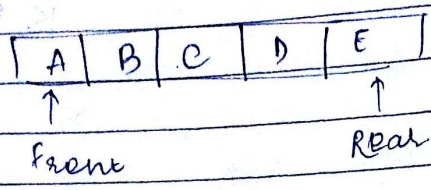
16/08/19

QUEUE

① LINEAR

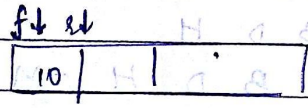


Insertion occurs at Rear end.
Deletion occurs at Front end

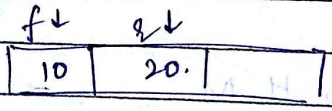
Rear and Front at '-1' ⇒ Empty Queue.
Maxsize → Maximum size of queue.

→ Insertion into linear queue:-

Ist element :-
item = 10;
rear = rear + 1
Queue[rear] = item;
Set front = 0

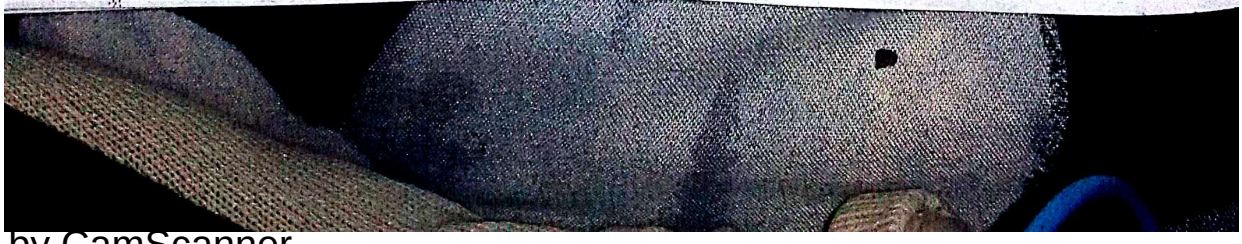


2nd element :-
rear = rear + 1
Queue[1] = 20
Front doesn't change.



Condition for OVERFLOW of queue

```
If (rear >= MAXSIZE - 1)
{
    Print "Overflow";
}
```



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PROGRAM Program for insertion into linear queue:-

Algorithm :-

Qinsert (Maxsize, item)

Step 1: Initialize front = -1
rear = -1

Step 2: [Check for Overflow]
If Rear >= Maxsize - 1
Print ("Overflow")
return

Step 3: else
(Increment Rear)
Rear = Rear + 1

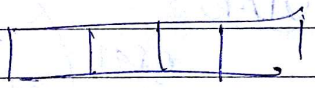
Step 4: [Insert element]
Queue [Rear] = item

Step 5: [check for front]
If front = -1
set (front = 0.)

Step :- Repeat step ③ and ④ until ② false becomes false

Step 6: Exit

DRY RUN MAXSIZE = 4



① f = -1, r = -1

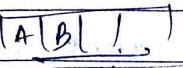
-1 >= 4-1 => -1 >= 3 FALSE

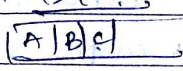
Skip to else ③.

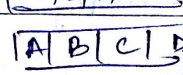
f=0, r=0

Q[0]

Repeat step ⑤ and ④

0 >= 3 

1 >= 3 

2 >= 3 

3 >= 3 → TRUE

Print "Overflow"

Rear - Front + 1 = No. of elements present at any instant

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① PROGRAM:

For deletion of elements from linear queue.

Q- delete (dequeue) the

Step 1: If front = = -1
Print "Underflow"
Return

Step 2: item = Queue [front].

Step 3: (Print the value to be deleted)
Print "item".

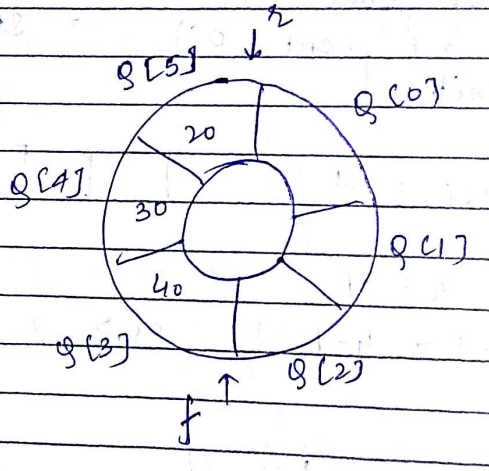
Step 4: (Increament front)
front = front + 1

Step 5: Repeat until
front = = rear.

