Gate 2nd March Morning

Q.1 The number of distrinct minimum spanning tree for weighted graph given below is

- 1. (6)
- Q.2 Maximum number of super keys for the relational schema (E, F, G, H) with E as key.
 - 2. (8)

$$2^{n-1} = 2^{4-1} = 8$$

- Q.3 Average of all the multiple of 10 from 2 to 198 is __

(b) 100

(c) 110

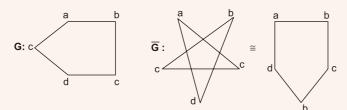
(d) 120

3. (b)

$$(10 + 190) + (20 + 180) + \dots + (90 + 110) + 100 = 1800 + 1000 = 1900$$
[Multiples of 10]

Average =
$$1900/19 = 100$$

- Q.4 A cycle of n vertices is isomorphic to its complement then value of n is?
 - 4. (5)



G and G' are complement and isomorphic to each other when G has five vertices.

- **Q.5** Which of the following is not performed during compilation?
 - (a) Dynamic memory allocation
- (b) Type checking
- (c) Symbol table management
- (d) Inline expression

5. (a)

Dynamic memory allocation is performed during run time.

- **Q.6** Value of $\sqrt{12 + \sqrt{12 + \sqrt{12 + \sqrt{12 + \dots}}}}$
 - (a) 3.466

(b) 3.932

(c) 4.000

(d) 4.444

```
6. (c)
```

$$\sqrt{12 + \sqrt{12 + \sqrt{12} + \sqrt{12}}} = 3.998343153 \approx 4$$

```
\mathbf{Q.7} inf f (int j)
             static int i = 50;
             int k;
             if (i = = j)
                  printf ("something");
                  k = f(i);
                  return 0;
             else
                  return 0;
```

- (a) function will return 0 for all j
- (b) function prints "something" for all values of j
- (c) for i = = j function goes into infinite loop
- (d) for i = j function returns 0
- 7. (c)

f(50) goes into infinite loop by calling f(i) recursively for i = j = 50.

- Q.8 Probability that a given integer lying between 1 and 100 (both inclusive) is not divisible by 2, 3 or 5 ___
 - 8. (0.26)

$$1 - \frac{74}{100} = 0.26$$

- **Q.9** If $|\mathbf{x}^2 2\mathbf{x} + 3| = 11$ then possible values of $|-\mathbf{x}^3 + \mathbf{x}^2 \mathbf{x}|$
 - (a) 4, 5

(b) 14, 5

(c) 4, 52

(d) 14, 52

9. (d)

$$x^{2} - 2x + 3 = 11$$

$$\Rightarrow x^{2} - 2x - 8 = 0$$

$$\Rightarrow x^{2} - 4x + 2x - 8 = 0$$

$$\Rightarrow x(x - 4) + 2(x - 4) = 0$$

$$\Rightarrow x = 4, -2$$
Put $x = 4$ in $|-x^{3} + x^{2} - x|$



$$\left| -(4)^3 + (4)^2 - (4) \right| = \left| -64 + 16 - 4 \right| = \left| -52 \right| = 52$$

Put $x = -2$ in $\left| -x^3 + x^2 - x \right|$
 $\left| -(-2)^3 + (-2)^2 - (-2) \right| = 14$

Q.10 Consider the following code

```
int n = 0
int S = 1
producer()
                               consumer()
{
     produce();
                                    wait (S);
     wait (S);
                                    wait (n);
     put in buffer ();
                                    consume();
     signal (S);
                                    signal();
     signal (n);
```

- (a) Consumer can consume only one item
- (b) If n = 1 initially it is deadlock free
- (c) Have a deadlock when buffer is empty if consumer precedes producer
- (d) They are working properly
- 10. (c)

Consumer executes wait(S) then wait(n) and goes to sleep by decreasing n value.

After consumer sleep, producer goes to the sleep by executing wait(S).

Q.11 What is tightest upper bound of $2T(n/2) + \log n$

(a) O(n)

(b) O(n²)

(c) O(nlogn)

(d) $O(\log n)^2$

11. (a)

$$T(n) = 2 T(n/2) + logn = O(n)$$

Q.12 Consider the following table

Studid	Studname	Age	Course
1245	Sachin	X	c1
4279	Manjit	18	c4
2481	Sachin	19	c5
9436	Sumit	17	c2

If we are using (Studname, Age) as a key then what should not be the value of x?

