

CSE 202

B.Tech. III<sup>rd</sup> SEMESTER EXAMINATION, 2024-25

B.TECH.

(Data Structure)

(CSE)

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Paper ID

(To be filled in the  
OMR Sheet)

Date (तिथि) : \_\_\_\_\_

2122

अनुक्रमांक (अंकों में) :

Roll No. (In Figures) :

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Roll No. (In Words) :

Time : 1:30 Hrs.

समय : 1:30 घण्टे

Max. Marks : 75

अधिकतम अंक : 75

नोट : पुस्तिका में 50 प्रश्न दिये गये हैं, सभी प्रश्न करने होंगे। प्रत्येक प्रश्न 1.5 अंक का होगा।

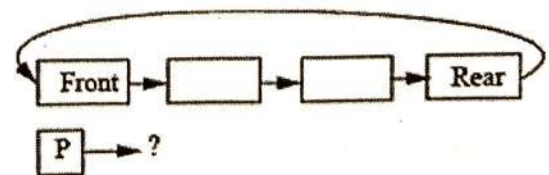
**Important Instructions :**

1. The candidate will write his/her Roll Number only at the places provided for, i.e. on the cover page and on the OMR answer sheet at the end and nowhere else.
2. Immediately on receipt of the question booklet, the candidate should check up the booklet and ensure that it contains all the pages and that no question is missing. If the candidate finds any discrepancy in the question booklet, he/she should report the invigilator within 10 minutes of the issue of this booklet and a fresh question booklet without any discrepancy be obtained.

**महत्वपूर्ण निर्देश :**

1. अभ्यर्थी अपने अनुक्रमांक केवल उन्हीं स्थानों पर लिखेंगे जो इसके लिए दिये गये हैं, अर्थात् प्रश्न पुस्तिका के मुख्य पृष्ठ तथा साथ दिये गये ओ०एम०आर० उत्तर पत्र पर, तथा अन्यत्र कहीं नहीं लिखेंगे।
2. प्रश्न पुस्तिका मिलते ही अभ्यर्थी को जाँच करके सुनिश्चित कर लेना चाहिए कि इस पुस्तिका में पूरे पृष्ठ हैं और कोई प्रश्न छूटा तो नहीं है। यदि कोई विसंगति है तो प्रश्न पुस्तिका मिलने के 10 मिनट के भीतर ही कक्ष परिप्रेक्षक को सूचित करना चाहिए और बिना त्रुटि की दूसरी प्रश्न पुस्तिका प्राप्त कर लेना चाहिए।

1. The following sequence of operations is performed on a stack :  
 PUSH (10), PUSH (20), POP, PUSH (10), PUSH (20), POP, POP, POP, PUSH (20), POP  
 The sequence of values popped out is :
- (A) 20,10,20,10,20  
 (B) 20,20,10,10,20  
 (C) 10,20,20,10,20  
 (D) 20,20,10,20,10
2. Which of the following is essential for converting an infix expression to the post fix form efficiently ?
- (A) An operator stack  
 (B) An operand stack  
 (C) An operand stack and an operator stack  
 (D) A parse tree
3. The best data structure to check whether an arithmetic expression has balanced parentheses is a :
- (A) Queue  
 (B) Stack  
 (C) Tree  
 (D) List
4. A circularly linked list is used to represent a Queue. A single variable p is used to access the Queue. To which node should p point such that both the operations enqueue and dequeue can be performed in a constant time ?
- (A) Real node  
 (B) Front node  
 (C) Not possible with a single pointer  
 (D) Node next to front



5. A single array  $A[1 \dots \text{MAXSIZE}]$  is used to implement two stacks. The two stacks grow from opposite ends of the array. Variable  $\text{top}_1$  and  $\text{top}_2$  ( $\text{top}_1 < \text{top}_2$ ) point to the location of the top most element in each of the stacks. If the space is to be used efficiently, the condition for the "stack is full" is :

- (A)  $(\text{top}_1 = \text{MAXSIZE}/2)$  and  $(\text{top}_2 = \text{MAXSIZE}/2)$
- (B)  $\text{top}_1 + \text{top}_2 = \text{MAXSIZE}$
- (C)  $\text{top}_1 = \text{top}_2 - 1$
- (D) None of these

