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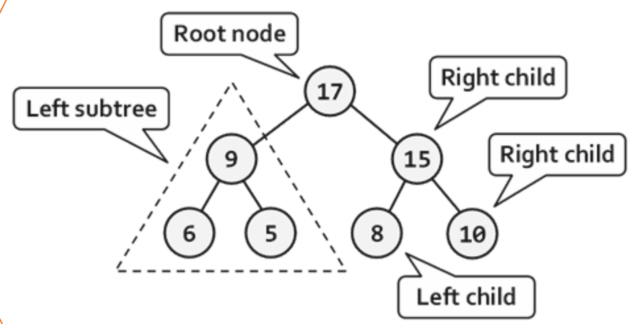


Computer Science & Information Technology

DATA STRUCTURES

Text Book:
Theory with worked out Examples and Practice Questions

Data Structures

(Solutions for Text Book Practice Questions)

Chapter 1 Arrays

01. Ans: 1010

Sol: Loc. of A (i) = L_0 + (i–lb) * C

Loc of A [0] = 1000 + (0+5) × 2 = 1010

02. Ans: 1024 and 1024

Sol: (i) By RMO, the loc. of

$A[i, j]=L_0+[(i-b_1)(u_2-b_2+1)+(j-b_2)]*C$

$A[0, 5] = 1000 + [(0+2) \times 5+ (5-3)] \times 2$

$= 1000+24 = 1024$

(ii) By CMO, the loc of

$A[i,j]=L_0+[(j-b_2)(u_1-b_1+1) + (i-b_1)]*C$

$A[0, 5] = 1000 +[(5-3) \times 5 + (0+2)] \times 2$

$= 1024$

03. Ans: (a)

Sol: In general

$RMO = L_0 + (i-1) r_2 + (j-1)$

$= 100 + (i-1)\,15 + (j-1)$

$= 100 + 15i - 15 + j - 1$

$= 15i + j + 84$

04. Ans: (c)

Sol: Lower triangular matrix

$$\begin{pmatrix} a & 0 & 0 \text{ ---- } 0 \\ b & c & 0 \text{ ---- } 0 \\ d & e & f \;\; 0 - 0 \\ g & h & i \;\; j - 0 \\ \text{-------------------} \\ \text{-------------------} \end{pmatrix}$$

RMO = L_0 + the number of elements in (i – 1) rows + one dimensional elements

$= L_0 + (1 + 2 + \ldots\ldots + i - 1) + (j - 1)$

$= L_0 + i\,\dfrac{(i-1)}{2} + (j-1)$

05. Ans: (c)

Sol: **CMO:**

Storage:

$a_{11}\ a_{21}\ a_{31}\ a_{41} \mid a_{22}\ a_{32}\ a_{42} \mid a_{33}\ a_{43} \mid a_{44}$

0 1 2 3 4 5 6 7 8 9

Retrieval:

loc of $A[i, j] = L_0 + 2D + 1D$

$= L_0 + [(j-1) \text{ cols} + (i - i\ell b)]$

In each col., $i\ell b = j$.

Loc. of $A[i, j] = L_0 + [(j-1) \text{ cols} + (i - j)]$

In (j–1) cols

The no. of elements is

$n + (n-1) + \ldots + (n - (j-1-1))$

$= (j-1)\,n - [1 + 2 + \ldots + j - 2]$

$= n(j-1) - \dfrac{(j-1)(j-2)}{2}$

loc. of A[i, j]

$= L_0 + \left[n(j-1) - \dfrac{(j-1)(j-2)}{2} + (i-j)\right]$

06. Ans: (d)

Sol: **RMO:**

Storage:

$a_{11}\ a_{12} \mid a_{21}\ a_{22}\ a_{23} \mid a_{32}\ a_{33}\ a_{34} \mid a_{43}\ a_{44}$

0 1 2 3 4 5 6 7 8 9

Retrieval:

loc of $A[i, j] = L_0 + 2D + 1D$

$= L_0 + \text{number of elements in } (i-1) \text{ rows}$
$+ (j - j\ell b)$

Row	j*l*b
4	3
3	2
2	1
except 1^{st} row	
i^{th}	(i–1)

$$\text{loc. of } A[i, j] = L_0 + [(3i-4) + j - (i-1)]$$
$$= L_0 + (2i + j - 3)$$

07. Ans: (a)

Sol: CMO:

Storage:

$a_{11}\ a_{21}\ |\ a_{12}\ a_{22}\ a_{32}\ |\ a_{23}\ a_{33}\ a_{43}\ |\ a_{34}\ a_{44}$
0 1 2 3 4 5 6 7 8 9

Retrieval:

loc. of A[i, j] = L_0 + 2D + 1D
$$= L_0 + (j-1)\text{cols} + (i - i\ell b)$$

Since i is Varying

Col	i*l*b
4	3
3	2
2	1
except	1^{st} column
j^{th}	j–1

$$\therefore \text{loc of } A[i, j] = L_0 + [3(j-1) - 1 + i - (j-1)]$$
$$= L_0 + [2j + i - 3]$$

08. Ans: (b)

Sol: Storage & Retrieval:

$a_{21}\ a_{32}\ a_{43}\ |\ a_{11}\ a_{22}\ a_{33}\ a_{44}\ |\ a_{12}\ a_{23}\ a_{34}$
0 1 2 3 4 5 6 7 8 9

If $i - j = 1$

$\text{loc of } A[i, j] = L_0 + 0 + (i - i\ell b)$

or

$(j - j\ell b)$

i.e.,

$\text{loc. of } A[i, j] = L_0 + 0$
$+ (i-2)$
or
$(j-1)$

If $i - j = 0$

$\text{loc. of } A[i, j] = L_0 + (n-1)$
$+ (i-1)$
or
$(j-1)$

If $i - j = -1$ // upper diagonal

$\text{loc. of } A[i, j] = L_0 + 2n - 1$
$+ (i-1)$
or
$(j-2)$

09. Ans: (a)

Sol: A sample 5 × 5 S-matrix is given below.

1	8	3	2	1
3	0	0	0	0
6	1	7	4	3
0	0	0	0	1
9	6	5	4	1

The compact representation is
[1,8,3,2,1, 6,1,7,4,3, 9,6,5,4,1, 3,1].

10. Ans: 9

Sol: 2n – 1 = 10 – 1 = 9

1	2	3	4
5	1	2	3
6	5	1	2
7	6	5	1

11. Ans: 990698

Sol: Computing number of elements in frame

Before reaching 50^{th} frame we need to complete 1…49 frame i.e. total 49 *frame*.

Each frame is consists of 100 × 100 elements

Hence total 49 × 100 × 100 = 490000 elements are arranged in *frames*.

Number of elements in Rows

In the 49^{th} row we have already completed 1 to 48 i.e. total 48 rows

Each row is consists of 100 elements

Hence total 48 × 100 = 4800 elements are arranged for 49^{th} row.

Number of elements in column

In the 50^{th} frame and 49^{th} row we have 1 to 49 i.e. 49 elements are already arranged.

Total number of element that are arranged is = 490000 + 4800 + 49 = 494849.

Address of *A*[50][49][50] is 1000 + 494849 × 2 = 990698

12. Ans: 1398

Sol: A[20][10]

Before reaching 20^{th} row, number of rows completed is 19

Total number of elements in 19 rows

$$1 + 2 + 3 + \ldots + 19 = \frac{19\times 20}{2} = 190$$

We are at 10^{th} column, number of element completed is 9

Total number of element completed is 190 + 9 = 199

Address of a[20][10] is
= 1000+199×2=1398

Chapter 2 Stacks & Queues

01. (i). **Ans: (a)** (ii). **Ans: (c)**

Sol: Given array size m, say 9

Number of stacks n, say 3

$$0 \le i < n \quad T[i] = B[i] = i.\left[\frac{m}{n}\right] - 1$$

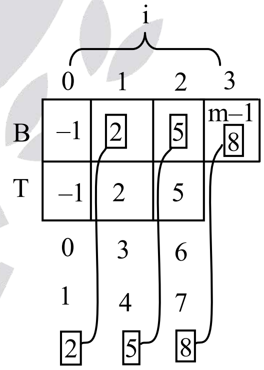
$$i = 0 \Rightarrow T[0] = B[0] = 0\left[\frac{9}{3}\right] - 1 = 0 - 1 = -1$$

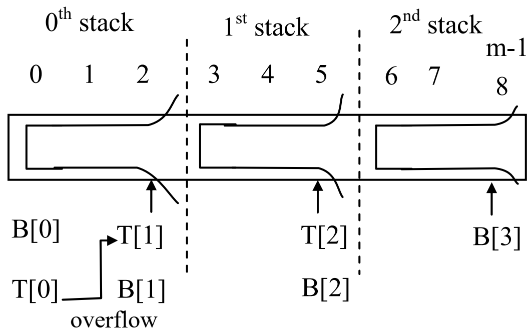
$$i = 1 \Rightarrow T[1] = B[1] = 1\left[\frac{9}{3}\right] - 1 = 3 - 1 = 2$$

$$i = 2 \Rightarrow T[2] = B[2] = 2\left[\frac{9}{3}\right] - 1 = 2[3] - 1 = 5$$

when i = 3 ⇒ B [3] = m – 1 = 9–1 = 8

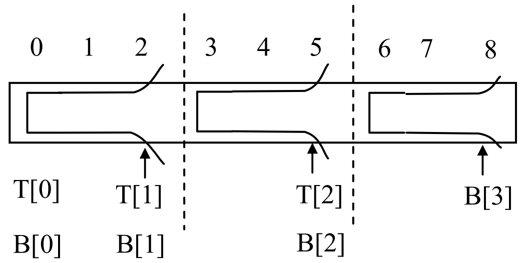
(i) Push = overflow = size





$$\left.\begin{aligned} T[0] &= B[1] \\ T[1] &= B[2] \\ T[2] &= B[3] \end{aligned}\right\} \text{overflow cases}$$

