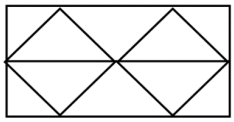
GATE

Real Test-01

CS & IT

Q1 In the figure shown below, various horizontal and vertical segments divide the outer shape into multiple regions. How many rectangles and triangles are there in the figure?



(A) Two rectangles & Twelve triangles
(B) Five rectangles & Ten triangles
(C) Six rectangles & Twelve triangles
(D) Eight rectangles & Eleven triangles

Q2 Train P leaves station A at 08:00 hours and reaches station B at 12:00 noon. Train Q leaves station B at 09:00 hours and reaches station A at 15:00 hours. Assuming both trains travel at constant speeds, at what exact time do the two trains cross each other?
(A) 10:15 hours
(B) 10:36 hours
(C) 10:48 hours
(D) 11:30 hours

Q3 Two fair dice are thrown simultaneously. In how many possible outcomes is the number shown on the top face of the first die greater than the number on the bottom face of the second die?
(A) 18 (B) 36
(C) 6 (D) 15

Q4 Select the most appropriate meaning of the underlined idiom.
The actor decided to live life **in the fast lane**.
(A) Racing away to the moon
(B) A life of extreme speed
(C) A life filled with excitement
(D) Dropping charges of crime

Q5 Select the most appropriate synonym of the given word.
LUCID
(A) Lucky (B) Timely
(C) Clear (D) Happy

Q6 Which of the following powers of 6 is the largest factor of : $1 \times 2 \times 3 \times 4 \times 5 \ldots\ldots\ldots \times 89 \times 90$.
(A) 6^{24} (B) 6^{44}
(C) 6^{34} (D) 6^{18}

Q7 In a bakery, Rohan can bake half as many cakes as Meera in one-sixth of the time it takes Meera. If they decide to work together, they can bake all the cakes in 10 days. How many days would Meera need to bake all the cakes by herself?
(A) 40 days (B) 25 days
(C) 30 days (D) 35 days

Q8 The given sentence contains a grammatical error. Identify the segment that contains the error.
Smitha was offered the job although having no qualifications.
(A) although having
(B) Smitha was offered
(C) the job
(D) no qualifications

Q9 A rectangular sheet of cardboard has its sides in the ratio 1:4. Riya keeps cutting it in half along the longer side. After several cuts, she wonders: after how many cuts will the rectangle again have the same 1:4 ratio of sides?
(A) 4 cuts (B) 6 cuts
(C) 3 cuts (D) Never

Q10 A chef intends to fill a display case with 20 cupcakes, reaching its full capacity. Every 30 seconds, he adds 2 cupcakes, but a mischievous

helper takes 1 cupcake out. How much time will it take for all 20 cupcakes to be in the display case for the first time?

(A) 600 seconds (B) 328 seconds
(C) 570 seconds (D) 300 seconds

Q11 In which of the following situations, CPU reads memory address as result of memory read?
(A) Fetching operand in indirect addressing mode
(B) Return from a function call
(C) Function call
(D) Conditional branching

Q12 A bit-stuffing based framing protocol uses an 6-bit delimiter pattern of 011110. If the output bit-string is 0111010111011101, then count the number of stuffed bits in the output bit-string?
[Except start and end frame delimiter]

Q13 Consider the relation R (A, B, C, D) with FDs set **F:** [AB →C, AB → D, C→ A, B → D]
Find the highest normal form of relation R.
(A) 1 NF
(B) 2 NF
(C) 3 NF
(D) BCNF

Q14 The number of requests arriving at a server follows a poisson distribution with an average arrival rate (λ) of 2 requests per minute the probability (upto three decimal places) that exactly 1 request arrives in a specific one-minute interval is _____ ?

Q15 A point is selected at random inside a circle. The probability that the point is closer to the center of the circle than to its circumference is _____ . (Round off to two decimal places)

Q16 The values of 'a' and 'b' for which the function $f(x) = x^3 + ax^2 + bx$ has local minima at x = 4 and point of inflection at x = 1, are
(A) a = –3, b = – 24
(B) a = –3, b = 24
(C) a = 3, b = – 24
(D) a = 3, b = 24

Q17 Q. Let P = {x, y, z} and let R = {(x, x), (y, y), (z, z), (x, y), (y, x), (z, y)} be a relation on P then which of the following is incorrect?
(A) R is not reflexive relation
(B) R is not symmetric relation
(C) R is transitive relation
(D) R is equivalence relation

Q18 Consider the following program:
What will be the output of the given C codes?

```
#include <stdio.h>
#include <stdlib.h>
int main ()
{
  int x, a[4] = {1, 3, 4, 5};
  int *p, *pp;
  p = a;
  pp = &p;
  printf ("%d", * p);
  printf("%d", ** pp + 1);
  printf ("%d",*p + 1) }
}
```

The output is _____?

Q19 Which of the following is NOT true?
Note: L is a language
(A) $L^* = (L^*)^*$
(B) $L^+ = (L^+)^+$
(C) $(L^*)^+ = (L^+)^*$
(D) None of these

Q20 Which of the following statements is incorrect?
(A) In checking hit or miss in cache using main memory address, byte offset field is not used
(B) For tag matching, cache controller has comparator hardware
(C) In set associative mapping, on single set in cache multiple different main memory blocks can be present at a time
(D)

In fully associative mapping, on single set in cache single main memory block only can be present at a time

Q21 Consider the following Orders TABLE:

Order_ID	Order_Price	Customer
1	500	Ram
2	300	Raju
3	100	Sita
4	600	Ram
5	800	Ram
6	900	Sita
7	400	Rohit

Number of tuple(s) that will be returned if we execute the following query on the above table is____.

```
Select Customer, Sum (Order_price)
From Orders
Group by Customer
Having Sum (Order_price) < = 1000
```

Q22 Consider the following function that takes queue Q as input:

```
Arrange (Queue Q)
{
  static int r = 0;
  if(!isEmpty(Q))
  {
      p = deQueue(Q);
      r++;
      Arrange(Q);
      enQueue(Q, p+r);
  }
}
```

Assume, the queue Q initially contains [1, 2, 3, 4], isEmpty(Q) returns TRUE if the Q is empty, else it returns false. The final contents of the queue is-

(A) 5, 6, 7, 8 (B) 4, 3, 2, 1

(C) 8,7,6,5 (D) 5, 4, 3, 2

Q23 Consider the following sets.

L_1 = set of all LR (0) CFGs.

L_2 = set of all CFGs.

L_3 = set of all LR (1) CFGs.

L_4 = set of all unambiguous CFGs.

Which of the following is TRUE?

(A) $L_1 \subset L_2 \subset L_3 \subset L_4$

(B) $L_1 \subset L_3 \subset L_2 \subset L_4$

(C) $L_1 \subset L_3 \subset L_4 \subset L_2$

(D) $L_1 \subset L_2 \subset L_4 \subset L_3$

Q24 Consider a graph with order 7. The degree sequence of the graph is 4, 3, 3, 3, 2, 2, 1. Assume x is the number of edges and y is the degree sequence of the complement graph of the given graph. Find x and y?

(A) x = 10 and y = 5, 3, 3, 3, 2, 2, 2

(B) x = 12 and y = 5, 4, 4, 3, 3, 3, 2

(C) x = 14 and y = 5, 5, 4, 4, 4, 4, 2

(D) x = 16 and y = 6, 5, 5, 5, 5, 3, 3

Q25 Consider the following CFG.

S → aaA | A

A → Bb

B → aB | a

Above CFG is _____

(A) LL(1) (B) LR(0)

(C) SLR(1) (D) None of these

Q26 Consider the following grammar, where S is the start variable.

S → AB

A → aaA |aa

B → aBb | ab

Which of the following represents the language generated by above grammar?

