1 \\ 2 & 3 & 4 \end{vmatrix}$

$= 3(8-3) - 7(4-2) + 1(3-4) = 0$

$$\text{adj}(A) = \begin{bmatrix} 5 & -2 & -1 \\ -25 & 10 & 5 \\ 5 & -2 & -1 \end{bmatrix}^T = \begin{bmatrix} 5 & -25 & 5 \\ -2 & 10 & -2 \\ -1 & 5 & -1 \end{bmatrix}$$

$$(\text{adj } A)\,B = \begin{bmatrix} 5 & -25 & 5 \\ -2 & 10 & -2 \\ -1 & 5 & -1 \end{bmatrix} \begin{bmatrix} 2 \\ 3 \\ 13 \end{bmatrix}$$

$$= \begin{bmatrix} 10 - 75 + 65 \\ -4 + 30 - 26 \\ -2 + 15 - 13 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

Hence, it has infinite number of solutions.

Alternate method

Augmented matrix $[A, B] = \left[\begin{array}{ccc|c} 3 & 7 & 1 & 2 \\ 1 & 2 & 1 & 3 \\ 2 & 3 & 4 & 13 \end{array}\right]$

$R_1 \leftrightarrow R_2$

$$\sim \left[\begin{array}{ccc|c} 1 & 2 & 1 & 3 \\ 3 & 7 & 1 & 2 \\ 2 & 3 & 4 & 13 \end{array}\right]$$

Use operations, $R_2 \to R_2 - 3R_1$, $R_3 \to R_3 - 2R_1$,

$$\sim \left[\begin{array}{ccc|c} 1 & 2 & 1 & 3 \\ 0 & 1 & -2 & -7 \\ 0 & -1 & 2 & 7 \end{array}\right]$$

$R_3 \to R_2 + R_3$,

$$\sim \left[\begin{array}{ccc|c} 1 & 2 & 1 & 3 \\ 0 & 1 & -2 & -7 \\ 0 & 0 & 0 & 0 \end{array}\right]$$

Here, Rank of $[A, B]$ = Rank of A

So, the system of equation is consistent.

Also, here rank of $A <$ Number of unknowns *i.e.*, $2 < 3$

Hence, the system has infinitely many solutions.

10. (b) Here, $\alpha + \beta = 2$ and $\alpha\beta = 4$

$\Rightarrow \quad (\alpha + \beta)^2 = 4$

$\Rightarrow \quad \alpha^2 + \beta^2 + 2\alpha\beta = 4$

$\Rightarrow \quad \alpha^2 + \beta^2 = 4 - 2(4) = -4$

$\Rightarrow \quad \alpha^4 + \beta^4 + 2\alpha^2\beta^2 = 16$

$\Rightarrow \quad \alpha^4 - \beta^4 = 16 - 2(16) = -16$

Now, $\quad \alpha^6 + \beta^6 = (\alpha^2)^3 + (\beta^2)^3$

$= (\alpha^2 + \beta^2)(\alpha^4 + \beta^4 - \alpha^2\beta^2)$

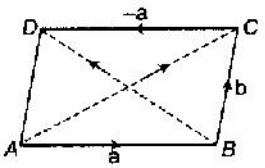
$= -4(-16 - 16) = 128$

11. (d) Given, $|a \times b| = |a \cdot b|$

$\Rightarrow \quad \|a\|\|b\||\sin\theta| = \|a\|\|b\||\cos\theta|$

$\Rightarrow \quad |\tan\theta| = 1 \quad \Rightarrow \quad \theta = \dfrac{\pi}{4}$

12. (c) $\therefore AC = a + b$



and $\quad BD = b - a$

$\therefore \quad AC - BD = 2C = 2AB$

13. (c) Since, $\cos^2 x = \sin x \tan x$

$\Rightarrow \quad \cos^3 x = \sin^2 x \qquad \ldots(i)$

$\therefore \quad \cot^6 x - \cot^2 x = \dfrac{\cos^6 x}{\sin^6 x} - \dfrac{\cos^2 x}{\sin^2 x}$

$$= \frac{\sin^6 x}{\sin^6 x} - \frac{\cos^2 x}{\sin^2 x} \qquad \text{[from Eq. (i)]}$$
$$= \frac{1 - \cos^2 x}{\sin^2 x}$$
$$\therefore \quad \frac{\sin^2 x}{\sin^2 x} = 1$$