$\therefore$ T[i] = B [i +1]



(ii) POP = underflow = initial

	0	1	2
B	–1	2	5
T	–1	2	5
	0	3	6
	1	4	7
	2	5	8

$$\left.\begin{aligned} T[0] &= B[0] \\ T[1] &= B[1] \\ T[2] &= B[2] \end{aligned}\right\} \text{underflow cases } \therefore T[i] = B[i]$$

02. Ans: (b)

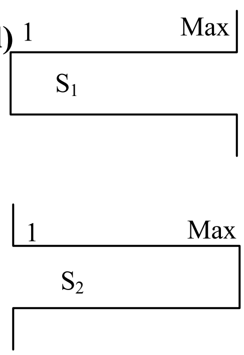
Sol:

Stack operation	Push (10)	Push (20)	Pop	Push (10)	Push (20)	Pop	Pop	Pop	Push (20)	Pop
Stack	10	10 20	10	10 10	10 10 20	10 10	10		20	
Pop list			20	20	20	20, 20	20, 20, 10	20, 20, 10, 10	20, 20, 10, 10	20, 20, 10, 10, 20

The sequence of popped out values $\Rightarrow$ 20, 20, 10, 10, 20

03. Ans: (d)

Sol:

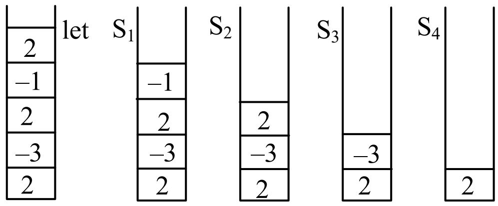


An instance of array having two stacks is shown above. Stack1 occupied from 1 to MAXSIZE and stack2 occupied from MAXSIZE to 1. Above shown array is filled completely. So condition for 'stack full' is

Top 1 = Top 2 – 1

04. Ans: (c)

Sol: Stack S is



f (0) = 0

f (S_4) = max {f (0),0} + 2 =2

f (S_3) = max {f (S_4),0} + –3 = –1

{ ∵ S_3 = push (S_4, – 3) }

f (S_2) = max {f (S_3),0} + 2 =2

f (S_1) = max {f (S_2),0} + (–1) =1

f (S) = max {f (S_1),0} + 2 =3

f (S) = 3

05. Ans: (b)

Sol: Stack insertion order ⇒ 1,2,3,4,5. The only possible output sequence 3,4,5,2,1

That occurs when

Push (1)

Push (2)

Push (3)

Pop (3) → 3

(∵ There is no constraint on the order of deletion operations)

Push (4)

Pop (4) ⟶ 3, 4

Push (5)

Pop (5) ⟶ 3,4,5

Pop (2) ⟶ 3,4,5,2

Pop (1) ⟶ 3,4,5,2,1

Other remaining combinations are not possible

06. Ans: 321

Sol: Invocation tail (3)

T (3) = 3

T (2) = 2

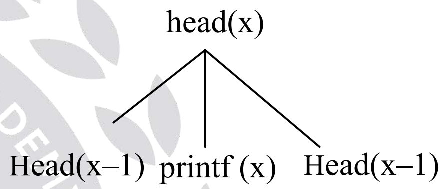
T (1) = 1

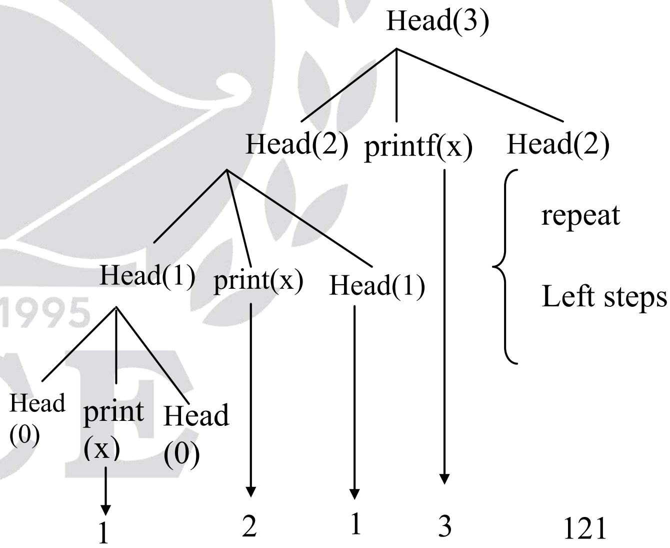
T (0) = stop

Output: 321

07. Ans: 1213121

Sol:

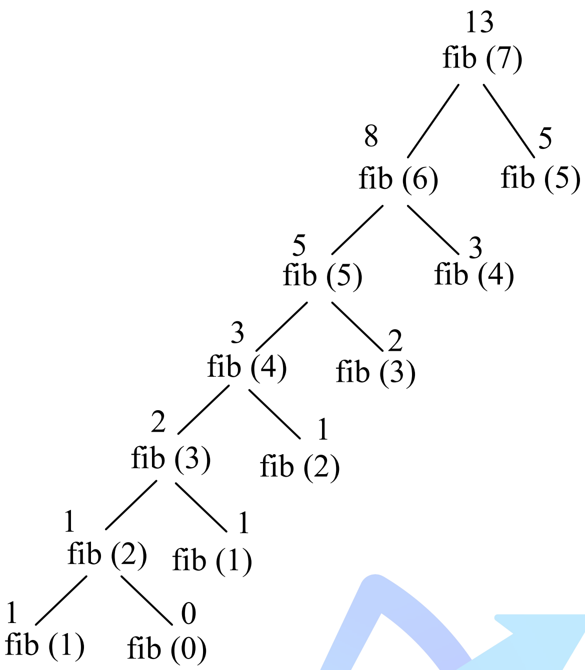




Output: 1213121

08.

Sol: (i) Ans: 13



(ii) Ans: 67

Sol: Number of calls for evaluating

f(n) = 2 ×f (n+1) – 1

The total number of calls in

Fibonacci (8) = 2 f(9) – 1

= 2 × 34 – 1 = 68 – 1 = 67

(iii) Ans: 54

n	0	1	2	3	4	5	6	7	8	9	10
Fib(n)	0	1	1	2	3	5	8	13	21	34	55
Call:	1	1	3	5	9			41	35		
Add:				2	4						

Additions = f (n+1) – 1

f(9) = f(10) –1 = 55 – 1 = 54

09.

Sol: Ackerman(m , n) =

$$\begin{cases} n+1 & \text{if } m=0 \\ \text{Ackerman}(m-1,1) & \text{if } n=0 \\ \text{Ackerman}(m-1,\text{Ackerman}(m,n-1)) & \text{otherwise} \end{cases}$$

(i) Ans: 9

Sol: Ackerman(2, 3) = A(1, A(2, 2)) = A(1, 7)

A(2,2) = A(1, A(2,1)) = A(1, 5) = 7

A(2,1) = A(1, A(2,0)) = A(1, 3) = 5

A(2, 0) = A(1,1) = 3

A(1, 1) = A(0, A(1, 0)) = A(0, 2) = 2 +1 = 3

A(1, 0) = A(0, 1) = 2

A(0, 1) = 1 + 1 = 2

A(1,3) = A(0,A(1, 2)) = A(0, 4) = 4 + 1 = 5

A(1,2) = A(0,A(1, 1)) = A(0, 3) = 3 + 1 = 4

A(1, 5) = A(0, A(1, 4))

= A(0, A(0, A(1, 3)))

= A(0, A(0, 5))

= A(0, 6) = 6 +1 = 7

A(1, 7) = A(0, A(1, 6))

= A(0, A(0, A(1, 5)))

= A(0, A(0, 7))

= A(0, 8) = 9

Ackerman(2, 3) = 9

(ii) Ans: 13

Sol: Ackerman(2, 5) = A(1, A(2, 4))

= A(1, A(1, A(2, 3)))

= A(1, A(1, 9))

A(1, 9) = A(0, A(1, 8))

= A(0, A(0, A(1, 7)))

= A(0, A(0, 9))

= A(0, 10)

= 11

A(1, 11) = A(0, A(1, 10))
= A(0, A(0, A(1, 9)))
= A(0, A(0, 11))
= A(0, 12)
= 13

Ackerman(2, 5) = 13

(iii) Ans: 4

Sol: Ackerman(0, 3) = 4

(iv) Ans: 5

Sol: Ackerman(3, 0) = A(2, 1)

A(2,1) = A(1, A(2, 0))
A(2, 0) = A(1, 1)
A(1, 1) = A(0, A(1, 0))
A(1, 0) = A(0, 1) = 2
A(1, 1) = A(0, 1) = 3
A(2, 0) = 3
A(2, 1) = A(1, 3)
A(1, 3) = 5 from (i)
A(2, 1) = 5
Ackerman(3, 0) = 5

10.

Sol: (a) After N +1 calls we have the first move.
So after 4 calls we have the first move.

(b) After total calls –1 calls, we have the last move.