(A) $\{a^{2m+n} b^n \mid m > 1, n > 1\}$

(B) $\{a^{2m+n} b^n \mid m \geq 0, n \geq 0\}$

(C) $\{a^{2n} b^n \mid n \geq 1\}$

(D) $\{a^{2m+n} b^n \mid m \geq 1, n \geq 1\}$

Q27 Consider the following statements:

I. Operator grammar can have two consecutive non-terminals.

II. Left recursive grammar causes infinite loop in

recursive descent parser.
III. An ambiguous grammar can be LL (1)
Which of the following is /are correct?
(A) Only I is true
(B) Only II is true
(C) Both II, III are true
(D) I, II and III all are true

Q28 What is the recurrence relation for max-min problem ?
(A) $T(n) = 2T\left(\frac{n}{2}\right) + n$
(B) $T(n) = 2T\left(\frac{n}{2}\right) + n^2$
(C) $T(n) = 2T\left(\frac{n}{2}\right) + 2$
(D) None of these

Q29 A 32-bits wide main memory unit with total capacity of 16Gbytes, is built using 256M × 8 bits DRAM chips. The size of decoder needed to access the memory unit chips with chip selection is?
(A) 3 × 8 decoder
(B) 4 × 16 decoder
(C) 5 × 32 decoder
(D) 6 × 64 decoder

Q30 Consider the following SQL Query:
Create table department
{
a integer:
b integer:
Primary key (a);
Foreign key (b) references department ON DELETE CASCADE;
The tuples (a, b) currently in the table department are:
(0, 2) (1, 2) (2, 1) (3,0) (5, 0) (7,3) (4, 2) (6, 1) (8, 7)
Consider the following Query:
Delete from department where a = 0
What is the number of tuples that must be additionally deleted to preserve referential integrity?
(A) 2 (B) 3
(C) 4 (D) None of these

Q31 Given two sequence x and y
x = <p, q, r, q, s, p, q, r>
y = <q, s, r, p, q, p, q >
The length of the LCS of x and y is ____.

Q32 Consider the following two columns column1 and columns2, regarding deadlock prevention and methods of implementation of deadlock prevention.

Column-1	Column-2
p. Mutual Exclusion	**1.** Take away resources forcefully
q. Hold & Wait	**2.** Order resources and assign numbers to each resource. Allow resource request in increasing order of resource number
r. No Preemption	**3.** Request all resources when all available
s. Circular wait	**4.** Allow independent processes only in system

Match the correct answers using codes given below?

(A)

p	q	r	s
3	4	1	2

(B)

p	q	r	s
1	3	4	2

(C)

p	q	r	s
4	3	1	2

(D)

p	q	r	s
3	1	4	2

Q33 Consider 5 processes A, B, C, D and E; all arrived at time 0. The processes executed in a system with round robin algorithm, having time slice of 2. The context switch between processes takes 0.2 time unit. If all processes executed by taking exactly 3 bursts at processor each, with each process taking 2 time on CPU every time. Then

the percentage of CPU efficiency (rounded to 2 decimal place) is _____%?
Note: Ignore the context switch before first process execution and after last process execution

Q34 Consider any 2-process solution for process synchronization. Which of the following statements is/are incorrect?
(A) If solution suffers from deadlock, then mutual exclusion is never satisfied
(B) If solution suffers from starvation, then bounded waiting is never satisfied
(C) If solution suffers from busy waiting, then bounded waiting can be satisfied
(D) If solution satisfies progress, then too system can suffer from starvation

Q35 Consider a demand paging system which takes m millisecond to for memory access when there is page fault and n millisecond to fulfil a memory request of CPU without page-fault. The maximum page fault rate(rounded to nearest integer) tolerated by system is _____%, to have average memory access time 3n milliseconds if m = 9n?

Q36 Consider the following a recurrence relation

$$T(n) = \sqrt{n}\, T(\sqrt{n}) + n,\ n > 2$$
$$= 1 \quad ,\ n = 2$$

What is the time complexity of above recurrence relation?
(A) θ (logn)
(B) $\theta(\sqrt{n})$
(C) $\theta(\sqrt{n}\ \log\log n)$
(D) θ (n loglogn)

Q37 Consider a process scenario with 8 processes P0, P1, P2 ..... P7. The arrival time and CPU burst times of processes are as follows:

Process ID	Arrival Time	Burst Time
P0	0	14
P1	1	12
P2	2	9
P3	3	11
P4	4	10
P5	5	5
P6	6	3
P7	7	2

Consider pre-emptive shortest remaining time first algorithm to execute the above-mentioned processes in uniprocessor system. Use arrival time (smaller arrival time first) to break tie if 2 processes have same remaining burst time. The processes do not have any IO requirement. The scheduling algorithm runs only on arrival of a new process or on completion of a running process. Further note that scheduling algorithm is required only when at least one process is there in ready queue. The number of times scheduling algorithm runs to execute all above 8 processes is _____ ?

Q38 Consider the following function:

```
int rec(int n, int m)
{
    if(m ==1) return n;
    return rec(n/10, m–1) + (n % 10) * pow(10, m–1);
}
```

The pow(x, y) computes x^y. Let $n = p_1 p_2 \ldots p_m$ where $p_1, p_2 \ldots p_m$ be the digits of the number n. Which of the following statement(s) is/are CORRECT?
(A) The function rec(n, m) returns the original integer n
(B) The function rec(n, m) returns the reversed form of the original integer n
(C) The i^{th} function call returns $p_{m-i} \ldots p_2 p_1$
(D) The i^{th} function call returns $p_{m-i+1} \ldots p_2 p_1$

Q39 A graph has 26 vertices and 58 edges. There are five vertices of degree 4, six vertices of degree 5, and seven vertices of degree 6. If the remaining

vertices all have the same degree, what is this degree?

Q40 Which of the following options represent the smallest possible number (except infinity) in IEEE-754 single precision floating point representation?

(A) Sign: 0, Exponent: 00000000, Mantissa: 00000000000000000000001

(B) Sign: 1, Exponent: 11111110, Mantissa: 11111111111111111111

(C) Sign: 0, Exponent: 00000001, Mantissa: 00000000000000000000000

(D) Sign: 1, Exponent: 00000000, Mantissa: 11111111111111111111

Q41 Consider UDP packet of size 3500 bytes is passed to IP for delivery. MTU (maximum transmission unit) for source network is 500 bytes and IPv4 header size is 20 bytes then calculate size of the last fragments (in bytes)?

Q42 Consider the following program:

```
#include <stdio.h>
int main()
  {
  int a[] = {2, 4, 6, 8, 10, 12};
  int *p[]={a+2, a+1, a, a+3, a+4};
  int **y = p;
  for(int i = 0; i<4; i++)
   *y[i]+ = *y[i+1];
  for(int i = 0; i<4; i++)
   printf("%d\t", **p+i);
}
```

The output string is:

(A) 10 8 10 18 (B) 10 11 12 13

(C) 6 8 9 10 (D) 10 11 10 18

Q43 In a computer system a files of size 15350 bytes need to be stored. For storing these files on disk, we can use either 200-bytes disk blocks or 400-bytes disk blocks (but can't mix block sizes). For each block used to store a file, 8 bytes of bookkeeping information also needs to be stored on the disk. Hence, the total space used to store a file is the sum of the space taken to store the file and the space taken to store the bookkeeping information for the blocks allocated for storing the file. A disk block can store either bookkeeping information for a file or data from a file, but not both.

Which of the following is true regarding the total space required for storing the files using 200 bytes disk blocks and 400 bytes disk blocks respectively?

