Booklet Code C

Entrance Examination (June 2010)

Master of Computer Applications (MCA)

Time: 2 Hours **Max. Marks: 75**

Hall Ticket Number:

INSTRUCTIONS

1. (a) Write your Hall Ticket Number in the above box AND on the OMR Sheet.
   (b) Fill in the OMR sheet, the **Booklet Code C** given above at the top left corner of this sheet. Candidates should also read and follow the other instructions given in the OMR sheet.
2. All answers should be marked clearly in the OMR answer sheet only.
3. This objective type test has two parts: Part A with 25 questions and Part B with 50 questions. Please make sure that all the questions are clearly printed in your paper.
4. Every correct answer carries **1 (one) mark** and for every wrong answer 0.33 **mark will be deducted.**
5. Do not use any other paper, envelope etc for writing or doing rough work. All the rough work should be done in your question paper or on the sheets provided with the question paper at the end.
6. During the examination, anyone found indulging in copying or have any discussions will be asked to leave the examination hall.
7. Use of non-programmable calculator and log-tables is allowed.
8. Use of mobile phone is NOT allowed inside the hall.
9. Submit both the question paper and the OMR sheet to the invigilator before leaving the examination hall.

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Part A

1. A test has 50 questions. A student scores 1 mark for a correct answer, $\frac{1}{3}$ for a wrong answer, and $\frac{1}{6}$ for not attempting a question. If the net score of a student is 32, the number of questions answered wrongly by that student cannot be less than

   A. 6

   B. 12

   C. 3

   D. 9

Questions 2 – 4 are based on the following information so read it carefully to answer the questions. Eleven students A, B, C, D, E, F, G, H, I, J, and K are seated in the first row of a class facing the teacher. D who is to the immediate left of F is second to the right of C. A is second to the right of E who is at one of the ends. J is the immediate neighbour of A and B and third to the left of G. H is to the immediate left of D and third to the right of I.

2. Who is sitting in the middle of the row?

   A. C

   B. I

   C. B

   D. G

3. Which of the following sequence of people is sitting to the right of G?

   A. IBJA

   B. ICHDF

   C. CHDF

   D. CHDE

4. Which of the following statements is true in the context of the above sitting arrangement?

   A. There are three students sitting between D and G

   B. G and C are neighbours sitting to the immediate right of H

   C. B is sitting between J and I

   D. K is between A and J

5. Krishna wrote a phone number on a note that he later lost. Krishna can remember that the number had 8 digits, and the digit 1 appeared in the first position and last three places and 0 did not appear at all. What is the probability that the phone number contains at least two distinct prime digits?

   A. 15/16

   B. 13/16

   C. 12/16

   D. 11/16

6. A cricketer's average in his first 18 innings was 16.5 runs. After a further 8 innings his average had increased to 32.5 runs. What was his average for the last 8 innings.

   A. 120

   B. 80.5

   C. 68.5

   D. 65.5

7. Three people Rohit (R), Sachin (S), and Tejas (T) make the following statements about their ages:

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R: I am the eldest.
S: I am the eldest if and only if T is not the youngest.
T: S is elder to me.
If one of them is lying and the other two are telling the truth, then the order of R,S,T in decreasing order of their ages is

A. R T S

B. R S T

C. S T R

D. S R T

8. Six points are marked on a piece of paper with a pen in a random manner. All pairs of points are now joined with either a red line or a blue line. Then which of the following are true:
(i) A red square has to be formed (ii) A red triangle is formed (iii) A blue triangle is formed

A. (i) only

B. (ii) only

C. (iii) only

D. either (ii) or (iii)

9. A watermelon weighs 500 gm. It turns out that 99% of the weight is due to water in the watermelon. After the watermelon was put in a drying room for sometime, it turned out that it is only 98% water by weight. What is the weight of the watermelon now?