14. (d) It is clear that, the greatest side is $x^2 + x + 1$

By cosine law

$$\therefore \cos\theta = \frac{(2x+1)^2 + (x^2-1)^2 - (x^2+x+1)^2}{2(2x+1)(x^2-1)}$$

$$= \frac{[(4x^2 + 1 + 4x) + (x^4 + 1 - 2x^2) - (x^4 + x^2 - 1 - 2x^3 + 2x + 2x^2)]}{2(2x^3 - 2x + x^2 - 1)}$$

$$= \frac{-2x^3 - x^2 + 2x + 1}{2(2x^3 - 2x + x^2 - 1)} = -\frac{1}{2}$$

$$\Rightarrow \quad \theta = 120^\circ$$

15. (d) Given, $2\sin^2\theta - 3\sin\theta - 2 = 0$

$$\Rightarrow \quad 2\sin^2\theta - 4\sin\theta + \sin\theta - 2 = 0$$

$$\Rightarrow 2\sin\theta(\sin\theta - 2) + 1(\sin\theta - 2) = 0$$

$$\Rightarrow \quad (\sin\theta - 2)(2\sin\theta + 1) = 0$$

$$\Rightarrow \quad \sin\theta = -\frac{1}{2}, \sin\theta \neq 2 \qquad (\because -1 \le \sin\theta \le 1)$$

$$\Rightarrow \quad \theta = n\pi - (-1)^n\left(\frac{7\pi}{6}\right)$$

16. (d) Given equation can be rewritten as $\frac{x}{3} + \frac{y}{2} = 1$ and $\frac{x}{2} + \frac{y}{3} = 1$.

∴ Lines intercept the coordinate axes are $A(3, 0)$, $B(0, 2)$, $C(2, 0)$ and $D(0, 3)$

Let equation of circle be

$$x^2 + y^2 + 2gx + 2fy + c = 0$$

Since, all points are concyclic.

$$\therefore \quad 9 + 6g + c = 0,\ 4 + 4f + c = 0$$

$$4 + 4g + c = 0,\ 9 + 6f + c = 0$$

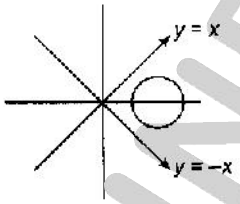
On solving, we get

$$g = -\frac{5}{2}, f = -\frac{5}{2}$$

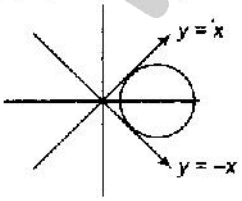
∴ Centre of circle

$$(-g, -f) = \left(\frac{5}{2}, \frac{5}{2}\right)$$

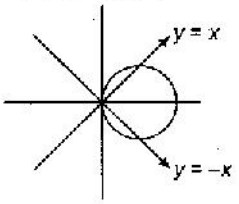
17. (d) *Case* I. Number of distinct solutions is zero.



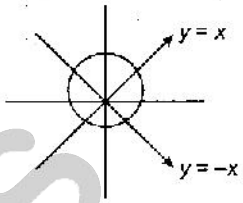
Case II. Number of distinct solutions is two.



Case III. Number of distinct solutions is three.



Case IV. Number of distinct solutions is four.



Hence, option (d) is correct.

18. (a) Given equation is, $y^2 - 8y - x + 19 = 0$

$$\Rightarrow \quad (y-4)^2 = x - 19 + 16$$

$$\Rightarrow \quad (y-4)^2 = x - 3$$

Hence, the vertex is (3, 4).

19. (b) Given, $9x^2 + 5y^2 - 30y = 0$

$$\Rightarrow \quad 9x^2 + 5(y^2 - 6y) = 0$$

$$\Rightarrow \quad 9x^2 + 5(y-3)^2 = 45$$

$$\Rightarrow \quad \frac{x^2}{5} + \frac{(y-3)^2}{9} = 1$$

Here, $a^2 = 5, b^2 = 9$ and $b > a$

$$\therefore \quad e = \sqrt{1 - \frac{a^2}{b^2}} = \sqrt{1 - \frac{5}{9}} = \frac{2}{3}$$

20. (c) Let $y = f(x) = 2^{x(x-1)}$

On taking log, we get

$$\log_2 y = x(x-1)\log_2 2$$

$$\Rightarrow \quad x^2 - x - \log_2 y = 0$$

$$\Rightarrow \quad x = \frac{1 \pm \sqrt{1 + 4\log_2 y}}{2}$$

$$\therefore \quad x = \frac{1 + \sqrt{1 + 4\log_2 y}}{2}$$

$$\therefore \quad f^{-1}(x) = \frac{1 + \sqrt{1 + 4\log_2 x}}{2}$$

Since, for $y \in [1, \infty)$, $4\log_2 y \ge 0$

$$\Rightarrow \quad \sqrt{1 + 4\log_2 y} \ge 1$$

$$\therefore \quad x = \frac{1 - \sqrt{1 + 4\log_2 y}}{2} \le 0 \notin [1, \infty)$$

21. (c) Let a polygon has n sides.

$$\therefore \quad {}^nC_2 - n = 44$$

$$\Rightarrow \quad \frac{n(n-1)}{2} - n = 44$$

$$\Rightarrow \quad n(n-3) = 88$$

$$\Rightarrow \quad n(n-3) = 11(11-3) \Rightarrow \quad n = 11$$

22. (b) Now, $n(A \cup B) = n(A) + n(B) - n(A \cap B)$

$$= 200 + 300 - 100 = 400$$

Also, $n(A' \cap B') = 300$

$$\Rightarrow \quad n(A \cup B)' = 300$$

$$\Rightarrow n(X) - n(A \cup B) = 300$$

$$\Rightarrow \quad n(X) = 300 + 400 = 700$$

23. (c) Let the number of newspapers be n.

$$\therefore \quad 300 \times 5 = 60 \times n$$

$$\Rightarrow \quad n = 25 \text{ newspaper (exactly)}$$

24. (c) Given number is 223355888.