(A) It takes lesser space to store file with 200 bytes block as compared to with 400 bytes block

(B) It takes lesser space to store file with 400 bytes block as compared to with 200 bytes block

(C) It takes equal space to store file with 200 bytes block and with 400 bytes block both

(D) Question has some missing data to calculate total space needed

Q44 Let M be a 2×2 matrix such that $M\begin{bmatrix}1\\-1\end{bmatrix}=\begin{bmatrix}-1\\2\end{bmatrix}$ and $M^2\begin{bmatrix}1\\-1\end{bmatrix}=\begin{bmatrix}1\\0\end{bmatrix}$. If λ_1 and λ_2 ($\lambda_1 > \lambda_2$) are the two values for which det(M – λI) = 0, where I is an identity matrix of order 2 then the value of $6\lambda_1 + 3\lambda_2$ should be equal to _____.

(A) 7 (B) 8

(C) 9 (D) 0

Q45 Given the matrix A as follows:

$$A=\begin{bmatrix}1&2&1\\3&6&3\\2&4&2\end{bmatrix}$$

What can be concluded about the system AX = b for any vector b?

(A) The system has a unique solution for any b.

(B) The system has no solution for any b.

(C) The system has infinitely many solutions for any b.

(D) The system may have no solutions or infinitely many solutions depending on b.

Q46 Consider the following C codes:

```
int foo (struct Binary Tree Node *root1, struct
Binary Tree Node *root2)
{
if (root1 == Null && root2 = = Null) return 1;
   if (root1 == Null || root2 == Null) return 0;
if (root1 → data != root2 → data) return 0;
else return foo(root1 → left, root2 → right) &&
foo(root1 → right, root2 → left);
```

The root node of two binary trees is passed as an argument to the given code.

Then code returns 1 if.

(A) Both the trees are having same height if height is defined as the distance from root to the farthest leaf node.

(B) Both the trees are binary search trees.

(C) Both the trees are mirror image of each other.

(D) Both the trees have equal number of nodes.

Q47 Which of the following schedules are conflict serializable?

S_1: $W_2(x), W_1(x), R_3(x), W_2(y), R_3(y), R_3(z), R_2(x)$

S_2: $R_3(z), W_2(x), W_2(y), R_1(x), R_3(x), R_2(x), R_3(y), W_1(z)$

(A) Only S_1

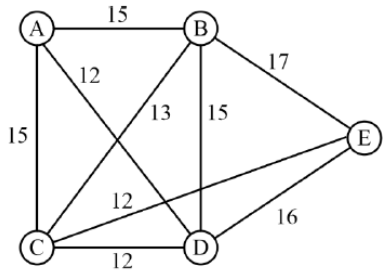
(B) Only S_2

(C) Both S_1 and S_2

(D) Neither S_1 nor S_2

Q48 Consider the following graph G:

G:



What will be the minimum cost of minimum spanning tree in such a way that C will be the leaf node? _____.

Q49 Consider the following program:

```
#include<stdio.h>
void fun2();
void fun1()
{
   static int count=67;
   printf("%c", count+++32);
   fun2();
}
void fun2()
{
   static int count=67;
   printf("%c", ++count);
}
int main(void) {
   int i, j;
   for(i=1;i<4;i = i*2){
     fun2();
     fun1();
     continue;
     fun2();
   }
   return 0;
}
```

The output string is_____?

(A) DcEfDg (B) DeEFdG

(C) DdEFGdHI (D) DcEFGgHI

Q50 Consider a disk with an average seek time of 6 ms rotation speed of 15000 rotations per minute (RPM) and 512-byte sectors with 200 sectors per track. The disk has 5 platters each with 2 recording surfaces. A file occupies all of the sectors on a cylinder. Disk is reading data cylinder-wise which means after reading the first track, remaining tracks can be read with no seek time; but for each track rotational latency is

needed. The time required in sequential organization to transfer the file will be nearly?

(A) 0.01 seconds (B) 0.04 seconds

(C) 0.022 seconds (D) 0.076 seconds

Q51 Consider the following CFG.

$S \rightarrow AB \mid BA$

$A \rightarrow CAC \mid 0$

$B \rightarrow CBC \mid 1$

$C \rightarrow 0 \mid 1$

Find the language generated by above CFG?

(A) $\{w \mid w \in \{0, 1\}^*, n_0(w) = n_1(w)\}$

(B) $\{w \mid w \in \{0, 1\}^*, n_0(w) \neq n_1(w)\}$

(C) $\{xy \mid x, y \in \{0, 1\}^*, |x| = |y|, x \neq y\}$

(D) $\{xy \mid x, y \in \{0, 1\}^*, |x| = |y|, x = y\}$

Q52 Consider the following grammar:

$S \rightarrow Ae \mid AB \mid dB \mid eAg$

$A \rightarrow d \mid f$

$B \rightarrow Sg$

Match the following groups.

	Group I		Group II
1.	First (S)	I.	{e, d, f, g}
2.	FIRST (A)	II.	{$, g}
3.	FOLLOW (S)	III.	{d, f}
4.	FOLLOW(A)	IV.	{d, f, e}

(A) 1 – I, 2 – III, 3 – IV, 4 – II

(B) 1 – IV, 2 – III, 3 – II, 4 – I

(C) 1 – IV, 2 – I, 3 – II, 4 – III

(D) 1 – I, 2 – IV, 3 – I, 4 – III

Q53 Let the following predicates be given, the domain is all computer science classes

P (a) = “a is interesting”

Q (a) = “a is useful”

R(a, b) = “a is harder than b”

S(a, b) = “a has more students than b”

Let P_x :$(\exists a)\ [P(a) \wedge (\forall b)\ (R\ (a, b) \rightarrow S(b, a))]$

The correct translation of the above predicate logic statement P_x is :

(A) There is a computer science classes that is interesting and has fewer students than all easier classes.

(B) There is a computer science class that is interesting and has more student than all easier classes

(C) There is a computer science classes that is interesting and fewer students than all harder classes

(D) None of the above

Q54 Consider the following languages.

$L_1 = \{M \mid M$ accepts ab within 4 steps$\}$

$L_2 = \{M \mid M$ halts on ab within 4 steps$\}$

Identify the TRUE statement.

(A) L_1 is Undecidable

(B) L_2 is undecidable

(C) L_1 is Decidable

(D) L_2 is Decidable

Q55 Consider a system with CPU clock rate of 4GHz. Assume that the system has CPI of 1 without memory stalls. The system is used for execution of a program which has 2% L1 miss rate. The main memory access time is 100ns when miss in cache. If L2 cache is also added to memory system with 5ns access time and only 0.5% references reaching to main memory as miss overall in cache levels; then the speed up (rounded to 1 decimal place) achieved with inclusion of L2 as compared to only using L1 is _____?

Q56 Consider Cyclic Redundancy Check (CRC) error detection technique is used, CRC bits "110" are generated for the corresponding message bits "11011011". Identify which generator polynomial function is used?

(A) $X^3 + 1$ (B) $X^3 + X^2 + 1$

(C) $X^3 + X + 1$ (D) $X^3 + X^2 + X$

Q57 How many states needed to design a minimal DFA for given language L?___

L = {w | w starts with ab, w ends with ba, w∈{a, b}*}

Q58 What is the average number of bits per character using Huffman encoding when it is known that the characters in the text occur as the following probabilities is _____.
(**NOTE:** Only up to three decimal point is allowed)

S.No.	Character	Probability
1	p	1/2
2	q	1/4
3	r	1/8
4	s	1/16
5	t	1/16

Q59 Identify the incorrect statement.
(A) {TM | TM accepts only ab} is decidable
(B) {TM | TM halts on only ab} is decidable
(C) {TM | TM accepts ab} is not decidable
(D) None of these

Q60 Consider a paged memory system with 8 pages (numbered 0 to 7) and 16 frames (numbered 0 to 15). The page size is 16 bytes (numbered 0 to 15). The page table contains only frame numbers and at present the page table is as follows:

0	12
1	5
2	10
3	9
4	1
5	14
6	6
7	4

The given all numbers are in decimal. For the physical address 233 of decimal, the logical address in decimal is_____?

