NIMCET MCA
Solved Paper 2008

Mathematics

1. If two events A and B such that $P(A') = 0.3$, $P(B) = 0.5$ and $P(A \cap B) = 0.3$, then $P\left(\frac{B}{A \cup B'}\right)$ is

(a) $\frac{1}{4}$ (b) $\frac{3}{8}$
(c) $\frac{1}{8}$ (d) None of these

2. If $y = mx$ bisects the angle between the lines $x^2(\tan^2\theta + \cos^2\theta) + 2xy\tan\theta - y^2\sin^2\theta = 0$ when $\theta = \frac{\pi}{3}$, then the value of $\sqrt{3}m^2 + 4m$ is

(a) 1 (b) $\frac{1}{\sqrt{3}}$
(c) $\sqrt{3}$ (d) $7\sqrt{3}$

3. If $f : R \to R$ and $g : R \to R$ and continuous functions, then the value of the integral $\int_{-\pi/2}^{\pi/2} [f(x) + f(-x)][g(x) - g(-x)]\,dx$ is

(a) π (b) 1
(c) -1 (d) 0

4. The maximum value of $(\cos\alpha_1)(\cos\alpha_2)\ldots(\cos\alpha_n)$ where $0 \le \alpha_1, \alpha_2, \alpha_n \le \frac{\pi}{2}$ and $(\cot\alpha_1)(\cot\alpha_2)\ldots(\cot\alpha_n) = 1$ is

(a) $\frac{1}{2^{n/2}}$ (b) $\frac{1}{2^n}$
(c) $\frac{1}{2n}$ (d) 1

5. Let M be a point inside the ΔABC. Then, which one of the following is true?

(a) $AB + AC < MB + MC$
(b) $AB + AC > MB + MC$
(c) $AB + AC = MB + MC$
(d) None of the above

6. A line L has intercepts 'a' and 'b' on the coordinate axes. When the axes are rotated through a given angle, keeping the origin fixed, the same line has intercepts 'p' and 'q' which of the following statements is true?

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

7. If a, b are the roots of $x^2 + px + 1 = 0$ and c, d are roots of $x^2 + qx + 1 = 0$ the value of $E = (a - c)(b - c)(a + d)(b + d)$ is

(a) $p^2 - q^2$ (b) $q^2 - p^2$
(c) $q^2 + p^2$ (d) None of these

8. If $f(x) + f(1 - x) = 2$, then the value of $f\left(\frac{1}{2001}\right) + f\left(\frac{2}{2001}\right) + \ldots + f\left(\frac{2000}{2001}\right)$ is

(a) 2000 (b) 2001
(c) 1999 (d) 1998

9. Suppose a, b, c are in AP with common difference d. Then, $e^{1/c}$, $e^{b/ac}$ $e^{1/a}$ are in

(a) AP (b) GP
(c) HP (d) None of these

10. Let α and β be the roots of the equation $x^2 + x + 1 = 0$. The equation whose roots are α^{19} and β^7 is

(a) $x^2 - x - 1 = 0$ (b) $x^2 + x - 1 = 0$
(c) $x^2 - x + 1 = 0$ (d) $x^2 + x + 1 = 0$

11. In the expression $(x + 1)(x + 4)(x + 9)(x + 16)\ldots(x + 400)$ the coefficient of x^{19} is

(a) 2870 (b) 210
(c) 4001 (d) 1900

12. The value of $y = -0.36\log_{0.25}\left(\frac{1}{3} + \frac{1}{3^2} + \ldots\right)$ is

(a) 0.9 (b) 0.18
(c) 0.6 (d) 0.25

13. If $H_1, H_2, \ldots, H_n$ are n harmonic means between a and b, $a \ne b$, then the value of $\frac{H_1 + a}{H_1 - a} + \frac{H_n + b}{H_n - b}$ is equal to

(a) $n + 1$ (b) $n - 1$
(c) $2n$ (d) $2n + 3$

14. For $a > 0$, $a \ne 1$, the number of values of x satisfying the equation $2\log_x(a) + \log_{ax}(a) - 3\log_{a^2x}(a) = 0$

(a) 2 (b) 3
(c) 4 (d) 5

NIMCET MCA Solved Paper 2008

15. An eight digit number divisible by 9 is to be formed by using 8 digits out of the digits 0, 1,...,9 without replacement. The number of ways in which this can be done is
(a) 9! (b) 2(7!)
(c) 4(7!) (d) 36(7!)

16. The number of ordered pairs $(m, n), m, n \in \{1,2,\ldots,100\}$ such that $7^m + 7^n$ is divisible by 5 is
(a) 1250 (b) 2000
(c) 2500 (d) 5000

17. If a, b, c are the roots of the equation $x^3 - 3px^2 + 3qx - 1 = 0$, then the centroid of the triangle with vertices $\left(a, \frac{1}{a}\right)$, $\left(b, \frac{1}{b}\right)$ and $\left(c, \frac{1}{c}\right)$ is at the point
(a) (p, q) (b) $\left(\frac{p}{3}, \frac{q}{3}\right)$
(c) $(p+q, p-q)$ (d) $(3p, 3q)$

18. Equation of the common tangent touching the circle $(x-3)^2 + y^2 = 9$ and the parabola $y^2 = 4x$ above the x-axis is
(a) $\sqrt{3}y = 3x + 1$
(b) $\sqrt{3}y = -(x + 3)$
(c) $\sqrt{3}y = x + 3$
(d) $\sqrt{3}y = -(3x + 1)$

19. The number of roots of the equation $|x^2 - x - 6| = x + 2$ is
(a) 2 (b) 3
(c) 4 (d) None of these

20. A pair of unbiased dice is rolled together till a sum of either 5 or 7 is obtained. The probability that 5 comes before 7 is
(a) 3/5 (b) 2/5
(c) 4/5 (d) None of these

21. A letter is taken at random from the letters of the word 'STATISTICS' and another letter is taken at random from the letters of the word 'ASSISTANT'. The probability that they are the same letter is
(a) $\frac{1}{45}$ (b) $\frac{13}{90}$
(c) $\frac{19}{90}$ (d) $\frac{5}{8}$

22. A bag contains 6 red and 4 green balls. A fair dice is rolled and a number of balls equal to that appearing on the dice is chosen from the urn at random. The probability that all the balls selected are red is
(a) $\frac{1}{3}$ (b) $\frac{3}{10}$
(c) $\frac{1}{8}$ (d) None of these

23. The value of λ for which the volume of parallelopiped formed by the vectors $\mathbf{i} + \lambda\mathbf{j} + \mathbf{k}$, $\mathbf{j} + \lambda\mathbf{k}$ and $\lambda\mathbf{i} + \mathbf{k}$ is minimum is given by
(a) -3 (b) 3
(c) $\frac{1}{\sqrt{3}}$ (d) $-\sqrt{3}$

24. A six faced die is a biased one. It is thrice more likely to show an odd number than to show an even number. It is thrown twice. The probability that the sum of the numbers in the two throws is even, is
(a) 4/8 (b) 5/8
(c) 6/8 (d) 7/8

25. A letter is known to have come from either TATANAGAR or CALCUTTA. On the envelope, just two consecutive letters, TA, are visible. The probability that the letter has come from CALCUTTA is
(a) 4/11 (b) 1/3
(c) 5/12 (d) None of these

26. If $\cos\alpha + \cos\beta = a$, and $\sin\alpha + \sin\beta = b$ and θ is the arithmetic mean between α and β, then $\sin 2\theta + \cos 2\theta$ is equal to
(a) $\frac{(a+b)^2}{(a^2+b^2)}$ (b) $\frac{(a-b)^2}{(a^2+b^2)}$
(c) $\frac{a^2-b^2}{a^2+b^2}$ (d) None of these

27. If $(1 + \tan 1^\circ)(1 + \tan 2^\circ)\ldots(1 + \tan 45^\circ) = 2^n$, then the value of n is
(a) 21 (b) 22
(c) 23 (d) 24

28. The value of $\sin 12^\circ \sin 48^\circ \sin 54^\circ$
(a) $\sin 30^\circ$ (b) $\sin^2 30^\circ$
(c) $\sin^3 30^\circ$ (d) $\cos^3 30^\circ$

29. The value of λ such that the four points whose position vectors are $3\mathbf{i} - 2\mathbf{j} + \lambda\mathbf{k}$, $6\mathbf{i} + 3\mathbf{j} + \mathbf{k}$, $5\mathbf{i} + 7\mathbf{j} + 3\mathbf{k}$ and $2\mathbf{i} + 2\mathbf{j} + 6\mathbf{k}$ are coplanar is
(a) -6 (b) 4
(c) 5 (d) 8

30. Let $\mathbf{A} = 2\mathbf{i} + \mathbf{j} - 2\mathbf{k}$ and $\mathbf{B} = \mathbf{i} + \mathbf{j}$. If $\mathbf{C}$ is a vector such that $\mathbf{A}\cdot\mathbf{C} = |\mathbf{C}|$, $|\mathbf{C} - \mathbf{A}| = 2\sqrt{2}$ and the angle between $\mathbf{A} \times \mathbf{B}$ and $\mathbf{C}$ is 30° then $|(\mathbf{A} \times \mathbf{B}) \times \mathbf{C}|$ is equal to
(a) $\frac{2}{3}$ (b) $\frac{3}{2}$
(c) 2 (d) 3

31. A rigid body is rotating at the rate of 3 rads about an axis AB, where A and B are the points $(1, -2, 1)$ and $(3, -4, 2)$. The velocity of the point P at $(5, -1, -1)$ of the body is
(a) $3\mathbf{i} + 8\mathbf{j} + 10\mathbf{k}$ (b) $\frac{3\mathbf{i} + 8\mathbf{j} + 10\mathbf{k}}{3}$
(c) $\frac{2\mathbf{i} - 2\mathbf{j} + \mathbf{k}}{3}$ (d) $4\mathbf{i} + \mathbf{j} + 2\mathbf{k}$

32. If $\mathbf{A} + \mathbf{B} + \mathbf{C} = \mathbf{0}$, $|\mathbf{A}| = 3$, $|\mathbf{B}| = 5$, $|\mathbf{C}| = 7$, then the angle between $\mathbf{A}$ and $\mathbf{B}$ is
(a) $\frac{\pi}{6}$ (b) $\frac{2\pi}{3}$
(c) $\frac{5\pi}{3}$ (d) $\frac{\pi}{4}$

33. If $f(x)$ is a polynomial satisfying $f(x)\cdot f\left(\frac{1}{x}\right) = f(x) + f\left(\frac{1}{x}\right)$ and $f(3) = 28$, then $f(4)$ is given by
(a) 63 (b) 65
(c) 67 (d) 68

34. Suppose $P_1, P_2, ..., P_{30}$ are thirty sets each having 5 elements and $Q_1, Q_2, ..., Q_n$ are n sets with 3 elements each. Let $\bigcup_{i=1}^{30} P_i = \bigcup_{j=1}^{n} Q_j = S$ and each element of S belongs to exactly 10 of the P_is and exactly 9 of the Q_js. Then n is equal to

(a) 15 (b) 3
(c) 45 (d) None of these

35. The number of functions f from the set $A = \{0, 1, 2\}$ into the set $B = \{0, 1, 2, 3, 4, 5, 6, 7\}$ such that $f(i) \le f(j)$ for $i < j$ and $i, j \in A$ is