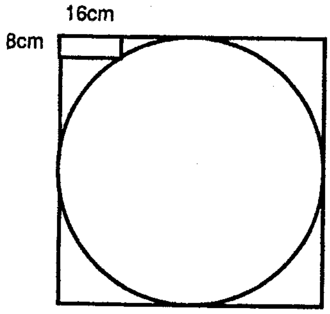
A. 495 gm

B. 250 gm

C. 5 gm

D. 450 gm

10. A circle is inscribed in a square. A small rectangle of size $8cm \times 16cm$ is placed as shown in the picture below. The radius of the circle is



A. 40

B. 50

C. 24

D. 128

11. In how many different ways can the letters of the word 'LEADING' be arranged in such a way that the vowels are always placed next to each other ?

A. 360

B. 480

C. 720

D. 5040

12. If you fold a newspaper sheet 50 times and if 10 million sheets are about a mile thick, then the thickness of the folded newspaper is found approximately as

A. one million miles

B. 10 million miles

C. hundred million miles

D. one billion miles

13. Place four dice on the table and arrange them so all four top numbers

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are the same. Turn any two dice upside down and add the top numbers. What is the sum?

A. 10

B. 14

C. 16

D. cannot say

14. Which one of the following ten digit number containing each digit once, so that the number formed by the first n digits is divisible by n for each value of n between 1 to 10 ?

A. 1234567890

B. 3,618,745,290

C. 3, 816, 547, 290

D. 6231458790

15. A paper of size $l \times w (l > w)$ is folded in half along the longer dimension. It is then folded in half along the other dimension and a third time, along the direction of the first fold. What are the dimensions of the folded paper?

A. $\frac{l}{4} \times \frac{w}{4}$

B. $\frac{l}{8} \times \frac{w}{4}$

C. $\frac{l}{8} \times \frac{w}{8}$

D. $\frac{l}{4} \times \frac{w}{2}$

Questions 16 – 17 are based on the following information.

The people of Namor have a peculiar number system. They use the English alphabet for writing numbers. Any letter with one straight line such as 'D', 'B', etc. is used to represent the number '1'. Any letter with two straight lines ('V', 'T', etc.) represents the number '5'; any letter with three straight lines ('A', 'Z', etc.) represents '10' and finally letters with four straight lines ('E', 'W' etc.) stand for '100.' Numbers are written as a sequence of letters from left to right. If the value of a letter is less than that of the one on its right, then it is *subtracted* from the larger one. If the values of a letter is equal to or greater than the one on its right, nothing is done. After doing all possible subtractions, the resulting numbers are added together. For example, the sequence 'VANE' represents the number '95 [(10-5) + (100-10)].'

16. The word 'WANT' is equal to

A. 120

B. 115

C. 125

D. 35

17. Which of the following statements is *true*?

A. MAZE = FALL

B. EAT = FEET

C. MAN = EVE

D. FLY = AT

18. A paper of size 21×30cm is made into a rectangular box with an open top with walls 4cm in height. Excess paper, if any, is cut and removed from the sheet. The total surface area of the open box (i.e., the area of its four sides plus that of the base) is

A. 630 sqcm

B. 566 sqcm

C. 2520 sqcm

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D. 416 sqcm

Questions 19 – 20 are based on the following:
A program uses a plotting board in the form of a Cartesian plane. The plotting pen is controlled by the program with following commands : RP - This raises the pen, LP -This lowers the pen onto the board and will make a mark if the pen is moved. The pen is moved to location (x, y) on the board with command MP(x,y).