12. (19)

Age can not be 19, because (Studname, Age) is a key.

- Q.13 Which of the following is true about RIP and OSPF protocol
 - (a) RIP uses distance vector routing and OSPF uses link state protocol
 - (b) RIP uses link state protocol and OSPF uses distance vector routing
 - (c) Both are using vector routing algorithm
 - (d) Both are using link state protocol
- 13. (a)

RIP uses distance vector rounting and OSPF uses link state protocol.

```
Q.14 int f (int num)
      {
           int num;
           int count = 0;
           while (num)
             count ++;
             num >>= 1;
             return (count);
```

What value is returned by f(435)?

14. (9)

435 = 110110011

num >>= 1; implies a num is shifted one bit right everytime while loop is executed. While loop is executed 9 times successfully and $10^{\rm th}$ time num is zero. So count is incremented 9 times.

- **Q.15** It $L_1 = \{a^n \mid n \ge 0\}$ and $L_2 = \{b^n \mid n \ge 0\}$
 - I. $L_1 \cdot L_2$ is regular
 - II. $L_1 \cdot L_2 = \{a^n b^n \mid n \ge 0\}.$

Which of the following is correct?

(a) I only

(b) II only

(c) both I and II

(d) none of these

- 15. (a)
- Q.16 Convert decimal -14.25 into IEEE 754 32-bit single precision into hexadecimal where sign bit contain 1 bit, bias field contain 8 bit and mantissa part contain 23 bits.
 - (a) 4 1 6 4 0 0 0 0

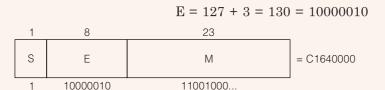
(b) 4 1 6 c 0 0 0 0

(c) c 1 6 4 0 0 0 0

(d) c 1 6 2 0 0 0 0

16. (c)

$$14.25 = 1110.010$$
$$= 1.110010 \times 2^{3}$$
$$M = 110010$$



Q.17 Host A and Host B are connected via with two intermediate routers R1 and R2 as shown in the following figure.



Each link has bandwidth of 10⁶ bits/sec. In packet switching host A sends data to host B via R1 and R2 of 1000 bytes. Assume only transmission time considered, propogation delay and interface delay are negligible. Consider there are three scenarios in which packet is transmitted from A to B using stor and forward mechanism. In first transmission data is sent at a time. In second transmission packet is divided into 10 equal parts. In third transmission, packet is divided into 20 equal parts. The overhead on the packet in form of header is 100 bytes. Assume T1, T2 and T3 are time taken by first, second and third transmissions respectively.

Then which of the following is correct

(a) T1 < T2 < T3

- (b) T1 = T3 and T2 < T3
- (c) T1 = T2 and T2 < T3
- (d) T3 < T2 < T1

17. (b)



Bandwidth: 10⁶ bps Packet size: 1000 bytes

1st transmission: 1000 +100 = 1100 bytes transmitted at a time from A

 $10^6 \text{ bits} \rightarrow 1 \text{ sec}$ 1100 bytes?

Transmission time at A = $1100 \times 8 / 10^6 = 8.8$ msec.

From A, R1 and R2 it takes T1 = 8.8 + 8.8 + 8.8 = 26.4 msec to reach B

 2^{nd} transmission: 100 +100 = 200 bytes transmitted 10 times from A $10^6 \text{ bits} \rightarrow 1 \text{ sec}$

200 bytes ?

Transmission time at A for 200 bytes = $200 \times 8 / 10^6 = 1.6$ msec.

From A transmission time for entire packet = $1.6 \times 10 = 16$ msec

Note: It uses store and forward so when 10th packet is transmitted from A, B receives 8th packet.

From A, R1 and R2 it takes T2 = 16 + 1.6 + 1.6 = 19.2 msec to reach B



$3^{\rm rd}$ transmission: 50 +100 = 150 bytes transmitted 20 times from A

 $10^6 \text{ bits} \rightarrow 1 \text{ sec}$

150 bytes?

Transmission time at A for 150 bytes = $150 \times 8 / 10^6 = 1.2$ msec.

From A transmission time for entire packet = $1.2 \times 20 = 24$ msec

Note: It uses store and forward so when 10th packet is transmitted from A, B receives 8th packet.

From A, R1 and R2 it takes T3 = 24 + 1.2 + 1.2 = 26.4 msec to reach B.