(a) ${}^8C_3$ (b) ${}^8C_3 + 2({}^8C_2)$
(c) ${}^{10}C_3$ (d) None of these

36. The value of $\int_0^{\pi/2} \frac{dx}{1+\tan^3 x}$ is

(a) 0 (b) 1
(c) $\frac{\pi}{4}$ (d) $\frac{\pi}{2}$

37. The integer n for which $\lim_{x\to 0} \frac{(\cos x - 1)(\cos x - e^x)}{x^n}$ is a finite non-zero number is

(a) 1 (b) 2
(c) 3 (d) 4

38. The area of the plane bounded by the curves $y = \sqrt{x}$, $x \in [0, 1]$, $y = x^2$, $x \in [1, 2]$ and $y = -x^2 + 2x + 4$, $x \in [0, 2]$ is

(a) $\frac{10}{7}$ sq units
(b) $\frac{19}{3}$ sq units
(c) $\frac{3}{5}$ sq unit
(d) $\frac{4}{3}$ sq units

39. The function $f(x) = 2 \sin x - \sin 2x$, $x \in [0, 2\pi]$ has absolute maximum and minimum at

(a) $\frac{\pi}{3}, \frac{5\pi}{3}$ (b) $\frac{\pi}{3}, \pi$
(c) $\frac{5\pi}{3}, \pi$ (d) None of these

40. If $y = \sec^{-1}\left(\frac{x+1}{x-1}\right) + \sin^{-1}\left(\frac{x-1}{x+1}\right) x \in [0, \infty)$ and $x \neq 1$, then $\frac{dy}{dx}$ is equal to

(a) 1 (b) $\frac{x-1}{x+1}$
(c) 0 (d) $\frac{x+1}{x-1}$

Analytical Reasoning

41. You are given two (unmarked) containers of capacity 9 and 4 L and a huge tank of water. Need is to get a measure of exactly 6 L of water. A move is either filling a container completely or emptying a container (either fully or partially). The smallest number of moves needed to do this task is

(a) 8 (b) 10
(c) 12 (d) None of these

42. What is the next letter in the seris OTTFFFSSSSN?

(a) T (b) O
(c) E (d) N

43. What is the diameter of the largest circle that can be drawn on a chessboard so that its entire circumference gets covered by the balck squares and no part of the circumference on any white space, given that the chessboard has black and white squares of size one inch.

(a) 1 inch (b) $\sqrt{2}$ inch
(c) $\sqrt{10}$ inch (d) $2\sqrt{3}$ inch

44. A car is filled with $4\frac{1}{2}$ L of fuel for a round trip. If amount of fuel taken while goings is $\frac{1}{4}$th more than the amount taken for coming, what is the amount of fuel consumed when coming back?

(a) 1.5 (b) 2
(c) 1.75 (d) None of these

45. Which of the following are greater than x when $x = \frac{9}{11}$?

I. $\frac{1}{x}$ II. $\frac{x+1}{x}$ III. $\frac{x+1}{x-1}$

(a) I only (b) I and II only
(c) I and III only (d) II and III only

46. Four friends-Arjan, Bhuvan, Guran and Lakha comparing the number of sheeps that they owned. It was found that Guran had ten more sheeps than Lakha. If Arjan gave one-third to Bhuvan and Bhuvan gave a quarter of what he then held to Guran, who then passed on a fifth of his holding to Lakha, they would all have an equal number of sheep. How many sheeps did each of them possess? Give the minimal possible answer.

(a) 200, 105, 110, 100
(b) 90, 55, 55, 45
(c) 180, 110, 110, 100
(d) None of the above

47. In a class, six students P, Q, R, S, T and U are the top six rank holders, not necessarily in the same order. R did not get the 4th rank. P's rank is higher than U's and R's but lower than Q's. Among these six rankers, there are four students whose ranks are lower than S's rank and five students whose ranks are above that of T. Who is ranked 5th in the class?

(a) U (b) T
(c) R (d) None of these

NIMCET MCA Solved Paper 2008

48. Three players-Aalu, Kachaalu and Bhalu were playing pocker and suddenly started to quarrel among themselves blaming each other for cheating. It was found out that atleast one person among the three cheated. When they were asked who cheated, their replies were as follows.

Aalu I did not cheat, Kachaalu cheated.
Kachaalu I did not cheat, both Aalu and Bhalu cheated.
Bhalu I did not cheat, only Kachaalu did not cheat.

If exactly one person among them always spoke truth, another always lied and the third alternated between the truth and lie, then which of the following statements can never be true in any case?

(a) Only Aalu and Bhalu cheated.
(b) Only Aalu and Bhalu did not cheat.
(c) Bhalu always spoke the truth.
(d) Bhalu alternated between truth and lie

49. If x and y are the two digits of the number $565xy$ such that this number is divisible by 80, then $x + y$ is equal to

(a) 2 (b) 3
(c) 8 (d) 6

50. If both 7^2 and 3^3 are factors of the number $(a \cdot 11^3 \cdot 6^2 \cdot 13^{11})$, then what is the smallest possible value of a?

(a) 1323 (b) 147
(c) 21 (d) 3087

51. Let x, y and z be distinct integers, x and y are odd and positive, and z is even and positive. Which one of the following statements cannot be true?

(a) $(x - z)^2 y$ is even (b) $(x - z) y^2$ is odd
(c) $(x - z) y$ is odd (d) $(x - y)^2 z$ is even

52. From a height of 16 m, a ball fell down and each time it bounces half the distance back. What is the distance travelled?

(a) 45 m (b) ∞
(c) 48 m (d) 24 m

53. If a man walks at the rate of 4 km/h, he misses a train by only 6 min. However, if he walks at the rate of 5 km/h he reaches the station 6 min before the arrival of the train. Find the distance covered by him to reach the station.

(a) 4 km (b) 7 km
(c) 9 km (d) 5 km

Directions (Q. Nos. 54-57) *Read the following statements and answer questions.*

The office staff of XYZ corporation presently consists of three book keepers, P, Q, R and 5 secretaries S, T, U, V, W. The Management is planning to open a new office in another city using 2 book keepers and 3 secretaries of the present staff. To do so they plan to separate certain individuals who don't function well together. The following guidelines were established to set up the new office.

(i) Book keepers P and R are constantly finding fault with one another and should not be sent together to the new office as a team.
(ii) R and T function well alone but not as a team, they should be separated.
(iii) S and V have not been on speaking terms and shouldn't go together.
(iv) Since, S and U have been competing for promotion they shouldn't be a team.

54. If P is to be moved as one of the bookkeepers, which of the following cannot be a possible working unit?

(a) PQSTW (b) PQSVW
(c) PQTUW (d) PQTVW

55. If R and U are moved to the new office, how many combinations are possible?

(a) 1 (b) 2
(c) 3 (d) 4

56. If R is sent to the new office, which member of the staff cannot go with R?

(a) Q (b) S
(c) W (d) V

57. If S goes to the new office, which of the following is true?

(a) Only R cannot go
(b) Only P cannot go
(c) Only P and R cannot go
(d) R cannot go and W must go

58. Substitute digits for the letters to make the following relation true.

$$\begin{array}{r} S\,T\,I\,L\,L \\ +\,W\,I\,T\,H\,I\,N \\ \hline L\,I\,M\,I\,T\,S \end{array}$$

Note The leftmost letter can't be zero in any word. Also, there must be a one-to-one mapping between digits and letters. *e.g.*, if you substitute 3 for the letters *S*, no other letter can be 3 and all other *S* in the puzzle must be 3.

(a) 98533 + 258056 = 356589
(b) 41211 + 527013 = 938224
(c) 98533 + 158056 = 256589
(d) 47166 + 517013 = 614179

59. 12 members were present at a board meeting. Each member shook hands with all of the other members before and after the meeting. How many hand shakes were there?

(a) 118 (b) 127
(c) 132 (d) 264

60. The letters P, Q, R, S, T, U and V not necessarily in that order represents seven consecutive integers from 22 to 33.
U is as much less than Q as R is greater than S.
V is greater than U.
Q is the middle term.
P is 3 greater than S.

Can you find the sequence of letters from the lowest value to the highest value?

(a) PVSQRTU (b) SUTQPRV
(c) USVQPRT (d) TUSQRPV

61. There were a total of 10 bicycles and tricycles. If the total number of wheels was 24, how many tricycles were there?

(a) 4 (b) 6
(c) 8 (d) 2

62. A person travels on a cycle from home to church on a straight road with wind against him. He took 4 h to reach there. On the way back to the home, he took 3 h to reach as wind was in the same direction. If there is no wind, how much time does he take to travel from home to church?
(a) 3 h 35 min 12 s
(b) 3 h 32 min 32 s
(c) 3 h 30 min 00 s
(d) 3 h 25 min 42 s

63. What are the next three numbers in the given series.
1 1 2 1 2 2 3 1 2 2 3 2 3 3 4 1 2 2 3 2 3 3 4 2 3 3?
(a) 2, 3, 4 (b) 2, 3, 2
(c) 1, 2, 3 (d) 4, 3, 4

64. In the middle of the confounded desert, there is the lost city of "Ash". To reach it, I will have to travel overland by foot from the coast. On a trek like this, each person can only carry enough rations for five days and the farthest we can travel in one day is 30 miles. Also, the city is 120 miles from the starting point. What I am trying to figure out is the fewest number of persons, including myself, that I will need in our group so that I can reach the city, stay overnight, and then return to the coast without running out of supplies. How many persons (including myself) will I need to accomplish this mission?
(a) 5 (b) 6 (c) 4 (d) 3

65. A woman took a certain number of eggs to the market and sold some of them. The next day through her poultry industry, the number left over had been doubled, and she sold the same number as the previous day. On the third day, the new remainder was tripled, and she sold the same number as before. On the fourth day, the remainder was quadrupled, and her sale were the same as before. On the fifth day, what had been left over were quintupled, yet she sold exactly the same as on all the previous occasions and so disposed of her entire stock. What is the smallest number of eggs she could have taken to the market the first day, and how many did she sell daily?
(a) 110.50 (b) 127.65
(c) 100.60 (d) 103.60

66. The Bulls, Pacers, Lakers and Jazz ran for a contest. Anup, Sujit, John made the following statements regarding results.
- Anup said either Bulls or Jazz will definitely win.
- Sujit said he is confident that Bulls will not win.
- John said he is confident that neither Jazz nor Lakers will win.

When the result came, it was found that only one of the above three had made a correct statement. Who has made the correct statement and who has won the contest?
(a) Anup, Bulls (b) John, Pacers
(c) Sujit, Lakers (d) Sujit, Jazz

67. A certain street has 1000 buildings. A sign-maker is contracted to number the houses from 1 to 1000. How many zeroes will be needed?
(a) 128 (b) 190
(c) 181 (d) 192

68. Examine the following sequence of numbers.
1
1 1
2 1
1 2 1 1
1 1 1 2 2 1
3 1 2 2 1 1
1 3 1 1 2 2 2 1
1 1 1 3 2 1 3 2 1 1
3 1 1 3 1 2 1 1 1 3 1 2 2 1
What are the next two numbers in the given series?
(a) 1 3 2 1 1 3 1 1 1 2 2 1 1 1 2 3 1 1 3 1 and 1 1 2 1 3 2 1 1 3 2 1 2 2 2 1 1 1 1 3 1 2 2 1 1 3 3
(b) 2 3 1 1 3 1 1 2 2 1 1 1 3 2 1 1 3 1 1 1 and 1 1 1 2 1 3 2 1 1 3 2 1 2 2 2 1 1 1 3 1 2 2 1 1 3 3
(c) 1 1 2 3 1 1 3 1 1 2 2 1 1 1 3 2 1 1 3 1 and 1 1 1 3 1 2 2 1 2 1 2 2 2 1 1 3 3 1 1 2 1 3 2 1 1 3
(d) 1 3 2 1 1 3 1 1 1 2 3 1 1 3 1 1 2 2 1 1 and 1 1 1 3 1 2 2 1 1 3 3 1 1 2 1 3 2 1 1 3 2 1 2 2 2 1

69. There were two men standing on a street. The one says to the other. "I have 3 daughters, the product of their ages is 36. What is the age of the OLDEST daughter?"
The second guy says, "I need more informaton." So, the first guy says, "The sum of their ages is equal to the address of the house across the street."
The second guy looks at the address and says, "I still need more information". So, the first guy says. "My oldest daughter wears a red dress."
(a) 9 (b) 6
(c) 12 (d) 4

70. Three Gold (G) coins, three Silver (S) coins and three Copper (C) coins are arranged in a single row as follows
- Only 2 adjacent unlike coins can be moved at any one time.
- The moved coins must be in contact with atleast one other coinc in line *i.e.*, no pair of coins is to be moved and placed away from the remaining ones.
- No coin pairs can be reversed *i.e.*, S-C combination must remain in that order in its new position when it is moved.