(c) Total moves $2^N - 1 = 7$

(d) Total invocations = $2^{N+1} - 1$
$= 2^4 - 1 = 15$

11. Ans: (b)

Sol: Postfix expression A B C D + * F /+DE * +

12. Ans: (a)

Sol: a = – b + c * d/e + f ↑ g ↑ h – i * j

Prefix:

a = – b + c * d/e +(↑f ↑gh) – i * j
a = – b + *cd/e + (↑f↑gh) – i * j
a = – b + /*cde + ↑f↑gh – *ij
a = +–b/*cde + ↑f↑gh – *ij
a = ++–b/*cde↑f↑gh – *ij
a = – + + – b/*cde ↑f↑gh*ij
⇒ = a – + + – b/*cde ↑f ↑gh*ij

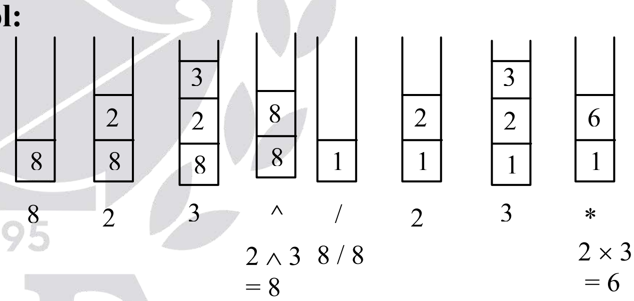
13. Ans: (a)

Sol: Infix expression: $[a+(b\times c)]-(d\wedge(e\wedge f))$

Postfix expression: $abc \times +def \wedge\wedge -$

14. Ans: (a)

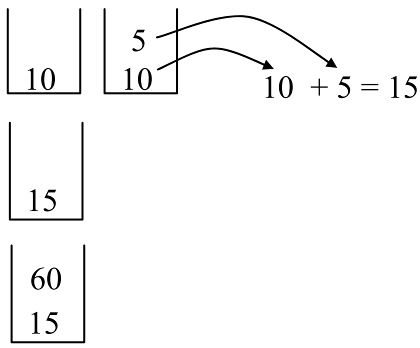
Sol:

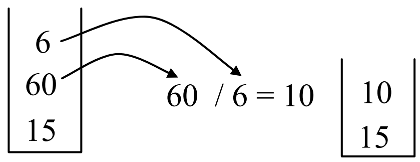


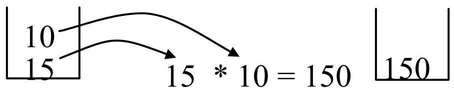
⇒ The top two elements are 6, 1

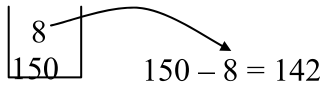
15. Ans: (c)

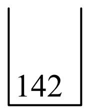
Sol: 10, 5, +, 60, 6, /, *, 8, –











Value of the postfix expression is 142

16. Ans: (c)

Sol: (i) ab

(ii) b

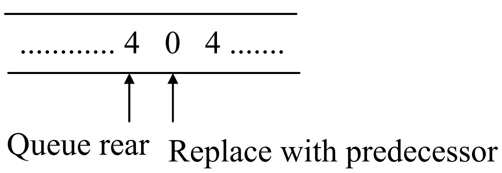
(iii) byz

(iv) yz

Output is ⇒ yz

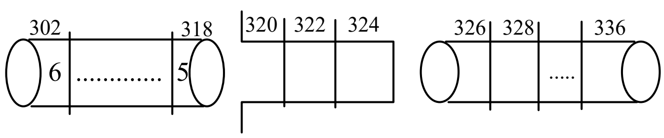
17. Ans: (b)

Sol:

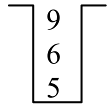


18. Ans: (i) 322 and (ii) 326

Sol:

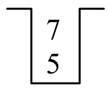


Until first '0' is encountered, stack contains



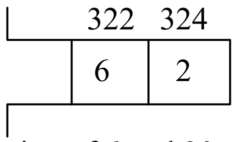
So 5+6+ 9 = 20 is enqueued in Q_2 @ loc 326

Until second '0' is encountered, stack contains



So 5 + 7 = 12 is enqueued in Q_2 @ loc 328

Then simply 2 and 6 are pushed in stack

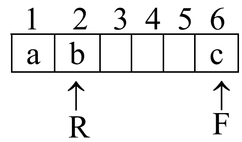


So the location of 6 and 20 are 322 and 326

19. Ans (c)

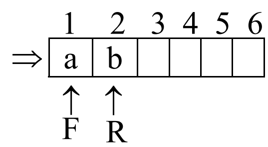
Sol: Suppose that array contains

Initial configuration:



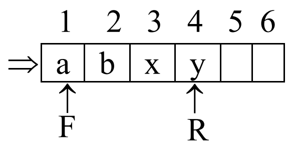
Delete element

Dequeue( ) ↘ c



Now two added

enqueue (x) and enqueue (y) :



∴ (R, F) = (4,1)

Option (c).

20. Ans: (b)

Sol: The given recursive procedure simply reverses the order of elements in the queue. Because in every invocation the deleted element is stored in 'i' and when the queue becomes empty.

Then the insert ( ) function call will be executed from the very last invoked function call. So, the last deleted element will be inserted first and the procedure goes on.

21. Ans: (a), (b) & (c)

Sol: DCBA is possible push D, pop D, Push C, pop c, push B, pop B, push A , pop A.

BCAD is possible push D,C,B pop B Pop C, push A , pop A , pop D

A B C D is possible push D,C,A pop A,B,C,D

CABD is not possible push D, Push C, Pop C, push B, Push A, Pop A, : Last element is B so pop B will happen therefore this sequence is not possible so answer should be (a), (b), (c).

22. Ans: (a)

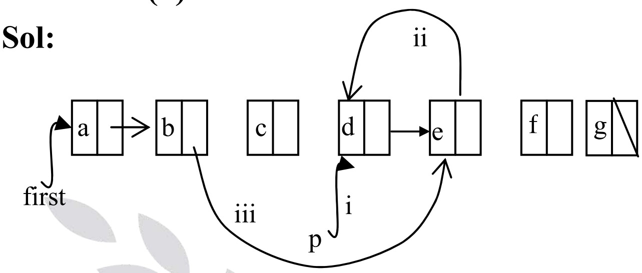
Sol: The front is the pointer in the queue from where dequeue happens. So we dequeue the element using the front. After dequeuing the front pointer moves by one, hence this is a circular array then we have to take the mod of the array length to again start from the first index after reaching the last index of the array.

Count-- // represents the number of elements is there in the queue. So after dequeuing, we also decrease the count. Return r will return the element value. Option (a) fills all these parameters that is correct.

Chapter 3 Linked Lists

01. Ans: (d)

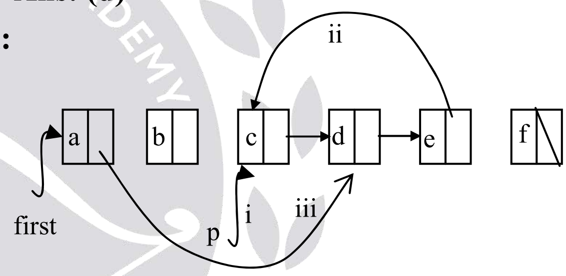
Sol:



Print = d

02. Ans: (d)

Sol:



Print = d

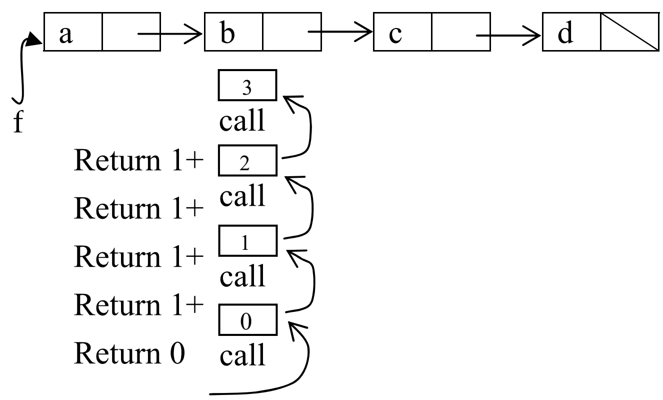
03. Ans: (a)

Sol: while (P) or while (P!= Null)

while P is pointing to somebody

04. Ans: (d)

Sol: Recursive routine for 'Count'



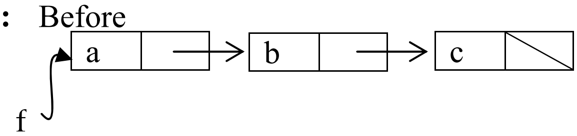
No. of nodes = 4

05. Ans: (b)

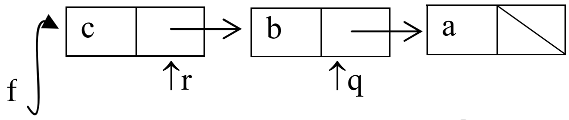
Sol: Either causes a null pointer dereference or append list m to the end of list n.

06. Ans: (b)

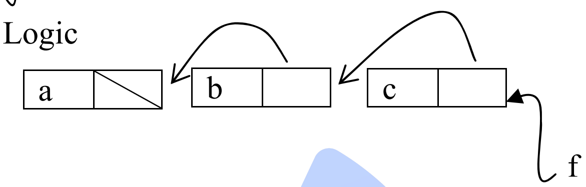
Sol: Before



After



Logic

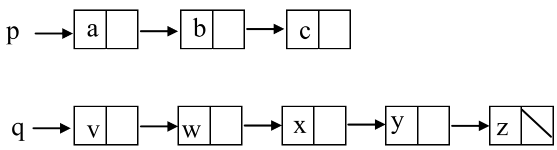


07. Ans: (b)

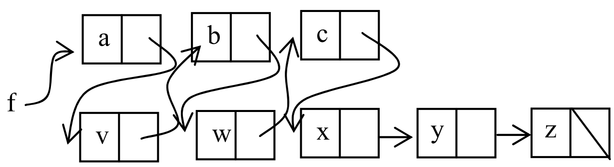
Sol: This is recursive routine for reversing a SLL.