6. The result evaluating the post fix expression  $10, 5, +, 60, 6, /, *, 8, -$  is :

- (A) 284
- (B) 213
- (C) 142
- (D) 71

7. An  $n \times n$  array  $V$  is defined as follows :

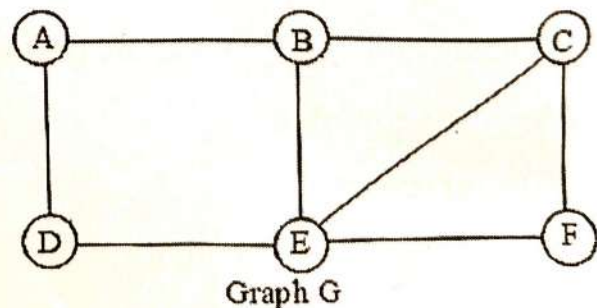
$$V[i,j] = i-j \text{ for all } i, j, 1 \leq i \leq n, 1 \leq j \leq n.$$

The sum of the elements of the array  $V$  is :

- (A) 0
- (B)  $n-1$
- (C)  $n^2-3n+2$
- (D)  $n^2(n+1)/2$

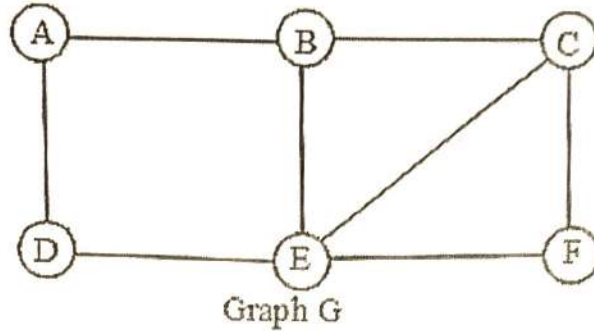
8. Consider the connected graph  $G$  given below. Find the number of all simple path from node  $A$  to node  $F$ .

- (A) 4
- (B) 5
- (C) 6
- (D) 7



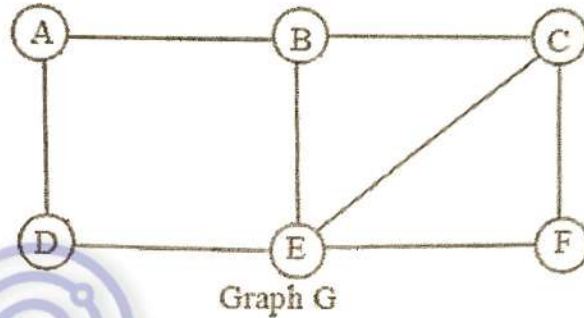
9. Consider the graph G given below. Find its diameter .

- (A) 3
- (B) 4
- (C) 5
- (D) 6



10. Consider the graph G given below. Find the distance between node A and node F.

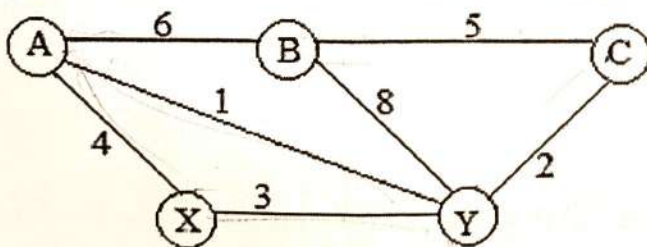
- (A) 4
- (B) 3
- (C) 5
- (D) 6



11. There are 6 discs in the problem of Tower of Hanoi. The total number of moves required to solve this problem will be \_\_\_\_\_.

- (A) 63
- (B) 64
- (C) 65
- (D) 66

12. Consider the undirected weighted graph G.



Cost of minimum spanning tree is :