What is the minimum number of moves required to get all the coins in following order?
C C C S S S G G G
(a) 6 (b) 9
(c) 8 (d) 12

71. Mr. and Mrs. Birla and Mr. and Mrs. Tata competed in a Chess tournament. Of the three games played
I. In only the first game were the two players married to each other.
II. The men won two games and the women won one game.
III. The Birlas won more games than the Tatas.
IV. Anyone who lost a game did not play a subsequent game.
Who did not lose a game?
(a) Mr Birla (b) Mrs Birla
(c) Mr Tata (d) Mrs Tata

NIMCET MCA Solved Paper 2008

72. Of the three numbers, second is twice the first and is also thrice the third. If the average of three numbers is 44, the largest number is
(a) 24 (b) 36
(c) 72 (d) 108

73. Larger, medium and small ships are used to bring water. 4 large ships carry as much water as 7 small ships. 3 medium ships carry the same amount of water as 2 large ships and 1 small ship. 15 large, 7 medium and 14 small ships, each made 36 journeys and brought a certain quantity of water. In how many journeys would 12 large, 14 medium and 21 small ships bring the same quantity of water?
(a) 32 (b) 25 (c) 29 (d) 49

74. Five men P, Q, R, S and T read newspaper. The one who reads first gives it to R. The one who reads last had taken it from P. T was not the first or the last to read. There were two readers between Q and P. To whom did Q pass the newspaper?
(a) R (b) P
(c) S (d) T

75. An airline has a certain free luggage allowance and charges for excess luggage at a fixed rate per kg. Two passengers Raja and Rahim have 60 kg of luggage between them, and are charged ₹ 1200 and ₹ 2400, respectively for excess luggage. Had the entire luggage belonged to one of them, the excess luggage charge would have been ₹ 5400. What is the weight of Rahim's luggage?
(a) 20 kg (b) 25 kg
(c) 30 kg (d) 35 kg

76. A group of 630 children is arranged in rows for a group photograph session. Each row contain three fewer children than the row in front of it. What numbers of rows is not possible?
(a) 3 (b) 4
(c) 5 (d) 6

Directions (Q. Nos. 77-80) *Read the following passage and answer the questions.*

Sports (and game) persons P, Q, R, S, T, U and V of a university are at the Bengaluru Airport. Five of them are selected players and leaving to participate in the Grand Sports Event in five different events cricket, carrom, badminton and table tennis being held at 5 different cities Mumbai, Chennai, Kolkata, Delhi and Hyderabad.
(i) P is going to Delhi, but he does not play either cricket or carrom.
(ii) Q has come to give send off to *R*, who is a chess player and is not leaving to either Mumbai or Hyderabad.
(iii) S is leaving to Kolkata to play table tennis.
(iv) U is leaving to Mumbai but he does not play either badminaton or cricket.
(v) T is not a selected player.

77. Who plays badminton?
(a) P (b) Q (c) R (d) S

78. Cricketer goes to
(a) Mumbai (b) Hyderabad
(c) Chennai (d) Delhi

79. Player of which game goes to Delhi?
(a) Badminton (b) Chess
(c) Cricket (d) Table Tennis

80. Who plays chess and where is he going?
(a) R and Chennai (b) S and Mumbai
(c) U and Delhi (d) None of these

Directions (Q. Nos. 81-85) *Read the following information carefully and answer the questions.*
(i) $P \psi Q$ means P is mother of Q
(ii) $P \subset Q$ means P is sister of Q
(iii) P $ Q means P is father of Q
(iv) P # Q means P is brother of Q

81. Which of the following means N is definitely daughter of K?
(a) K $ L # M # N (b) M ψ K $ N ∈ L
(c) K ψ M # L ∈ N (d) L ψ K $ N # M

82. Which of the following means R is brother of T?
(a) R ψ S # U $ T (b) U ψ R # S # T
(c) U ψ R ∈ S ψ T (d) T # $ $ Q ∈ R

83. Which of the following means X is real grandmother of Y?
(a) X ∈ Z ψ K $ L # Y (b) Y ψ K $ X # L
(c) Y # L $ K ψ X ∈ Z (d) K # X ψ Z # L $ Y

84. If K ψ L ∈ M # N, then how K is related with N?
(a) Mother (b) Aunt
(c) Great Aunt (d) Grandmother

85. Which of the following means K is nephew of M?
(a) N # M $ L # K ∈ O (b) K # L $ N ∈ O $ M
(c) L ψ O # M $ O ∈ K (d) M # N $ L # K $ O

86. There are six houses in a row. Mr. Lal has Mr. Babu and Mr. Anil as neighbours. Mr. Bhatia has Mr. Gupta and Mr. Sharma as neighbours. Mr. Gupta's house is no next to Mr. Babu or Mr. Anil and Mr. Sharma does not live next to Mr. Anil. Who are Mr. Babu's next-door neighbours?
(a) Mr. Lal and Mr. Bhatia (b) Mr. Lal and Mr. Anil
(c) Mr. Sharma and Mr. Lal (d) Only Mr. Lal

87. A watch which gains 10 s in 5 min was set correct at 9 am When the watch indicated 20 min past 7 0′ clock, the same evening, the true time is
(a) 7 pm (b) 7:40 pm
(c) 7:10 pm (d) 8 pm

88. A boy observes the reflection of a clock in a mirror. The time observed by the boy in the mirror is 3 h 45 min. What is the actual time shown in the clock?
(a) 8 h 45 min (b) 9 h 45 min
(c) 8 h 15 min (d) 9 h 15 min

89. Gold is 19 times as heavy as water and copper is 9 times as heavy as water. In what ratio should these be mixed to get an alloy 15 times as heavy as water?
(a) 1 : 2 (b) 2 : 3
(c) 3 : 2 (d) 1 : 1

90. In an objective type examination, 120 objective type questions are there : each with 4 options P, Q, R and S. A candidate can choose either one of these options or can leave the question unanswered. How many different ways exist for answering this question paper?
(a) 5^{120} (b) 4^{120}
(c) 120^5 (d) 120^4

Computer Awareness

91. A CPU has an arithmetic unit that adds bytes and then sets its V,C and Z flag bits as follows : The V-bit is set if arithmetic overflow occurs. The C-bit is set if a carry-out is generated from the most significant bit during an operation. The Z-bit is set if the result is zero. What are the values of the V, C and Z flag bits respectively after the 8-bit bytes 1100 1100 and 1000 1111 are added?
(a) 0, 0, 0 (b) 1, 1, 0
(c) 1, 1, 1 (d) 0, 1, 0

92. Which one of the following statements is always true?
(a) A compiled program uses more memory than an interpreted program.
(b) A compiler converts a program to a lower level language for execution.
(c) A compiler for a high level language takes less memory than its interpreter.
(d) Compiled programs take more time to execute than interpreted programs.

93. Floating point numbers in a computer are represented using a 10-bit mantissa (including a sign bit) and a 7-bit exponent (including a sign bit). What is the approximate value of the maximum number, which can be represented? Assume that the mantissa is stored in the normalised form, that is, without leading zeroes.
(a) 2^{128} (b) 2^{127}
(c) 2^{64} (d) 2^{63}

94. The capacity of a memory unit is defined by the number of words multiplied by the number of bits per word. How many separate address and data line are needed for a memory of $4K \times 16$?
(a) 10 address lines and 16 data lines
(b) 12 address lines and 10 data lines
(c) 12 address lines and 16 data lines
(d) 12 address lines and 8 data lines

95. The main disadvantage of direct mapping of cache organization is that
(a) it doesn't allow simultaneous access to the intended data and its tag.
(b) it is more expensive than other type of organizations.
(c) the cache hit ratio is degreaded if two or more blocks used alternatively map onto the same block frame in the cache.
(d) the number of blocks required for the cache increases linearly with the size of the main memory.

96. Let $A[1...10]$ be an array, let $A[i] = 2i$ for $1 \le i \le 10$. After the assignment $j = A[A[5]]$ is executed, the value of $A[j]$ is equal to
(a) Undefined (b) 1
(c) 5 (d) 10

97. The first instruction of bootstrap loader program of an operating system is stored in
(a) RAM (b) BIOS
(c) Hard disk (d) None of these

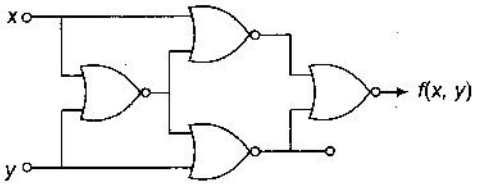
98. The function $AB'C + A'BC - ABC' + A'B'C$ is equivalent to
(a) $AC' + AB + A'C$
(b) $AB' + AC' + A'C$
(c) $A'B + AC' + AB'$
(d) $A'B + AC + AB'$

99. The additon of 4 bit, 2's complement binary numbers 1101 and 0100 results in
(a) 0001 and an overflow
(b) 1001 and no overflow
(c) 0001 and no overflow
(d) 1001 and an overflow

100. Given $\sqrt{(224)}_r = (13)_r$, the value of radix r is
(a) 10 (b) 8
(c) 6 (d) 5

101. Let $A = 11111010$ and $B = 00001010$ be two 8 bit 2's complement numbers. Their product in 2's complement is
(a) 11000100 (b) 10011100
(c) 10100101 (d) 11010101

102. Identify the logic function performed by the circuit.



(a) Exclusive OR (b) Exclusive NOR
(c) NAND (d) NOR

103. Which of the following is (are) true about virtual memory systems that uses pages?
I. The virtual address space can be larger than the amount of physical memory.
II. Programs must be resident in main memory throughout their execution.
III. Pages correspond to semantic characteristics of the programs.
(a) I only (b) II only
(c) I and II (d) I and III

104. The minimum number of gates needed to implement the Boolean function $f(x, y, z) = z(x + y) + \overline{(\bar{z} + x + y)(\bar{x} + \bar{y})}$ is
(a) 2 (b) 3
(c) 4 (d) 5

105. How many bits are required to store an ASCII character?
(a) 7 (b) 6
(c) 8 (d) None of these

NIMCET MCA Solved Paper 2008

General English

Directions (Q. Nos. 106-107) *Read the following information carefully and answer the questions.*

Each sentence given in the questions has two blanks, each blank indicating that something has been omitted. Beneath the sentence are four sets of words. Choose the set of words for each blank that best fits the meaning of the sentence as a whole.

106. Greek philosophers tried to ..... contemporary notions of change and stability by postulating the existence of the atom, ... particle from which all varieties of matter are formed.
(a) confirm... an interesting
(b) reconcile... an indivisible
(c) simplify ... a specific
(d) eliminate... an infinitesimal

107. The Tata group will need all its considerable management ..... and ..... to manage tough challenges ahead after taking over Corus Steel.
(a) skills...interests
(b) knowledge...manpower
(c) acumen...onus
(d) experience...brand equity

Directions (Q. Nos. 108-109) *Read the following information carefully and answer the questions.*

In each of the following questions, a related pair of words or phrases is followed by four pairs of words or phrases. Select the pair that best expresses a relationship similar to that expressed in the original pair.