08. Ans: (a)

Sol: Before



After



concatenation of two single linked lists by choosing alternative nodes.

09. Ans: (d)

Sol: Cur. Next = new Node (X, Cur. Next)

(i) Struct Node * n = Get Node ( ) ;

(ii) n → data = X ;

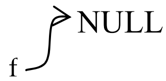
(iii) n → Next = Cur → Next ;

(iv) Cur → Next = n

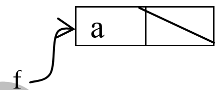
10. Ans: (a)

Sol: Linked stack push ( ) = insert front ( )

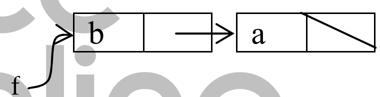
Initial **Do( )**



Do(a)



Do(b)



11.

Sol:

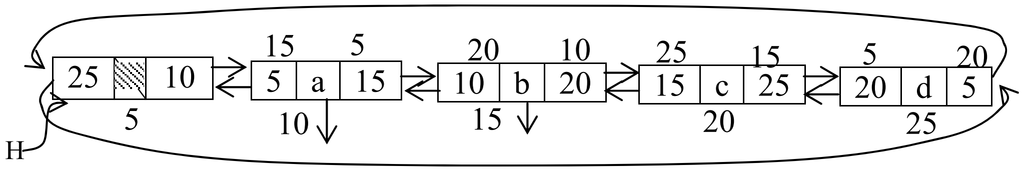
Operation	Left most	Right most	Middle
Insert	3	3	4
Delete	1	1	2

12. Ans: (b)

Sol: Inserts to the left of middle node in doubly linked list.

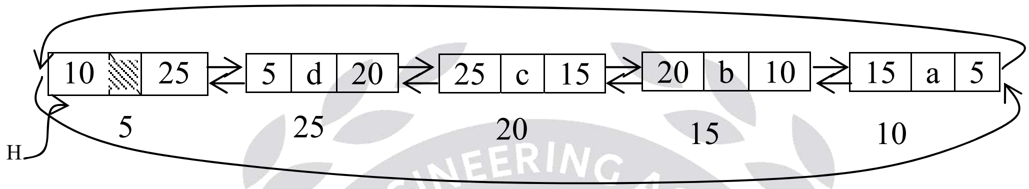
13. Ans: (a)

Sol: Before reverse:



t = t→ link

After reverse:



14. Ans: (c)

Sol: In the doubly linked list, the maximum pointers will change if we insert them in the intermediate of the linked list. If we insert the element then we have to change the next and previous of inserting node. Next of the previous node and previous of the next node.

15. Ans: (b)

Sol: For counting the number of nodes we have to move the temp pointer.

while(temp!=NULL)//The last node next stores the NULL

If we take the while(temp→next!=NULL) the last node will not be counted here.

Chapter 4 Trees

01. Ans: (d)

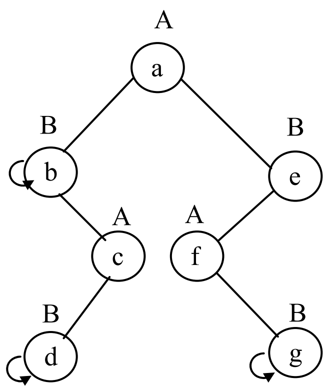
Sol:
1. Traverse the left subtree in postorder.
2. Traverse the right subtree in postorder.
3. Process the root node

02. Ans: (c)

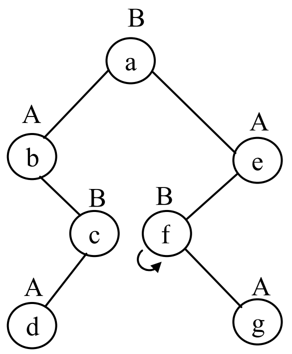
Sol:
1. Traverse the right subtree in postorder.
2. Traverse the left subtree in postorder.
3. Process the root node

03. Ans: (c)

Sol:



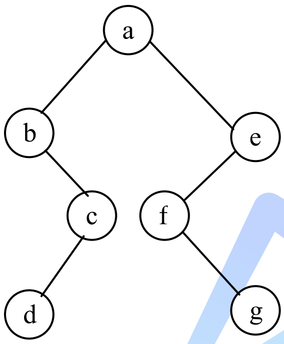
A(t) =a b c d f g e



B(t) =b d c a e f g

04. Ans: (b)

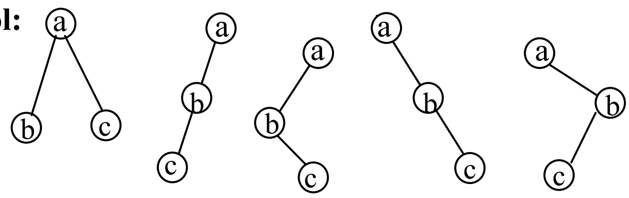
Sol:



B(t) = egfabcd

05. Ans: 5

Sol:



∴ Totally 5 distinct trees possible

Note: The number of binary trees can be formulated with unlabeled nodes are

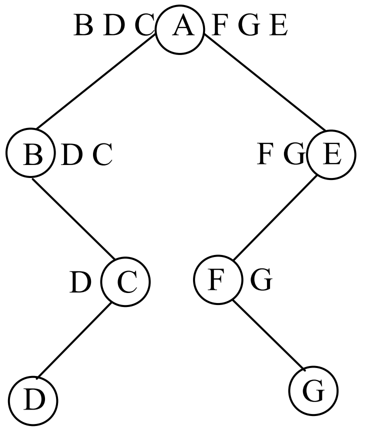
$$= \frac{^{2n}C_n}{n+1}.$$

06. Ans: (c)

Sol: Preorder : A B C D E F G

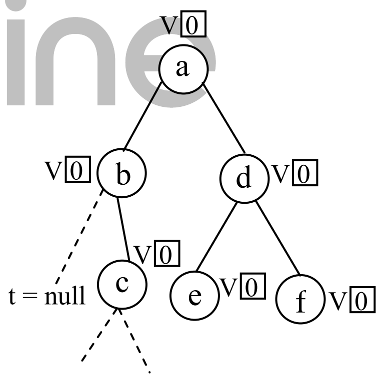
In-order : B D C A F G E

Post-order: D C B G F E A



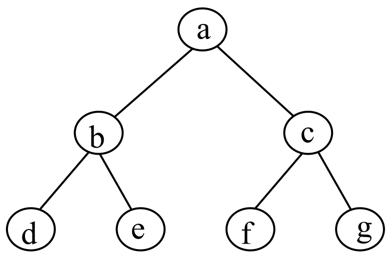
07. Ans: 3

Sol: **Note:** If pre-order is given, along with terminal node information & all right child information the unique pattern can be found. If post-order is given along with terminal information and all left child information, the unique pattern can be identified.



08. Ans: 3

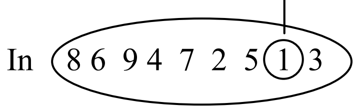
Sol:

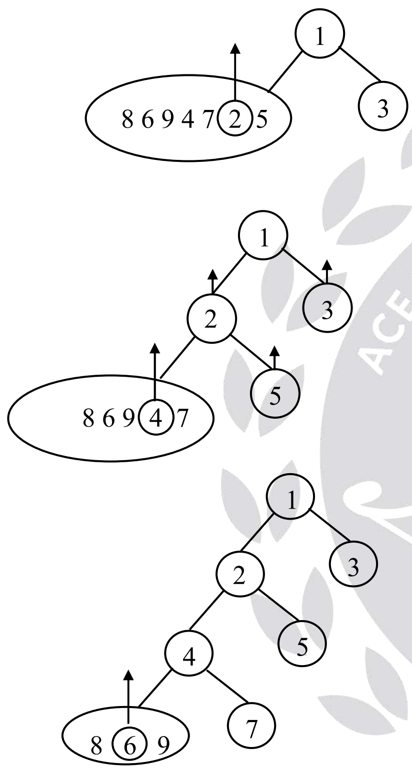


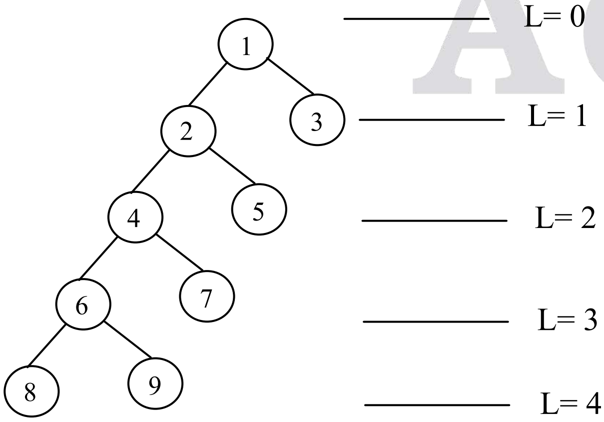
09. Ans: 4

Sol: Post 8 9 6 7 4 5 2 3 1

In 8 6 9 4 7 2 5 1 3







Height = 4

10. (a) Ans: 19

Sol: Leaf nodes (L) = Total nodes–internal nodes

L = In+1–I

L = I(n–1)+1

L = 20

I = ?