Here, digits are (2, 2, 3, 3, 5, 5, 8, 8, 8).

Here, odd digits are (3, 3, 5, 5) and even digits are (2, 2, 8, 8, 8).

In a nine digit number, there are four even position in which four odd number (3, 3, 5, 5) can be arranged in

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$\frac{4!}{2! \times 2!} = 6$ and rest of five odd position, five even number (2, 2, 8, 8, 8) can be arranged in $\frac{5!}{2! \times 3!} = 10$

$\therefore$ Total number of ways $= 6 \times 10 = 60$

25. (c) Given, $P(I) = 0.4$, $P(II) = 0.3$,
$P(III) = 0.2$, $P(IV) = 0.1$
$\Rightarrow P(\bar{I}) = 0.6$, $P(\bar{II}) = 0.7$, $P(\overline{III}) = 0.8$
and $P(\overline{IV}) = 0.9$
$\therefore$ Required probability
$= P(I) + P(\bar{I})\, P(II) + P(I)\, P(\bar{II})\, P(III)$
$+ P(\bar{I})\, P(\bar{II})\, P(\overline{III})\, P(IV)$
$= 0.4 + (0.6)(0.3) + (0.6)(0.7)(0.2) - (0.6)(0.7)(0.8)(0.1)$
$= 0.4 + 0.18 + 0.084 + 0.0336 = 0.6976$

26. (a) Given, $(k-2)x^2 + 8x + k + 4 > 0$
$\Rightarrow (k-2) > 0$ and $D < 0$
$\Rightarrow k > 2$ and $D < 0$ ...(i)
Now, $64 - 4(k-2)(k+4) < 0$
$\Rightarrow 16 - (k^2 + 2k - 8) < 0$
$\Rightarrow k^2 + 2k - 8 > 16$
$\Rightarrow k^2 + 2k - 24 > 0$
$\Rightarrow (k+6)(k-4) > 0$

$+$ (−6) $-$ (4) $+$

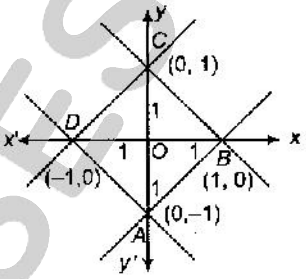
$\Rightarrow k < -6$ or $k > 4$ ...(ii)
$\therefore$ From Eqs. (i) and (ii), we get $k > 4$
$\therefore$ Hence, least integral value of k is 5.

27. (b) We know, $(1-x)^{2n} = C_0 + C_1 x + \ldots + C_{2n} x^{2n}$
$= C_0 x^{2n} + C_1 x^{2n-1} + \ldots + C_{2n}$ ...(i)
and $(1-x)^{2n} = C_0 - C_1 x + \ldots + C_{2n} x^{2n}$ ...(ii)
On multiplying Eqs. (i) and (ii), we get
$(1-x^2)^{2n} = (C_0 x^{2n} + C_1 x^{2n-1} + \ldots + C_{2n})$
$\times (C_0 - C_1 x + \ldots + C_{2n} x^{2n})$
On equating coefficient of x^{2n} on both sides, we get
$(-1)^n C_n = C_0^2 - C_1^2 + C_2^2 - \ldots + C_{2n}^2$
$= \sum_{k=0}^{2n} (-1)^k \left(\frac{2n}{k}\right)^2 = A$ (given) ...(i)
Similarly, we can find
$C_1^2 - 2C_2^2 + 3C_3^2 - \ldots - 2n\, C_{2n}^2$
$= \sum_{k=0}^{2n} (-1)^k\, k \left(\frac{2n}{k}\right)^2 = (-1)^n \cdot n \cdot C_n$
$\therefore \sum_{k=0}^{2n} (-1)^k\, k \left(\frac{2n}{k}\right)^2 - 2n \sum_{k=0}^{2n} (-1)^k \left(\frac{2n}{k}\right)^2$
$= (-1)^n \cdot n \cdot C_n - 2n(-1)^n \cdot C_n$
$= -(-1)^n\, n \cdot C_n = -nA$ [from Eq. (i)]

28. (b) Given, $\log_3 (x+2)(x+4) + \log_{1/3} (x+2) < \frac{1}{2} \log_{\sqrt{3}} 7$
$\Rightarrow \log_3 (x+2)(x-4) - \log_3 (x+2) - \log_3 7 < 0$
$\Rightarrow \log_3 \frac{(x+2)(x+4)}{(x+2)7} < 0,\ x \neq -2$
$\Rightarrow \log_3 \frac{(x+4)}{7} < 0,\ x \neq -2$
$\Rightarrow \frac{x+4}{7} < 1,\ x \neq -2$
$\Rightarrow x < 3,\ x \neq -2$
$\therefore -2 < x < 3$ [$\because x < -2 \log (x+2)$ is not defined]