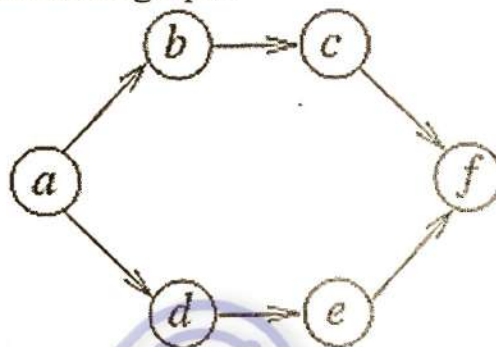
- (A) 8
- (B) 9
- (C) 11
- (D) 10

13. Let us consider the keys 10,20 and 30. Consider all possible combinations of the keys. How many binary search tree can be created from these keys ?
- (A) 3  
(B) 4  
(C) 5  
(D) 6
14. Consider the linear array AAA [5:50]. Suppose base address of AAA is 300 and width of each cell is 4 words per memory cell for AAA. The difference between address of AAA [35] and AAA [15] will be.
- (A) 80  
(B) 79  
(C) 81  
(D) 82
15. Consider the hash table of size 7, with starting index 0 and a hash function  $(3 \text{ key} + 4) \% 7$ , here  $\%$  represents modular division. Assuming the hash table is initially empty, which of the following is the contents of the table when the sequence 1,3,8,10 is inserted into the table using closed hashing ? Note that      denotes an empty location in the table.
- (A) 8, -, -, -, -, -, 10  
(B) 1, 8, 10, -, -, -, 3  
(C) 1, -, -, -, -, -, 3  
(D) 1, 10, 8, -, -, -, 3
16. Given a hash table T with 25 slots that stores 2000 elements, the load factor  $\alpha$  for T is \_\_\_\_\_.
- (A) 40  
(B) 80  
(C) 60  
(D) 75

17. In a complete K-ary, every internal node has exactly K children. The number of leaves in such a tree with n internal node is :

- (A)  $nK$
- (B)  $n(K-1)+1$
- (C)  $(n-1)K+1$
- (D)  $n(K-1)$

18. Consider the following directed graph :



The number of different topological ordering of the vertices of the graph is :

- (A) 6
  - (B) 7
  - (C) 8
  - (D) 9
19. While inserting the elements 71, 65, 84, 69, 67, 83 in an empty binary search tree in the sequence shown, the element in the lowest level is :
- (A) 65
  - (B) 67
  - (C) 69
  - (D) 83
20. A binary tree T has 20 leaves. The number of node in T having two children is -
- (A) 19
  - (B) 18
  - (C) 21
  - (D) None of these

21. An array of 25 distinct elements is to be sorted using quick sort. Assume that the pivot element is chosen at random. The probability that the pivot element get place in the worst possible location in the first round of partitioning is -

- (A) 0.08
- (B) 0.1
- (C) 1
- (D) 0

22. Which of the following is not  $O(n^2)$  ?

- (A)  $(15)*n^2$
- (B)  $n^{1.98}$
- (C)  $\frac{n^3}{\sqrt{n}}$
- (D)  $(20)*n^2$

23. Quick sort is sum on two inputs shown below to sort in ascending order

A : 1, 2, 3 ----- ,n

B : n, n-1, -----, 1

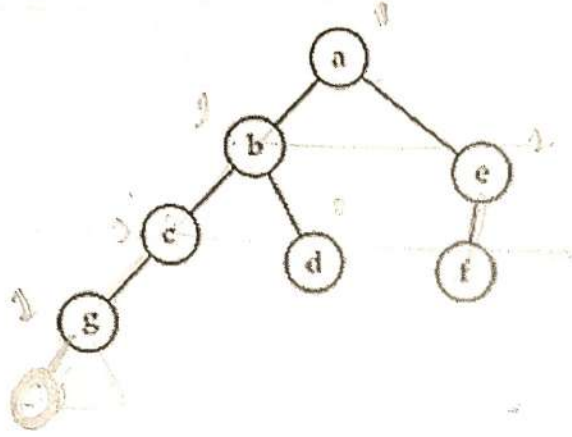
Let  $C_1$  and  $C_2$  be the number of comparisons made for A and B respectively.

Then

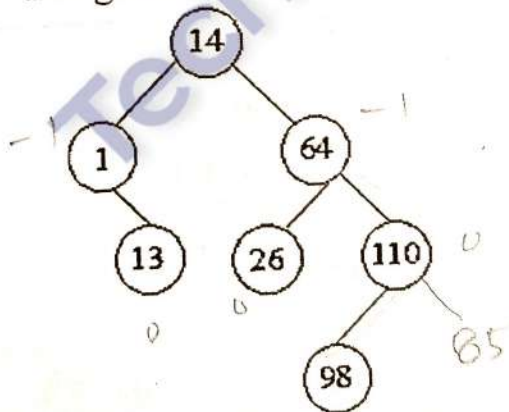
- (A)  $C_1 > C_2$
- (B)  $C_1 = C_2$
- (C)  $C_1 < C_2$
- (D) Can not say

3-1/2

24. In the balanced binary search tree (AVL), given below, how many nodes will be unbalanced when a node is inserted as a child of the node 'g' ?