19. Which of the following series of commands will cause a letter 'T' to be drawn

    A. RP,MP(0,0),LP,MP(0,20),MP(-5,20),MP(5,20)

    B. RP,MP(0,0),MP(0,20),MP(-5,20),MP(5,20)

    C. RP,MP(0,0),LP,MP(0,20),RP,MP(-100,20),MP(100,20)

    D. None of these

20. Assuming that the directions North, South, East, West are aligned with the axes of the board, and given the following command sequence: RP, MP(x,y), LP, MP(x,y+1), MP(x, y+1), MP(x-1,y), RP, MP(x,y). This command sequence plots a figure that is

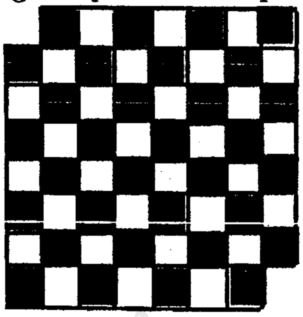
    A. Closed on all sides

    B. Open to North

    C. Open to South

    D. Closed to the South

21. Two diagonally opposite corner tiles of a chessboard are cut and thrown away to give the shape containing 62 squares shown in the figure below. In how many different ways can 31 rectangular pieces, each 2 squares in size be placed on the incomplete chessboard such that no part of the chessboard is left uncovered and no two rectangular pieces overlap?



    A. 0

    B. 1

    C. $\binom{31}{2}$

    D. $\binom{31}{2}/2$

22. In a game, a fair die is tossed repeatedly until a '6' is obtained, to win. The probability that a player needs 3 tosses to win is

    A. 5/36

    B. 125/216

    C. 25/216

    D. 125/216

23. Think of any two digit prime number. Write it down twice side by side to give a 4 digit number. The number of factors for the four digit number (excluding '1') is

    A. 1

    B. 2

    C. 3

    D. Varies with the prime number originally selected

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24. This question is about IPL. There are eight teams and each team played 14 games in the league phase. A win gives '2' points, a loss gives '0' points and there are no ties or draws. Let us define *sum* as the **total number of points won by all the teams**. Which of the following statements about *sum* are true?

   I. The *sum* is a constant independent of the results of the individual matches.

   II. The *sum* varies according to the results of the individual matches.

   III. The difference between the maximum and minimum values the *sum* can take is exactly equal to the difference between the points won by the top-ranked team and the bottom-ranked team.

   A. Only I

   B. Only II

   C. Only III

   D. Only II and III

25. There are three envelopes on a table and one of them contains a secret formula. On the first envelope, it is written, "*The formula is not in here. It is in Envelope 2.*" On the second it is written, "*The formula is not in Envelope 1. It is in Envelope 3*". On the third, it is written, "*The formula is not in here. It is in Envelope 1.*" If both the statements on one of the envelopes are true; one statement is true and one is false on another envelope; and, both the statements are wrong on the remaining one, where is the formula?

   A. In Envelope 1

   B. In Envelope 2

   C. In Envelope 3

   D. In none of the envelopes.

Part B

26. Let $y = \tan^{-1}\frac{1}{1+x+x^2} + \tan^{-1}\frac{1}{x^2+3x+3} + \tan^{-1}\frac{1}{x^2+5x+7} + \ldots$ denote the sum upto n terms, then $y'(0)$ is

   A. $-\frac{1}{1+n^2}$

   B. $-\frac{n^2}{1+n^2}$

   C. $\frac{n}{1+n^2}$

   D. none of these

27. Find the value of the integral

$$\int_0^{\log(5)} \frac{e^x\sqrt{e^x-1}}{e^x+3}dx$$

   A. $3+\pi$

   B. $4-\pi$

   C. $2+\pi$

   D. None of these

28. If $\mid z - \frac{4}{z} \mid = 2$ then the maximum value of $\mid z \mid$ is equal to ,where z is a complex number

   A. $2+\sqrt{2}$

   B. $\sqrt{2}+1$

   C. $\sqrt{5}+1$

   D. 2

29. $2^{\sin^2 x} + 6(2^{\cos^2 x}) = 7$ has

   A. No real solution

   B. Exactly one real solution

   C. Finitely many real solutions

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D. infinitely many real solutions