108. INFLAMMABLE : IGNITED :: ..... : .....
(a) Fragile : Shattered
(b) Flexible : Broken
(c) Famous : Plagiarized
(d) Somber : Mourned

109. SAVANT : OBTUSE :: ..... : .....
(a) Seer : Ominous (b) Writer : Verbose
(c) Judge : Melodramatic (d) Athlete : Sluggish

Directions (Q. Nos. 110-111) *Each question consists of a word printed in capital letters, followed by four words or phrases. Choose the word or phrase that is* ***most nearly opposite*** *in meaning to the word in capital letters.*

110. OPPROBRIUM
(a) Honour (b) Prudence
(c) Ostentation (d) Umbrage

111. INCESSANT
(a) Perpetual (b) Persistent
(c) Sporadic (d) Unrelenting

Directions (Q. Nos. 112-113) *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.*

112. EXASPERATE
(a) Pacify (b) Mollify
(c) Irritate (d) Placate

113. INIMICAL
(a) Antagonistic (b) Anonymous
(c) Fanciful (d) Accurate

Directions (Q. Nos. 114–116) *Read the following passage and answer the questions, based on what is stated or implied in the passage.*

Declassification of government documents has shed new light on the events comprising the Cuban missile Crisis of October 1962. Prior to the accessibility of these records, the only source of account of the Crisis for scholars and historians were the personal memoirs and narratives of the officials who served under Kennedy and Krushchev during this period. Many of the declassified documents are transcriptions and notes of meetings between members of the CIA and President Kennedy's Cabinet, as well as the President himself. The revelations in these documents have demonstrated the inadvertent inaccuracies and intended obscurities inherent in the first-person narratives of the Crisis, and has aided historians from all three countries involved in the Crisis to get a more authentic representation of what truly transpired, and for what reasons. Of perhaps the most interest to historians are declassified correspondence between John F. Kennedy and Nikita Krushchev that challenge the idea that the height of the Crisis extended only over the course of thirteen days. Indeed, these letters indicate that the Crisis was far from resolved by Krushchev's October 28 decision to withdraw the Soviet missiles from Cuba : instead it endured far into the following month, while America slept fitfully under the illusion of peace.

114. The author is mainly concerned with
(a) Petitioning the government to make all classified documents of historic interest accessible to the general public.
(b) Discounting the sense of danger many Americans felt during the Cuban Missile Crisis
(c) Revealing a calculated deception perpetrated by members of Kennedy's Cabinet.
(d) Illustrating how previously accepted ideas based on hearsay are being refuted by concrete evidence.

115. According to the passage, which of the following statement(s) is/are true for the Cuban Missile Crisis?
I. The Crisis is still shrounded in mystery.
II. The memories of those closely involved in the Crisis were not entirely factual.
III. The crisis spanned thirteen tense days.
(a) I only (b) II only
(c) III only (d) II and III

116. The author's use of the phrase "inadvertent inaccurancy and intended obscurities" suggests all of the following EXCEPT
(a) historical record is often skewed by human perception
(b) details of the crisis were purposely omitted or vague
(c) every politician deals in deception and prevarication
(d) memory is incapable of recapturing the full details of an event

Directions (Q. Nos. 117–118) *In each of the following questions, a sentence is given with a blank followed by four alternatives. Choose the word or phrase that most correctly completes the sentences.*

117. Mary did not attend office yesterday. She ..... for a picnic.
(a) will have gone (b) have gone
(c) may have gone (d) would go

118. I don't know where Maya is. She ..... at home.
(a) would be (b) is
(c) can be (d) could be

119. Choose the most appropriate meaning for the following idiom 'To fish in troubled waters'
(a) To make the situation worse
(b) To make profit when others in trouble
(c) To create trouble for others
(d) To indulge in evil acts

120. Read the following sentence and choose one underlined word or phrase that would not be appropriate in standard English. One of the chair's legs was broken and the upholstery need mending
(a) the (b) chair's
(c) legs (d) needed

Answers *with* Solutions

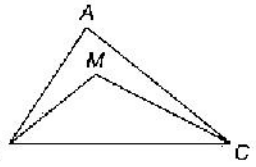
1. (b) $P(A) = 1 - P(A') = 1 - 0.3$
$= 0.7$
$P(B) = 1 - P(B') = 1 - 0.5$
$= 0.5$
$P(A \cap B) = P(A) - P(A \cap B')$
$= 0.7 - 0.3 = 0.4$
$\Rightarrow P(A \cup B) = P(A) + P(B) - P(A \cap B)$
$= 0.7 + 0.5 - 0.4$
$= 0.8$
Now, $P\left(\dfrac{B}{A \cup B'}\right) = \dfrac{P[B \cap (A \cup B)]}{P(A \cup B')}$
$= \dfrac{P[(B \cap A) \cup (B \cap B)]}{P(A \cup B')}$
$= \dfrac{P(B \cap A)}{P(A \cup B')} = \dfrac{0.3}{0.8} = \dfrac{3}{8}$

2. (c) Equation of angle bisectors of $ax^2 + 2hxy + by^2 = 0$ is
$$\frac{x^2 - y^2}{a - b} = \frac{xy}{h}$$
$\Rightarrow$ Angle bisectors of
$x^2(\tan^2\theta + \cos^2\theta) + 2xy\tan\theta - y^2\sin^2\theta = 0$ is
$$\frac{x^2 - y^2}{\tan^2\theta + \cos^2\theta + \sin^2\theta} = \frac{xy}{\tan\theta}$$
$$\Rightarrow \quad \frac{x^2 - y^2}{\sec^2\theta} = \frac{xy}{\tan\theta} \qquad (\because \theta = \pi/3)$$
$$\Rightarrow \quad \frac{x^2 - y^2}{4} = \frac{xy}{\sqrt{3}} \qquad \ldots(i)$$
As $y = mx$ satisfy Eq. (i), so
$$\frac{x^2 - m^2x^2}{4} = \frac{mx^2}{\sqrt{3}}$$
$$\Rightarrow \quad \frac{1 - m^2}{4} = \frac{m}{\sqrt{3}}$$
$$\Rightarrow \quad \sqrt{3} - \sqrt{3}m^2 = 4m$$
$$\Rightarrow \quad \sqrt{3}m^2 + 4m = \sqrt{3}$$

3. (d) Let $h(x) = [f(x) + f(-x)][g(x) - g(-x)]$
$\Rightarrow h(-x) = [f(-x) + f(x)][g(-x) - g(x)]$
$= -[f(x) + f(-x)][g(x) - g(-x)]$
$= -h(x)$
$\Rightarrow$ $h(x)$ is an odd function.
$$\Rightarrow \quad \int_{-\pi/2}^{\pi/2} h(x)\,dx = 0$$

4. (a) $(\cot\alpha_1)(\cot\alpha_2)\ldots(\cot\alpha_n) = 1$
$\Rightarrow (\cos\alpha_1)(\cos\alpha_2)\ldots(\cos\alpha_n)$
$= (\sin\alpha_1)(\sin\alpha_2)\ldots(\sin\alpha_n) \qquad \ldots(i)$
LHS and RHS will be maximum with equal values
if $\alpha_1 = \alpha_2 = \ldots = \alpha_n = \dfrac{\pi}{4}$
As, $\cos\dfrac{\pi}{4} = \sin\dfrac{\pi}{4}$
$\Rightarrow$ Maximum value of $(\cos\alpha_1)(\cos\alpha_2)\ldots(\cos\alpha_n)$
$= \left(\dfrac{1}{\sqrt{2}}\right)\left(\dfrac{1}{\sqrt{2}}\right)\ldots\left(\dfrac{1}{\sqrt{2}}\right)$ n times $= \dfrac{1}{2^{n/2}}$

5. (b)



If M is a point inside the ΔABC, then perimeter of $\Delta ABC >$ perimeter of ΔMBC
$\Rightarrow AB + AC + BC > MB + MC + BC$
$\Rightarrow AB + AC > MB + MC$

6. (b) The line L will be $\dfrac{x}{a} + \dfrac{y}{b} = 1$ in xy-coordinate system.
When the axes are rotated by an angle 'θ' in anti-clockwise direction.
$x' = x\cos\theta + y\sin\theta$
$y' = -x\sin\theta + y\cos\theta \qquad \ldots(i)$
$\Rightarrow x = x'\cos\theta - y'\sin\theta$
$y = x'\sin\theta + y'\cos\theta$
$\Rightarrow$ Line is $\dfrac{x'\cos\theta - y'\sin\theta}{a} + \dfrac{x'\sin\theta + y'\cos\theta}{b} = 1$
$$\Rightarrow \quad x'\left[\frac{\cos\theta}{a} + \frac{\sin\theta}{b}\right] + y'\left[\frac{\cos\theta}{b} - \frac{\sin\theta}{a}\right] = 1$$
$\Rightarrow$ Intercept p and q are
$$p = \frac{ab}{b\cos\theta + a\sin\theta};\ q = \frac{ab}{a\cos\theta - b\sin\theta} \qquad \text{(given)}$$
$$\Rightarrow \quad \frac{1}{p^2} + \frac{1}{q^2} = \frac{\left[\begin{array}{l} a^2\sin^2\theta + b^2\cos^2\theta \\ + a^2\cos^2\theta - b^2\sin^2\theta \end{array}\right]}{a^2b^2} = \frac{a^2 + b^2}{a^2b^2}$$
$$= \frac{1}{a^2} + \frac{1}{b^2}$$

7. (b) a, b are roots of $x^2 + px + 1 = 0$
$$\Rightarrow \quad a + b = -p;\ ab = 1 \qquad \ldots(i)$$
Also, c and d are roots of $x^2 + qx + 1 = 0$
$$\Rightarrow \quad c + d = -q;\ cd = 1 \qquad \ldots(ii)$$
Now, $E = (a - c)(b - c)(a - d)(b - d)$
$= (a - c)(b + d)(b - c)(a + d)$

NIMCET MCA Solved Paper 2008

$= (ab - cd - bc + ad)(ab - ac + bd - cd)$ ($\because ab = cd$)
$= (ad - bc)(bd - ac)$
$= ab(d^2 + c^2) - cd(a^2 + b^2)$
$= ab\{(c + d)^2 - 2cd\} - cd\{(a + b)^2 - 2ab\}$
$= (q^2 - 2) - (p^2 - 2)$
$= q^2 - p^2$

8. (a) $f(x) + f(1 - x) = 2$

$\Rightarrow \quad f\left(\frac{1}{2001}\right) + f\left(\frac{2000}{2001}\right) = 2$

$\Rightarrow \quad f\left(\frac{2}{2001}\right) + f\left(\frac{1999}{2001}\right) = 2$

.....

.....

$\Rightarrow \quad f\left(\frac{1000}{2001}\right) + f\left(\frac{1001}{2001}\right) = 2$

which are 1000 pairs in all.

So, $f\left(\frac{1}{2001}\right) + f\left(\frac{2}{2001}\right) + \ldots + f\left(\frac{2000}{2001}\right) = 2000$

9. (b) Since, a, b and c are in AP.

$\Rightarrow \quad 2b = a + c$ ...(i)

Now, we take

$e^{1/c} \cdot e^{1/a} = e^{1/c + 1/a} = e^{a + c/ac} = e^{2b/ac}$ [from Eq. (i)]

$= (e^{b/ac})^2$

$\Rightarrow$ $e^{1/c}, e^{b/ac}$ and $e^{1/a}$ are in GP.