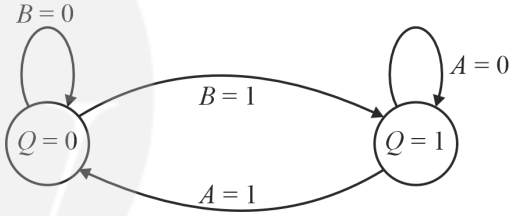
Q61 Consider the instance of relational schema for relation employee and dependent:

Employee		
Eid	**E_{name}**	**Eage**
1	Ankit	30
2	Ram	32
3	Govind	28
4	Vishakha	30
5	Govind	30

Dependent			
Did	**Deid**	**D_{name}**	**Dage**
D_1	1	CS	30
D_2	2	EC	31
D_3	4	EE	32
D_2	2	CE	30
D_4	3	IN	19

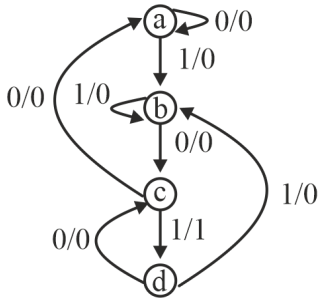
The following is the query made on the database:
$\pi_{\text{Eid}}(\text{Employee}) - \pi_{\text{Eid}}(\text{Employee} \bowtie_{(\text{Eid} = \text{Died}) \wedge (\text{Dage} \leq \text{Eage})} (\text{Dependent}))$
The number of tuples in output are_____.

Q62 A state transition diagram is as given below:



This represents
(A) SR-FF with S=A, R = B
(B) JK-FF with J = A, K = B
(C) JK-FF with J = B, K = A
(D) SR-FF with S = B, R = A

Q63 Consider the following state diagram of a sequence detector.



Which of the following statements is/are correct for input bits

1 0 1 0 1 1 0 1 0 0 1 1 0 1 ?

(A) It is overlapping sequence detector

(B) It is non-overlapping sequence detector

(C) Output sequence = 0 0 1 0 1 00 1 0 0 1 0 0 1

(D) Output sequence = 0 0 1 0 1 0 0 1 0 0 0 0 0 1

Q64 Assume a computer has 32-bits addresses. Each block stores 128 bytes. A direct-mapped cache has 512 blocks. Which of the following is/are correct statement?

(A) Address 0xAADDA712 maps to cache block $(334)_{10}$

(B) Address 0xFFAD50FF maps to cache block $(161)_{10}$

(C) Address 0x12342F78 maps to cache block $(96)_{10}$

(D) Address 0xCBA40ABC maps to cache block $(21)_{10}$

Q65 Consider a packet switched network where host S is connected to host D via a path having three intermediate routers, assume all links have negligible propagation delay. Host S wants to send a message of size 60 bytes to host D and each packet contains a header of 5 bytes, then calculate optimum packet size (in bytes)?

GATE

Answer Key

Q1	(B)
Q2	(C)
Q3	(D)
Q4	(C)
Q5	(C)
Q6	(B)
Q7	(A)
Q8	(A)
Q9	(D)
Q10	(C)
Q11	(A, B)
Q12	3
Q13	(A)
Q14	0.26~0.28
Q15	0.25~0.25
Q16	(A)
Q17	(A, C, D)
Q18	122~122
Q19	(D)
Q20	(D)
Q21	3~3
Q22	(C)
Q23	(C)
Q24	(B)
Q25	(C)
Q26	(D)
Q27	(B)
Q28	(C)
Q29	(B)
Q30	(C)
Q31	5
Q32	(C)
Q33	91.46
Q34	(A, B)
Q35	25
Q36	(D)
Q37	15
Q38	(B, D)
Q39	3~3
Q40	(B)
Q41	160
Q42	(B)
Q43	(B)
Q44	(C)
Q45	(D)
Q46	(C)
Q47	(B)
Q48	55
Q49	(B)
Q50	(B)
Q51	(C)
Q52	(B)
Q53	(A)
Q54	(C, D)
Q55	2.6
Q56	(C)
Q57	6~6
Q58	1.875

Q59 (A, B)

Q60 89

Q61 2~2

Q62 (C)

Q63 (A, D)

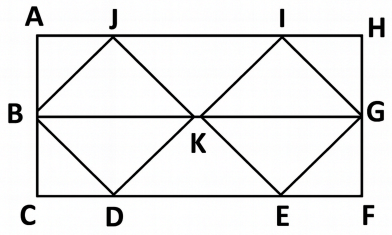
Q64 (A, B, D)

Q65 15

Hints & Solutions

Q1 Text Solution:

Pointing the figure as



The Rectangles are :

ABGH, BCFG, ACFH, BDKJ & KEGI. Total 5.

The Triangles are:

ABJ, BJK, JKI, IKG, IHG, BCD, BDK, KDE, KEG & GEF. Total 10.

Q2 Text Solution:

If the distance between Stations A and B is D km

Train P speed = D/4 (covers in 4 hours i.e. 0800 to 1200)

Train Q speed = D/6 (covers in 6 hours i.e. 0900 to 1500)

To reach the meeting point, Distance covered by Train P + Distance covered by Train Q = Total Distance (D).

Let's say they meet after 'x' hours from 0800.

Thus, x(D/4) + (x-1) (D/6) = D

Or (x/4) + (x-1 / 6) = 1

Or 3x + 2x – 2 = 12

Or 5x = 14

Thus x =14/5 = 2 and 4/5 hours = 2 hours 48 minutes

From 0800, 2 hours 48 minutes = 10:48 hours

Q3 Text Solution:

If top face of 1st die is 2, then second die is 1 (Only 1 case)

If top face of 1st die is 3, then second die is 1 or 2 (2 cases)

If top face of 1st die is 4, then second die is 1 or 2 or 3 (3 cases)

Similarly, If top face of 1st die is 5, then 4 cases

If top face of 1st die is , then 5 cases.

Total 1 + 2 + 3 + 4 + 5 = 15

Q4 Text Solution:

The idiom "live life in the fast lane" means a life filled with excitement → Option C.

Q5 Text Solution:

Lucid means easy to understand, clear, transparent in meaning or thought.

Q6 Text Solution:

As 6 is formed by the product of 3 and 2. Also number of 3's is less as compared to 2's. So, as many 3's those many 6's are formed.

To find in 90!

$\frac{90}{3}$ gives 30

$\frac{30}{3}$ gives 10

$\frac{10}{3}$ gives 3 (whole number)

$\frac{3}{3}$ gives 1

And $\frac{1}{3}$ gives 0 (whole number).

Thus total 30 + 10 + 3 + 1 = 44. Thus 90! has largest factor 6^{44}.

Q7 Text Solution:

If Meera bakes 1 cake in 1 unit time, Rohan bakes ½ cake in $\frac{1}{6}$ unit time.

Or Rohan bakes 1 cake $\frac{2}{6}$ unit time.

Comparing Time taken to do the work

Meera : Rohan = 1 : $\frac{1}{3}$ = 3 : 1

If Rohan takes x days, Meera takes 3x days.

Given that they do together the work in 10 days,

i.e. $\left(\frac{1}{x}\right) + \left(\frac{1}{3x}\right) = \frac{1}{10}$

Or $\left(\frac{4}{3x}\right) = \frac{1}{10}$ Or $\frac{3x}{4}$= 10 Or x = $\frac{40}{3}$.

Thus Meera takes $3\left(\frac{40}{3}\right)$ = 40 days.

Q8 Text Solution:

"Although" is a conjunction and must be followed by a subject + finite verb (e.g., "although she had no qualifications").

Here it is incorrectly followed by just the

participle "having", so the phrase is ungrammatical.
Correct versions would be:

- "Smitha was offered the job although she had no qualifications."
- "Smitha was offered the job despite having no qualifications.

