Q. No. 1 – 25 Carry One Mark Each

1. What does the binary number "1000" represent in one's complement, two's complement and sign magnitude representations, respectively?
(A) $+8,+8,+8$ (B) $+8,-8,0$ (C) $-7,-4,+8$ (D) None of these

2 Let A and B be two sets and O(A) and O(B) be their respective cardinalities. If the total number of functions from A to B is 47, then we can conclude that
(A) $O(A)=1;\ O(B)=47$ (B) $O(A)=47;\ O(B)=1$
(C) $O(A)=47;\ O(B)=47$ (D) None of these

3. What is the Newton Raphson iterative formula to get the solution(s) for the given equation?

Equation : $x = e^{-x}$

(A) $x_{n+1}=\dfrac{(1+x_n)e^{-x_n}}{1+e^{-x_n}}$ (B) $x_{n+1}=\dfrac{x_n e^{x}}{(1+e^{x_n})x_n}$

(C) $x_{n+1}=\dfrac{x_n^{2}e^{x}}{(1+e^{x_n})}$ (D) $x_{n+1}=\dfrac{x_n^{2}e^{x_n}+1}{e^{x_n}(x_n+1)}$

4. Consider the following program:

```
#define funct(x) x*x+x
    int main()
       {
        int x;
        x=36+funct(5)*funct(3);
        printf("%d",x);
        return 0;
        }
```

What will be the output of the above program?
(A) 73 (B) 396 (C) 109 (D) 360

5. Consider the following function given below:

```
int function(int n)
{
    if(n-1)
        return 2*function(n-1)+n;
    else
        return 0;
}
```

What is the value returned by function (5)?

(A) 33 (B) 41 (C) 57 (D) 65

6. What will be the maximum and minimum number of elements in a max heap of height 'h'?

{Height of a heap is defined as the number of edges from root to the farthest leaf node.}

(A) $2^h, 2^{h-1}$ (B) $2^h - 1, 2^{h-1}$ (C) $2^{h+1} - 1, 2^h$ (D) None of these

7. Consider the pair of regular expressions given below:

$(I)\quad 0*(10*)*\ \&\ (1*0)*1*$

$(II)\quad (r*+s*)\ \&\ (r+s)*$

$(III)\ (a*+b)*\ \&\ (a+b*)*$

$(IV)\ (PQ)*P\ \&\ P(QP)*$

Which of the above pairs represent equivalent regular expressions?

(A) (II) and (I) only (B) (III) & (IV) only

(C) (I), (III), (IV) only (D) All of these

8. Which of the following is FALSE about recursive/Recursive enumerable languages?

(A) Recursive enumerable languages are not closed under complementation

(B) Complement of context - free language must be recursive

(C) Membership problem is not decidable under recursive languages

(D) None of these

9. What is the total number of keys required for a set of 17 individuals to communicate using public key cryptosystem and secret key cryptosystem, respectively?

(A) 36, 153 (B) 34, 153 (C) 36, 136 (D) 34, 136

10. A student can register for at most n courses and each course can have at most m students. Each student is enrolled to at least one course and each course has at least one student. This schema is normalized into three tables:

Student, Registers, Courses

The number of tuples in student and course table are X and Y respectively. Which of the following can be incorrect?

(A) $Y \geq 1$ (B) $Y \leq n \times X$ (C) $X \geq m \times Y$ (D) $X > 0$

11. Which of the following statements is incorrect about XML?

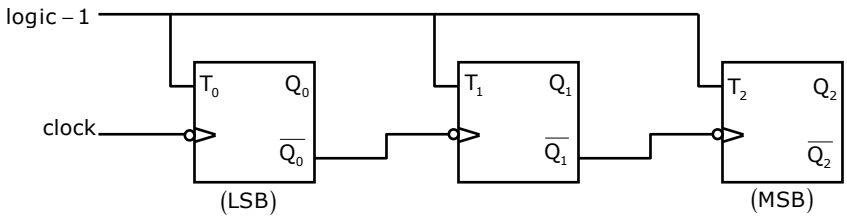
(A) XML documents use a self-describing and simple syntax

(B) It is illegal to omit the closing tag in XML

(C) XML is not case sensitive

(D) All XML documents must have a root element

12. Consider the following circuit of a counter. Given that each of the flip-flops is negative edge triggered, identify the correct configuration for this counter.