Step 6: Else set
front = -1 , rear = -1

Step 7: Exit.

② CIRCULAR



Drawback of linear queues -

10, 20, 30, 40, 50, 60

| 10 | 20 | 30 | 40 |

→

| | | 30 | 40 |

Elements cannot be further added to the empty columns.

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PROGRAM :- For insertion of elements in circular queue

Q insert (MAXSIZE, item)

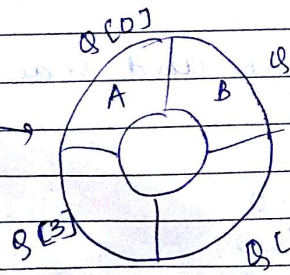
Algorithm :-

① If (front == (Rear+1) % MAXSIZE)
Print "Overflow"
Exit

② else take value
If (front == -1)
Set front = Rear = 0.
else
set Rear = ((Rear+1) % MAXSIZE).

③ [Assign value]
Queue[Rear] = item

④ Exit



No. of elements = front + Rear + 1

PROGRAM :- Q Delete (MAXSIZE, item)

Algorithm :-

① If (front == -1)
print "Underflow"
return.

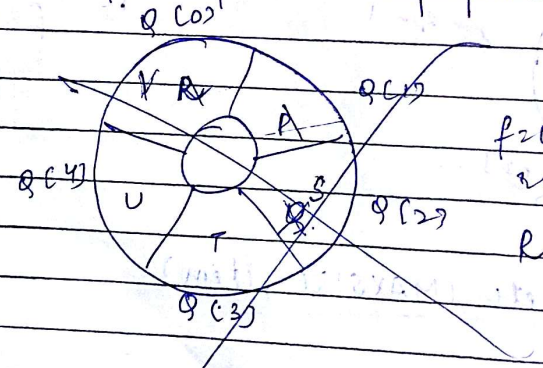
② else item = queue[front]
if (front == Rear)
set front = -1
rear = -1
else
front = (front + 1) % MAXSIZE

NUMERICAL

Consider the foll circular queue of characters which is allocated 5 memory slots. Describe the foll operations :-

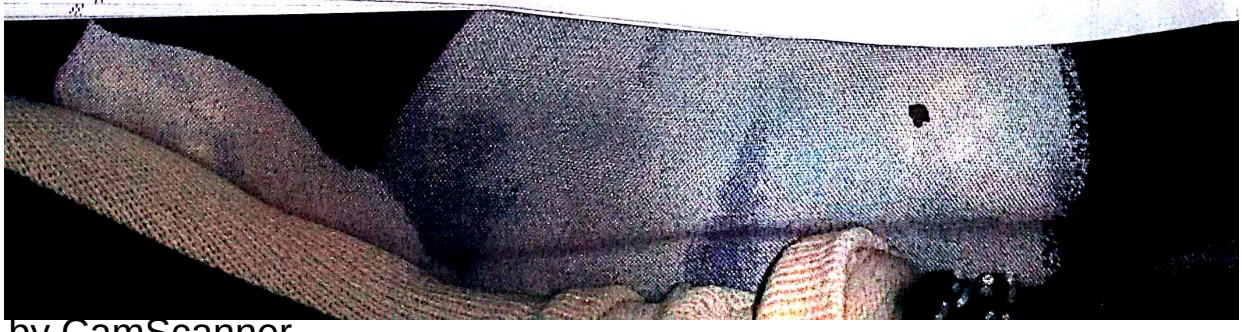
a) R is added to queue
b) P and Q are added to the queue
c) Q is deleted
d) S, T, U and R are added to the queue
e) 2 letters deleted
f) 'V' is added to the queue.