20 = I(2 – 1) +1

20 = I + 1

I = 19

10. (b) Ans: 199

Sol: L = I(n–1)+1

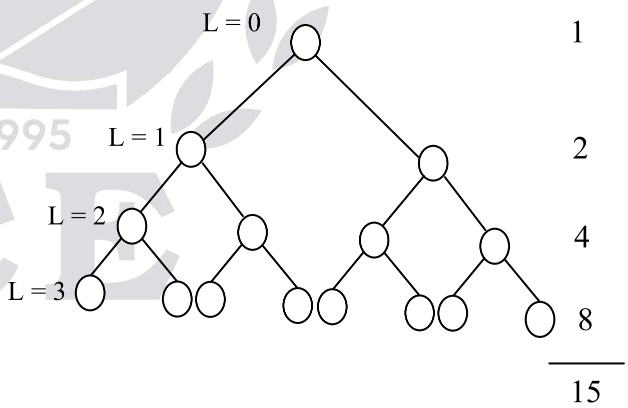
L = 200

200 = I + 1

I = 199

11. Ans: (b)

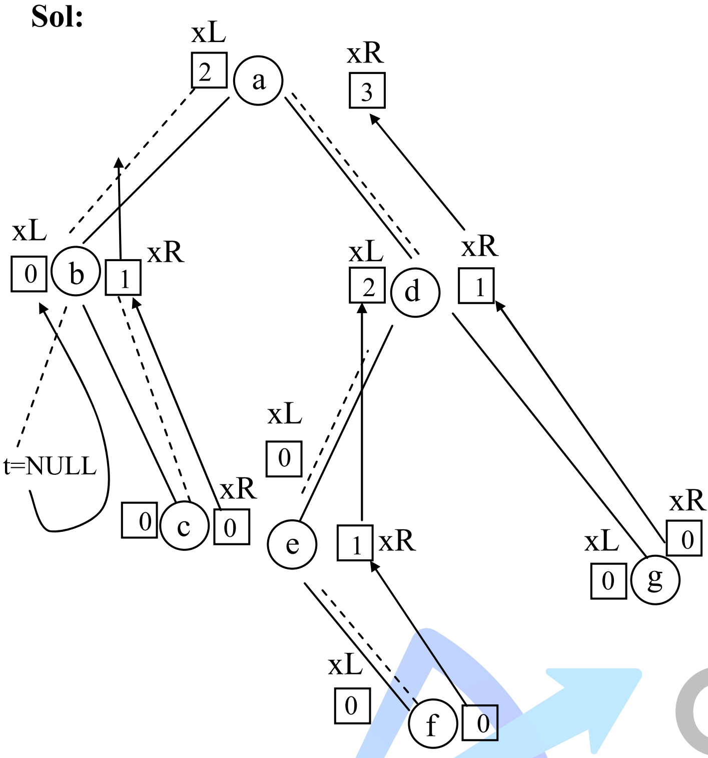
Sol:



Minimum = 3, Maximum = 14

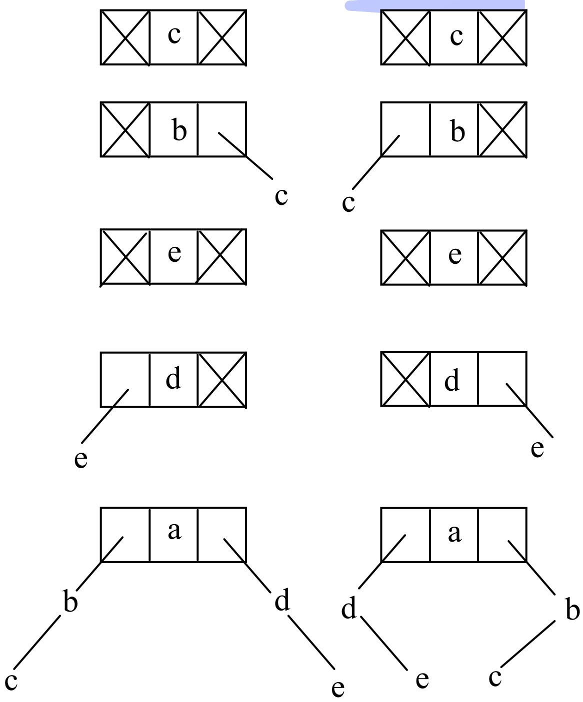
12. Ans: 2 and 1

Sol:



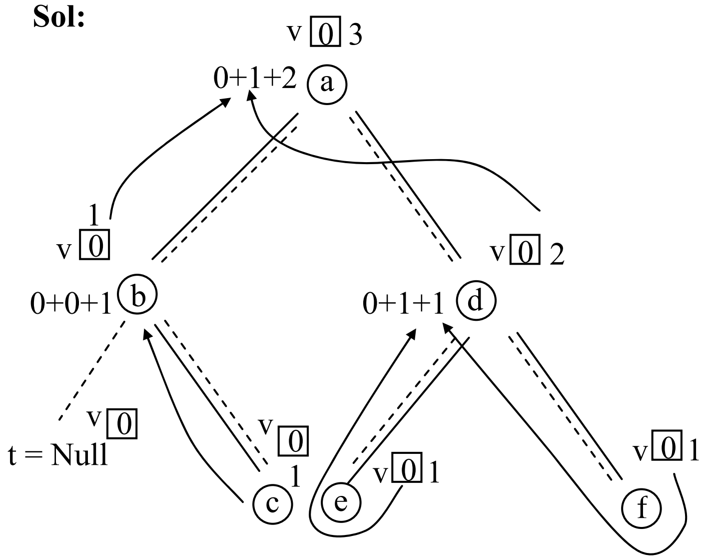
13. Ans: (a)

Sol: Before Swap After swap



14. Ans: (d)

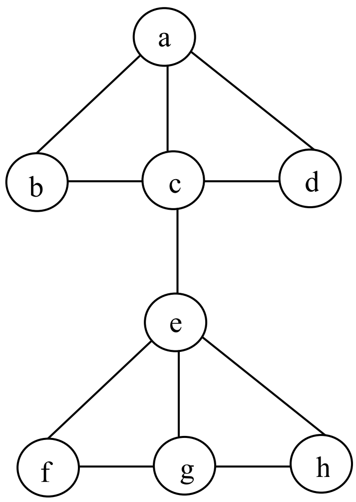
Sol:



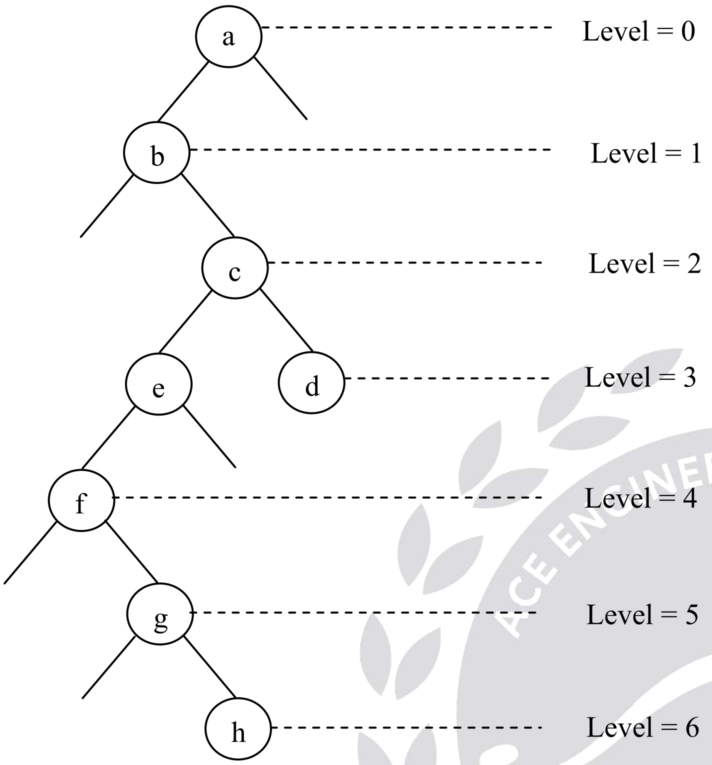
15. Ans: 6

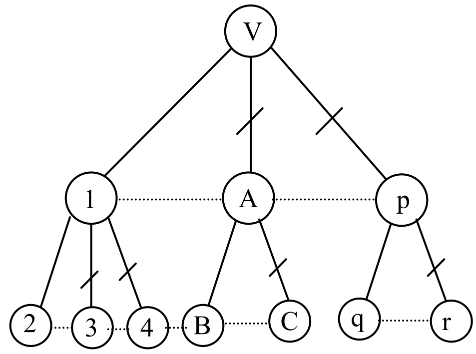
Sol: a (b, c (e (f, g, h)),d)

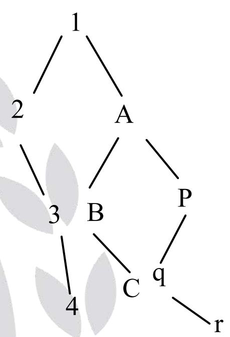
Parent of f, g, h is e. i.e. internal parenthesis has children of parent which is out of parenthesis.