(A) 3-bit binary ripple up counter (B) 3-bit binary ripple down counter

(C) BCD counter (D) Mod 7 up/down counter

13. Which of the following file allocation techniques do not suffer from external fragmentation?

I. Contiguous allocation

II. Indexed allocation

III. Linked allocation

(A) All of these (B) I only (C) II only (D) II and III only

14. What is the addressing mode of the following given instruction?

'MUL R1, #2'

(A) Immediate (B) Indexed (C) Indirect (D) Direct

15. Which of the following statements are True/False, map them appropriately, with respect to syntax directed definitions?

I. The terminals in a SDD can have both synthesized as well as inherited attributes.

II. Value of attributes of terminals is generally supplied by lexical analyzer

III. The start symbol does not have an inherited attribute

IV. Attribute grammar is a SDD in which function in the semantic rules should produce side effects.

(A) T T T T (B) T F T F (C) T T T F (D) F T T F

16. In a pipelined RISC computer, where all arithmetic instructions have same CPI, then which of the following actions would improve the execution of typical program

1. Increasing the clock rate
2. Disallowing any forwarding in the pipeline
3. Doubling the size of instruction cache and data cache without changing clock cycle time
4. Increasing the pipeline depth

(A) 1 only (B) 2, 3 only (C) 1, 3 only (D) 1, 3, 4 only

17. For the given schedule, which of the following is TRUE?

T_1	T_2	T_3	T_4
			Read(A)
	Read (A)		
		Read (A)	
Write (B)			
	Write (A)		
		Read (B)	
	Write (B)		

(A) The above schedule is not serializable

(B) The above schedule is equivalent to serial schedule T_3, T_4, T_1, T_2

(C) The above schedule is equivalent to serial schedule T_1, T_4, T_3, T_2

(D) The above schedule is equivalent to serial schedule T_2, T_3, T_1, T_4

18. Consider the message bit stream "0011101111001111010101111 0" which is transmitted from sender to receiver. If the delimiter flag being "011111", then the number of bits that are unstuffed at receiver's end is _____

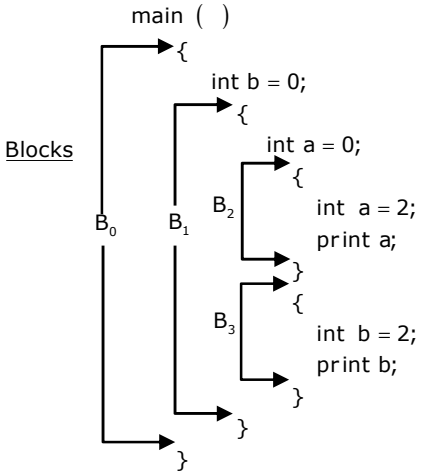
19. The number of 1×4 demultiplexers required to implement a 1×64 demultiplexer is _____

20. Consider a collection of 20 balls, where each ball has a unique number 1 to 20 printed on it. If we take out 8 balls from this collection at random, then the expected value of sum of numbers printed on these 8 balls is _____

21. Consider a paging system with the page table in memory. Each memory reference takes 200 ns. The TLB has the hit ratio of 75% and time to look for pages in TLB is almost negligible. The effective time taken by a paged memory reference in ns is_____

22. Consider a hypothetical processor that supports two address, one address and zero address instructions. It has a 256 word memory, and a 20 bit instruction is placed in 1 word of memory (memory is word addressable). Given that there exist 8 two address instructions and 1984 one address instructions. The total number of zero address instructions formulated is _____