30. The differential equation $(3a^2x^2 + by\cos(x))dx + (2\sin(x) - 4ay^2)dy = 0$ is exact for

A. $a = 5, b = 0$

B. $a = 4, b = 3$

C. $a = 3, b = 2$

D. $a = 0, b = 1$

31. 2's complement result of $0110.0010 + 1001.0110$ is

A. $+1.4375$

B. $+0.5$

C. -0.5

D. -1.4375

32. For $0 < \theta < \pi$, the matrix $A = \begin{bmatrix} cos\theta & -sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$

A. has no real eigenvalue

B. is orthogonal

C. is symmetric

D. is skew symmetric

33. The AM and GM of the roots of the following polynomial is $F(x) = x^4 - 20 * x^2 + 64$

A. $5, 2\sqrt{2}$

B. $16, 0$

C. $0, 2\sqrt{2}$

D. $0, 2\sqrt{5}$

34. The derivative of the integral $I = \int_{\sin^2 x}^{2\sin x} e^{t^2} dt$ at $x = \pi$ is

A. 2

B. 1

C. -1

D. -2

35. Let A be a $n \times n$ matrix which is both Hermitian and unitary. Then

A. $A^2 = \mathrm{I}$

B. A is real

C. The eigenvalues of A are -1,0,1

D. The minimum and characteristic polynomials are same

36. The determinant

$$\begin{vmatrix} a & b & a\alpha + b \\ b & c & b\alpha + c \\ a\alpha + b & \beta + c & 0 \end{vmatrix}$$

is equal to zero if

A. a, b, c are in $A.P$

B. a, b, c are in $G.P$

C. a, b, c are in $H.P$

D. none of the above

37. If p, q, r are three mutually perpendicular vectors of the same magnitude and if a vector x satisfies the equation $p \times ((x - q) \times p) + q \times ((x - r) \times q) + r \times ((x - p) \times r) = 0$, then the vector x is

A. $(\frac{1}{2})(p + q - 2r)$

B. $(\frac{1}{2})(p + q + r)$

C. $(\frac{1}{3}(p + q + r)$

D. $(\frac{1}{3}(2p + q - r)$

38. A number is chosen at random from the numbers $1, 2, \ldots, 6n + 3$. Let A and B be defined as follows:
A: number is divisible by 2, B: number is divisible by 3 then what is $P(A \cap B)$?

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A. $\frac{2n}{6n+3}$

B. $\frac{n}{6n+3}$

C. $\frac{3n}{6n+3}$

D. none of the above

39. The largest value of a third order determinant whose elements are either one or zero can be

A. 1

B. 2

C. 3

D. none of the above

40. The sum $1 + \frac{2}{3} + \frac{6}{3^2} + \frac{10}{3^3} + \ldots$ is

A. 6

B. 2

C. 3

D. 4

41. Suppose the binary representation of an integer A is $b_m, b_{m-1}, \ldots, b_1, b_0$, where each b_i is either 0 or 1. The integer A is divisible by 3 if and only if

A. The sum of $b_0+b_1+\ldots+b_{m-1}+b_m$ is divisible by 3

B. $b_0 = b_1 = 1$

C. The alternating sum $b_0 - b_1 + b2 - \ldots + (-1)^m b_m$ is divisible by 3

D. The alternating sum $b0 - b_1 + b_2 - \ldots + (-1)^m b_m$ is 0

42. Using the same representation and notation as in the previous question (Q 41), a new integer B is created from A such that b_m in B is equal to b_{m-1} in A, b_{m-1} in B is equal to b_{m-2} in A and so on with $b_0 = 0$ in B. Then,