10. (d) α, β are roots of $x^2 + x + 1 = 0$

$\alpha + \beta = -1, \alpha\beta = 1$

$\Rightarrow \quad \alpha = w, \beta = w^2$

$\Rightarrow \quad \alpha^{19} = \alpha, \beta^7 = w^2 = \beta$

$\alpha^{19} + \beta^7 = \alpha + \beta = -1$

$\alpha^{19} \cdot \beta^7 = \alpha\beta = 1$

Hence, the equation remains same.

11. (a) $(x + 1)(x + 4)(x + 9) \ldots (x + 400)$

$= (x - 1)(x + 2^2)(x + 3^2) \ldots (x + 20^2)$

So, coefficient of x^{13} will be

$1^2 - 2^2 + \ldots + (20)^2 \quad \left[\because \Sigma n^2 = \frac{n(n+1)(2n+1)}{6}\right]$

$= \frac{20 \times 21 \times 41}{6} = 41 \times 70 = 2870$

12. (b) $y = 0.36 \log_{0.25}\left(\frac{1}{3} + \frac{1}{3^2} + \ldots\right)$

$= 0.36 \log_{0.25}\left(\frac{1/3}{1 - \frac{1}{3}}\right) = 0.36 \log_{0.25} 1/2$

$= 0.36 \log_{(1/2)^2} (1/2)$

$= \frac{0.36}{2} \log_{1/2} (1/2)$

$= 0.36 \times \frac{1}{2} = 0.18$

13. (c) $a, H_1, H_2, \ldots, H_n, b$ in HP.

$\Rightarrow \quad \frac{1}{a}, \frac{1}{H_1}, \frac{1}{H_2} \ldots \frac{1}{H_n}, \frac{1}{b}$ in AP.

$\Rightarrow \quad \frac{1}{b} = \frac{1}{a} + (n + 2 - 1)d$

$\Rightarrow \quad \frac{1}{b} - \frac{1}{a} = (n + 1)d$

$\Rightarrow \quad d = \frac{\frac{1}{b} - \frac{1}{a}}{(n + 1)}$

$\therefore \quad \frac{1}{H_1} = \frac{1}{a} + d = \frac{1}{a} + \frac{\frac{1}{b} - \frac{1}{a}}{n - 1}$

$= \frac{1}{a} - \frac{a - b}{ab(n + 1)}$

$= \frac{b(n + 1) + a - b}{ab(n + 1)}$

$\Rightarrow \quad H_1 = \frac{ab(n + 1)}{bn + a}$

$\Rightarrow \quad \frac{H_1}{a} = \frac{bn + b}{bn + a}$

Using componendo and dividendo, we get

$\frac{H_1 + a}{H_1 - a} = \frac{bn + b + bn + a}{bn + b - bn - a}$

$= \frac{a + b + 2bn}{b - a}$ ...(i)

Also, $\frac{1}{H_n} = \frac{1}{b} - d = \frac{1}{b} - \frac{a - b}{ab(n + 1)}$

$= \frac{a(n + 1) - a + b}{ab(n + 1)}$

$\Rightarrow \quad H_n = \frac{ab(n - 1)}{an + b}$

$\Rightarrow \quad \frac{Hn}{b} = \frac{an - a}{an + b}$

Using componendo and dividendo, we get

$\Rightarrow \quad \frac{H_n + b}{H_n - b} = \frac{an + a + an + b}{an - a - an - b}$

$= \frac{a + b + 2an}{a - b}$ ...(ii)

On adding Eqs. (i) and (ii),

$\therefore \quad \frac{H_1 - a}{H_1 - a} + \frac{H_n + b}{H_n - b} = \frac{a - b + 2bn}{b - a} - \frac{a + b + 2an}{b - a}$

$= \frac{2n(b - a)}{b - a} = 2n$

14. (a) Given equation, $2\log_x(a) + \log_{ax}(a) - 3\log_{a^2 x}(a) = 0$

$\Rightarrow \quad \log a\left[\frac{2}{\log x} + \frac{1}{\log a + \log x} + \frac{3}{2\log a + \log x}\right] = 0$

Let $\log x = y$ and $\log a = c$

$\Rightarrow \quad \frac{2}{y} + \frac{1}{y + c} + \frac{3}{y + 2c} = 0$

$\Rightarrow \quad 2(y + c)(y + 2c) + y(y + 2c) - 3y(y + c) = 0$

$\Rightarrow \quad 6y^2 + 11cy + 4c^2 = 0$

$\Rightarrow \quad y = \frac{-11c \pm \sqrt{121c^2 - 96c^2}}{12}$

$= \frac{-11c \pm 5c}{12} = \frac{-4c}{3}, -\frac{c}{2}$

$\Rightarrow \quad \log x = \frac{-4}{3}\log a$

and $\log x = -\frac{1}{2}\log a$

$\Rightarrow \quad x = a^{-4/3}; a^{-1/2}$

i.e., two solutions are there.

15. (d) Sum of the digits of a number divisible by 9 is also divisible by 9.

Now, sum of digits 0, 1, 2, 3, ..., 9 is 45 which is divisible by 9.

So, two digits out of 10 digits given will be omitted in such a way that their sum should also be divisible by 9. So, omitted digits will be (0, 9), (1, 8), (2, 7), (3, 6) and (4, 5). In the first case, there will be 8! numbers divisible by 9 and in the last four cases there will be 7 (7!) ways due to presence of 0.

So, total number of ways $= 8! + 4 \times 7(7!) = 36(7!)$

16. (c) Last digit of $7^{4p+1} = 7$

Last digit of $7^{4p+2} = 9$

Last digit of $7^{4p+3} = 3$

Last digit of $7^{4p} = 1$

If m is $4p + 1$, then n should be $4p + 3$.

So that $7^m + 7^n$ is divisible by 5 and *vice-versa* also.

Similarly, if m is 7^{4p+2} then n should be 7^{4q} and *vice-versa* to be divisible by 5.

So, number of ordered pairs

$$= 4 \times ({}^{25}C_1 \times {}^{25}C_1) = 2500$$

17. (a) a, b and c are roots of $x^3 - 3px^2 - 3qx - 1 = 0$

$$\Rightarrow \quad a + b + c = 3p;\ ab + bc - ca = 3q$$

and $$abc = 1$$

$$\Rightarrow \quad \frac{1}{a} + \frac{1}{b} + \frac{1}{c} = \frac{3q}{abc}$$

$$\Rightarrow \quad \frac{1}{a} + \frac{1}{b} + \frac{1}{c} = 3q$$

Now, centroid of triangle with vertices $\left(a, \frac{1}{a}\right), \left(b, \frac{1}{b}\right), \left(c, \frac{1}{c}\right)$ is

$$\left(\frac{a+b+c}{3}, \frac{\frac{1}{a}+\frac{1}{b}+\frac{1}{c}}{3}\right) = (p, q)$$

18. (c) Tangent to parabola $y^2 = 4ax$ is

$$y = mx + \frac{a}{m}$$

$\Rightarrow$ Tangent to $y^2 = 4x$ will be

$$y = mx + \frac{1}{m} \qquad \ldots(i)$$

It will be tangent to the circle

$$(x - 3)^2 + y^2 = 9 = (3)^2$$

If length of perpendicular from (3, 0) will be 3.

$$\Rightarrow \quad \left|\frac{3m + \frac{1}{m}}{\sqrt{m^2 + 1}}\right| = 3$$

$$\Rightarrow \quad 3m^2 + 1 = 3m\sqrt{m^2 + 1}$$

$$\Rightarrow \quad 9m^4 + 6m^2 + 1 = 9m^2(m^2 + 1)$$

$$\Rightarrow \quad m = \frac{1}{\sqrt{3}}, \text{ for above } x\text{-axis}$$

So, tangent is $$y = \frac{1}{\sqrt{3}}x + \frac{1}{1/\sqrt{3}}$$

$$\Rightarrow \quad \sqrt{3}y = x + 3$$

19. (b) $$|x^2 - x - 6| = x + 2$$

$$\Rightarrow \quad |(x - 3)(x + 2)| = x + 2$$

$$\Rightarrow \quad (x - 3)(x + 2) = (x + 2)$$

if $x \le -2$ or $x \ge 3$

and $-(x - 3)(x + 2) = (x + 2)$

if $-2 \le x \le 3$

$$\Rightarrow \quad (x + 2)(x - 4) = 0 \text{ if } x \le -2 \text{ or } x \ge 3$$

and $(x + 2)(x - 2) = 0$

if $-2 \le x \le 3$

$$\Rightarrow \quad x = -2, 4, 2$$

$\therefore$ The number of roots is 3.

20. (b) Number of cases for sum '5' = 4

Number of cases for sum '7' = 6

Probability of getting sum 5 in one roll $= \frac{4}{36} = \frac{1}{9}$

Probability of getting either 5 or 7 in a roll

$$= \frac{4+6}{36} = \frac{5}{18}$$

$\Rightarrow$ Probability of getting 5 before 7

$$= \frac{1}{9} + \frac{13}{18}\cdot\frac{1}{9} + \left(\frac{13}{18}\right)^2 \cdot \frac{1}{9} + \ldots$$

$$= \frac{\frac{1}{9}}{1 - \frac{13}{18}} = \frac{1}{9} \times \frac{18}{5} = \frac{2}{5}$$

21. (c) The same letter can be either S, T, I or A.

Probability of required will be

$P(S) + P(T) + P(I) + P(A)$

$$= \frac{3}{10} \times \frac{3}{9} + \frac{3}{10} \times \frac{2}{9} + \frac{2}{10} \times \frac{1}{9} + \frac{1}{10} \times \frac{2}{9} = \frac{19}{90}$$

22. (d) Required probability

$= P(1R) + P(2R) + P(3R) + P(4R) + P(5R) + P(6R)$

$$= \frac{1}{6} \times \frac{6}{10} + \frac{1}{6} \times {}^6C_2 \times {}^{10}C_2 + \frac{1}{6} \times {}^6C_3 \times {}^{10}C_3 + \frac{1}{6} \times {}^6C_4 \times {}^{10}C_4 + \frac{1}{6} \times {}^6C_5 \times {}^{10}C_5 + \frac{1}{6} \times {}^6C_6 \times {}^{10}C_6$$

$$= \frac{1}{6}\left[\frac{3}{5} + \frac{1}{3} + \frac{1}{6} + \frac{1}{14} + \frac{1}{42} + \frac{1}{210}\right]$$

$$= \frac{1}{6} \times \frac{136}{105} = \frac{68}{315}$$

23. (c) Volume of parallelopiped will be

$$V = \begin{vmatrix} 1 & \lambda & 1 \\ 0 & 1 & \lambda \\ \lambda & 0 & 1 \end{vmatrix} = 1 + \lambda(\lambda^2 - 1) \quad \Rightarrow \quad V = \lambda^3 - \lambda + 1$$

For minimum value

$$\frac{dV}{d\lambda} = 3\lambda^2 - 1 = 0$$

$$\Rightarrow \quad \lambda = \frac{1}{\sqrt{3}}$$

$$\frac{d^2V}{d\lambda^2} = 6\lambda$$

At $\lambda = \frac{1}{\sqrt{3}}$,

$$\Rightarrow \quad \frac{d^2V}{d\lambda^2} = \frac{6}{\sqrt{3}} > 0 \text{ (min)}$$

24. (b) $P(1) = P(3) = P(5) = \frac{1}{4}$;

$P(2) = P(4) = P(6) = \frac{1}{12}$

Now, sum of two odd numbers, and also sum of two even numbers is even, so,

P (odd, odd) + P (even, even)

$$= \frac{3}{4} \times \frac{3}{4} + \frac{1}{4} \times \frac{1}{4} = \frac{10}{16} = \frac{5}{8}$$

25. (a) TATANAGAR has 9 letters, so number of ways in which two consecutive letters can be printed will be 8, out of which there are 2 ways in which TA can be printed. Similarly, for CALCUTTA, there are 7 ways of printing two consecutive letters, from which there is only one way to print 'TA'.