23. In the given code fragment, while implementing lexical scoping of variables, identify the correct scope for declaration: `int b = 0;`



(A) Block B_0 (B) Block $B_0 - B_2$ (C) Block $B_0 - B_3$ (D) Block $B_0 - B_1$

24. What is the time complexity of the following code fragment?

```
void function(int n)
{
    int i, j, k, count = 0;
    for (i = n / 3; i <= n; i++)
        for (j = 1; j <= n / 2 ; j = 2 * j)
            for (k = 1; k * k <= n; k++)
                count++;
}
```

(A) $0\left(\left(\log_3^n \log_2^n\right) n^{1/2}\right)$ (B) $0\left(n^2 \log n\right)$

(C) $0\left(n^{3/2} \log n\right)$ (D) $0\left(n \log^2 n\right)$

25. Which of the following array does not represent a Min-Heap?

i) {2, 3, 5, 8, 11, 4, 7, 9, 12, 6,10}
ii) {2, 3, 5, 8, 4, 11, 7, 9, 12, 6,10}
iii) {2, 3, 5, 4, 8, 11, 7, 9, 12, 6,10}

(A) (i) and (ii)only (B) (ii) only
(C) (iii) only (D) (i) and (iii) only

Q. No. 26 – 51 Carry Two Marks Each

26. What does the following definite integral evaluates to?

$$I = \int_{\pi/6}^{\pi/3} \frac{dx}{1 + \sqrt{\tan x}}$$

(A) $\frac{\pi}{12}$ (B) $\frac{\pi}{6}$ (C) $\frac{3\pi}{8}$ (D) None of these

27. Consider the following predicates:

$\text{singular}(x)$: x is a singular matrix

$\text{orthogonal}(x)$: x is an orthogonal matrix

$\text{symmetric}(x)$: x is a symmetric matrix

What is the correct translation of the assertion given below into logical notation? Every singular and orthogonal matrix is not symmetric.

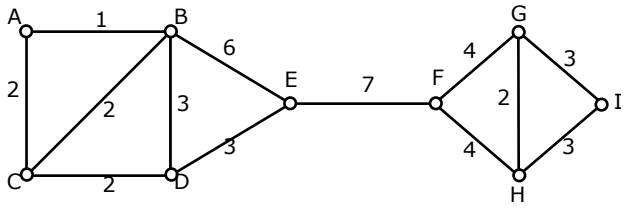
(A) $\forall x\left[\left(\text{singular}(x) \vee \text{orthogonal}(x)\right) \rightarrow \sim \text{symmetric}(x)\right]$

(B) $\forall x\left[\sim \text{singular}(x) \wedge \sim \text{orthogonal}(x) \vee \sim \text{symmetric}(x)\right]$

(C) $\forall x\left[\sim \text{singular}(x) \vee \sim \text{orthogonal}(x) \vee \sim \text{symmetric}(x)\right]$

(D) $\forall x\left[\sim \text{singular}(x) \wedge \sim \text{orthogonal}(x) \wedge \sim \text{symmetric}(x)\right]$

28. Consider the graph given below:



What is the number of distinct minimal spanning trees possible for the above graph using kruskal's algorithm?

(A) 10 (B) 6 (C) 12 (D) None of these

29. Consider a table $R(A,B,C,D,E)$ with functional dependencies as

$A \rightarrow B$

$B \rightarrow C$

$D \rightarrow E$

Table is decomposed as $D=\{R_1(A,B), R_2(B,C), R_3(D,E)\}$. Then decomposition is

(A) Dependency preserving and lossless

(B) Dependency preserving and lossy

(C) Neither dependency preserving nor lossless

(D) Not dependency preserving but lossless

30. Assume that there are three departments A, B and C in an organization. Each of the department requires a separate subnet, and respective requirement of address being 28, 14 and 53. Also organization got a class C network address 216.85.102.0. Which of the following could be possible broadcast address for each subnet?