Q9 Text Solution:
Initial ratio 1 : 4.
Always cutting the longer side.
1st Cut ratio 1 : 2
2nd Cut ratio 1 : 1
3rd cut ratio (any side) 2 : 1.
4th Cut ratio again 1 : 1.
Thus Never it will come again to same ratio 1 : 4.

Q10 Text Solution:
In 30 seconds net cupcakes in display = 1 (2-1)
1 cup cake in 30 seconds
18 cupcakes in 30 × 18 = 540 seconds.
In the next 30 seconds chef adds 2 cupcakes to make it 20.
Thus total earliest time = 540 + 30 = 570 seconds.
Note: The last moment can't be withdrawal as the display holds only 20 cupcakes.

Q11 Text Solution:
(a) **Correct:** In indirect addressing mode first memory read give effective address of operand
(b) **Correct:** When returning from a function call, the return address is read from memory (from stack)
(c) **Incorrect:** For function call, the return address is stored in memory at stack
(d) **Incorrect:** In branching there is no any memory read required

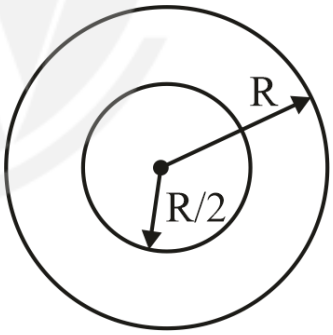
Q12 Text Solution:
Bit Pattern = 0 1 1 1 1 0
Output string = 0 1 1 1 0 1 0 1 1 1 0 1 1 1 0 1
Input string = 0 1 1 1 1 0 1 1 1 1 1 1 1

Q13 Text Solution:
F: [AB → C, AB → D, C → A, B → D]
$(AB)^+$ = {ABCD}
$(BC)^+$ = {BCAD}
Candidate keys = {AB, BC}
Prime attributes = {A, B, C}
B → D is violation case of 2NF. So, the given relation is not in 2NF.
Hence, relation R is in 1NF.

Q14 Text Solution:
The probability mass function (PMF) is;
$P(X = k) = \frac{e^{-\lambda}\lambda^k}{k!}$
Given λ = 2
Now, we need to find out P(x = 1):
$P(X = 1) = \frac{e^{-2}2^1}{1!} = 2e^{-2} = 0.27067$
≈ 0.271

Q15 Text Solution:
For a point to lie close to the center, point should lie inside the circle of Radius R/2

$\therefore$ Required Probability $= \frac{\pi\left(\frac{R}{2}\right)^2}{\pi R^2} = \frac{1}{4}$ = 0.25



Probability of point lying close to center is 0.25.

Q16 Text Solution:
$f(x) = x^3 + ax^2 + bx$
$f'(4) = 0$ and $f''(1) = 0$
$f'(x) = 3x^2 + 2ax + b,$
$f''(x) = 6x + 2a$
$f''(1) = 0 \Rightarrow 6 + 2a = 0 \Rightarrow a = -3$
$f'(4) = 0 \Rightarrow 3(16) - 6(4) + b = 0 \Rightarrow b = -24$

Q17 Text Solution:

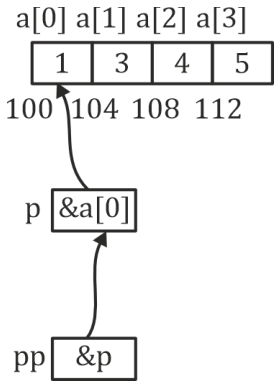
Relation is reflexive because (x, x), (y, y), (z, z) ∈ R

R is not symmetric as (x, y) ∈R → (y, x)∈R, that is, x Ry ⇒ yRx for all (x, y) ∈R but for (y, z) we do not have (z, y).

R is not transitive as (x, y), (y, z) ∈R, but (x, z) ∈R

Since R is not transitive, R is not equivalent as well.

Q18 Text Solution:



p=(& a[0])

= a[0]

∴ 1st printf will print 1.

** PP+1

** &p + 1

= *p + 1

= a[0] + 1

= 1 + 1 = 2

IInd printf prints 2

We know that

*p = 1

So, 1 + 1 = 2

∴output is 122.

Q19 Text Solution:

$L^* = (L^*)^*$ is True

$L^+ = (L^+)^+$ is True

$(L^*)^+ = (L^+)^*$ is True

Q20 Text Solution:

(a) **Correct:** For checking hit or miss only tag and index are used

(b) **Correct:** For tag matching, tag comparators are used in cache controller

(c) **Correct:** In k-way set associative mapping, on single set k number of main memory blocks can be present in cache at a time

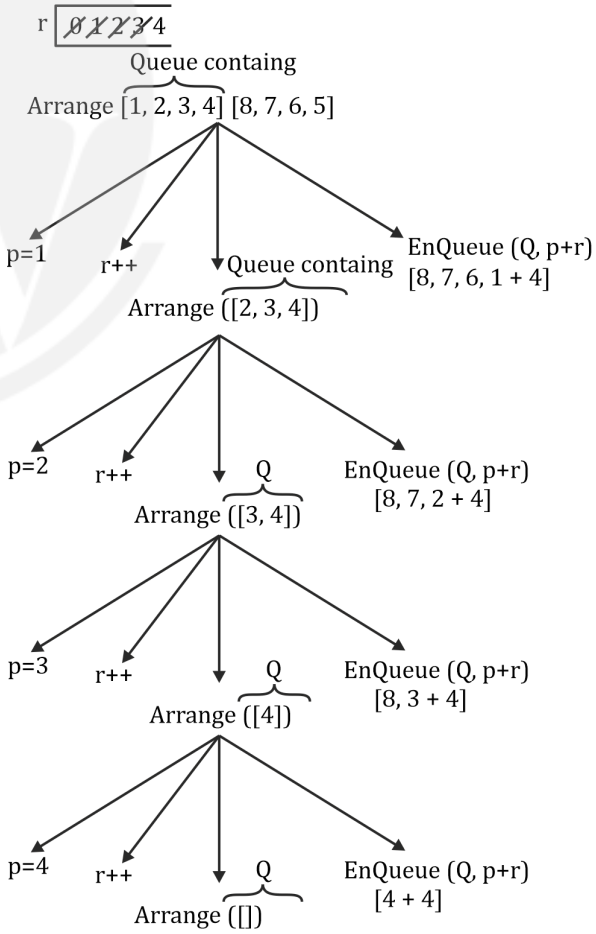
(d) **Incorrect:** In fully associative mapping, all cache blocks come under single set and hence on this set or index many main memory blocks can be present at a time.

Q21 Text Solution:

The ouptut table:

Customer	Sum (Order–Price)
Raju	300
Sita	1000
Rohit	400

Q22 Text Solution:

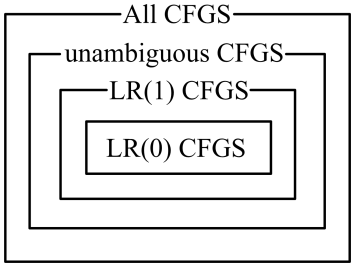


Now tracing the tree we get 8, 7, 6, 5

∴option (c) is correct.

Q23 Text Solution:

$L_1 \subset L_3 \subset L_4 \subset L_2$ is correct.



Therefore, option (c) is correct.

Q24 Text Solution:

I. The degree sequence for the given graph G is 4, 3, 3, 3, 2, 2, 1.

Now, the degree sequence of the complemented graph $\overline{G}$ will be as follows:

$$K_7 = 6, 6, 6, 6, 6, 6, 6$$
$$G = 4, 3, 3, 3, 2, 2, 1$$
$$\overline{G} = 2, 3, 3, 3, 4, 4, 5$$

Hence , y = 5, 4, 4, 3, 3, 3, 2

Q25 Text Solution:

S → aaA | A

First (aaA) ∩ Frist (A) is not empty

So, it is not LL (1)

Given grammar is ambiguous

Because for string "aab" we have two parse trees.