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Hence, required probability

$$= \frac{\frac{1}{7}}{\frac{1}{7}+\frac{2}{8}} = \frac{\frac{1}{7}}{\frac{1}{7}+\frac{1}{4}} = \frac{4}{11}$$

26. (d) Given, $\cos\alpha + \cos\beta = a$

$$\Rightarrow \quad 2\cos\left(\frac{\alpha+\beta}{2}\right)\cos\left(\frac{\alpha-\beta}{2}\right) = a$$

$$\Rightarrow \quad 2\cos\theta\cos\left(\frac{\alpha-\beta}{2}\right) = a \qquad \ldots(i)$$

$$\left[\because \theta = \frac{\alpha+\beta}{2} \text{ (AM of } \alpha, \beta)\right]$$

Also, $\sin\alpha + \sin\beta = b$

$$\Rightarrow \quad 2\sin\left(\frac{\alpha+\beta}{2}\right)\cos\left(\frac{\alpha-\beta}{2}\right) = b$$

$$\Rightarrow \quad 2\sin\theta\cos\left(\frac{\alpha-\beta}{2}\right) = b \qquad \ldots(ii)$$

$$\Rightarrow \quad \frac{a}{\cos\theta} = \frac{b}{\sin\theta}$$

$$= \frac{\sqrt{a^2+b^2}}{\sqrt{\sin^2\theta+\cos^2\theta}} = \sqrt{a^2+b^2}$$

[from Eqs. (i) and (ii)]

$$\Rightarrow \quad \cos\theta = \frac{a}{\sqrt{a^2+b^2}}$$

and $\sin\theta = \frac{b}{\sqrt{a^2+b^2}}$

$$\Rightarrow \quad \sin 2\theta = \frac{2ab}{a^2+b^2}$$

$$\cos 2\theta = \frac{a^2-b^2}{a^2+b^2}$$

$$\Rightarrow \sin 2\theta + \cos 2\theta = \frac{a^2-b^2+2ab}{a^2+b^2}$$

27. (c) As, $\tan 45^\circ = \tan[x + (45^\circ - x)]$

$$= \frac{\tan x + \tan(45^\circ - x)}{1 - \tan x \tan(45^\circ - x)} = 1$$

$$\Rightarrow \quad 1 - \tan x \tan(45^\circ - x) = \tan x + \tan(45^\circ - x)$$

$$\Rightarrow \quad 1 = \tan x + \tan(45^\circ - x) + \tan x \tan(45^\circ - x)$$

$$\Rightarrow \quad 2 = (1 + \tan x)(1 + \tan(45^\circ - x)) \qquad \text{(i)}$$

So, $(1 + \tan 1^\circ)(1 + \tan 44^\circ) = 2$

$(1 + \tan 2^\circ)(1 + \tan 43^\circ) = 2$

$(1 + \tan 22^\circ)(1 + \tan 23^\circ) = 2$

and $(1 + \tan 45^\circ) = 2$

$$\Rightarrow \quad [(1 + \tan 1^\circ)(1 + \tan 2^\circ) \ldots 22 \text{ times}](1 + \tan 45^\circ)$$
$$= (2 \cdot 2 \cdot 2 \ldots 22 \text{ times}) \cdot 2 = 2^{22} \cdot 2 = 2^{23}$$

$$\rightarrow \quad n = 23$$

28. (c) $\sin 12^\circ \sin 48^\circ \sin 54^\circ$

$$= \frac{1}{2}(2\sin 12^\circ \sin 48^\circ)\sin 54^\circ$$

$$= \frac{1}{2}[\cos(-36^\circ) - \cos 60^\circ]\cos 36^\circ$$

$$= \frac{1}{2}\left[\frac{\sqrt{5}+1}{4} - \frac{1}{2}\right]\frac{\sqrt{5}-1}{4}$$

$$= \frac{1}{2}\left[\frac{\sqrt{5}+1-2}{4}\right]\frac{\sqrt{5}+1}{4}$$

$$= \frac{1}{32}(5-1) = \frac{1}{8} = \left(\frac{1}{2}\right)^3 = \sin^3 30^\circ$$

29. (b) Let given four points are A, B, C, D which are coplanar, if $[AB, BC, CD] = 0$

$$AB = 3\mathbf{i} + 5\mathbf{j} + (1-\lambda)\mathbf{k}$$
$$BC = -\mathbf{i} + 4\mathbf{j} + 2\mathbf{k}$$
$$CD = -3\mathbf{i} - 5\mathbf{j} + 3\mathbf{k}$$

$$\Rightarrow \quad \begin{vmatrix} 3 & 5 & 1-\lambda \\ -1 & 4 & 2 \\ -3 & -5 & 3 \end{vmatrix} = 0$$

$$\Rightarrow \quad 3(12+10) - 5(-3+6) + (1-\lambda)(5+12) = 0$$

$$\lambda = 4$$

30. (b) Given, $|C - A| = 2\sqrt{2}$

$$\Rightarrow \quad |C - A|^2 = 8$$

$$\Rightarrow \quad |C|^2 + |A|^2 - 2C \cdot A = 8 \quad (\because C \cdot A = |C| = C)$$

$$\Rightarrow \quad C^2 + 9 - 2C = 8$$

$$\rightarrow \quad C^2 - 2C + 1 = 0$$

$$\Rightarrow \quad (C-1)^2 = 0$$

$$C = 1$$

$$\Rightarrow \quad |C| = 1$$

Now, $|(A \times B) \times C| = ||A \times B||C| \sin 30^\circ \hat{n}|$

$$= \frac{1}{2}|A \times B| \qquad \ldots(i)$$

$$A \times B = \begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ 2 & 1 & -2 \\ 1 & 1 & 0 \end{vmatrix}$$

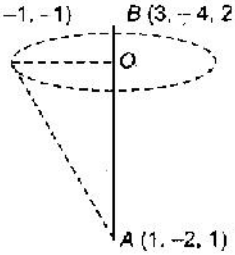
$$= \mathbf{i}(0+2) - \mathbf{j}(0+2) + \mathbf{k}(2-1)$$
$$= 2\mathbf{i} - 2\mathbf{j} + \mathbf{k}$$

$$\Rightarrow \quad |A \times B| = \sqrt{4+4+1} = 3 \qquad \ldots(ii)$$

From Eqs. (i) and (ii), we get

$$|(A \times B) \times C| = \frac{3}{2}$$

31. (b) $P(5, -1, -1)$ $B(3, -4, 2)$



$$AB = 2\mathbf{i} - 2\mathbf{j} + \mathbf{k}$$
$$AP = 4\mathbf{i} + \mathbf{j} - 2\mathbf{k}$$

$$\Rightarrow \quad AB \times AP = \begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ 2 & -2 & 1 \\ 4 & 1 & -2 \end{vmatrix} = -3\mathbf{i} + 8\mathbf{j} + 10\mathbf{k}$$

$$\Rightarrow \quad V = \frac{AB \times AP}{w} = \frac{-3\mathbf{i} + 8\mathbf{j} + 10\mathbf{k}}{3}$$

32. (c) Given, $A + B - C = 0$

$$\Rightarrow \quad -C = (A + B)$$

$$\Rightarrow \quad (-C)\cdot(-C) = (A+B)\cdot(A+B)$$

$$\rightarrow \quad |C|^2 = |A|^2 + |B|^2 + 2(A \cdot B)$$

$$\Rightarrow \quad |C|^2 = |A|^2 + |B|^2 + 2|A||B| \cdot \cos\theta$$

$$\Rightarrow \quad 49 = 25 + 9 + 2(3 \times 5\cos\theta)$$

where θ is the angle between A and B.

$$\Rightarrow \quad \cos\theta = \frac{1}{2}$$

$$\rightarrow \quad \theta = \frac{\pi}{3}$$

or $\quad 2\pi - \frac{\pi}{3} = \frac{5\pi}{3}$

33. (b) $f(x)\cdot f\left(\frac{1}{x}\right)=f(x)+f\left(\frac{1}{x}\right)$ (given)

$\Rightarrow \quad f(x)=\pm x^n+1$

Given, $f(3)=28=3^n+1$

$\Rightarrow \quad 3^n=27=3^3$

$\Rightarrow \quad n=3$

$\Rightarrow \quad f(x)=x^3+1$

$\Rightarrow \quad f(4)=(4)^3+1=65$

34. (c) $\Sigma P_i=(UP_j)\times 10$

and $\Sigma Q_j=(UQ_j)\times 9$

$\Rightarrow \quad 10S=30\times 5$

$\Rightarrow \quad S=15$

Also, $3n=9S$

$\Rightarrow \quad n=3S=45$

35. (c) For 0, we have 8 options.

For 1, number of options $=1+2+\ldots+8$

$$=\frac{8\cdot 9}{2}={}^9C_2$$

For 2, we have $\sum_{r=1}^{8}\frac{r(r+1)}{2}$ options

$$=\frac{8\cdot 9\cdot 10}{2\cdot 3}={}^{10}C_3 \text{ options}$$

36. (c) $I=\int_0^{\pi/2}\frac{dx}{1+\tan^3 x}=\int_0^{\pi/2}\frac{dx}{1+\tan^3\left(\frac{\pi}{2}-x\right)}$

$$=\int_0^{\pi/2}\frac{dx}{1+\cot^3 x}$$

$\Rightarrow \quad 2I=\int_0^{\pi/2}\left(\frac{1}{1+\tan^3 x}+\frac{1}{1+\cot^3 x}\right)dx$

$\Rightarrow \quad 2I=\int_0^{\pi/2}dx=\frac{\pi}{2}$

$\Rightarrow \quad I=\frac{\pi}{4}$

37. (c) $\lim_{x\to 0}=\frac{(\cos x-1)(\cos x-e^x)}{x^n}$

$$=\lim_{x\to 0}\frac{\left(1-\frac{x^2}{2!}+\ldots-1\right)\left(1-\frac{x^2}{2!}+\ldots\left(1+\frac{x}{1!}+\ldots\right)\right)}{x^n}$$

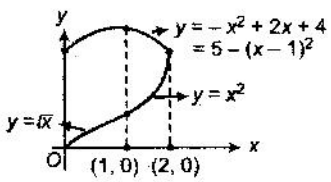
$$=\lim_{x\to 0}\frac{\left(-\frac{x^2}{2!}+\frac{x^4}{4!}+\ldots\right)\left(-\frac{x}{1!}-\frac{2x^2}{2!}-\frac{x^3}{3!}+\frac{x^4}{4!}\ldots\right)}{x^n}$$

$$=\lim_{x\to 0}\frac{x^3\left(-\frac{1}{2!}+\frac{x^2}{4!}+\ldots\right)\left(-1-\frac{2x}{2!}-\frac{x^2}{3!}\ldots\right)}{x^n}$$

which will be finite non-zero value, if $n=3$

and the value is $\frac{1}{2}$.