(A) A – 216.85.102.31
B – 216.85.102.95
C – 216.85.102.127

(B) A – 216.85.102.15
B – 216.85.102.31
C – 216.85.102.63

(C) A – 216.85.102.63
B – 216.85.102.31
C – 216.85.102.127

(D) None of these

31. Consider an array multiplier, used to multiply 'm' bits multiplicand with 'n' bit multiplier. Then what should be the number of AND gates, adders and size of ROM need to store the result respectively?

(A) $(m \times n), (n-1)$'m' bit adders, $2^{m+n} \times (m+n)$ bits

(B) n , $(m-1)$'n' bit adders, $2^{m+n-1}(m+n)$ bits

(C) $(m \times n), (m-1)$'n' bit adders, 2^{m+n} bits

(D) n, $(n-1)$'m' bit adders, $2^{m+n-1} \times (m+n-1)$ bits

32. Assume that in a system, there are 4 processes P_0, P_1, P_2, P_3 with maximum need of resource R as:

	Max. Need	Current Allocation
P_0	11	8
P_1	5	3
P_2	9	3
P_3	13	9

If there are 25 instances of resource R, then which of the following is not a safe sequence?

(A) $\langle P_1, P_0, P_3, P_2 \rangle$ (B) $\langle P_1, P_3, P_0, P_2 \rangle$

(C) $\langle P_1, P_2, P_3, P_0 \rangle$ (D) None of these

33. What should be the minimum number of NAND gates only, NOR gates only, 2×1 MUX only, and size of decoder, respectively, in order to implement a Half Adder circuit

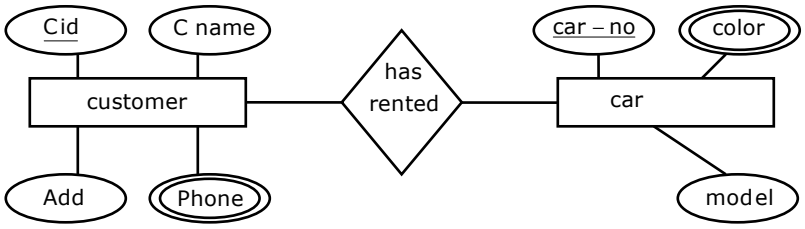
(A) $5, 5, 3, (2 \times 4)$ decoder

(B) $5, 5, 4, (2 \times 4)$ decoder

(C) $4, 4, 3, (3 \times 8)$ decoder

(D) $4, 5, 4, (2 \times 4)$ decoder

34. The ER diagram shown below depicts a car rental scheme, where every customer can take more than 1 car for rent, or 1 car may be rented to multiple customers.



If the above ER diagram is mapped to a relational model, to correctly depict above scenario, the total number of required relations is_____

35. Consider the following grammar:

$T \rightarrow R \mid aTc$

$R \rightarrow \varepsilon \mid bR$

The total number of LR(0) items or states in the SLR(1) parsing table of the above grammar is _____

36. Suppose that disk drive has 250 cylinders. The drive is currently serving the request at cylinder 67. The previous request was at cylinder 50. A queue of pending request in FIFO order is:

92,164,111,12,77,200,248,155

Starting from the current head position, the percentage of head movements saved when using shortest seek time first algorithm instead of elevator algorithm is_____

37. A hard disk needs 50ms for placing the head on the right track. One track rotational delay is 5ms. There are 63 sectors on each track, each sector storing 512 bytes, and the data is supposed to be distributed in the best possible way. If transfer time is 0.5 ms/sector then the time required to read 500KB of data in milli seconds is _____

38. Consider a 1000MBps token ring network with a ring latency of 500μseconds. Assume that there are 15 stations attached to the ring and the network allows each station to transmit 2 KB frame, each time the station possess the token.