A. B is exactly half of A

B. B is exactly half of A

C. B depends on A but is always either equal to or greater than A

D. $B = A - 2$

43. The solution of the differential equation

$$9yy' + 4x = 0, \text{where } y' = \frac{dy}{dx}$$

represents a family of

A. Ellipses

B. Circles

C. Parabolas

D. Hyperbolas

44. Number of integral solutions to the equation $xy = 15!$ is

A. 4032

B. 8064

C. 2016

D. 1500

45. The empty relation ϕ is

A. Asymmetric only

B. Symmetric, Antisymmetric but not asymmetric

C. Symmetric, asymmetric bu not antisymmetric

D. Symmetric, antisymmetric and asymmetric

46. Let $f : \mathbf{R} \to \mathbf{R}$ be given as $f(x) = x^3 + 5x + 1$ then

A. f is neither onto nor one-one

B. f is one-one but not onto

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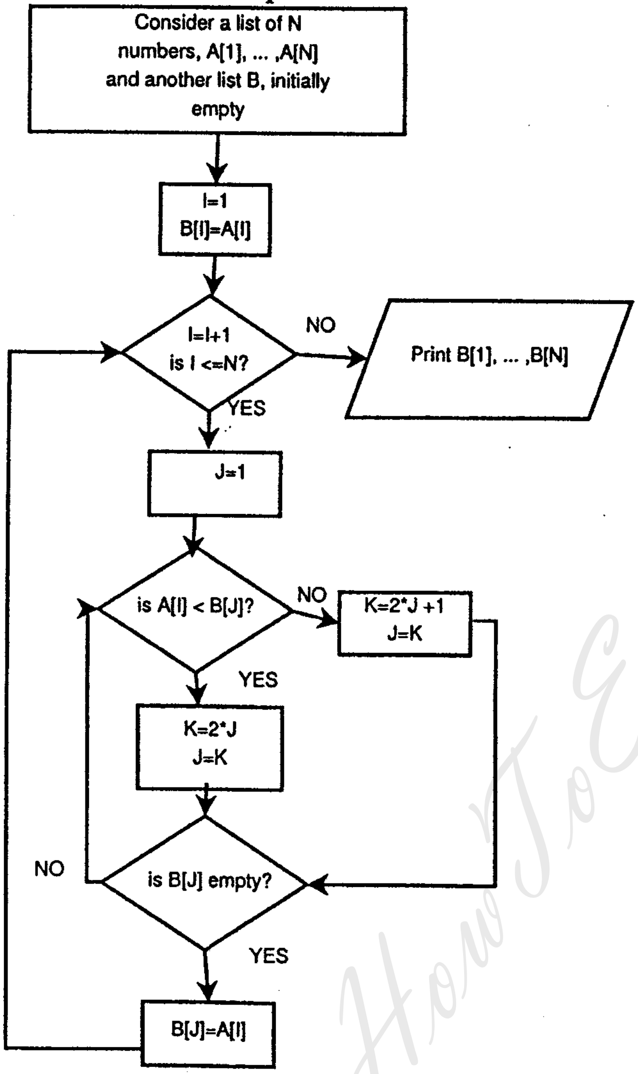
C. f is onto but not one-one

D. f is one-one and onto

Consider the flow graph given here and answer questions 47 – 49 based upon it.



47. Consider list A as 20,5,4,31,56,15. At what position 56 is placed in list B

A. 4

B. 5

C. 6

D. 7

48. Which positions in list B are empty?

A. $B[5]$

B. $B[6]$

C. $B[7]$

D. none of the above

49. The positions 1, 2, 4, 8, 16, 32 in list B are non-empty only when?

A. when elements in list A are all in ascending order

B. when elements in list A are partially ordered

C. when elements in list A are in a random order

D. when elements in list A are are all in descending order

50.

$f(x) = max\{1-x, 1+x, 2\}, x \in (-\infty, \infty)$,

Which one of the following is true about the above function $f(x)$?