T1 = T3 = 26.4 msec

T2 = 19.2 msec, T2 < T3

- Q.18 R and S are distinct subsets of {1, 2, ..., 2014}. R < S if symmetric difference has smallest element in R. Which of the following is true?
 - 1. There exist a subset which is less than every subset.
 - 2. The exist a subset which is larger than every subset.
 - (a) Both False

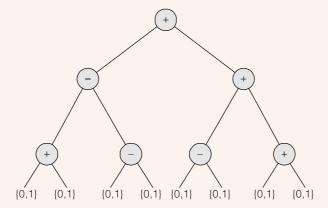
- (b) Both true
- (c) 1 is false and 2 is true
- (d) 1 is true and 2 is false

18. (a)

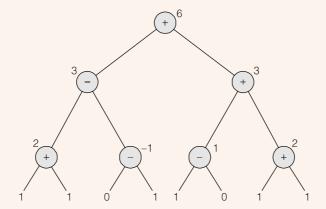
- Q.19 Select * from R where a in (select S.a from) which of the following is same as above SQL?
 - (a) #
 - (b) #
 - (c) Select * from R as R (select distinct a) as S1 where R.a = S1.a
 - (d) #

19. (c)

Q.20 Maximum value of the following tree where each key hot the decimal value 0 or 1.



20. (6)



Q.21 Consider the following grammer.

$$C \rightarrow S \mid T$$

$$S \rightarrow U + S$$

$$\mathrm{S} \to \mathrm{U}$$

$$U \rightarrow id$$

$$T\to T{*R}$$

$$\mathrm{T} \to \mathrm{R}$$

$$R \rightarrow id$$

Which of the following is true?

- (a) + is left associative, * is right associative
- (b) + is right associative, * is left associative
- (c) + and * both left associative
- (d) + and * both right associative

21. (b)

- + is right associative (with right recursion from S) and
- * is left associative (with left recursion from T)

Q.22 What is the maximum number of edges in bipartite graph with 12 vertices?

22. (36)

Bipartite graph

- (a) $1, 11 \Rightarrow 1 \times 11 = 11$ edges maximum
- (b) $2, 10 \Rightarrow 2 \times 10 = 20$ edges maximum
- (c) $3, 9 \Rightarrow 3 \times 9 = 27$ edges maximum
- (d) $4, 8 \Rightarrow 4 \times 8 = 32$ edges maximum
- (e) $5, 7 \Rightarrow 5 \times 7 = 35$ edges maximum
- (f) $6, 6 \Rightarrow 6 \times 6 = 36$ edges complete bipartite graph = 36 edges

Q.23 Which of the following time with hours and minutes clock produces 60 degree angle between 6 am to 7 am

(a) 6:27 am

(b) 6:22 am

(c) 6:38 am

(d) 6:45 am

23. (b)

Q.24 Determine of
$$\begin{bmatrix} 2 \\ -4 \\ 7 \end{bmatrix} [159] = \underline{\qquad}$$

24. (0)

$$\begin{bmatrix} 2 \\ -4 \\ 7 \end{bmatrix} \begin{bmatrix} 1 & 5 & 9 \end{bmatrix} = \begin{bmatrix} 2 & 10 & 18 \\ -4 & -20 & 36 \\ 7 & 35 & 63 \end{bmatrix} \rightarrow \det = 0$$

- Q.25 Queue is inplemented using the stack where stack has 2 operation push and pop. as well as stack has third operation "reverse" to reverse all the elements of the stack. How many stack operations are needed to implement enqueue and dequeue operations of queue respectively?
 - (a) 2 operations for equeue and 1 operation for queue
 - (b) 3 operations for enqueue and 2 operation for dequeue
 - (c) 3 operations for enqueue and 1 operation for dequeue
 - (d) 1 operation for enqueue and 3 operations for dequeue.