Assume that stations having no data to send simply bypass the token. If 8 out of 15 machines have data to send then the token rotation time(in μsec) is _____

39. Suppose that a direct-mapped cache has 2^{10} cache lines, with 2^4 bytes of data per cache line. If the cache is used to store blocks for a byte addressable memory of size 2^{30} bytes, then how many bytes of space will be required for storing the tags?

(A) 2^{15} bytes (B) 2^{11} bytes (C) 2^6 Kbytes (D) None of these

40. Consider the following set of relations:

EMP(eno, ename, dno)
DEPT(dno,dname)

Primary key columns are underlined and dno in EMP is a foreign key referring primary key of DEPT table.

Now consider the following queries:

QUERY : 1
SELECT *
FROM emp e, dept d
WHERE e.dno = d.dno;

QUERY : 2
SELECT *
FROM emp NATURAL JOIN dept;

Then which of the following statements are TRUE regarding the above queries?

I. Both Query:1 and Query:2 returns same no of rows.
II. Both Query:1 and Query:2 returns same no of columns.
III. Both Query:1 and Query:2 returns different no of rows.
IV. Both Query:1 and Query:2 returns different no of columns.

(A) I, II only
(B) I, IV only
(C) II, III only
(D) III, IV only

41. For the given matrix $A = \begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$, find the corresponding matrix A^{20}

(A) $\begin{bmatrix} \frac{3^{20}}{2}+1 & \frac{3^{20}}{2}-1 \\ \frac{3^{20}}{2}-1 & \frac{3^{20}}{2}+1 \end{bmatrix}$

(B) $\begin{bmatrix} \frac{\sqrt{3^{20}-3}}{2} & \frac{\sqrt{3^{20}+3}}{2} \\ \frac{\sqrt{3^{20}+3}}{2} & \frac{\sqrt{3^{20}-3}}{2} \end{bmatrix}$

(C) $\begin{bmatrix} \frac{3^{20}+1}{2} & \frac{3^{20}-1}{2} \\ \frac{3^{20}-1}{2} & \frac{3^{20}+1}{2} \end{bmatrix}$

(D) $\begin{bmatrix} \frac{3^{20}+1}{2} & \frac{3^{20}-3}{2} \\ \frac{3^{20}-3}{2} & \frac{3^{20}+1}{2} \end{bmatrix}$

42. Let A be the set of all non-singular matrices of order n over real numbers and let * be the matrix multiplication operator. Then
(A) A is closed under * but <A,*> is not a semi group
(B) <A,*> is a semi group but not a monoid
(C)<A,*> is a monoid but not a group
(D)<A,*> is a group but not an abelian group

43. For the language $L = a^i b^j c^k$, consider the following possible conditions on i, j, k

$(C1)$ $i = j + k$, $i, j, k \geq 0$

$(C2)$ $j = i + k$, $i, j, k \geq 0$

$(C3)$ $k = i + j$, $i, j, k \geq 0$

$(C4)$ $i < j$ & $j < k$, $i, j, k \geq 0$

$(C5)$ $i = j$ & $j < k$, $i, j, k \geq 0$

For which of the above conditions, the language L is not a context-free language?
(A) C2, C4 only (B) C2, C4 and C5 only
(C) C1, C2, C3, C4 only (D) C3, C4, C5 only

44. Consider the following languages L_1, L_2 represented as grammars G_1 & G_2

$G_1 \Rightarrow S \rightarrow aB \mid BA$ $G_2 \Rightarrow S \rightarrow Sba \mid a$

$A \rightarrow bAA \mid aS \mid a$

$B \rightarrow b \mid bS \mid aBB$

Which of the following statements is true about $L_3 = L_1 \cap L_2$ and $L_4 = L_1.L_1^*$?