A. continuous at all points except $x = 2$

B. differentiable at all points

C. differentiable at all points except at $x = 1$ and $x = -1$

D. continuous at all points except $x = 1$ and $x = -1$, where it is discontinuous

51. Let $f : (0, \infty) \to \mathbf{R}$, and $F(x) = \int_0^x f(t)dt$ if $F(x^2) = x^2(1 + x)$, then $f(4) =$

A. $\frac{5}{4}$

B. 7

C. 4

D. 2

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52. Let $f(x) = \frac{4^x}{4^x + 2}$ then

$$f(\frac{1}{2010}) + f(\frac{2}{2010}) + \ldots + f(\frac{2009}{2010})$$

equals

A. 2009
B. $\frac{2009}{2}$
C. 2010
D. $\frac{2010}{2}$

53. A person speaks the truth 4 times out of 5. He throws a die and speaks that its a six. The probability that it is actually a six is

A. $\frac{1}{3}$
B. $\frac{2}{9}$
C. $\frac{5}{9}$
D. $\frac{4}{9}$

54. The number of relations from A to B where $n(A) = m$, $n(B) = n$ is

A. 2^{m+n}
B. 2^{mn}
C. m+n
D. $2^{m+n} - n$

55. If R, R' are equivalence relations defined on S then $R \cup R'$ is

A. reflexive, symmetric
B. reflexive, transitive
C. irreflexive, symmetric
D. transitive, symmetric

56. The set A has 3 elements, B has four elements and C has 5 elements. The maximum number of elements in $(A \cap C) \cup B$ is

A. 3
B. 5
C. 7
D. 9

57. Given the following statement where the symbols $\neg, \vee, \wedge$ stand for negation, disjunction and conjunction respectively:

$$(P \wedge \neg Q \wedge R) \vee (\neg(Q \vee \neg P)) \vee R.$$

The expression that is most equivalent to it is

A. R
B. $(\neg Q \wedge P \wedge R)$
C. $(\neg Q \vee R) \wedge (P \vee R)$
D. $(\neg Q \vee R) \wedge P)$

58. Let **A** be the set of all 3×3 symmetric matrices whose entries can assume values either 0 or 1. Of the nine entries let five be 1 and four be 0, then the number of matrices in **A** is

A. 12
B. 9
C. 6
D. 3

59. The relationship between $det(AB)$, $det(A)$ and $det(B)$, is best given by which of the following, where

$$A = \begin{bmatrix} 2 & 3 & 4 \\ -5 & 5 & 6 \\ -7 & 8 & 9 \end{bmatrix}, B = \begin{bmatrix} -3 & 4 & 2 \\ -2 & 7 & 6 \\ 5 & -8 & 1 \end{bmatrix}$$

A. $det(AB) < det(A)det(B)$
B. $det(AB) > det(A).det(B)$

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C. $det(AB) = det(A)det(B)$

D. cannot be computed

60. Let $\mathbf{x}$ be an eigenvector of A, and $\mathbf{y}$ be an eigenvector of B, then which of the following is true, given

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}, B = \begin{bmatrix} 1 & 4 & 7 \\ 2 & 5 & 8 \\ 3 & 6 & 9 \end{bmatrix}$$

A. $\mathbf{x} = 1/\mathbf{y}$

B. $\mathbf{x} = \mathbf{y}$

C. $\mathbf{y} = 1/\mathbf{x}$

D. $\mathbf{x} < \mathbf{y}$

61. The set of all points where the function $f(x) = \sqrt{1 - e^{-x^2}}$ is differentiable is

A. $(0, \infty)$

B. $(-\infty, \infty)$

C. $(-\infty, \infty) \setminus \{0\}$

D. $(-1, \infty)$

62. Which of the following gives values of the coefficients a and b for which the function $f(x)$ is continuous and has a derivative at x_0, where

$$f(x) = \begin{cases} x^2 & \text{if } x \leq x_0 \\ ax + b & \text{if } x > x_0 \end{cases}$$

A. $a = x_0, b = -x_0$

B. $a = 2x_0, b = -x_0^2$

C. $a = x_0^2, b = -x_0$

D. $a = x_0, b = -x_0^2$

63. The value of the integral

$$\int_0^{\pi/4} \frac{\sin\theta + \cos\theta}{9 + 16\sin 2\theta} d\theta \text{ is}$$