Ambiguous grammar cannot be LR (1) and SLR (1).

Q26 Text Solution:

S → AB = aa(aa)* {an bn | n ≥ 1} = $\{a^{2m+n} b^n \mid m \geq 1, n \geq 1\}$

A → aaA |aa = aa(aa)*

B → aBb | ab = $\{a^n b^n \mid n \geq 1\}$

Therefore option (d) is correct.

Q27 Text Solution:

Operator grammar cannot have two consecutive non-terminals.

Left recursive grammar may cause infinite loop in recursive descent parses ambiguous grammar cannot be LL (1)

Q28 Text Solution:

Time complexity of max - min problem = O(n)

(a) $T(n) = 2T\left(\frac{n}{2}\right) + n$

= O(n log n)

(b) $T(n) = 2T\left(\frac{n}{2}\right) + n^2$

= $O(n^2)$

(c) $T(n) = 2T\left(\frac{n}{2}\right) + 2$

= O(n)

Q29 Text Solution:

Size of data expected on each address in memory = 32 bits = 4 bytes

Number of addresses in memory unit = 16GBytes / 4 Bytes = 4 G

Hence expected memory to be built = 4G × 4 bytes = 4G × 32 bits

Number of chips required = $\frac{4G \times 32 \text{ bits}}{256M \times 8 \text{ bits}} = 16 \times 4$

16 vertical arrangements are needed in memory system with each having 4 chips in horizontal manner.

For 16 vertical arrangements, 4 × 16 decoder is needed to access the chips.

Q30 Text Solution:

(0,2) (1,2) (2, 1) (3, 0) (5, 0) (7,3) (4,2) (6, 1) (8,7)

Delete A =0

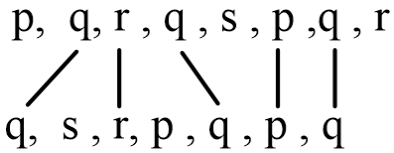
	A	B
	~~0~~	~~2~~
	1	2
	2	1
①	~~3~~	~~0~~
②	~~5~~	~~0~~
③	~~7~~	~~3~~
	4	2
	6	1
④	~~8~~	~~7~~

After the execution of query (A = 0 delte) with on delete cascade (3,0) (5,0) (7,3) will be deleted.

Due to primary key '7' (8,7) also deleted.

So, 4 tuple additionally deleted.

Q31 Text Solution:



maximum length of LCS = 5.

Q32 Text Solution:

Mutual Exclusion: To prevent deadlock if mutual exclusion is to be prevented then one of the options is to have only independent processes in system. Other option is to keep as many as resources in the system so that resource sharing is not at all required.

Hold & Wait: Either hold all resources or wait for all resources. Hence request resources only when all resources are available.

No Preemption: Allow preemption of resources.

Circular wait: Assign number to each resource and allow a process to request for a resource which is numbered greater than all resources the process holds.

Q33 Text Solution:

Total 5 processes run on CPU 3 times each, which means total run = 5 × 3 = 15 times

A	B	C	D	E	A	B	C	D	E	A	B	C	D	E

Total run time = 15 × 2 = 30 units

For running processes 15 times, there will be 14 context switches.

Total context switch time = 14 × 0.2 = 2.8

Percentage of CPU efficiency = $\frac{30}{(30+2.8)} \times 100\%$ = 91.46 %

Q34 Text Solution:

(A) Incorrect: If deadlock is there in solution then mutual exclusion can be or can ot be satisfied.

(B) Incorrect: If starvation is there in solution then bounded waiting can be or cannot be satisfied.

(C) Correct: If solution has busy waiting, then bounded waiting can be or cannot be satisfied.

(D) Correct: If solution satisfies progress, then too system can suffer from starvation.

Q35 Text Solution:

m =9n

Assume page fault rate is p

Effective memory access time = p * m + (1 – p) * n

3n = p * 9n + (1–p)* n

3 = 9p + 1 – p

2 = 8p

p = 0.25 = 25%

Q36 Text Solution:

$$T(n) = n^{\frac{1}{2}} T\left(n^{\frac{1}{2}}\right) + n$$

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

$$= n^{\frac{1}{2}+\frac{1}{2^2}} T\left(n^{\frac{1}{2^2}}\right) + n + n$$

$$= n^{1-\frac{1}{2^2}} T\left(n^{\frac{1}{2^2}}\right) + 2n$$

$$\ldots\ldots \text{ after k terms}$$

$$T(n) = n^{1-\frac{1}{2^k}} T\left(n^{\frac{1}{2^k}}\right) + kn$$

$$\text{According to the base condition}$$

$$n^{\frac{1}{2^k}} = 2$$

$$k = \log\log n$$

$$T(n) = \frac{n}{2} * 1 + n \log\log n$$

$$T(n) = \theta(n\log\log n)$$

Q37 Text Solution:

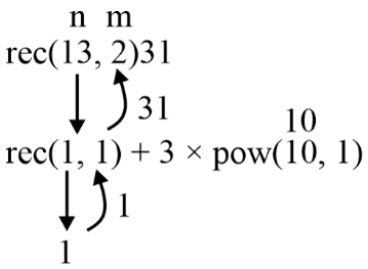
All 8 processes arriving at different times and till whenever all processes arrive there is no any process completed. Hence 8 times on arrival of all processes and then 7 times when first 7 processes complete; the scheduling algorithm needed. After that when last remaining process completes. There is no any need of scheduling, because there will not be any pending process in ready queue. So number of times scheduling algorithm runs = 8+7=15

Q38 Text Solution:

pow(10, 1) = 10^1 = 10

pow(10, 0) = 10^0 = 1

Example:



∴ The function rec (m, n) returns the renamed form of the original integer.

I[st] function

i = 1

$n = p_1p_2 = p_m$

$p_mp_{m-1} = p_1p_2$

∴ The i^{th} function call returns $p_{m-i+1} = p_1p_2$

∴ (b) and (d) is correct.

Q39 Text Solution:

There are 26 – 5 – 6 – 7 = 8 vertices of degree x.

Applying Euler's Theorem:

5 · 4 + 6 · 5 + 7 · 6 + 8 · x = 2 · 58, Rearranging we obtain x = 3.

Thus, the degree of the remaining eight vertices is 3.

Q40 Text Solution:

Smallest possible value will be a negative biggest number. Which can be the implicitly normalized number with largest magnitude.

For the same, exponent should be largest possible value of 254, which is in binary 11111110 and mantissa should be all 1s. And sign should be 1 for negative value.

Q41 Text Solution:

UDP Packet size = SDU size = 3500 bytes

MTU = 500 Bytes

Header size = 20 bytes

Payload size = (MTU – Header size)

= (500 – 20) bytes

= 480 bytes

Number of IP fragments

$$N = \left\lceil \frac{\text{SDU size}}{\text{Payload size}} \right\rceil$$

$$= \left\lceil \frac{3500 \text{ bytes}}{480 \text{ bytes}} \right\rceil = 8$$

Last fragmenet size =

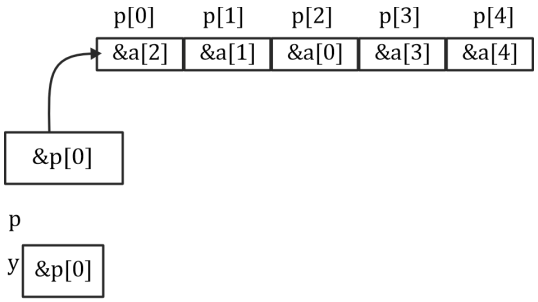
Header size + [SDU size – (N – 1) × Payload size]

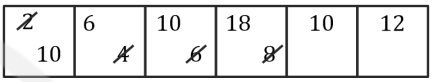
= 20 bytes + [3500 bytes – (8 – 1) × 480 bytes]

= (20 + 140) byte

= 160 bytes

Q42 Text Solution:





y = &p[0]

y+i= &p[0] + i

*(y+i) = *(&p[i])

y[i] = P [i]

i	*y[i] =*y[i] + *y[i + 1]
0	*y[0] = *y[0] + *y[i] *p[0] = *p[0] + *p[1] a[2] = a[2] + a[1]
1	*y[1] = *y[1] + *y[2] *p[1] = *p[1] + *p[2] a[1] = a[1] + a[0]
2	*y[2] = *y[2] + *y[3] *p[2] = *p[2] + *p[3] a[0] = a[0] + a[3]

3	*p[3] = *p[3] + *p[4] a[3] = a[3] + a[4]

**p = **&p[0]

= &p[0]

= *&a[2]

**p = a[2]

i	**p + i
0	**p + 0 ⇒10 + 0 = 10
1	**p + 1 ⇒10 + 1 = 11
2	**p + 2 ⇒10 + 2 = 12
3	**p + 3 ⇒13

∴Option (b) is correct.