29. (c) Since, $b = \frac{2ac}{a+c}$ (given)
$\therefore \log(a+c) + \log(a+c-2b)$
$- \log[(a+c)^2 - (a+c)2b]$
$= \log[(a+c)^2 - 4ac] = \log(c-a)^2 = 2\log(c-a)$

30. (b) Given, $|x| + |y| = 1$



$\Rightarrow \pm x \pm y = 1$
Here, $ABCD$ is square whose side
$BC = \sqrt{1^2 + 1^2} = \sqrt{2}$
$\therefore$ Area of square $= (\sqrt{2})^2 = 2$

31. (c) According to the given condition,
$\frac{1^2 + 2^2 + \ldots + n^2}{n} = 11$
$\Rightarrow \frac{n(n+1)(2n+1)}{6n} = 11$
$\Rightarrow 2n^2 + 3n - 65 = 0$
$\Rightarrow n = \frac{-3 \pm \sqrt{9 + 8 \times 65}}{4} = \frac{-3 \pm \sqrt{529}}{4}$
$= \frac{-3 \pm 23}{4} = 5, -\frac{13}{2}$
$\therefore n = 5$ ($\because n$ cannot be negative)

32. (b) Since, probability of defective razor blade is 0.002, therefore, probability of non-defective razor blade is 0.998
$\therefore$ Probability of non-defective razor blade in one packet
$= {}^{10}C_{10} (0.998)^{10} = 0.980179$
$\therefore$ Required number of packets $= 0.980179 \times 10000$
$= 9801.79 = 9802$ (approx)

33. (d) Let line of regression y on x is
$y = -\frac{3}{2}x + 13$
and x on y is $x = -\frac{y}{6} + \frac{31}{6}$
$\therefore b_{yx} = -\frac{3}{2}$ and $b_{xy} = -\frac{1}{6}$
$\therefore r = -\sqrt{b_{yx} \cdot b_{xy}}$
$= -\sqrt{\left(-\frac{3}{2}\right)\left(-\frac{1}{6}\right)} = -\sqrt{\frac{1}{4}}$
$= -\frac{1}{2} = -0.5$

34. (c) Let d be the distance in first half and second half respectively of the journey. Time taken in first half and second half journey are $\frac{d}{v_1}$ and $\frac{d}{v_2}$ respectively.
$\therefore$ Average velocity $= \frac{\text{Total distance}}{\text{Total time}}$
$= \frac{2d}{\frac{d}{v_1} + \frac{d}{v_2}} = \frac{2v_1 v_2}{v_1 + v_2}$

35. (c) Since, mean $= \frac{n+7}{3}$

$\therefore \quad \frac{1+2+\ldots+n}{n} = \frac{n+7}{3}$

$\Rightarrow \quad \frac{n(n+1)}{2n} = \frac{n+7}{3}$

$\Rightarrow \quad 3n+3 = 2n+14$

$\Rightarrow \quad n = 11$

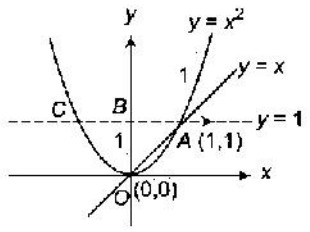
36. (a) $\int_0^{1/2} \frac{dx}{\sqrt{x-x^2}} - \int_0^{1/2} \frac{dx}{\sqrt{x-x^2+\frac{1}{4}-\frac{1}{4}}}$

$= \int_0^{1/2} \frac{dx}{\sqrt{\frac{1}{4}-\left(x-\frac{1}{2}\right)^2}} = \left[\sin^{-1}\left(\frac{x-\frac{1}{2}}{\frac{1}{2}}\right)\right]_0^{1/2}$

$= [\sin^{-1}(2x-1)]_0^{1/2}$

$= \sin^{-1}(0) - \sin^{-1}(-1) = 0 - \left(-\frac{\pi}{2}\right) = \frac{\pi}{2}$

37. (a) Since, it is given area of curve $OAO = A$



Now, area of $\Delta OAB = \frac{1}{2} \times 1 \times 1 = \frac{1}{2}$

$\therefore$ Area of curve $OABO \quad A + \frac{1}{2}$

$\therefore$ Total required area = area of curve $OABCO$

$= 2$ (area of curve $OABO$)

$= 2\left(A + \frac{1}{2}\right)$

$= (2A + 1)$ sq units

38. (a) $\therefore (2\mathbf{a}-\mathbf{b}) \cdot [(2\mathbf{b}-\mathbf{c}) \times (2\mathbf{c}-\mathbf{a})]$

$= (2\mathbf{a}-\mathbf{b}) \cdot [(2\mathbf{b} \times 2\mathbf{c}) - (2\mathbf{b} \times \mathbf{a}) - \mathbf{0} + (\mathbf{c} \times \mathbf{a})]$

$= \{8[\mathbf{a}\ \mathbf{b}\ \mathbf{c}] - 0 + 0 - 0 + 0 - [\mathbf{b}\ \mathbf{c}\ \mathbf{a}]\}$

$= 7[\mathbf{a}\ \mathbf{b}\ \mathbf{c}] = 0 \qquad [\because [\mathbf{a}\ \mathbf{b}\ \mathbf{c}] = 0$ (given)]

39. (c) Since, the angle between the vectors a and b is acute and the angle between b and y-axis lies between $\frac{\pi}{2}$ and π, it means they are obtuse.