A. $\log 3$

B. $\log 2$

C. $\frac{1}{20}\log 3$

D. $\frac{1}{20}\log 2$

64. The value of the integral

$$\int_{-\pi}^{\pi} \sin mx \sin nx dx$$

where $m \neq \pm n, (m, n \in \mathbb{Z})$ is

A. 0

B. π

C. $\pi/2$

D. 2π

65. Given $\cot\alpha + \tan\alpha = m$ and $(\cos\alpha)^{-1} - \cos\alpha = n$, then which of the following is true

A. $m(mn^2)^{1/3} - n(nm^2)^{1/3} = 1$

B. $m(m^2n)^{1/3} - n(n^2m)^{1/3} = 1$

C. $n(mn^2)^{1/3} - m(nm^2)^{1/3} = 1$

D. $n(m^2n)^{1/3} - m(n^2m)^{1/3} = 1$

66. Consider the curves $y = \mid x - 1 \mid$ and $y = 3 - \mid x \mid$. The area of their intersection is given by

A. 1

B. 2

C. 3

D. 4

67. A computer scientist jotted down the lengths of the sides of a right angled triangle to be 11 units, 30 units, and 31 units. A colleague looked at these figures and said, " Clearly you don't seem to be using the decimal system." What is the radix used?

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A. 2
B. 3
C. 4
D. 5

68. Let ρ be the ratio of milk prices per litre to brinjal prices per kilogram. $\rho = 3.0$ during one year and in the next year, it was 2.0. σ is defined as the ratio of the brinjal prices per kilogram to milk prices per litre. Which of the following statements is *true*?

A. The geometric mean of ρ is equal to the reciprocal of the geometric mean of σ over the two years.
B. The arithmetic mean of ρ is equal to the reciprocal of the arithmetic mean of σ over the two years.
C. The arithmetic mean of ρ is equal to the geometric mean of σ over the two years.
D. None of the above.

69. The bacterial count in a certain culture increased from 1000 to 4000 in three days. What is the average percentage increase in a day?

A. 100
B. 70.7
C. 58.7
D. 33.3

70. Consider a set of N samples, given by $x_1, x_2, \ldots, x_N$. Let d_j be the sum of deviations w.r.t. x_j and is defined as $\sum_{i=1}^{N}(x_i - x_j)$. Then $\frac{1}{N}\sum_{j=1}^{N} d_j$ is

A. Standard deviation
B. Sample Mean, $\bar{X}$
C. Median
D. 0

71. $y = \exp(-x^2/a)$ is a solution of the differential equation

A. $ayy'' - a(y')^2 + 2y^2 = 0$
B. $ayy'' + a(y')^2 - 2y^2 = 0$
C. $yy'' - (y')^2 + 2ay^2 = 0$
D. $yy'' + (y')^2 - 2ay^2 = 0$

72. 46 + (−98) using 10's complement method is

A. 48
B. 948
C. -52
D. 952

73. Consider the family of functions $y = x^n, (n > 0)$. Apart from the fact that they all coincide at (0,0), which of the the following is most appropriate

A. They meet at (1,1)
B. They meet at (1,1) and also at (-1,1)
C. They meet at (-1,-1) and also at (1,1)
D. They are all symmetric with respect to y axis

74. Which of the following has the largest number of real solutions, where i is given by $\sqrt{-1}$, a, b are constants.

A. $e^{-(a+ix)} = 0$
B. $e^{-(a+bx)} = 0$
C. $e^{-(x^2+i^2)} = 0$
D. $-x^2 e^{-a(x^2+a)} = 0$

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75.

$$\frac{\cos 6x + 6\cos 4x + 15\cos 2x + 10}{\cos 5x + 5\cos 3x + 10\cos x}$$

The above trigonometric expression is more compactly written as

A. $\cos 2x$

B. $2\cos x$

C. $\cos^2 x$

D. $1 + \cos x$

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