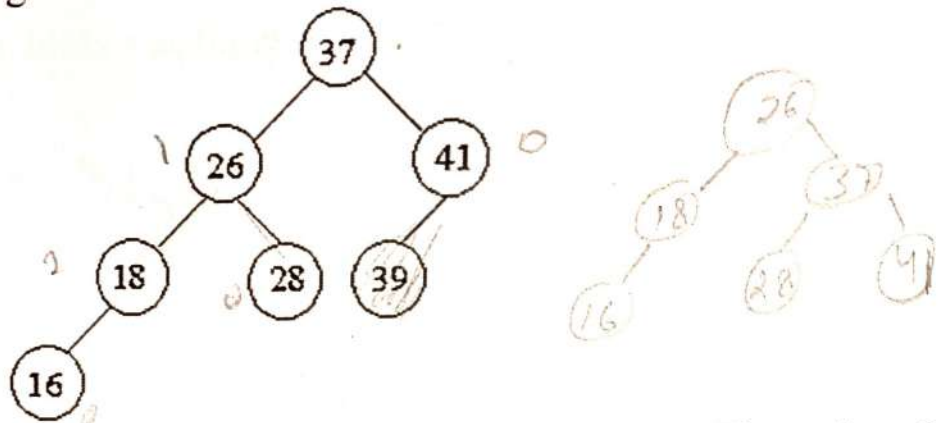
- (A) 1  
 (B) 3  
 (C) 7  
 (D) 8
25. What is the maximum height of any AVL tree with 7 nodes ? Assume that the height of a tree with a single node is 0.
- (A) 2  
 (B) 3  
 (C) 4  
 (D) 5
26. Let us consider an AVL – tree given below :



Now, 85 is inserted. How many nodes are now there with the balance factor of - 2.

- (A) 1  
 (B) 2  
 (C) 3  
 (D) 0

27. Consider the AVL – tree given below :



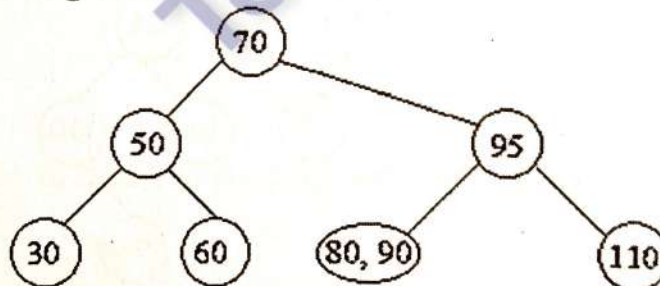
Node 39 is deleted from the AVL tree and tree is balanced again. The order of nodes, appearing at last level (ie leaf nodes) from left to right will be \_\_\_\_\_.

- (A) 16, 18, 26
- (B) 18, 37, 41
- (C) 28, 41, 16
- (D) 16, 28, 41

28. A B-tree of order 3 is constructed by using the following keys. M, Q, A, N, P, W, X, T, G, E, J. How many keys are there in the leaf nodes ?

- (A) 5
- (B) 6
- (C) 7
- (D) 8

29. A B-Tree of order 3 is given below :



Key 60 is deleted. How many keys are now there in the B-Tree at last level (in the leaf nodes) :

- (A) 4
- (B) 5
- (C) 3
- (D) 6

30. Let  $n$  denote a positive integer. Suppose a function  $L$  is defined recursively as

$$\text{follows : } L(n) = \begin{cases} 0 & \text{if } n = 1 \\ L\left(\left\lfloor \frac{n}{2} \right\rfloor + 1\right) & \text{if } n > 1 \end{cases}$$

Now find the value of  $L(25)$  :