Find the final positions of front and rear.



r = 0
f = 2

Initial, r = -1
f = -1



② else item = queue[front]
if [front == Rear
set front = -1
rear = -1

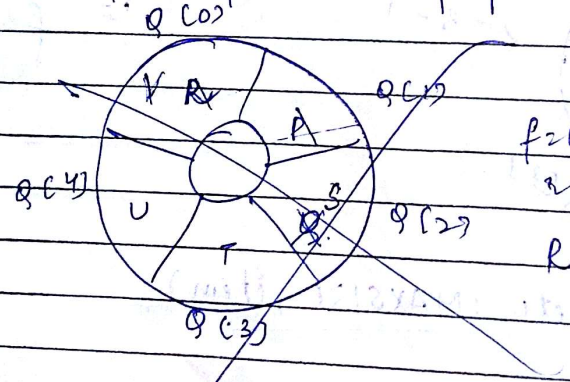
else
front = (front+1) % MAXSIZE

NUMERICAL

Consider the foll circular queue of characters which is allocated 5 memory sites. Describe the foll operations :-

a) R is added to queue
b) P and Q are added to the queue
c) 2 letters deleted
d) S, T, U and R are added to the queue
e) 2 letters deleted
f) 'V' is added to the queue.

Find the final positions of front and rear.



r = 0
f = 2.

Initial, r = -1
f = -1

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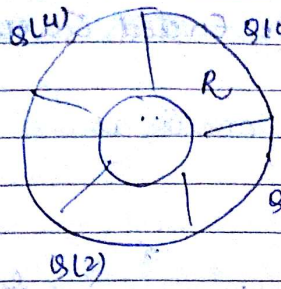
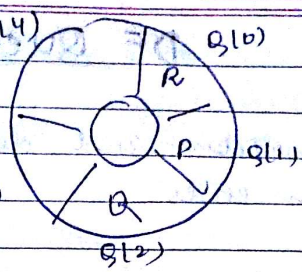
Step a)



f = 0
r = 0

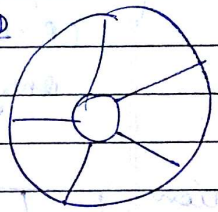
Step b)



Rear = (Rear + 1) % MAXSIZE
0 = (0 + 1) % 5
= 1
1 = (1 + 1) % 5
= 2 % 5
Rear = 2. f = 0.

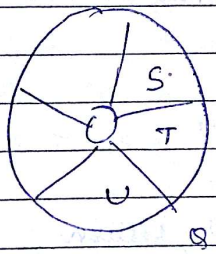
Step c) Deletion takes from FRONT END

front = (f + 1) % MAXSIZE
= 1 % 5.
= 1

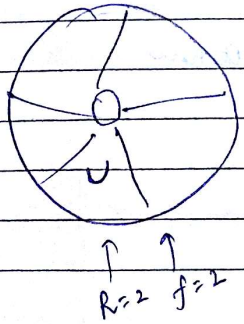


R is deleted f = 1
P is deleted f = 2
Q is deleted f = -1, r = -1 (empty queue)

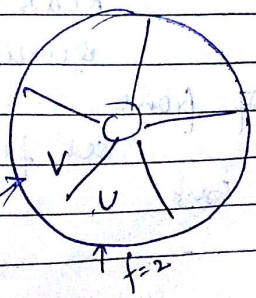
Step d)



Step e) 2 times deleted

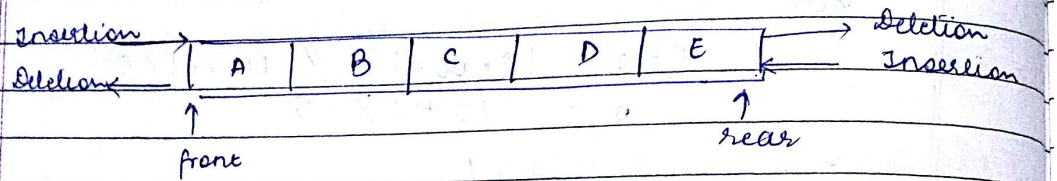


f) V is added



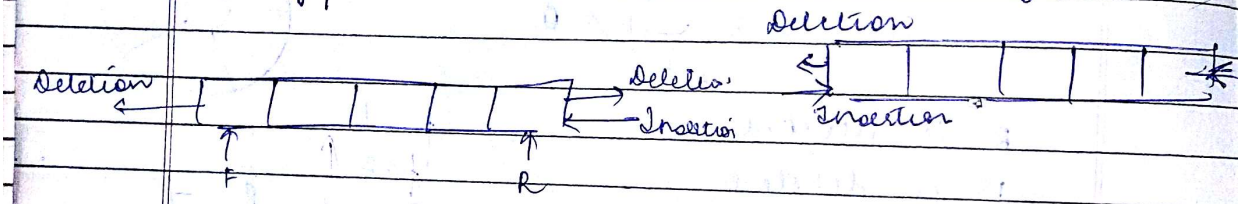
(3) DE Queue (Double Ended Queue)