Q43 Text Solution:

File Size	No. of blocks to store file	No. of blocks to store bookkeeping	Total blocks	Total Size
15350 Bytes	Ceil (15350 / 200) = 77	Ceil [(77 * 8) / 200] = 4	77 + 4 = 81	81*200 = 16200 bytes
15350 Bytes	Ceil (15350 / 400) = 39	Ceil [(39 * 8) / 400] = 1	39 + 1 = 40	40*400 = 16000 bytes

Q44 Text Solution:

$$M\begin{bmatrix}1\\-1\end{bmatrix}=\begin{bmatrix}-1\\2\end{bmatrix}\Rightarrow\begin{bmatrix}a&b\\c&d\end{bmatrix}\begin{bmatrix}1\\-1\end{bmatrix}$$

$$=\begin{bmatrix}-1\\2\end{bmatrix}$$

$$\Rightarrow\begin{bmatrix}a-b\\c-d\end{bmatrix}=\begin{bmatrix}-1\\2\end{bmatrix}$$

$$\Rightarrow\begin{matrix}a-b=-1\ \_\_\ (i)\\c-d=2\ \_\_\_\ (ii)\end{matrix}$$

also

$$M^2\begin{bmatrix}1\\-1\end{bmatrix}=\begin{bmatrix}1\\0\end{bmatrix}=M\left(M\begin{bmatrix}1\\-1\end{bmatrix}\right)$$

$$=M\begin{bmatrix}-1\\2\end{bmatrix}=\begin{bmatrix}1\\0\end{bmatrix}$$

$$\Rightarrow\begin{bmatrix}a&b\\c&d\end{bmatrix}\begin{bmatrix}-1\\2\end{bmatrix}=\begin{bmatrix}1\\0\end{bmatrix}\Rightarrow\begin{bmatrix}-a+2b\\-c+2d\end{bmatrix}$$

$$=\begin{bmatrix}1\\0\end{bmatrix}$$

$$\Rightarrow\begin{matrix}-a+2b=1\ \_\_\_\_\ (3)\\-c+2d=0\ \_\_\_\ (4)\end{matrix}$$

From (1), (2), (3) & (4) we get a = –1, b = 0, c = 4, d = 2

Hence, $M=\begin{bmatrix}-1&0\\4&2\end{bmatrix}$

Now, $\det(M-\lambda I)=0$

$$\det\begin{bmatrix}-1-\lambda&0\\4&2-\lambda\end{bmatrix}=0\Rightarrow$$

$$-\left(1+\lambda\right)\left(2-\lambda\right)=0$$

$$\Rightarrow\lambda=2,-1,\ \left(\lambda_1>\lambda_2\right)$$

So,

$\lambda_1=2,\ \lambda_2=-1$

Now,

$6\lambda_1+3\lambda_2=6\times2+3(-1)=9$

Q45 Text Solution:

Given:

$$A=\begin{bmatrix}1&2&1\\3&6&3\\2&4&2\end{bmatrix}$$

$$\det A=\begin{vmatrix}1&2&1\\3&6&3\\2&4&2\end{vmatrix}=0$$

∵ det (A) = 0, the matrix is singular, meaning it is not invertible. This implies the system does not have a unique solution.

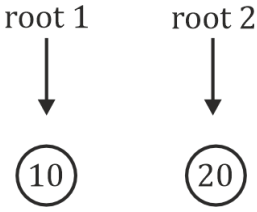
Nature of solution :

If the rank of the augmented matrix [A/B] equals the rank of A, the system has infinitely many solutions; otherwise, it has no solutions.

Therefore depending on b, the system may have no solution or infinitely many solution
Option 'd' is correct

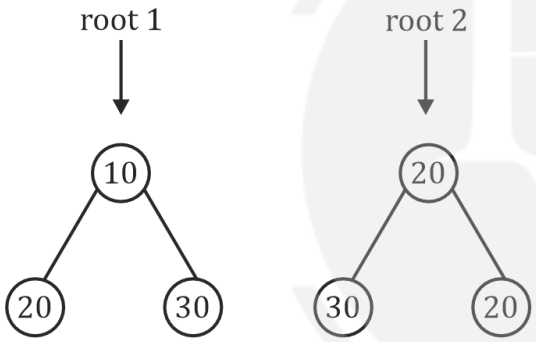
Q46 Text Solution:

Binary tree with single node



As both returns '0' Hence
Option b is elminated

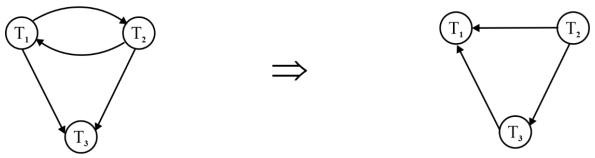
- Option 'd' is also elminated for same reason (example) of above.
- As there is no conecpt of height involoved in the code fragement option 'A' is also elimanted.



Option c satisifies for the given example above
Hence option 'c' is correct.

Q47 Text Solution:

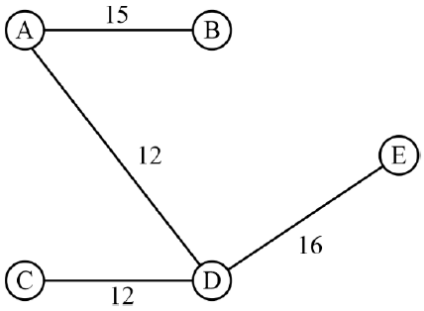
Predence Graph for S_1



Cycle between T_1 & T_2 not conflict Serialzable
No cycle Schedule S_2 is conflict serializable.
Precedence graph for S_2.

Q48 Text Solution:

Prims:



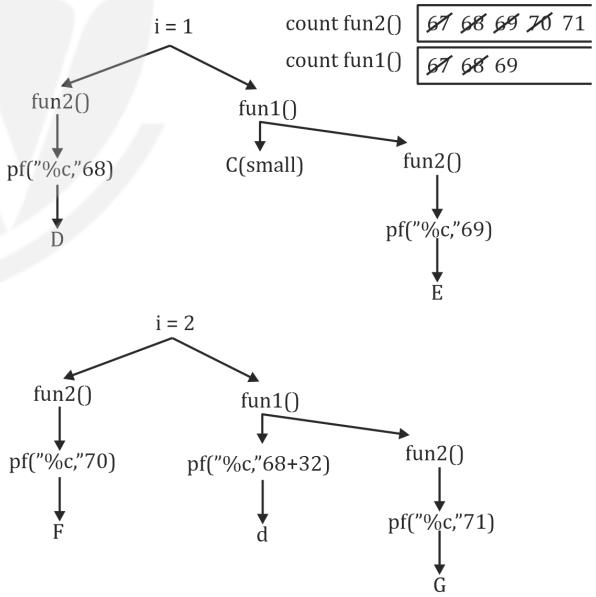
• For leaf node in undirected graph degree must be 1.