Converted Binary Tree:

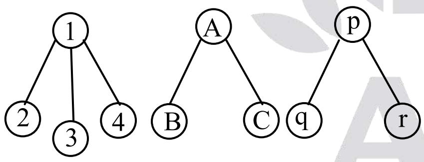






16. Ans: 4

Sol: Given are 3 trees



To get the converted binary tree of these given trees

∵ parent is not given we have to assume virtual parent

Among siblings

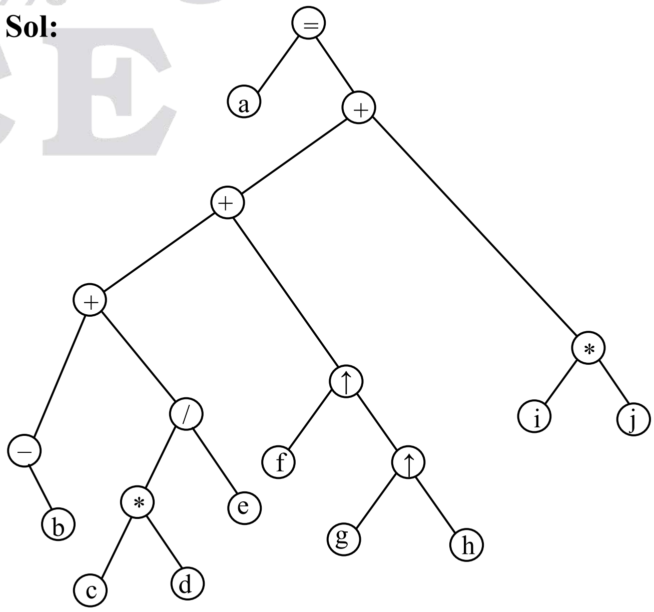
- Keep the leftmost as it is,
- Cut and connect right siblings as shown in diagram

17. Ans: (d)

Sol: Count the number of trees in forest.

18. Ans: (b)

Sol:



19. Ans: 6

Sol: Expanded as

$((1+1) - (0 - 1)) + ((1 - 0) + (1+1))$

$= 3 + 3 = 6$

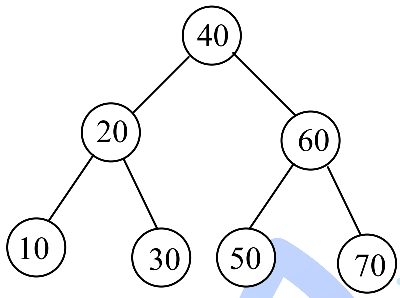
20. Ans: –2

Sol: $(0 + 0) - (1 - 0) + (0 - 1) + (0 + 0)$

$= -1 + (-1) = -2$

21. Ans: 4

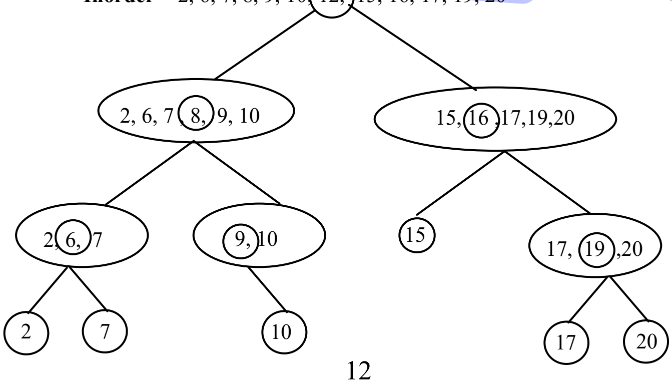
Sol:

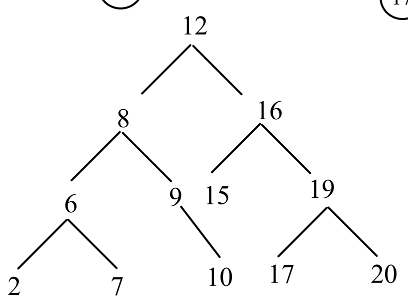


22. Ans: (b)

Sol: Preorder = 12, 8, 6, 2, 7, 9, 10, 16, 15, 19, 17, 20

Inorder = 2, 6, 7, 8, 9, 10, 12, 15, 16, 17, 19, 20

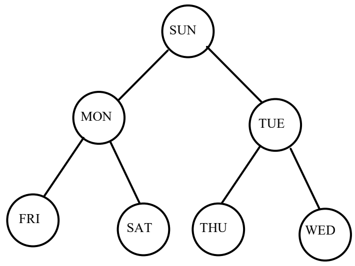




= 2, 7, 6, 10, 9, 8, 15, 17, 20, 19, 16, 12

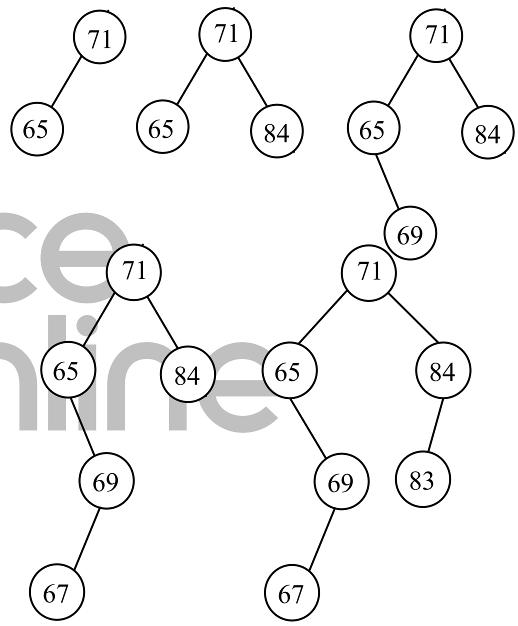
23. Ans: 4

Sol:



24. Ans: 67

Sol: 71, 65, 84, 69, 67, 83 insert into empty binary search tree



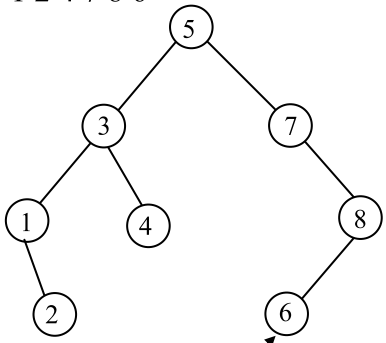
∴ Element in the lowest level is 67

25. Ans: 30

Sol: Refer gate PYQ book

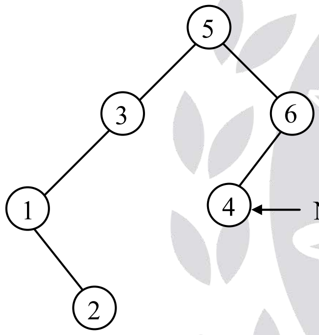
26. Ans: (d)

Sol: (a) 5 3 1 2 4 7 8 6



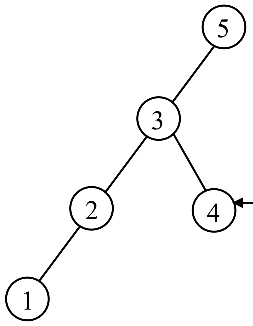
Not possible
IN: not sorted order

(b) 5 3 1 2 6 4 8 7



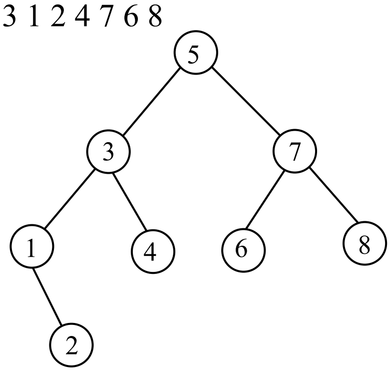
Not possible

(c) 5 3 2 4 1 6 7 8



Not possible

(d) 5 3 1 2 4 7 6 8



27. Ans: 15

Sol: 1. Jump right

2. Go on descend left

28. Ans: 88

Sol:
$$N_{min}(H) = \begin{cases} 1 & L = H = 0 \\ 2 & L = H = 1 \\ 1 + N(H-1) + N(H-2) & (L = H) > 1 \end{cases}$$

N(H) = 1 + N(H–1) + N(H–2)

N(2) = 1 + N(1) + N(0)

= 1 + 2 + 1

= 4

N(3) = 1 + N(2) + N(1)

= 1 + 4 + 2

= 7

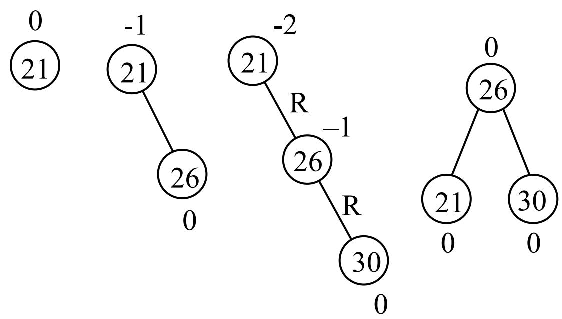
N(8) = 1 + N(7) + N(6)