→ Insertion and deletion can occur at both ends



(a) Input - restricted (R-end will be used only for insertion)

(b) Output - restricted (F-end will be used only for deletion)



PROGRAM → Insertion of element from DE-Queue at Rear End

Algorithm

1. Set front = -1 and Rear = -1
2. If Rear = Maxsize - 1
   Print ("Overflow"); return;
3. Else
   Rear = Rear + 1
   Queue [Rear] = item
4. If front = = -1
   Set front = 0
5. Exit

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Deletion of element from Deletion (Output queue restricted)

Algorithm

1. If front == -1
   Print ("Underflow")
2. Else item = Queue [front]
   print ("item)
3. front = front + 1

Insertion from front end

A	B	C	

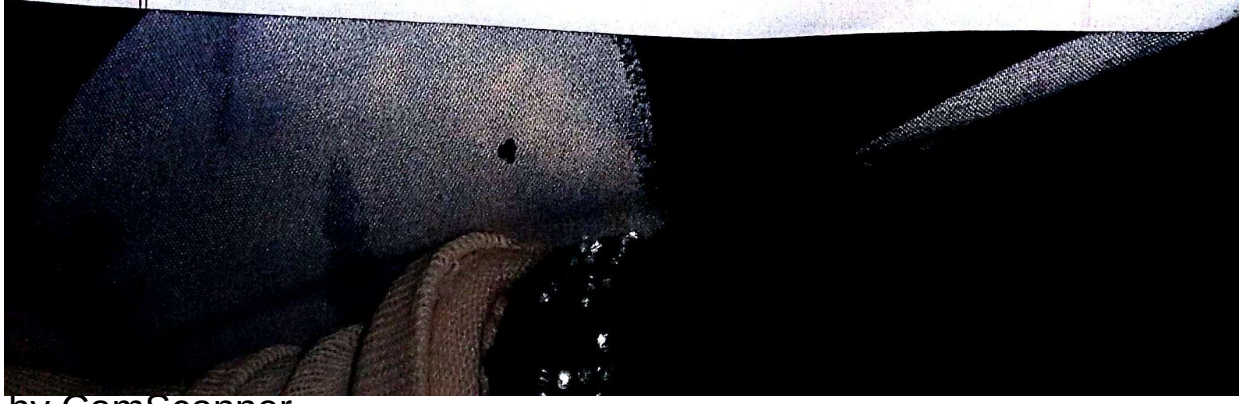
f = 0, r = 2

→ Insertion

If D is to inserted,

D	A	B	C

1. (check for space at the front end)
   If ((~~f == 0 && r == 0~~)
   ~~If (Rear == 0) &&~~ (
2. If (Front == 0) && (Rear == MAXSIZE - 1)
   || (front = Rear + 1))
3. : Print "overflow"
4. else (insert item at front)
   front = front - 1
   Q[Queue [front] = "item



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Program: Deletion from Rear End

① If [Check for ("Underflow")]
if rear = = -1
Print "Queue is Empty"

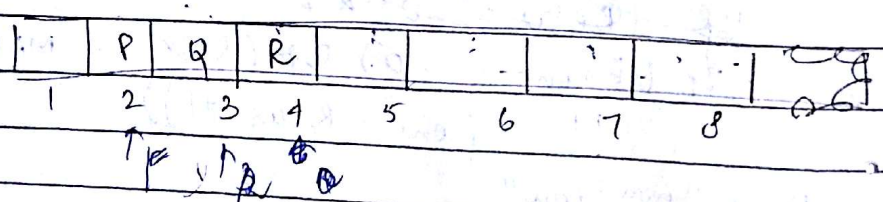
② Else
item = Q[Rear]
Rear = Rear - 1

③ Exit

For printing element;

i = front to i = rear - 1
i++;
Total no of elements;

Qu) Perform the foll. operation on a circular de-queue.