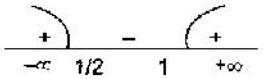
$\therefore \mathbf{a} \cdot \mathbf{b} > 0$ and $\mathbf{b} \cdot \mathbf{j} < 0$

$\Rightarrow (\mathbf{i} - 3\mathbf{j} - \mathbf{k}) \cdot (2\mathbf{i} + x\mathbf{j} - \mathbf{k}) > 0$

and $(2\mathbf{i} + x\mathbf{j} - \mathbf{k}) \cdot \mathbf{j} < 0$

$\Rightarrow \quad 2x^2 - 3x - 1 > 0$ and $x < 0$

$\Rightarrow \quad (2x-1)(x-1) > 0$ and $x < 0$



$\Rightarrow \quad \left(x < \frac{1}{2}$ or $x > 1\right)$ and $x < 0$

$\Rightarrow \quad x < 0$

40. (c) Given, $\mathbf{v} = 2\mathbf{i} + \mathbf{j} - \mathbf{k}$ and $\mathbf{w} = \mathbf{i} + 3\mathbf{k}$

$\therefore \quad [\mathbf{u}\ \mathbf{v}\ \mathbf{w}] = \mathbf{u} \cdot (\mathbf{v} \times \mathbf{w}) \le |\mathbf{u}|\,|\mathbf{v} \times \mathbf{w}|$ $(\because |\mathbf{a} \cdot \mathbf{b}| \le |\mathbf{a}|\,|\mathbf{b}|)$

$\Rightarrow \quad [\mathbf{u}\ \mathbf{v}\ \mathbf{w}] \le |\mathbf{v} \times \mathbf{w}|$ $(\because |\mathbf{u}| = 1)$

Now, $\mathbf{v} \times \mathbf{w} = \begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ 2 & 1 & -1 \\ 1 & 0 & 3 \end{vmatrix} = 3\mathbf{i} - 7\mathbf{j} - \mathbf{k}$

$\Rightarrow \quad |\mathbf{v} \times \mathbf{w}| = \sqrt{3^2 + 7^2 + 1^2} = \sqrt{59}$

$\therefore \quad [\mathbf{u}\ \mathbf{v}\ \mathbf{w}] \le \sqrt{59}$

41. (a) Given, $xy = r^2$ ...(i)

Let $u = px + qy$ [from Eq. (i)]

$\Rightarrow \quad u = px + q\left(\frac{r^2}{x}\right)$

$\Rightarrow \quad \frac{du}{dx} = p - \frac{qr^2}{x^2}$

For maxima and minima, put $\frac{du}{dx} = 0$

$\Rightarrow \quad p - \frac{qr^2}{x^2} = 0 \Rightarrow x = \pm\, r\sqrt{\frac{q}{p}}$

Now, $\frac{d^2u}{dx^2} = \frac{2qr^2}{x^3}$

At $x = r\frac{\sqrt{q}}{p}$

$\frac{d^2u}{dx^2} > 0$, minima

$\therefore$ Minimum value is $u = p \times r\sqrt{\frac{q}{p}} + q\left(\frac{r^2}{r\sqrt{\frac{q}{p}}}\right)$

$= pr\sqrt{\frac{q}{p}} + qr\sqrt{\frac{p}{q}}$

$= r\sqrt{pq} + r\sqrt{pq} = 2r\sqrt{pq}$

42. (d) Given, $\int_0^{\pi/2} \left\{a^2\left(\frac{\cos 3x}{4} + \frac{3}{4}\cos x\right) + a\sin x - 20\cos x\right\} dx \le -\frac{a^2}{3}$

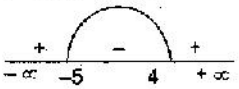
$\Rightarrow \left[a^2\left(\frac{\sin 3x}{12} + \frac{3}{4}\sin x\right) - a\cos x - 20\sin x\right]_0^{\pi/2} \le -\frac{a^2}{3}$

$\Rightarrow \left[a^2\left(-\frac{1}{12} + \frac{3}{4} - 0 - 0\right) - a(0-1) - 20(1-0)\right] \le -\frac{a^2}{3}$

$\Rightarrow \quad \frac{8a^2}{12} + a - 20 \le -\frac{a^2}{3}$

$\Rightarrow \quad a^2 + a - 20 \le 0$

$\Rightarrow \quad (a-4)(a+5) \le 0$



$\Rightarrow \quad -5 \le a \le 4$

Since, a is a positive integer, hence four values of a (*i.e.*, 1, 2, 3, 4) exist.