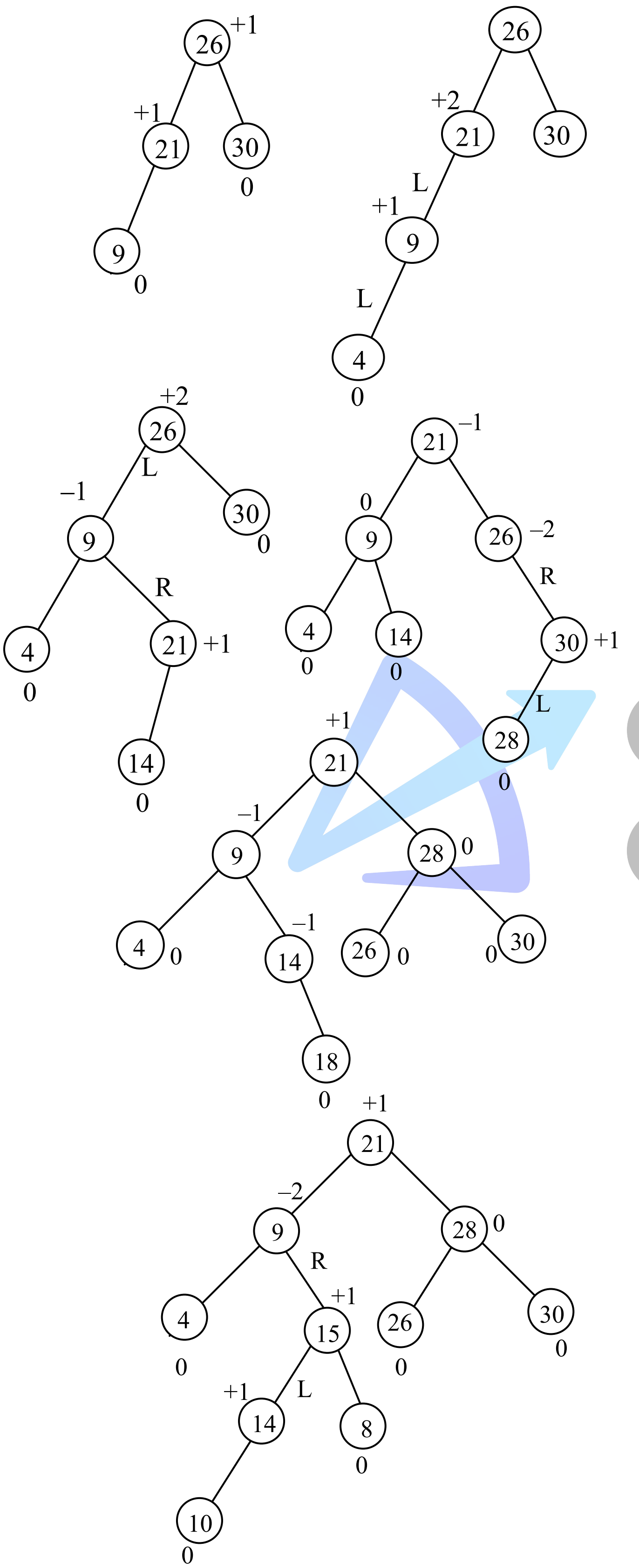
= 1 + 54 + 33 = 88

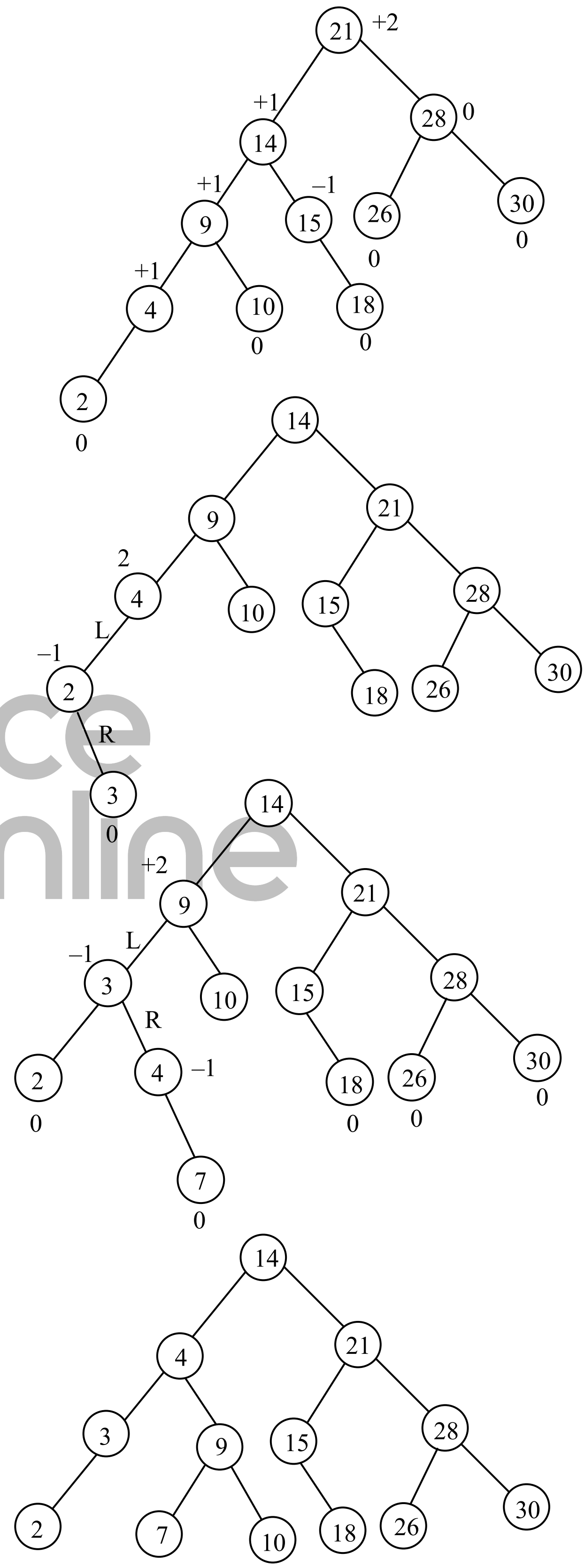
H	0	1	2	3	4	5	6	7	8
N(H)	1	2	4	7	12	20	33	54	88

29. Ans: 14

Sol: 21, 26, 30, 9, 4, 14, 28, 18, 15, 10, 2, 3, 7



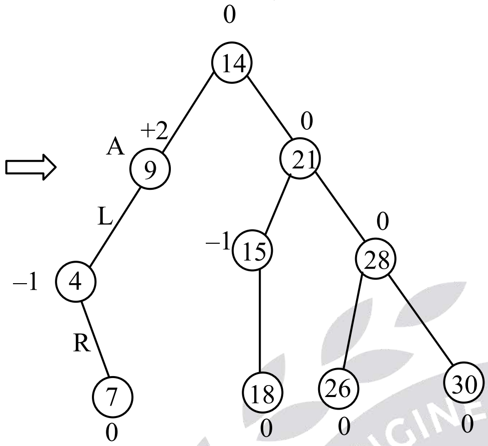




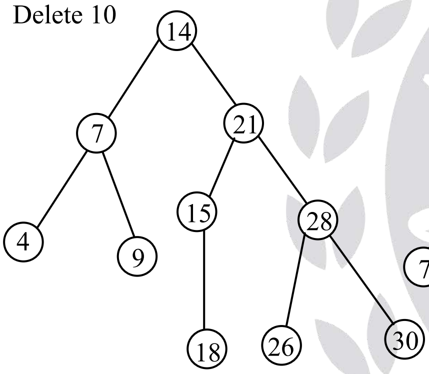
30. Ans: 28

Sol:

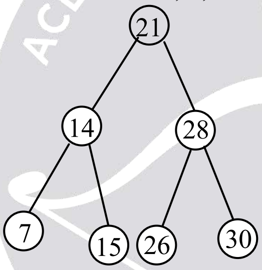
Delete 2, 3



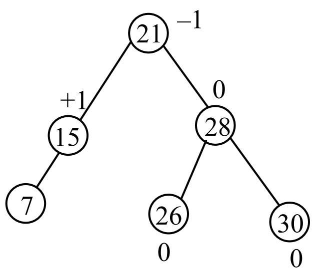
Delete 10



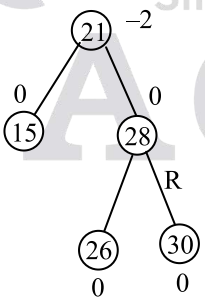
Delete 18, 4, 9



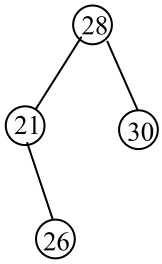
Delete 14



Delete 7



Delete 15



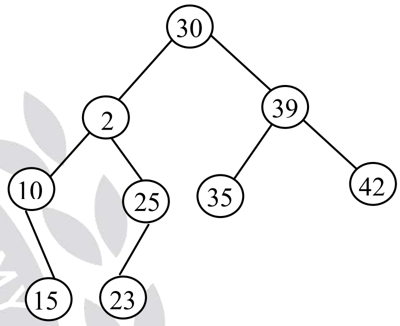
31. Ans: (a), (b) & (c)

Sol: The inorder of the binary search tree is always the sorted order.

Inorder: 10 15 20 23 25 30 35 39 42

To make a unique tree the inorder and the pre-order is sufficient.

A unique tree is:



Post-order traversal is:

15 10 23 25 20 35 42 39 30

So answer should be (a), (b), (c)

32. Ans: (a), (b) & (c)

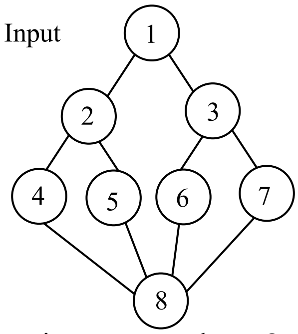
Sol: Every option follows the same tree apart from the option (d). In option (d): 6 come before the 7 which makes store the 6 in place of 7. Hence option (d) will not be the same considering this given tree.

Chapter 5

Graphs

01. Ans: 8

Sol:



Following are the 8 different BFs sequences

V_1	V_2	V_3	V_4	V_5	V_6	V_7	V_8
V_1	V_2	V_3	V_5	V_4	V_6	V_7	V_8
V_1	V_3	V_2	V_6	V_7	V_4	V_5	V_8
V_1	V_3	V_2	V_7	V_6	V_4	V_5	V_8
V_1	V_2	V_3	V_4	V_5	V_7	V_6	V_8
V_1	V_2	V_3	V_5	V_4	V_7	V_6	V_8
V_1	V_3	V_2	V_7	V_6	V_5	V_4	V_8
V_1	V_3	V_2	V_6	V_7	V_5	V_4	V_8

02. Ans: 7

Sol: Maximum possible recursion depth is 7

$V_1 \rightarrow V_2 \rightarrow V_4 \rightarrow V_8 \rightarrow V_7 \rightarrow V_3 \rightarrow V_6$

03. Ans: 3

Sol: $V_1 \rightarrow V_2 \rightarrow V_4 \rightarrow V_8$

$V_1 \rightarrow V_2 \rightarrow V_5 \rightarrow V_8$

$V_1 \rightarrow V_3 \rightarrow V_6 \rightarrow V_8$

$V_1 \rightarrow V_3 \rightarrow V_7 \rightarrow V_8$

All the paths contain 3 edges.
So distance from V_1 to V_8 is 3.