(i) deletion of last element
(ii) insertion of element 'O' at front end
(iii) insertion of elements R, S, T at the rear end
(iv) insertion of element U and V at front end
(v) insertion of element 'W' at rear end
(vi) Insertion of element 'X' at the left end.

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1. Deletion of last element
2. O → f
3. R, S, T → R
4. U, V → f
5. I → R
6.
7. N → f

1. Rear = (Rear - 1) TRUE
= 3 - 1 = 2 / 8 TRUE
= 0.

| P | Q | R | S | |

F R

| . | O P | Q | R | S | T | U | V |

Further insertion not required.

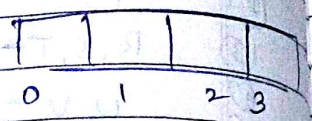
There is an input restricted PQ, Deque & elements are:
PQ 1. ~~Student~~
2. 6, 4, 5
3. 4, 3
4. Delete from front
5. Delete from rear.

(~~Output~~ restricted) I/P

6	4	5	.
0	1	2	3

Scanned by CamScanner

There is an empty output restricted queue.
Insert 10, 20, 30.
Insert 40 at front.



19/08/16

PRIORITY QUEUE

Operation	Linear Queue	circular Queue
Overflow	Rear >= Maxsize - 1	front == (Rear+1) % Maxsize OR (front == 0 && Rear == Maxsize-1) || front == Rear+1
Underflow	front == -1	front == -1
Insertion	rear == rear+1 {	rear = (rear+1) % Maxsize OR if (front == maxsize - 1) rear = 0 else rear = rear+1
Deletion	front = front+1	front = (front+1) % maxsize

Priority Queue insertion in circular queue-

1. [Check if queue is full.]
   If front == (Rear+1) % Maxsize
   Print("Overflow")
   Exit
2. else (front == -1)
   set
   front = rear = 0

else
rear = (rear + 1) % Maxsize

Circular Priority queue (Insert)

→ ① [check if queue is full]
If ((front == 0 && Rear == max size - 1) || (front == Rear + 1))
print ("Queue is full")

② [check whether Rear points to the last position of Queue]
If (Rear == max size - 1) then
Rear = 0
else if (Rear == -1)
Rear = front = 0
else
Rear = Rear + 1

rear = (rear + 1) % Maxsize

③ [Insert new element]
P. queue [Rear] = Item

④ [sort the element of queue in Ascending or descending order]
sort (f sort, Rear, PQ)

⑤ Exit

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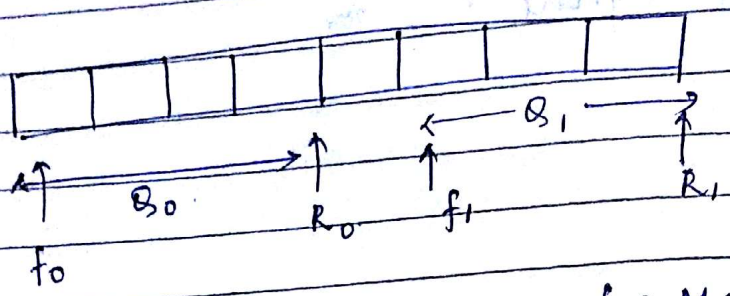
MULTIPLE QUEUE



$f_0 = -1$
$R_0 = -1$

$f_1 = \text{Maxsize}$
$R_1 = \text{Maxsize}$

Insertion into a Multiple Queue :-

(1) [check for overflow]
If (count == MAXSIZE)
print ("Overflow")
return

(2) else
[check in which queue item is to be inserted]
If (queue no. == 0)
then if ($q.rear_0$ == -1)
$q.rear_0 = q.front_0 = 0$

(3) else
$q.rear_0 = q.rear_0 + 1$
$q.num[rear_0] = item$

(4) else
$q.rear_1 = q.rear_1 - 1$
$q.num[rear_1] = item$

(5) Exit

Algorithm for multiple queue deletion :-

① [check for underflow]

If (count = = 0)
print ("Underflow")
return

If (front$_0$ = = -1 && front$_1$ = = maxsize)

② else

[check from which side item is to be deleted]

If (queue no. = = 0)
then (check if front$_0$ = = -1)
item = q [front$_0$].
front$_0$ ++

front 1 = front 1 - 1

If front = = rear
last element is deleted
If front$_1$ = rear$_1$ = Maxsize
queue 2 is empty.