43. (d) $\frac{d}{dx}\left(\sqrt{x} - \frac{5}{\sqrt{x}}\right) = \frac{x^{-1/2}}{2} + \frac{1}{2}5x^{-3/2} = \frac{1}{2\sqrt{x}} + \frac{5}{2}x^{-3/2}$

44. (b) $\lim_{x\to\infty} \sqrt{\frac{x+\sin x}{x-\cos x}} = \lim_{x\to\infty} \sqrt{\frac{1+\frac{\sin x}{x}}{1-\frac{\cos x}{x}}} = \sqrt{\frac{1+0}{1-0}} = 1$

45. (b) Given, $f(x) = \int_0^x t\sin t\, dt$

On differentiating w.r.t. x, we get

$f'(x) = x\sin x$ (by Leibnitz theorem)

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Solutions (Q. Nos. 46-48)

A's amount $= 500 \times \frac{1}{4} - 2 = ₹ 123$

$\therefore B$'s amount $= ₹ 123 - ₹ 21 = ₹ 102$

(A's + B's) amount $= ₹ 123 + ₹ 102 = ₹ 225$

Remaining amount $= ₹ 500 - ₹ 225 = ₹ 275$

$\therefore$ D's amount $= ₹ 128$

$\therefore$ C's amount $= ₹ 128 + ₹ 19 = ₹ 147$

46. (a) C's amount $= ₹ 147$

47. (a) B's amount $₹ 102$

48. (c) C get the highest amount ₹ 147.

49. (b) Number 2 represents the educated, hardworking and urban people.

50. (b) Number 7 represents non-urban educated people who are neither hardworking nor honest.

51. (d) Number 9 represents honest, educated and hardworking non-urban people.

52. (d) Let the entire estate was ₹ x.

(Daughter + Son)'s estate $= ₹ \frac{x}{2}$

$\because$ Daughter and son sharing ratio is 4 : 3.

$\therefore$ Daughter's estate $= ₹ \frac{x}{2} \times \frac{4}{7} = ₹ \frac{4x}{14}$

Son's estate $= ₹ \frac{x}{2} \times \frac{3}{7} = ₹ \frac{3x}{14}$

So, mother's estate $= 2 \times ₹ \frac{3x}{14} = ₹ \frac{6x}{14}$

Remaining estate $= x - \left(\frac{x}{2} + \frac{6x}{14}\right)$

$= x - \frac{13x}{4} - ₹ \frac{x}{14}$

Then, $\frac{x}{14} = 500 \Rightarrow x = ₹ 7000$

53. (c) Suppose number of boys $= b$

1st boy dances with 5 girls (1 + 4 = 5)

2nd boy dances with 6 girls (2 + 4 = 6)

3rd boy dances with 7 girls (3 + 4 = 7)

$\therefore b$th boy dances with $(b + 4)$ girls

Hence, $g = b + 4$

$\Rightarrow \quad b = g - 4$

54. (a) Five years ago total age of husband and wife

$= 22 \times 2$

$= 44$ yr

Present age of husband and wife $= 44 + 2 \times 5$

$= 44 + 10 = 54$ yr

$\therefore$ Total age of the family $= 54 + 3 = 57$ yr

Hence, average age of the family $= \frac{57}{3} = 19$ yr

55. (c) Availability of observable evidences will be acceptable for establishing a fact.

Solutions (Q. Nos. 56-59)

From the given information, we can definitely say that B's presentation will be immediately before C's presentation and their presentation together will be either pre lunch or post lunch. D is either first or last scientist to present his paper.

56. (d) If C is fifth scientist to present his paper, then B must be fourth to present his paper because B's presentation will be immediately before C's presentation.

57. (b) We know that B and C scientists presentation cannot be separated by the lunch break, in this case B could be placed in third order of presenters.

58. (d) From the given information, we can say that, D is the first scientist and F is the second scientist, then C can be present in only either fifth or sixth place. As B and C have to present in two consecutive position either pre lunch or post lunch.

59. (c) If F and E are fifth and sixth scientists, then D will be the first scientist, B and C will be the second and third presenters. Hence, A is the fourth presenter.

Solutions (Q. Nos. 60-63)

Persons	Occupation	Male/Female	Relationship
Grandmother	Lawyer	Female	Reena's mother-in-law
Mukesh	Teacher	Male	
Rakesh	Teacher	Male	
Reena	Lawyer	Female	Rakesh's wife
Ajay	———	Male	Mukesh's son
Mukesh's wife	Doctor	Female	

60. (c) Rakesh's wife profession is a lawyer.

61. (b) Three male members in the family.

62. (b) We cannot determined Ajay's grandfather occupation.

63. (d) We cannot determined the profession of Ajay.

Solutions (Q. Nos 64-66)

Time taken for stitching school uniforms

School	Cutting	Stitching	Button Stitching
May flower	20 min	60 min	15 min
Little flower	30 min	60 minu	30 min

Number of fabric cutters = 2

Number of tailors = 5

Number of assistants = 2

Each of them do the work for 10 h.