25. (c)

Three operations for enqueue (reverse, push, reverse). One operation for dequeue (pop)

- **Q.26** Fon n-variables, how many self dud Boolean functions are possible?
 - (a) 2ⁿ

(c) 2^{2^n}

(d) $2^{2^{n-1}}$

26. (d)

- **Q.27** If a cubic polynomiad in X has roots at x = 1, x = 2 and x = 3 then which of the following must be true?
 - (a) $f(0) \cdot f(4) < 0$

(b) $f(0) \cdot f(4) > 0$

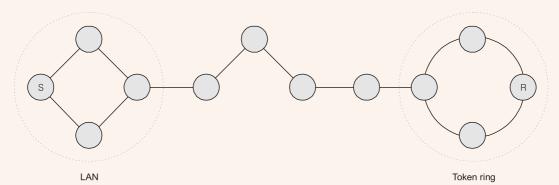
(c) f(0) + f(4) > 0

(d) f(0) + f(4) > 0

27. (a)

$$f(0) \cdot f(4) < 0$$

Q.28 Consider the following Figure



If IP packet sent from S with TTL value initially 32 then what is the maximum possible TTL when received at R?

28. (23)

From S to R there are 10 nodes.

32 - 9 = 23 is TTL value when packet is received at R.

(Except R all nodes will decrement the TTL value)

- Q.29 In TCP, which of the following function converts an active unconnected mode to passive mode?
 - (a) connect()

(b) bind()

(c) listen()

(d) None of these

29. (c)

listen() converts unconnected mode to passive mode.

- Q.30 If A is mapping reducible to B, which of the following is false
 - (a) If A is undecidable then B is also undecidable
 - (b) If A is not recursive enumerable then B is also not recursive enumerable
 - (c) If B is recursive then A is recursive
 - (d) If B is undecidable then A is undecidable
- 30. (d)

If B is undecidable then A need not be undecidable.

Q.31 Find how many x-y values are possible to satisfy following equation

$$(123)_5 = (x8)_v$$

31. (3)

$$1*5^{2} + 2*5^{1} + 3*5^{0} = x*y^{2} + 8*y^{0}$$

 $25 + 10 + 3 = xy + 8$
 $38 - 8 = xy$
 $xy = 30$

Possible combinations:

$$x = 1, y = 30$$

$$x = 2, y = 15$$

$$x = 3, y = 10$$

$$x = 5, y = 6$$

Possible x-y values to satisfy given equation

1.
$$x = 1, y = 30$$

2.
$$x = 2, y = 15$$

3.
$$x = 3, y = 10$$

= 3 possibilities

- **Q.32** L = {"M | M accepts the strings of length 2014"}. The language L is _____
 - (a) Undecidable and Recursive enumerable
 - (b) Undecidable but not recursive enumerable
 - (c) Decidable and recursive
 - (d) Decidable but not recursive
- 32. (a)

Language is recursive enumerable and it is undecidable.

- Q.33 HTML webpage contain an embedded picture within it. How many requests are needed to browse the webpage and embeded pic respectively?
 - (a) 2 HTTP requests and 2TCP requests
 - (b) 1 HTTP request and 1 TCP request
 - (c) 1 HTTP request and 2 TCP requests
 - (d) 2 HTTP requests and 1 TCP request
- 33. (c)
- 1 HTTP request to load the webpage and 2 TCP requests page and picture.
- Q.34 Match List-I and List-II

List-I

- A. Eradicate
- B. Utilize
- C. Saturate
- D. Distort

Codes

A B C D

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

34. (c)

List-II

- 1. Use
- 2. Misrepresent
- 3. Completely soaked
- 4. Destory

- Q.35 If there are 10 computers in a systems out of which 4 are working correctly. 4 computers are selelected randomly to test the system functionality. If atleast 3 are found working perfectly then system is declared as working. If the probability that the system is working is 'p', then find 100 p.
- 35. (17.92)

$$p = {}^{4}C_{3} \cdot (0.4)^{3} \cdot (0.6)^{1} + ({}^{4}C_{4}) \cdot (0.4)^{4}$$
$$= 0.1792$$

$$\Rightarrow$$
 100 p = 17.92

- Q.36 A system has 8 memory chips. CPU can request a chip through bus in 100 ns and chip needs 500 ns more to service that request. In 1 ms how many requests can be made at maximum?
- 36. (1666)

Total time of each request = 500 ns + 100 ns = 600 ns

There are 8 memory chips

 $1 \text{ request} \rightarrow 600 \text{ ns}$

 $? \rightarrow 1 \text{ ms}$

$$\frac{1 \text{ ms}}{600 \text{ ns}} = \frac{10^6}{600} = \lfloor 1666.6 \rfloor = 1666 \text{ requests.}$$

- Q.37 In an connected unweighted simple graph, breadth first search (BFS) returns ___
 - (a) #
 - (b) #
 - (c) Shorter path from a source to every other vertex
 - (d) #
- 37. (c)
- Q.38 Find expected length of following 9 strings if each is written on one card and selected at random.