- (A) 4
- (B) 5
- (C) 3
- (D) 6

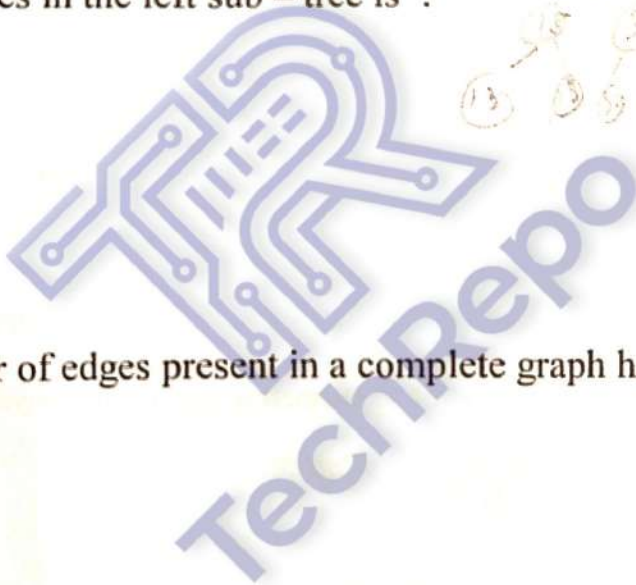
$$\begin{aligned} & \frac{25}{2} + 1 \\ & L\left[\frac{25}{2}\right] + 1 \\ & L[12] + 1 \\ & L[6] + 2 \\ & L[3] + 3 \\ & L[1] + 4 \end{aligned}$$

31. The BST is constructed by inserting the following number in order :

60, 25, 72, 15, 30, 68, 101, 13, 18, 47, 70, 34

The number of nodes in the left sub - tree is :

- (A) 7
- (B) 6
- (C) 3
- (D) 5



32. What is the number of edges present in a complete graph having  $n$  vertices ?

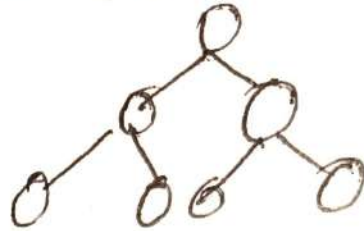
- (A)  $\frac{n*(n+1)}{2}$
- (B)  $\frac{n*(n-1)}{2}$
- (C)  $n$
- (D)  $n^{n-2}$

33. What is the worst case time complexity of inserting a node in a doubly linked list ?

- (A)  $O(n \log n)$
- (B)  $O(\log n)$
- (C)  $O(n)$
- (D)  $O(1)$

34. What is the maximum height of an AVL tree with "p" nodes ?

- (A) p
- (B)  $\log(p)$
- (C)  $\log(p)/\alpha$
- (D)  $(p)/\alpha$



35. Find the time complexity of Floyd – Warshal algorithm ?

- (A)  $O(1)$
- (B)  $O(n)$
- (C)  $O(n^L)$
- (D)  $O(n^3)$

36. Which of the following data structure is used to convert post expression to infix expression ?

- (A) Stack
- (B) Queue
- (C) Linked list
- (D) Heap

37. For the adjacency matrix of a directed graph the row sum is \_\_\_\_\_ degree and the column sum is the \_\_\_\_\_ degree.

- (A) In, out
- (B) Out, in
- (C) In, total
- (D) Total, out

38. A B-tree of order 4 and height 3 will have a maximum of \_\_\_\_\_ keys.

- (A) 255
- (B) 63
- (C) 127
- (D) 188

39. The worst case time complexity of Quick sort is \_\_\_\_\_.

- (A)  $O(n)$
- (B)  $O(n^2)$
- (C)  $O(\log n)$
- (D)  $O(n \log n)$

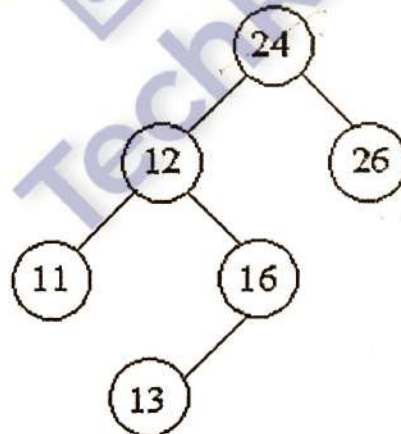
40. The worst case running times of Merge Sort is \_\_\_\_\_.

- (A)  $O(n)$
- (B)  $O(n^2)$
- (C)  $O(\log n)$
- (D)  $O(n \log n)$

41. The worst case running times of Insertion sort is :

- (A)  $O(n)$
- (B)  $O(n^2)$
- (C)  $O(\log n)$
- (D)  $O(n \log n)$

42. Consider the following BST :



If we remove root node, which of the node from the left sub-tree will be the new root?