04. Ans: (a)

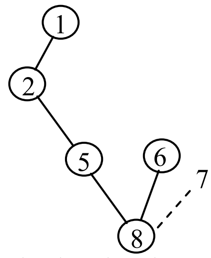
Sol: (a) invalid

(b) valid

(c) valid

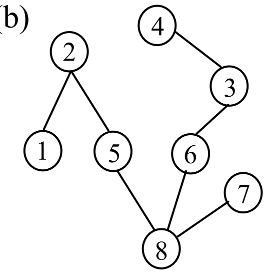
(d) valid

(a)

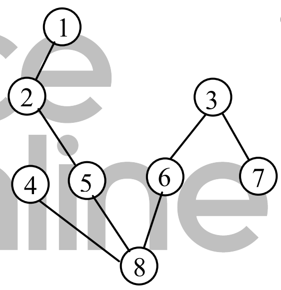


Step back only when already explored vertices are there

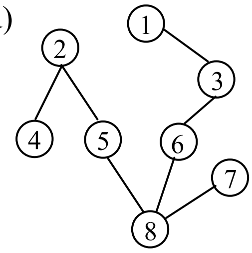
(b)



(c)



(d)

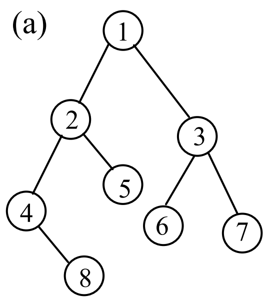


05. Ans: (c)

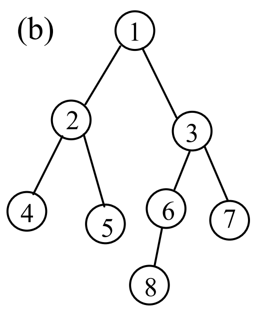
Sol: (a) valid (b) valid

(c) invalid (d) valid

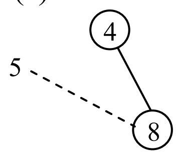
(a)



(b)

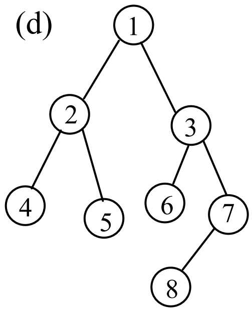


(c)



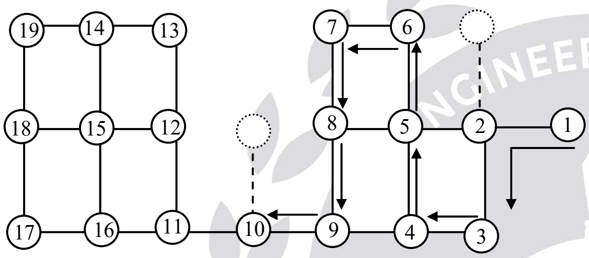
Step back only when already explored vertices are there

(d)



06. Ans: 19

Sol:

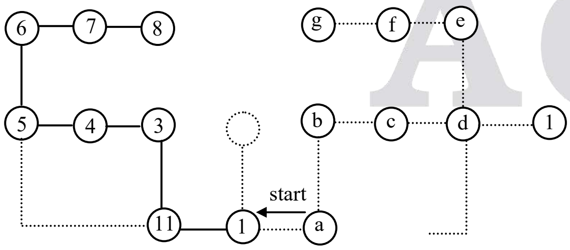


Maximum possible recursion depth = 19

(The dashed link 'nodes' are explored while stepping backward.)

07. Ans: 8

Sol:

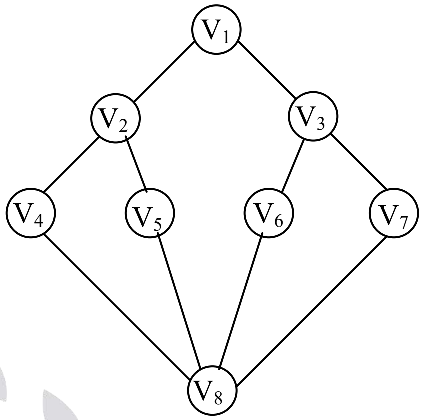


Minimum possible recursion depth = 8

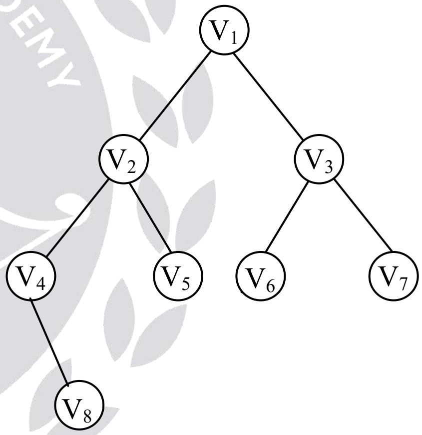
(The dashed link 'nodes' are explored while stepping backward.)

08. Ans: (d)

Sol:



Traversal: BFS



queue

V_2	V_3	

Dequeue

queue

V_3	V_4	V_5	

Dequeue

queue

V_4	V_5	V_6	V_7

Dequeue

queue

V_5	V_6	V_7	V_8

09. Ans: (d)

Sol: Refer gate PYQ book

10. Ans: (d)

Sol: Refer gate PYQ book

11. Ans: (a), (b) & (c)

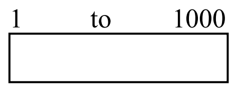
Sol: S1: True. If DFS finds no back edges, then the graph is acyclic. Removing any back edges found doesn't change the traversal order of DFS, so running DFS again on the modified graph would produce no back edges.

S2: True. Each needs to keep track of the vertices that have already been visited.

Chapter 6 Hashing

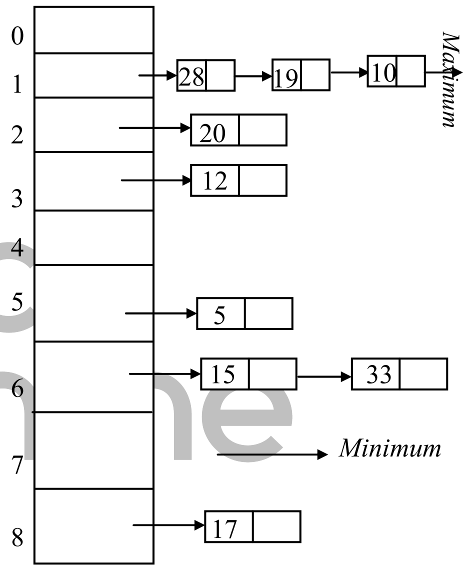
01. Ans: (d)

Sol:



02. Ans: (a)

Sol:



$$\frac{3+1+1+1+2+1}{9} = 1 \text{ (average)}$$

03. Ans: 80

Sol: Slots = 25

Elements = 2000

$$\text{Load factor} = \frac{\text{elements}}{\text{slots}}$$

$$= \frac{2000}{25} = 80$$

04. Ans: (b)

Sol: Hash function

h(x) = (3x + 4) % 7

h(1) = (3+4) % 7 = 0

h(3) = (9 + 4) % 7 = 6

h(8) = (24 +4) % 7 = 0

h(10) = (30 +4) % 7 = 6

Assume Linear probing for collision resolution

The table will be like

1	8	10				3
0	1	2	3	4	5	6

05. Ans: (d)

Sol: After inserting all keys, the hash table is

Key	43	36	92	87	11	4	71	13	14
Loc	10	3	4	10	0	4	5	2	3

0	1	2	3	4	5	6	7	8	9	10
87	11	13	36	92	4	71	14			43

Last element is stored at the position 7

06. Ans: (c)

Sol: Resultant hash table.

In linear probing, we search hash table sequentially starting from the original location. If a location is occupied, we check the next location. We wrap around from the last table location to the first table location if necessary.

07. Ans: (c)

Sol:

	×	×	✓	×
	A	B	C	D
0				
1				
2	42	42	42	42
3	52	23	23	23
4	34	34	34	23
5	23	52	52	34
6	46	33	46	46
7	33	46	33	52
8				
9				

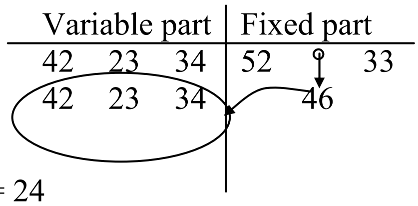
08. Ans: (c)

Sol: **Case (I):** To store 52

Variable part			**Fixed part**		
42	23	34	52	46	33
42	34	23	52	46	33
23	42	34	52	46	33
23	34	42	52	46	33
34	42	23	52	46	33
34	23	42	52	46	33

3! = 6

Case (II): To store 33



! = 24

Since 46 is not getting collided with any other key, it can be moved to the variable part.

Case (I) & Case (II) are mutually exclusive

Case (I) + Case (II) = 24 + 6 = 30

Total 30 different insertion sequences.

09. Ans: (a), (b) & (c)

Sol: **Hash table:** There is no restriction of depletion, any item can be deleted

Priority Queue: It works on the priority and if the priority of 1 is higher then it may be deleted first.

Search tree: There is no restriction on deletion, any item can be deleted from the search tree.

Queue: Queue follows FIFO, in the queue the first item should be deleted first which is 6.