38. (b)



$y=-x^2+2x+4=5-(x-1)^2$

The required area will be

$\int_0^1[(-x^2+2x+4)-\sqrt{x}]\,dx+\int_1^2[(-x^2+2x+4)-x^2]\,dx$

$$=\left[-\frac{x^3}{3}+x^2+4x-\frac{x^{3/2}}{3/2}\right]_0^1+\left[\frac{-2x^3}{3}+x^2+4x\right]_1^2$$

$$=-\frac{1}{3}+1+4-\frac{2}{3}+\left[\left(-\frac{16}{3}+4+8\right)-\left(\frac{-2}{3}+1+4\right)\right]$$

$$=4+\left[\frac{20}{3}-\frac{13}{3}\right]=4+\frac{7}{3}=\frac{19}{3}\text{ sq units}$$

39. (a) Given, $f(x)=2\sin x+\sin 2x$

$\Rightarrow \quad f'(x)=2\cos x+2\cos 2x$

For max or min of $f(x)$

$\Rightarrow \quad f'(x)=0$

$\Rightarrow \quad \cos x+2\cos^2 x-1=0$

$\Rightarrow \quad \cos x=\frac{-1\pm\sqrt{1+8}}{4}=-1,\frac{1}{2}$

$\Rightarrow$ Critical points are $\pi,\frac{\pi}{3},\frac{5\pi}{3},0,2\pi$.

$f(\pi)=0;\ f\left(\frac{\pi}{3}\right)=\frac{3\sqrt{3}}{2};f\left(\frac{5\pi}{3}\right)=\frac{-3\sqrt{3}}{2}$

$f(0)=0;f(2\pi)=0$

$\Rightarrow$ Absolute maximum is at $\frac{\pi}{3}$ and absolute minimum is at $\frac{5\pi}{3}$.

40. (c) $y=\sec^{-1}\left(\frac{x+1}{x-1}\right)+\sin^{-1}\left(\frac{x-1}{x+1}\right)\left(\because \sec^{-1}x=\cos^{-1}\frac{1}{x}\right)$

$\Rightarrow \quad y=\cos^{-1}\left(\frac{x-1}{x+1}\right)+\sin^{-1}\left(\frac{x-1}{x+1}\right)$

$\left(\because \sin^{-1}x+\cos^{-1}x=\frac{\pi}{2}\right)$

$\Rightarrow \quad y=\frac{\pi}{2}\Rightarrow \quad \frac{dy}{dx}=0$

41. (a) **Step 1** Fill 9 L container.

Step 2 Pour 4 L water from 9 L container to 4 L container

Step 3 Empty 4 L container.

Step 4 Again pour 4 L water from 9 L container to 4 L container.

Step 5 Again empty 4 L container

Step 6 Now pour remaining 1 L water from 9 L container to 4 L container.

Step 7 Fill 9 L container.

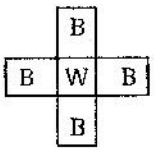
Step 8 Pour water from 9 L container to 4 L container, so that it is completely full.

Now, 9 L container contains 6 L water.

42. (d) The letters are repeat ONE, TWO, THREE, FOUR and FIVE times respectively.

So, the required letter is N.

43. (b)



The required diameter will be diagonal of white square which will give it's middle point as the centre.

So, diameter $=\sqrt{2}$ inch

44. (b) If x is the amount of fuel consumed while coming back, then $x+x+\frac{x}{4}=4\frac{1}{2}$

$\Rightarrow \quad \frac{9x}{4}=\frac{9}{2}$

$\Rightarrow \quad x=2$

NIMCET MCA Solved Paper 2008

45. (b) At $x = \frac{9}{11}$; $\frac{1}{x} = \frac{11}{9} > x$;

At $x = \frac{9}{11}$; $\frac{x+1}{x} = \frac{20}{9} > x$;

At $x = \frac{9}{11}$; $\frac{x+1}{x-1} = -10 < x$

Hence, I and II are correct.

46. (d) None of the given answer is correct from the available data set.

$$G = L + 10;$$

$$\frac{2A}{3} = \frac{3}{4}\left(B + \frac{A}{B}\right) = \frac{4}{5}\left(G + \frac{1}{4}\left(B + \frac{A}{3}\right)\right)$$

$$= L + \frac{1}{5}\left(G + \frac{1}{4}\left(B + \frac{A}{3}\right)\right)$$

$$\Rightarrow \quad \frac{2A}{3} = \frac{3B}{4} + \frac{A}{4} = \frac{4G}{5} + \frac{B}{5} + \frac{A}{15}$$

$$= L + \frac{G}{5} + \frac{B}{20} + \frac{A}{60}$$

$$\Rightarrow \quad A = 180;\ B = 100;\ G = 110;\ L = 80$$

which becomes inconsistent.

47. (c)

Q
S
P
U
R
T

Rank from data, top is bottom is given.

Hence, R's rank is 5th in the class.

48. (d) If Bhalu alternated between truth and lie, so will Kachaalu, which will be a contradiction, as only one person alternated between truth and lie.

49. (d) 565xy will be divisible by 80, if $x = 6$ and $y = 0$

$$\Rightarrow \quad x + y = 6$$

50. (b) 7^2 and 3^3 will be factors of $(a \cdot 11^3 \cdot 6^3 \cdot 13^{11})$ if $a = 7^2 \cdot 3 = 147$

51. (a) Odd-even = Odd, so $(x - z)^2 y$ will be odd.

Hence, (a) cannot be true.

52. (c) Required distance

$$= 16 + 2\left[16 \times \frac{1}{2} + 16 \times \frac{1}{2^2} + 16 \times \frac{1}{2^3} + 16 \times \frac{1}{2^4} + \ldots\right]$$

$$= 16 + 2 \times \frac{16 \times \frac{1}{2}}{1 - \frac{1}{2}} = 48 \text{ m}$$

53. (a) If d is the distance covered, then if 't' hour is the required time to catch the train in time, then

$$\frac{d}{4} = t + \frac{1}{10}$$

and $$\frac{d}{5} = t - \frac{1}{10}$$

$$\Rightarrow \quad \frac{d}{4} - \frac{d}{5} = \frac{1}{10} + \frac{1}{10}$$

$$\Rightarrow \quad \frac{d}{20} = \frac{1}{5} \Rightarrow d = \frac{20}{5} = 4 \text{ km}$$

54. (b) PQSVW is not possible, as S and V cannot be together.

55. (a) If R is in new office, then as book keeper there is only one option Q.

Due to R and U in new office T and S cannot be considered. So, V and W will be sent as new secretaries. So, there is only one option QRUVW.

56. (b) If R goes, T won't go and if S went further U and V won't go, so we will not get three secretaries.

57. (d) If S goes to new office, then team will be S, T, W, P, Q only. So, R cannot go and W must go.

58. (a)

	S	T	I	L	L	
+	W	I	T	H	I	N
	L	I	M	I	T	S

$\Rightarrow$

	9	8	5	3	3	
+	2	6	8	0	6	6
	3	5	6	5	8	9

59. (c) Total number of hand shakes will be $2(^{12}C_2) = 132$

60. (d) From given informations, we get

$$Q - U = R - S;$$

$$V > U;\ P = S + 3$$

$\Rightarrow$ Sequence from the lowest to the highest is,

$$\underline{T}\ \underline{U}\ \underline{S}\ \underline{Q}\ \underline{R}\ \underline{P}\ \underline{V}$$

61. (a) If x tricycles are there, then there will be $(10 - x)$ bicycles.

$$\Rightarrow \quad 3x + 2(10 - x) = 24$$

$$\Rightarrow \quad x + 20 = 24$$

$$\Rightarrow \quad x = 4$$

62. (d) Let the speed of person and that of wind be u and v km/h respectively.

Then, $$\frac{d}{u - v} = 4 \text{ and } \frac{d}{u + v} = 3$$

$$\Rightarrow \quad 4(u - v) = 3(u + v)$$

$$\Rightarrow \quad u = 7v$$

$$\Rightarrow \quad \frac{d}{u + \frac{u}{7}} = 3$$

$$\Rightarrow \quad \frac{d}{\left(\frac{8u}{7}\right)} = 3$$

$$\Rightarrow \quad \frac{d}{u} = \frac{24}{7}$$

Hence, required time $= \frac{24}{7}$ h $= 3$ h 25 min 42 s

63. (d) Each 1 in the given series has the digits on it's right exceeding by the digits on the left by 1.

1 1 2; 1 1 2 1 2 2 3;

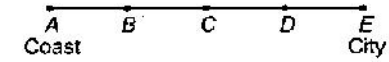
1 1 2 1 2 2 3 1 2 2 3 2 3 3 4

1 1 2 1 2 2 3 1 2 2 3 2 3 3 4 1 2 2 3 2 3 3 4 2

3 3 4 3 4 4 5

So, next three numbers is 4, 3, 4.

64. (c)



The person himself reach the city E from coast A, by travelling through B, C and D each at 30 km each in 4 days.

Then, when returning he will spend his rations at D, where he will be joined by second person with ration of 2 days. At C, third person will be there with ration of 3 persons for one day. Again at B, fourth person will be there, with ration of 4 persons for one day, and hence finally all 4 will reach the coast A.

65. (d) If y was the total number of eggs and x is the daily sale. Then,

Left over egg on day $1 = y - x$

Left over egg on day $2 = 2(y - x) - x = 2y - 3x$

Left over egg on day $3 = 3(2y - 3x) - x$

$= 6y - 10x$

Left over egg on day $4 = 4(6y - 10x) - x$

$= 24y - 41x$

Left over egg or say total eggs on day 5

$= 5(24y - 41x) = x$

$$\Rightarrow \quad 120y - 205x = x$$

$$\Rightarrow \quad 120y = 206x$$

$$\Rightarrow \quad 60y = 103x$$

$\Rightarrow y = 103$ and $x = 60$ as minimum values.

66. (c) Sujit has told the truth and Lakers will be the winner, so automatically remaining two statements become wrong.

67. (d) $\underset{\uparrow}{0}$ 9 cases for two digit numbers.

$\underset{\uparrow}{0}\ \underset{\uparrow}{\ }$ $9 \times 10 = 90$ cases

9 For three digit numbers.

$\underset{\uparrow}{\ }\ \underset{\uparrow}{0}$ $9 \times 10 = 90$ cases

In 1000 there is 3 0's

Total 0's $= 9 + 90 + 90 + 3 = 192$

68. (a) There is continuation of series.

111 211 211 111 221 312 211 131 122 211 113 213 211 311 312 111 312 211 321 131 112 211 123 113 111 213 211 321 222 111 131 221 133

69. (a) From the first information oldest daughter will be 9 or 12 yr old.

From the next information her age will be 9.

(AS $9 + 4 = 13$)

70. (a)

G S C G S C G S C → C G S G S C G S C

→ C G S C G S C S G → C C G G S S C S G

→ C C C S G G S S G → C C C S S G G G S

→ C C C S S G S G G → C C C S S S G G G

Seven moves are shown here out of which one of them is trivial. *i.e.*, six moves are required.

71. (a) 1st Game ⇒ Mr. Birla defeated Mrs. Birla

2nd Game ⇒ Mr. Birla defeated Mrs. Tata

3rd Game ⇒ Mrs. Birla defeated Mr. Tata

72. (c) Second number is the largest. Let it be x, then first number is $x/2$ and third number is $x/3$.

So, their average is

$$\frac{x + \frac{x}{2} + \frac{x}{3}}{3} = 44$$

$$\Rightarrow \quad \frac{11x}{18} = 44$$

$$\Rightarrow \quad x = \frac{44 \times 18}{11} = 72$$

73. (c) 15 large, 7 medium and 14 small ships

$$= 15 \times \frac{7}{4} + 7 \times \frac{\left(2 \times \frac{7}{4} - 1\right)}{3} + 14 \text{ small ships.}$$

$$= \frac{105}{4} + \frac{21}{2} + 14 = \frac{203}{4} \text{ small ships.}$$

Now, 12 large, 14 medium and 21 small ships

$$= 12 \times \frac{7}{4} + \frac{14\left(2 \times \frac{7}{4} + 1\right)}{3} + 21 \text{ small ships}$$

$= 21 + 21 + 21 = 63$ small ships

Number of trips by $\frac{203}{4}$ ships $= 36$

So, number of trips by 63 ships $= \frac{\frac{203}{4} \times 36}{63} = 29$ trips.