"The quick brown for jumps over the lazy dog"

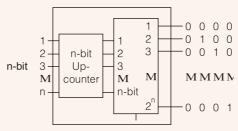
- 38. (3.9)
- **Q.39** If $k = 2^n$ and there is an UP counter of mod k, and which is connected to $n \times 2^n$ decoder then it resembles which of the following?
 - (a) Ring counter

(b) Johnson counter

(c) Mod k up counter

(d) Mod k down counter

39. (a)



Ring counter of 2ⁿ bits

Q.40 Consider the following function.

```
double f(double x)
     if(abs (x \times x - 3) < 0.01) return x
     else
     return f(x/2 + 1.5/x);
```

Give a value q (to 2 decimal) such that f(q) will return 'q'

40. (1.73)

$$q = 1.73 \Rightarrow f(q) = q$$

- Q.41 On increasing the associating of the cache, which of the following is not affected?

- (b) #
- (c) Data bus from cache to CPU
- (d) #

41. (c)

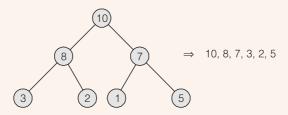
- Q.42 Given max heap with level order elements as 10, 8, 5, 3, 2 in order. Insert 1 and 7 into the heap tree and find the BFS of resultant tree.
 - (a) #

(b) #

(c) 10, 8, 7, 3, 2, 1, 5

(d) #

42. (c)

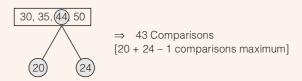


Q.43 Given 5 sorted files with sizes 20, 24, 30, 35 and 50. Find the minimum number of comparisions using optimal merging of these files:

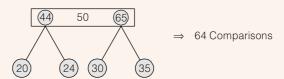
43. (358)

Given files: 20, 24, 30, 35, 50

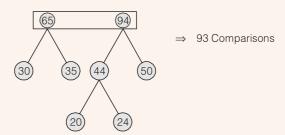
Step-I:



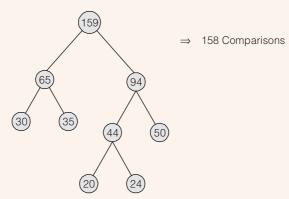
Step-II:



Step-III:



Step-IV:



$$\therefore$$
 158 + 93 + 64 + 43 = 358 comparisons

- **Q.44** Assume n is very large and $p = {}^{n}C_{3}$. In C, which of the following can compute correctly for p?
 - (a) $P = n \times (n-1) \times (n-2)/6$
- (b) $P = n \times (n-1) \times (n-2)/6.0$
- (c) $P = n \times (n-1)/3 \times (n-2)/2$
- (d) $P = n \times (n-1)/2 \times (n-3)/3$

44. (b)

- Q.45 India is a colonial country because
 - (a) India was former british colony
 - (b) Indian information technology professional colonize the world
 - (c) India does not follow colonial practices
 - (d) India has helped other country to gain freedom

45. (a)

Q.46 Which of the following is not a tautology?

- (b) #
- (c) $(a \leftrightarrow c) \rightarrow (\sim b \rightarrow (a \land c))$
- (d) #

46. (c)

Q.47 Consider the following languages over $\Sigma = \{0, 1\}$.

 $L1 = \{\text{string has at least as many } 011 \text{ as } 110\}$

 $L2 = \{\text{string has at least as many } 000 \text{ as } 111\}$

Which of the following is correct?

- (a) L1 is regular, L2 is not regular
- (b) L1 is non-regular, L2 is regular
- (c) L1 and L2 both are regular
- (d) L1 and L2 both are non-regular

47. (a)

Q.48 How many number of distinct integer factors for the number 2014?

1, 2, 19, 38, 53, 106, 1007, 2014

 $1 \times 2014 = 2014$

 $2 \times 2007 = 2014$

 $19 \times 106 = 2014$

 $38 \times 53 = 2014$

Q.49 Consider the following matrix of size 5×5 .

1 0 0 0 1

0 1 1 1 0

0 1 1 1 0

0 1 1 1 0

1 0 0 0 1

Find the product of non-zero eigen values.