Time duration for fabric cutters $= 2 \times 10$ h

$= 20$ h

$= 1200$ min

Time duration for tailors $= 5 \times 10$ h

$= 50$ h

$= 3000$ min

Time duration for button stitchers $= 2 \times 10$ h

$= 20$ h

$= 1200$ min

Maximum number of Little flower uniforms that can be cut in a day $= \frac{1200}{30} = 40$

Maximum number of Little flower uniforms that can be stitch in a day $= \frac{3000}{60} = 50$

Maximum number of Little flower uniforms that can be buttoned in a day $= \frac{1200}{30} = 40$

64. (c) Number of Little flower uniforms that Mrs Thomas can complete in a day = 40

65. (a) If Mrs Thomas decided to complete 20 Little flower uniforms.

Then, time duration for fabric cutters

$= 1200 - (20 \times 30)$

$= 600$ min

Time duration for tailors $= 3000 - (20 \times 60)$

$= 1800$ min

Time duration for assistants $= 1200 - (20 \times 30)$

$= 600$ min

Hence, number of May flower uniforms that can be completed in a day $=$ minimum of $\left(\frac{600}{20}, \frac{1800}{60}, \frac{600}{15}\right)$

$=$ minimum of $(30, 30, 40) = 30$

66. (b) If Mrs Thomas hires one more assistants, then time duration for button stitchers
$= 1200 + (1 \times 10 \times 60) = 1800$ min
Hence, maximum May flower uniforms that can be completed in a day = minimum of $\left(\frac{1200}{20}\ \frac{3000}{60}\ \frac{1800}{15}\right)$
= minimum of $(60, 50, 120) = 50$

67. (a)

R	I	P	P	L	E	and	L	I	F	E
↓	↓	↓	↓	↓	↓		↓	↓	↓	↓
6	1	3	3	8	2		8	1	9	2

Hence

P	I	L	L	E	R
↓	↓	↓	↓	↓	↓
3	1	8	8	2	6

68. (b) Doctor go to see the patients before
$1:40$ pm $= 1:40$ pm $- 3:30$
$= 13:40$ pm $- 3:30$ h
$= 10:10$ am
Hence, required time $= 10:10 + 1:20 = 11:30$ am

69. (c) Only statements (ii) and (iii) logically follow the conclusion.

70. (b)

E		A		I	
1	2	3	4	5	6

Hence, number of ways $= 3! \times 3!$
$= 3 \times 2 \times 3 \times 2$
$= 36$

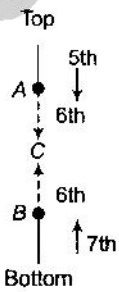
71. (d) Numbers between 4 to 55 which are divisible by 3 and contain 3 as one of the digits are 6, 9, 12, 13, 15, 18, 21, 23, 24, 27, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 42, 43, 45, 48, 51, 53, 54 = 27 numbers.
Hence, remaining number $= 52 - 27 = 25$

72. (d) The pattern of the series is

5	12	19	33	47	75	103
	+7	+7	+14	+14	+28	+28

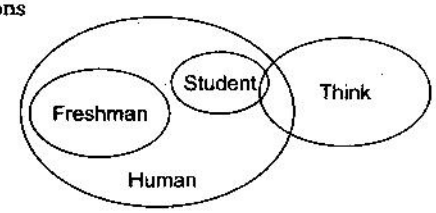
Hence, 104 is the wrong number.

73. (b) C's position from the top $= 5th + 6th$
$= 11th$
C's position from the bottom $= 7th + 8th$
$= 13th$
Hence, total number of students in the class
$= (11 + 13) - 1$
$= 23$



74. (b) Suppose, $2^2 + 3^2 < 4^2$ ($\because 4 + 9 < 16$),
$\Rightarrow \quad 2^3 + 3^3 < 4^3$ ($\because 8 + 27 < 64$)
$\Rightarrow \quad 2^4 + 3^4 < 4^4$ ($\because 16 + 81 < 256$)
So, solving the pattern be conclude that for higher value
$n > 1$
$2^n + 3^n < 4^n$
Then, $X + Y < Z$

75. (a) According to the statements, Venn-diagram is
Conclusions
I. ×
II. ✓
III. ×
IV. ×



76. (c) $A^+ \xleftarrow{\text{Brother}} D^+ \xrightarrow{\text{Wife}} B$ – (Drove)
$[+ \rightarrow$ male, $- \rightarrow$ female$]$
E^+ (Drove)
Hence, C is definitely the other lady in the group.

77. (d) The given pattern follows the three series.
I $\rightarrow 61 \xrightarrow{+0} 61 \xrightarrow{+0} 61$
II $\rightarrow 57 \xrightarrow{-14} 43 \xrightarrow{-14} 29$
III $\rightarrow 50 \xrightarrow{-14} 36 \xrightarrow{-14} 22$

78. (d) Given equation, $3 - 9 \times 27 + 9 \div 3 = 3$
From option (d), interchanging the signs
$3 \times 9 - 27 + 9 \div 3 = 3$
$\Rightarrow \quad 27 - 27 + 3 = 3$
$\Rightarrow \quad 3 = 3$

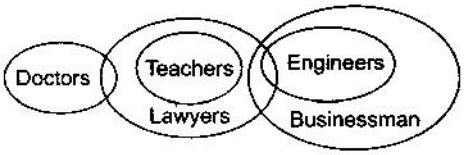
79. (b) Let the present age of Pushpa be x yr. Then, the present age of Rita would be $(x - 2)$ yr.
So, $x = 2(x - 2 - 2)$
$\Rightarrow \quad x = 2x - 8$
$\Rightarrow \quad x = 8$ yr
Therefore, the present age of Pushpa is 8 yr.