③ else

[check from which side item is to be deleted]

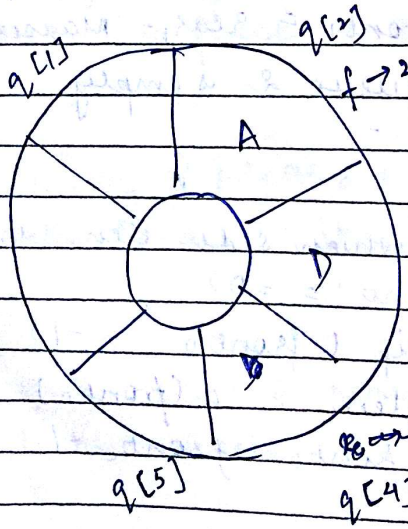
If (queue no. = = 0)
check if (front$_0$ = = -1)
item = q [front$_0$]
front$_0$ = front$_0$ + 1

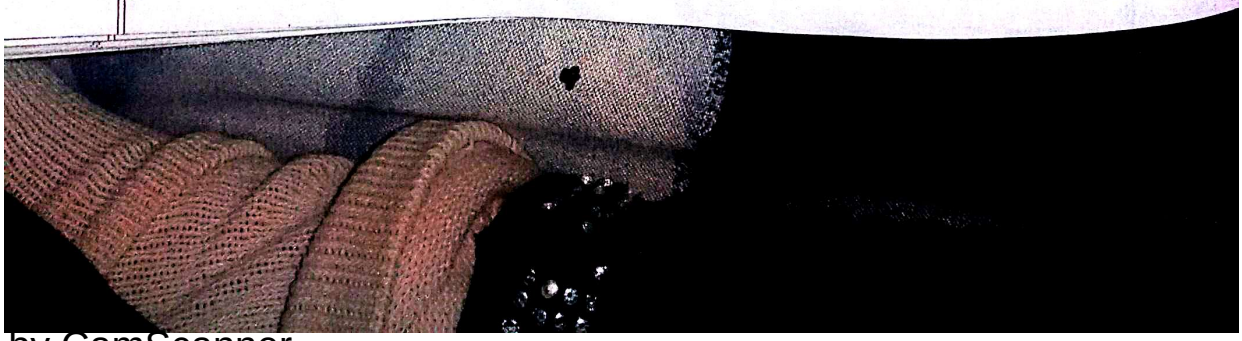
Applications of Queue :-

1. Client - server routines
   (order of requesting = order of processing)
   Eg :- Printing of documents.
2. Multi-processing, batch processing,
3. CPU scheduling
4. Round-Robin scheduling
5. Daily routine :- Movie ticket, reservation, railway/metro reservation

A circular queue of _, A, D, —, —,
front = 2, rear = 3
Operations to be performed :-

a) Add S
b) Add J
c) Delete two letters
d) Shift towards left to bring all free spaces to right
e) Insert M, H, I and delete one letter.





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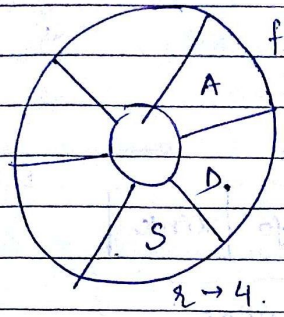
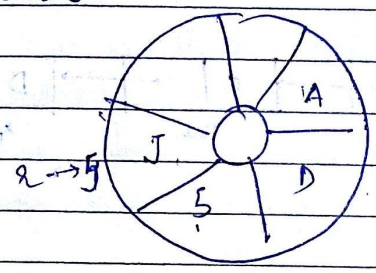
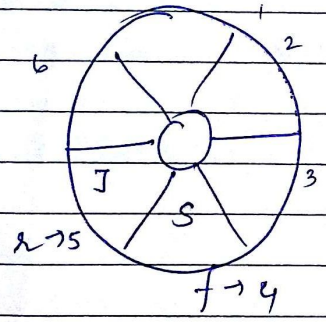
a) Add S



(b) Add J



(c) Delete 2 letters



_ _ _ S J _

(d) S J _ _ _ _