49. (6)

$$\mathbf{A} = \begin{bmatrix} 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 \\ 1 & 0 & 0 & 0 & 1 \end{bmatrix}, \text{ let } X = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \end{bmatrix}$$

1. $k \neq 0$

say,
$$x_1 = x_5 = a$$

 $x_2 = x_3 = x_4 = b$

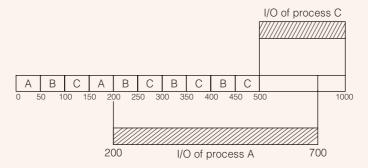
 \therefore There are 3 distinct eigen values = 0, 2, 3

Product of non-zero eigen values = $2 \times 3 = 6$

Q.50 There are three processes A, B and C are running in round robin. A process can execute again when its CPU and I/O execution completed. Each process is executed three times. All processes are arrived at '0'. I/O requests of multiple processes can be done parallel. Each has the following CPU burst time and I/O time and quantam time is 50 units. Find the time when C completes its I/O?

	CPU Burst Time	I/O
Α	100	500
В	300	500
С	200	500

50. (1000)



- At 1000 time units C completes its I/O
- Q.51 In a system, 20 frames are available in memory and optimal page replacement policy is being used to replace the page. The pages are numbered from 1 to 100. If these 100 pages are accessed twice in the order from 1 to 100, which of the following gives same number of page faults?
 - (a) FIFO

(b) LIFO

(c) LRO

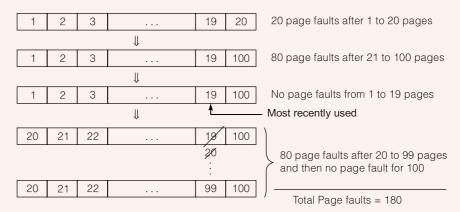
(d) MRU

51. (d)

Pages: 1, 2, 3, . . . 19, 20, 21, . . . 100, 1, . . . 19, 20, 21, . . . 100 Optimal page replacement:

1	2	3		19	20	20 page faults after 1 to 20 pages
			\Downarrow			
1	2	3		19	100	80 page faults after 21 to 100 pages
			\downarrow			
1	2	3		19	100	No page faults from 1 to 19 pages
			\Downarrow			
20	21	22		18	100	
40	41	42		59		80 page faults after 20 to 99 pages
6 Ø	61	62		79		and then no page fault for 100
80	81	82		99	100	Total page faults = 180

Most recently used:



Q.52 Evaluate using Newton-Raphson method $0.75x^3 - 2x^2 + 4x - 4 = 0$. If $x_0 = 2$

Then statement

- I. The value of x_3 is 0
- It will converge in finite number of steps.

Then which of the following is true?

(a) I only

(b) II only

(c) I and II both

(d) Neither I nor II

52. (c)

$$\mathbf{x}_0 = 2$$
, $\mathbf{x}_1 = 0$, $\mathbf{x}_2 = 2$, $\mathbf{x}_3 = 0$, $\mathbf{x}_3 = 0$, and converges in finite steps

Questions with insufficient information

- Q.53 A 4-way set associative with 16 kB cache memory. The block size is 8 word. 1 word means 32 bits and have a main memory of 4 GB. Then calculate the number of tag bit?
- 53. (?)
- Q.54 Find the LCS of given sequences is? and qpqsrr. Let x is the number of character in LCS and let y be the number of the subsequences. Then find x + 10y.
- **54.** (?)
- Q.55 Two relation A and B both are having block size of three assume number of rows r(A) < r(B). If we are using nested block join then what is true about the result that have minimum number of tuples?
 - (a) Relation A should have outer query (b) Relation B should be outer query
- - (c) Both are independent
- (d) None of these

- **55.** (?)
- **Q.56** What is the maximum site of file you can store on a disk of 100×10^6 bytes with overhead of 4 bytes for every block site of 1000 bytes?
 - (a)

(c)

(d)

- **56.** (?)
- Q.57 Consider the following three address code mC for A[i][j][k]

$$\mathbf{t_1} = 1024 \times i$$

$$t_9 = 32 \times j$$

$$t_3 = t_1 + t_2$$

$$t_4 = 4 \times k$$

$$t_5 = t_3 + t_4$$

$$t_6 = t_5$$

Consider the size of integer is 32-byte and character is 8 bytes which of the following represents correctly for the above code.

(a) A[16] [32] [8]

(b) A[4] [32] [16]

(c) A[1024] [16] [4]

(d) A[32] [32] [4]

57. (?)

If there are any queries please contact: 09560815915