80. (b) Time from 8 am of a particular day to 1 pm on the following day = 29 h. Now, the clock gains 10 min in 24 h, it means that 24 h 10 min of this clock is equal to 24 h of the correct clock.
$\frac{145}{6}$ h of this clock = 24 h of the correct clock
24 h of this clock $= \frac{24}{145} \times 6 \times 29$
= 28 h, 48 min of the correct clock
24 h of this clock = 28 h 48 min of the correct clock.
It means that the clock in question is 12 min faster than the correct clock. Therefore, when clock indicates 1 pm the correct time will be 48 min past 12.

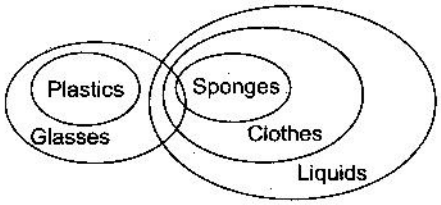
81. (b) Answer figure (b) is correct substitute of the problem figure (4).

82. (c) According to the statements, Venn-diagram is
Conclusions
I. ✓
II. ×
III. ✓
IV. ×

83. (d) According to the statements, Venn-diagram is
Conclusions
I. ×
II. ✓
III. ×
IV. ✓



84. (a) According to the statements, Venn-diagram is
Conclusions
I. ×
II. ×
III. ×
IV. ×



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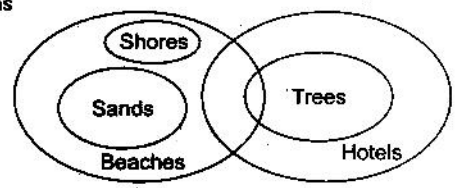
85. (a) According to the statements, Venn-diagram is

Conclusions

I. ×
II. ×
III. ✓
IV. ×



86. (b) The ASCII code of A in decimal system is 65, which can be written as 41 in hexadecimal system.

16	65	1
	4	

$\Rightarrow \quad (65)_{10} = (41)_{16} = 41$ H

87. (c) We know that, n bit byte can represent $(2)^n$ different characters.

Hence, 8 bit byte can represent $(2)^8 = 256$ characters.

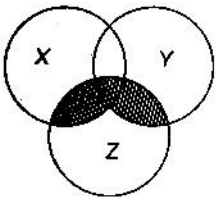
88. (b) Least significant bit is the only bit which is equal to odd number in magnitude $(2^0 = 1)$

It represent any odd decimal number.

This bit must be included. So, in any an odd decimal number least significant bit must be 1.

89. (b) Given Venn-diagram

In Set theory, this Venn-diagram shows the following **expression**



$Z \cap (X \cup Y)$ ...(i)

We know that, in Boolean Algebra

$\cap$ = AND operation = $\cup$ = OR operation = +

From Eq. (i), the required Boolean expression is $Z \cdot (X + Y)$.

90. (d) The given Boolean expression is

Let $E = x \cdot (x + y)$

$= x \cdot x + x \cdot y$ "by distributive law"

$= x + x \cdot y$ "by idempotent law"

$= x \cdot (1 + y)$ "by distributive law"

$= x \cdot 1$ "by boundness law"

$= x$ "by identity law"

which is the required simplified form of E.

91. (b) From options

(i) $A + 1 = 1$ is boundness law

(ii) $AA = A$ is idempotent law

(iii) $A + 0 = A$ is identity law

(iv) $A = (A')'$ is involution law

But $A = A'$ is not a valid rule of Boolean algebra which is valid in matrix and is called symmetric matrix.

92. (d) When two binary numbers are added, then an overflow will never occur if, the carry into the sign bit position is 1

93. (a)

$$\begin{array}{r} 11010 \\ +\ 01111 \\ \hline 101001 \end{array}$$

94. (a) TCP/IP ⇒ Transmission Control Protocol/Internet Protocol.

95. (c) We know that, 1 petabyte = 2^{50} bytes

$\approx 10^{15}$ = 1000 Terabyte

(∵ Terabyte = $2^{40} \approx 10^{12}$)

96. (c) **97.** (b) **98.** (d) **99.** (b) **100.** (a) **101.** (b)
102. (d) **103.** (a) **104.** (b) **105.** (b) **106.** (b) **107.** (a)
108. (c) **109.** (a) **110.** (a) **111.** (a) **112.** (b) **113.** (d)
114. (d) **115.** (a) **116.** (c) **117.** (c) **118.** (d) **119.** (d)
120. (c)