(A) Both L_3 and L_4 are not context free

(B) L_3 is context free, but L_4 is not

(C) Both L_3 and L_4 are context free

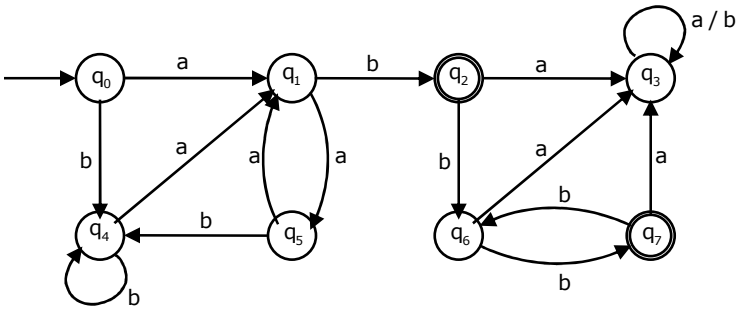
(D) L_4 is context free, but not L_3

45. Consider a hash table with size 11 & hash function h(key) = h(key)%11. Collisions are resolved using linear probing. Following operations are performed sequentially on the given hash table.

I. Insert (17) IV. Insert (28)
II. Insert (54) V. Insert(40)
III. Insert (66) VI. Insert (50)

What will be the number of collisions?
(A) 2 (B) 3 (C) 4 (D) 5

46. Consider the DFA shown below:



The number of sets of states in the equivalent minimized DFA is ---------

47. A 2km 8 kbps token ring LAN has 25 stations. Each station introduce 2 bit delay. By assuming the propagation speed as $200m/\mu sec$, then the maximum length of token is -----

Common Data Questions: 48 & 49

The odds are 11:5 against a man, who is 38 years old, living till he is 73 and 5:3 against another man, who is now 43 years old, living till he is 78.

48. What is the probability that both will be alive 35 years hence?

(A) $\frac{55}{128}$ (B) $\frac{11}{16}$ (C) $\frac{5}{16}$ (D) $\frac{15}{128}$

The odds are 11:5 against a man, who is 38 years old, living till he is 73 and 5:3 against another man, who is now 43 years old, living till he is 78.

49. What is the probability that at least one of then will be alive 35 years?

(A) $\frac{15}{128}$ (B) $\frac{73}{128}$ (C) $\frac{84}{128}$ (D) $\frac{55}{128}$

Common Data Questions: 50 & 51

For a system the Mean time between failures is 24 days and mean time to repair is 12 hours. Availability of the software is given as x

50. The mean time to failure in hours _____

For a system the Mean time between failures is 24 days and mean time to repair is 12 hours. Availability of the software is given as x

51. The value of x in percentage is_____

Linked Answer Questions: Q.52 to Q.55 Carry Two Marks Each
Statement for Linked Answer Questions: 52 & 53

Following keys are inserted into a binary search tree and AVL tree in given order.
Keys: 45 30 8 36 60 51

52. What is the difference in the height of given binary search tree and AVL tree?
(A) 3 (B) 2 (C) 0 (D) 1

Following keys are inserted into a binary search tree and AVL tree in given order.
Keys: 45 30 8 36 60 51

53. The following nodes are added into corresponding BST and AVL tree then what is the difference in height of BST and AVL tree?
Keys: 4 16 25 (added afterwards in the corresponding trees)
(A) 1 (B) 2 (C) 3 (D) 0

Statement for Linked Answer Questions: 54 & 55

Consider the following code fragment:

```
int map [128][2];
int i, j;
int com, count;
com = count = 0;
for (i = 0; i < 128; i++)
{
        for (j = 0; j < 2 ; j++)
        {
                com += map[ i ][ j ];
        }
}
for (i = 0 ; i < 128 ; i++)
{
        for (j = 0; j < 2; j++)
        {
                if (map[i][j] == 0)
                count ++;
        }
}
```

Assume that the address of array map is 0, and i, j, com, count are all in registers.