Minimum cost = 12 + 12 + 15 + 16
= 24 + 31
= 55

(55) is correct answer.

Q49 Text Solution:

i = 1
fun2();
fun1();
i = 2
fun2();
fun1();



DcEFdG
∴option (b) is correct.

Q50 Text Solution:

1 rotation time = 60000/15000 = 4milliseconds

Number of surfaces on disk = 5 * 2 = 10, hence there are 10 tracks within one cylinder. The number of total sectors in one cylinder = 200*10 = 2000

Hence 2000 sectors to be transferred.

Given that seek time is needed only once, but rotational latency will be needed for each track, which means 10 times.

So total file transfer time = seek time + 10* 1 rotational latency + 2000 * 1 sector transfer time

= 4 + 10*(4/2) + 2000* (4/500) milliseconds

= 4 + 20 + 16 milliseconds

= 40 milliseconds

= 0.04 seconds

Q51 Text Solution:

S → AB | BA

A → CAC | 0

B → CBC | 1

C → 0 | 1

This CFG generated language L = {xy | x, y ∈{0, 1}*, |x| = |y|, x ≠ y}

Q52 Text Solution:

FIRST (S) = {d, f, e}

FIRST (A) = {d, f}

FOLLOW (S) = {$, g}

FOLLOW (A) = {e, d, f, g}

Q53 Text Solution:

(∃a) [P(a) ∧ ∀b (R (a, b) → S(b, a))]

There is a computer science class that is interesting and has fewer students than all easier classes.

Q54 Text Solution:

Whether M accepts ab within 4 steps is decidable.

Whether M halts on ab within 4 steps is also decidable.

Q55 Text Solution:

Clock cycle time = 1/4GHz = 0.25 nanoseconds

Miss penalty to main memory from cache = 100 nanoseconds = 100/0.25 = 400 cycles

CPI stall with only L1 = 0.02 * 400 = 8

CPI overall with only L1 = 1 + 8 = 9

When L2 is added then Miss penalty of L1 to L2 = 5ns / 0.25ns = 20 cycles

CPI stall with L1 and L2 both = 0.02 * 20 + 0.005 * 400 = 2.4

CPI overall with L1 and L2 both = 1 + 2.4 = 3.4

Speed up = 9/3.4 = 2.6

Q56 Text Solution:

Data = 1 1 0 1 1 0 1 1

CRC = 1 1 0

G(X) = ? = $x^3 + x + 1$

G(x) = $x^3 + 1$

CRC = 011

G(x) = $x^3 + x^2 + 1$

Divisor = 1101

CRC = 100

G(x) = $x^3 + x + 1$

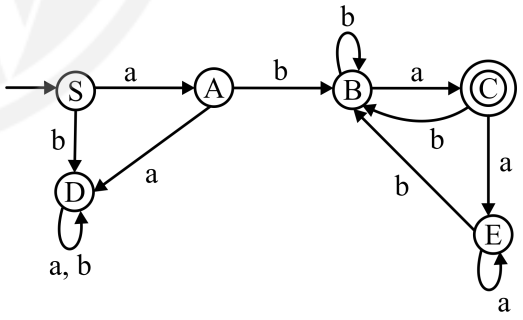
Divisor = 1011

CRC = 110

Q57 Text Solution:

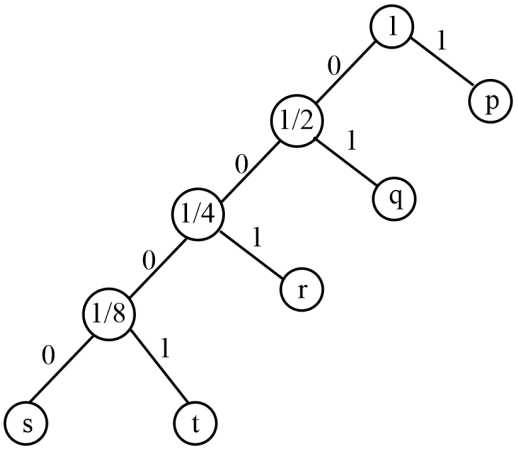
L = {aba, bbba, bbba, ….}

DFA:



Number of states = 6.

Q58 Text Solution:



The average length is =

$\frac{1}{16}(4)+\frac{1}{16}(4)+\frac{1}{8}(3)+\frac{1}{4}(2)+\frac{1}{2}(1)$

$=1.875$

Q59 Text Solution:

- Whether TM accepts only ab" is NOT RE
- Whether TM halts only ab" is not RE
- Whether TM accepts ab" is RE but not decidable

Q60 Text Solution:

Frame number = floor (physical address / page size) = floor (233/16) = 14

Offset = physical address % page size = 233%16 = 9

Frame 14 is storing page number 5 as per the given page table.

Logical address = (page number * page size) + offset

= (5 * 16) + 9

= 89

Q61 Text Solution:

1. π_{Eid} (Employee) = {1, 2, 3, 4, 5}

2. π_{Eid} (Employee$\bowtie_{(Eid = Deid) \wedge (Dage \leq Eage)}$ (Dependent)) = {1, 2, 3, 4, 5}

$\Rightarrow$ results employee id whose age is greater than equal to his/her dependent i.e. {1, 2, 3}

Output = (1) – (2)

= {1, 2, 3, 4, 5} – {1, 2, 3}

= {4, 5}

Q62 Text Solution:

Q_n	Q_{n+1}	A	B
0	0	X	0
0	1	X	1
1	0	1	X
1	1	0	X

Consider the excitation table of JK-FF.

Q_n	Q_{n+1}	J	K
0	0	0	X
0	1	1	X
1	0	X	1
1	1	X	0

Hence, J = B, K = A

Q63 Text Solution:

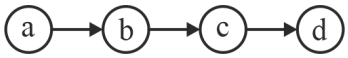
The following concept is valid when we get output 1 from the 2nd last state.

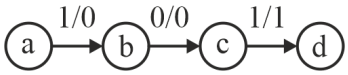
• If we get initial state from the last state for either of the inputs (0 or 1), then it is non-overlapping sequence detector.

• If we are not getting initial state from the last state for either of the inputs (0 or 1), then it is overlapping sequence detector.

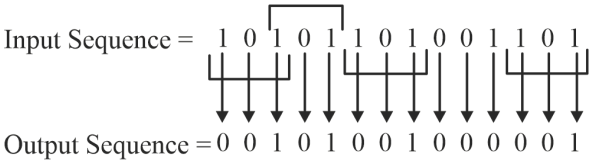
In this case, we are not getting initial state (a) from last state (d) for either of the inputs (0 or 1). Thus, it is overlapping sequence detector.

The state of the sequence detector changes & mores forward (except in the last state) when it detects the bits of the sequence. We check the input bits until output 1.





∴Detector sequence = 101



Q64 Text Solution:

Number of blocks in cache = 512, hence cache block number = 9-bits

Block size = 128 bytes, hence byte offset = 7 bits

The 32 bits main memory address is divided into 3 parts as follows:

Tag	Cache block number	Byte Offset
16	9	7

(a) For given address 0xAADDA712 the middle 9 bits will be: 101001110 = $(334)_{10}$

(b) For given address 0xFFAD50FF the middle 9 bits will be: 010100001 = $(161)_{10}$

(c) For given address 0x12342F78 the middle 9 bits will be: 001011110 = $(94)_{10}$

(d) For given address 0xCBA40ABC the middle 9 bits will be: 000010101 = $(21)_{10}$

Q65 **Text Solution:**

Message (M) = 60 bytes

Header size (H) = 5 bytes

Number of Hops (k) = 4

Optimal payload size (P)

$$\sqrt{\frac{MH}{(k-1)}} = \sqrt{\frac{60\text{byte} \times 5\ \text{byte}}{(4-1)}}$$

P = 10 bytes

Optimum packet size = (H + p) = 15 bytes

= (5 byte + 10 byte)