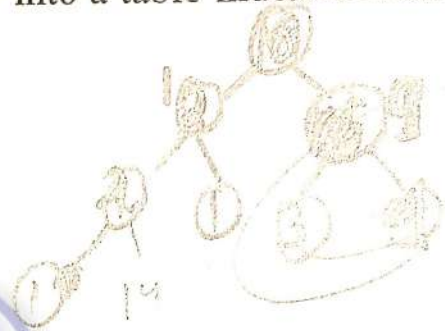
- (A) 11
- (B) 12
- (C) 13
- (D) 16

43. Which of the following is not an inherent application of stack ?

- (A) Implementation of recursion
- (B) Evaluation of a postfix expression
- (C) Job scheduling
- (D) Reverse a string

44. A hash function  $h$  defined  $h(\text{key}) = \text{key} \bmod 7$ , with linear probing, is used to insert the keys 44, 45, 79, 55, 91, 18, 63 into a table indexed from 0 to 6. What will be the location of key 18 ?

- (A) 3
- (B) 4
- (C) 5
- (D) 6



45. Consider the array  $A = \langle 4, 1, 3, 2, 16, 9, 10, 14, 8, 7 \rangle$ . After building heap from the array  $A$  the depth of the heap and the right child of max-heap are \_\_\_\_\_ and \_\_\_\_\_ respectively.

- (A) 3, 14
- (B) 3, 10
- (C) 4, 14
- (D) 4, 10



46. Consider the following postfix expression : (with single digit operands)

$$623*/42*+68*-$$

The top two elements of the stack after second \* is evaluated, are :

- (A) 6, 3
- (B) 8, 1
- (C) 8, 2
- (D) 6, 2

$$623^* / 8 + 48$$

Act as

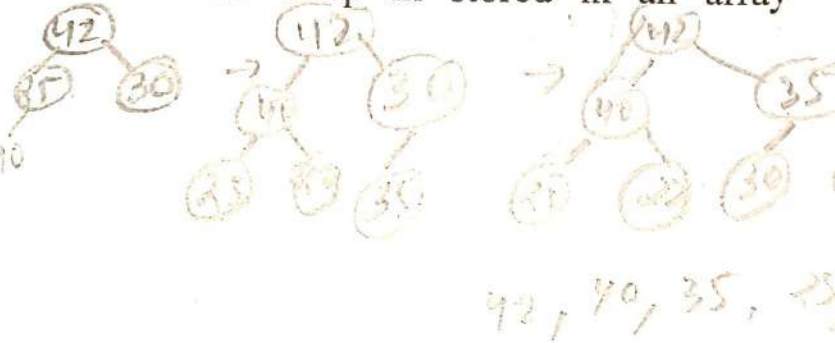
47. The elements 42, 25, 30, 40, 22, 35, 26 are inserted one by one in the given order into a max-heap. The resultant max-heap is stored in an array implementation as :

(A) 42, 35, 40, 22, 25, 26, 30

(B) 42, 35, 40, 22, 25, 30, 26

(C) 42, 40, 35, 25, 22, 26, 30

(D) 42, 40, 35, 25, 22, 30, 26



48. In a binary max heap containing  $n$  numbers, the smallest element can be found in \_\_\_\_\_ time.

(A)  $O(n)$

(B)  $O(\log_2 n)$

(C)  $O(1)$

(D)  $O(\log_2 \log_2 n)$

49. Consider the traversal of a tree :

Preorder  $\rightarrow$  A B C E I F J D G H K L

Inorder  $\rightarrow$  E I C F J B G D K H L A

Which of the following is correct post order traversal ?

(A) E I F J C K G L H D B A

(B) F C G K L H D B U A E

(C) F C G K L H D B A E I J

(D) I E J F C G K L H D B A

50. The conditions to detect queue empty and queue full are (FRONT = 0, REAR = 0):

(A) Empty: REAR == FRONT

Full : (REAR+1) mod n == FRONT

(B) Empty : (FRONT+1) mod n == REAR

Full : (REAR+1) mod n == FRONT

(C) Empty : (REAR+1) mod n == FRONT

Full : REAR == FRONT

(D) None of the above