54. What is the miss rate for the code, assuming that the cache holds 512 bytes of data and is direct mapped, block size = 8 bytes.
Also assume size of integer = 2 bytes.
(A) 18% (B) 12.5% (C) 5% (D) 25%

Consider the following code fragment:

```
int map [128][2];
int i, j;
int com, count;
com = count = 0;
for (i = 0; i < 128; i++)
{
        for (j = 0; j < 2 ; j++)
        {
                com += map[ i ][ j ];
        }
}
for (i = 0 ; i < 128 ; i++)
{
        for (j = 0; j < 2; j++)
        {
                if (map[i][j] == 0)
                count ++;
        }
}
```

Assume that the address of array map is 0, and i, j, com, count are all in registers.

55. In order to reduce the miss rate by half as that in previous question, which of the following is most appropriate way to achieve that?

(A) 2 * size of cache memory (B) 2* size of block

(C) Use of associative mapping instead of direct mapping

(D) Both (A) and (B) simultaneously

Q. No. 56 – 60 Carry One Mark Each

56. The synonym for the word "PROFLIGACY" is

(A) Conservation (B) Reservation (C) Wasteful (D) Tasteful

57. Find the odd one out:

(A) Zoom (B) Rush (C) Whizz (D) Zither

58. Examiner: Examinee: : Preceptor:

(A) Disciple (B) Customer (C) Guest (D) Host

Find out the error part in the given sentences:

59. He told that /he hadn't/ eaten anything/ for over a week

[A] [B] [C] [D]

60. The sum of money at S.I amounts to Rs.800 in 4 years & to Rs.900 in 5 years. The sum is

(A) 400 (B) 600 (C) 300 (D) 1200

Q. No. 61 – 65 Carry Two Marks Each

61. A girl Sneha always complained about breakfast. The cook tried everything but she was unhappy. She went to a super market and brought one of those ready-to-cook packets. She cooked the packets on her own and found the food to be delicious.

Choose the best supporting statement:

(A) Practice makes man perfect.

(B) The mind is not a vessel to be filled, but a fire to be ignited.

(C) Smart work is the key to success.

(D)Nothing gives as much satisfaction as earning our rewards

62. Price of commodities X & Y increases 40paise & 15paise every year respectively. If in 2001, the price of commodity X was Rs, 4.20 and that of Y was Rs. 6.30, in which year commodity X will cost 40paise more than Y ?

(A) 2010 (B) 2011 (C) 2012 (D) 2013

63. A alone can do a piece of work in 6 days & B in 8 days. A & B undertook to do it for Rs.3200 with the help of C, they completed work in 3 days. How much is to be paid to C?

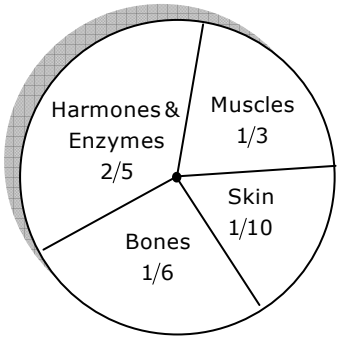
(A) 200 (B) 300 (C) 400 (D) 600

64. Three times the first of three consecutive odd integers is 3 more than twice the third integer. Find the third integer.

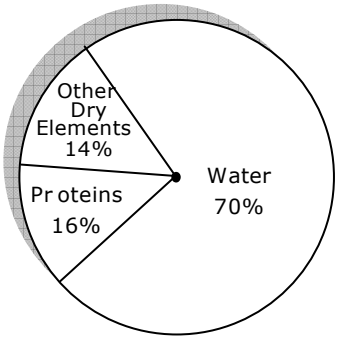
(A) 17 (B) 11 (C) 9 (D) 1

Information for Q.N. 65

Proportion of components in Human body



Percentage of components in Human body



65. What % of total weight of human body is equivalent to weight of proteins in skin in human body?

(A) 3.6 (B) 2.6

(C) 1.6 (D) Cannot be determined