74. (a) Q R T P S

According to the given information the order of reading newspaper, so Q passed newspaper to R.

75. (d) If free luggage is y kg, then Raja has x kg, and Rabim has $2x$ kg extra luggage.

Then, $2y + 3x = 60$

If $3x$ kg extra luggage cost ₹ 3600, then ₹ 5400 will be cost of

$$\frac{5400}{3600} \times 3x = \frac{9}{2}x$$

$$\Rightarrow \quad y + 3x = \frac{9}{2}x$$

$$\Rightarrow \quad y = \frac{3}{2}x$$

$$\Rightarrow \quad x = 10 \text{ kg}$$

and $y = 15$ kg

So, Rabim's luggage is $y + 2x = 35$ kg

76. (d) If x is the number of rows, then if number of children in last row is y, then

$$y + (y + 3) + (y + 6) + \ldots + \{y + 3(x - 1)\} = 630$$

$$\Rightarrow \quad xy + \frac{3(x-1)(x)}{2} = 630$$

$x = 3 \Rightarrow 3y + 9 = 630$ (possible, $y = 207$)

$x = 4 \Rightarrow 4y + 18 = 630$ (possible, $y = 153$)

$x = 5 \Rightarrow 5y + 30 = 630$ (possible, $y = 120$)

$x = 6 \Rightarrow 6y + 45 = 630$ (impossible)

Solutions (Q. Nos. 77-80)

City / Player	M	C	K	D	H
P	×	×	×	✓	×
R	×	✓	×	×	×
S	×	×	✓	×	×
U	✓	×	×	×	×
V	×	×	×	×	✓

Game / Player	Cr.	Ch.	Ca.	Ba.	T.T.
P	×	×	×	✓	×
R	×	✓	×	×	×
S	×	×	×	×	✓
U	×	×	✓	×	×
V	✓	×	×	×	✓

77. (a) P

78. (b) Hyderabad

79. (a) Badminton

80. (a) R and Chennai

81. (b) M ψ K $ N ∈ L

⇒ M is mother of K, who is father of N, who is sister of L.

Hence, N is daughter of K.

82. (b) U ψ R # S # T ⇒ R is brother of S who is brother of T.

Hence, R is brother of T.

83. (d) K # X ψ Z # L $ Y

X is mother of Z, who is brother of father of Y

Hence, X is real grandmother of Y.

84. (a) K ψ L ∈ M # N

⇒ K is mother of sister of brother of N

Hence, K is mother of N.

85. (d) M # N $ L # K $ O

⇒ M is brother of father of brother of K who is father of O.

Hence, K is nephew of M.

86. (c) From the given data following is the possibility.

Anil Lal Babu Sharma Bhatia Gupta

⇒ Babu has Lal and Sharma as the neighbours.

87. (a) As the watch gains 10 s in 5 min so it gains 2 min in 1 h. 20 min past 7 O'clock implies 10 h 20 min after 9 am, so actual time is 10 h ahead and 20 min is the gain.

Hence, actual time is 7 pm.

NIMCET MCA Solved Paper 2008

88. (c) As by reflexion left hand becomes right hand and *vice-versa*, so in original clock hour hand is between 8 and 9 and minute hand is at 3, so time is actually 8 : 15.

89. (c) Let the ratio be $\lambda : 1$

then, $18\lambda + 9 = 15(1 + \lambda)$

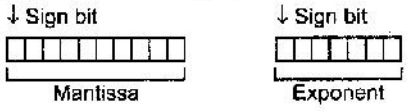
$\Rightarrow \quad 4\lambda = 6 \Rightarrow \lambda = \frac{6}{4} \Rightarrow \lambda : 1 :: 3 : 2$

90. (a) Each question has 5 options, as it can be answered as A, B, C, D or left also.
Now, all 120 questions will have 5 independent options.
Hence, total number of required ways
$= 5 \times 5 \times 5 \ldots \times 5$ (120 times) $= 5^{120}$

91. (b)
$$\begin{array}{r} 1 \cdots \rightarrow \text{carry} \\ 1\,1\,0\,0\,1\,1\,0\,0 \\ +\,1\,0\,0\,0\,1\,1\,1\,1 \\ \hline 1\,0\,1\,0\,1\,1\,0\,1\,1 \end{array}$$
V = 1, as there is an overflow
C = 1, as carry out is generated by most significant bits.
Z = 0, as the result is not zero
Hence, 1, 1, 0 is the bits obtained.

92. (b) A compiler converts a high level program into low level language (Machine language) for execution.

93. (d)



Maximum number
$= 111111111 \times 2^{(1111)_2} \approx 2^{63}$

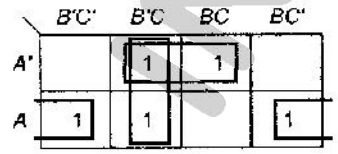
94. (c) $4K \times 16 = 2^{12} \times 16$
$\Rightarrow$ We should have 12 address lines and 16 data lines.

95. (d) The number of blocks required for the cache increases linearly with the size of the main memory which is the main disadvantage of direct mapping of cache organization.

96. (a) Given, $A[i] = 2i$, where $1 < i < 10$
$\Rightarrow \quad A[10] = 2 \times 10 = 20$
Now, $\quad j = A[A[5]] = A[2 \times 5] = A[10] \Rightarrow j = 20$
$\Rightarrow \quad A[j] = A[20]$
which is not defined because A takes the values from 1 to 10. But here, the condition occurs of overflow.

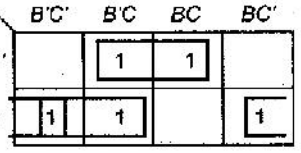
97. (b) BIOS = Basic Input Output System.

98. (b) It will be simplified by Karnaugh map as follows.
There are three pairs.



$\Rightarrow$ Function is $AC' + B'C + A'C$

or



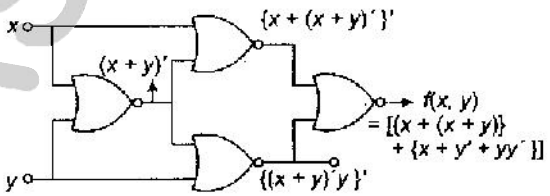
$= A'C + AB' + AC'$

99. (c) 1's complement of $1101 - 0010$
2's complement of $1101 = 0010 + 1 = 0011$
and 1's complement of $0100 = 1011$
2's complement of $0100 = 1011 + 1 = 1100$
Addition both 4 bits :
$$\begin{array}{r} 0011 \\ +\,1100 \\ \hline 1111 \end{array}$$
It's one's complement = 0000
and 2's complement = $0000 + 1 = 0001$
There is no overflow.

100. (d) $\sqrt{(224)_r} = (13)_r \Rightarrow \sqrt{2r^2 + 2r + 4} = r + 3$
$\Rightarrow \quad 2r^2 + 2r + 4 = (r + 3)^2 = r^2 + 6r + 9$
$\Rightarrow \quad r^2 - 4r - 5 = 0$
$\Rightarrow \quad (r - 5)(r + 1) = 0$
$\Rightarrow \quad r = -1, 5$
As r cannot be -1, so $r = 5$

101. (a) 2's complement of $A = 00000110$
2's complement of $B = 11110110$
$$\begin{array}{r} 11110110 = (246)_{10} \\ \times\,00000110 \\ \hline 00000000 \\ 11110110 \\ 11110110 \\ \hline 10111000100 = (1476)_{10} \end{array}$$
8 bit representation of, 10111000100 is
$11000100 = (196)_{10}$

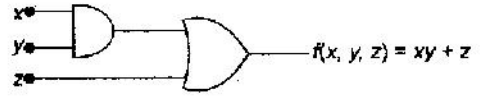
102. (b)



$f(x, y) = [\{x + x' \cdot y'\}' + \{x' \cdot y' + y\}']'$
(by De Morgan's law)
$= [x' \cdot (x' \cdot y')' + (x' \cdot y)' \cdot y]'$ (by De Morgan's law)
$= \{x' \cdot (x + y) + (x + y) \cdot y'\}'$ (by De Morgan's law)
$= \{x' \cdot (x + y)\}' \cdot \{(x + y) \cdot y'\}'$ (by De Morgan's law)
$= [x + (x + y)] \cdot [(x + y)' + y]$ (by De Morgan's law)
$= [x + x' \cdot y'] \cdot [x' \cdot y' + y]$ (by De Morgan's law)
$= (x + x')(x + y') \cdot (x' + y) \cdot (y' + y)$
(by Distributive law)
$= 1 \cdot (x + y) \cdot (x' + y) \cdot 1$ (by Complement law)
$= (x + y') \cdot (x' + y)$ (by Identity law)
$= x \cdot x' + xy + y'x' + y'y$ (by Distributive law)
$= 0 + xy + y'x' + 0$ (by Complement law)
$= xy + x'y'$ (by Identity and Commutative law)
which represent exclusive NOR.

103. (c)

104. (a) $f(x, y, z) = z(x + y) + \overline{(\bar{z} + x + y)(\bar{x} + \bar{y})}$ (given)
$= z(x + y) + (z\bar{x}\,\bar{y}) + (xy)$ (by De Morgan's law)
$= xy + yz + zx + z\bar{x}\,\bar{y}$ (by Distributive law)
$= yz + zx + (xy + z\bar{x}\,\bar{y})$
$= yz + zx + (xy + z)(xy + \bar{x}\bar{y})$ (by Distributive law)
$= yz + zx + (xy + z) \cdot 1$ (by Complement law)
$= zx + xy + z(y + 1)$
$= zx + xy + z \cdot 1$ (by Absorption law)
$= xy + z(x + 1) = xy + z \cdot 1 = xy + z$
$\Rightarrow \quad f(x, y, z) = xy + z$



It requires two gates.

105. (a)

106. (b) Reconcile to find way to make ideas, beliefs, needs etc. Indivisible not able to be separated or broken into parts.

107. (c) **Acumen** the ability to make good quick decisions and judgements.
Onus responsibility or duty.

108. (d) **Inflammable** something that is inflammable burns easily
Ignite to make something start to burn.
Thus, both these words show similar meaning. Here, somber and mourned are similar to each other
Somber sad, unhappy, sorrowful
Mourned to feel extremely sad because someone died.

109. (d) **Savant** who has lot of knowledge
Obtuse who does not understand explanations or situations quickly.
Thus, these words show almost opposite relationship.
Athlete and sluggish show opposite relationship.
Athlete one who takes part in sports
Sluggish not moving as quickly as usual.

110. (a) **Opprobrium** very strong criticism of something that you do not approve of or dishonour.
Its opposite-Honour to respect.

111. (c) **Incessant** continuing for a long time without stopping in a way that is annoying.
Its opposite.
Sporadic not regular or frequent.

112. (c) **Exasperate** to make someone extremely annoyed and impatient.
Its similar meaning Irritate

113. (a) **Inimical** unfriendly. Its similar meaning.
Antagonistic disliking someone or behaving in a very unfriendly way.

114. (d) According to author; after the revelation, government documents previously accepted ideas were proved to be only partially correct and some narrative are proved to be completely wrong.

115. (d) Statement I is wrong as after revelation of government documents the crisis becomes clear, it was not still a mystery.

116. (c)

117. (b)

118. (a) would be-hoping

119. (b) To fish in troubled waters means to take advantage of a shaky or unstable situation.
e.g., Arun is fishing in troubled waters by buying more shares of that company.

120. (c) Here 'leg' will be used instead of 'legs' as legs is plural where 'one' should be followed by singular noun.