Data Structures and its Applications

UE24CS252A

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DATA STRUCTURES AND ITS APPLICATIONS

Queues – Linked List Implementation

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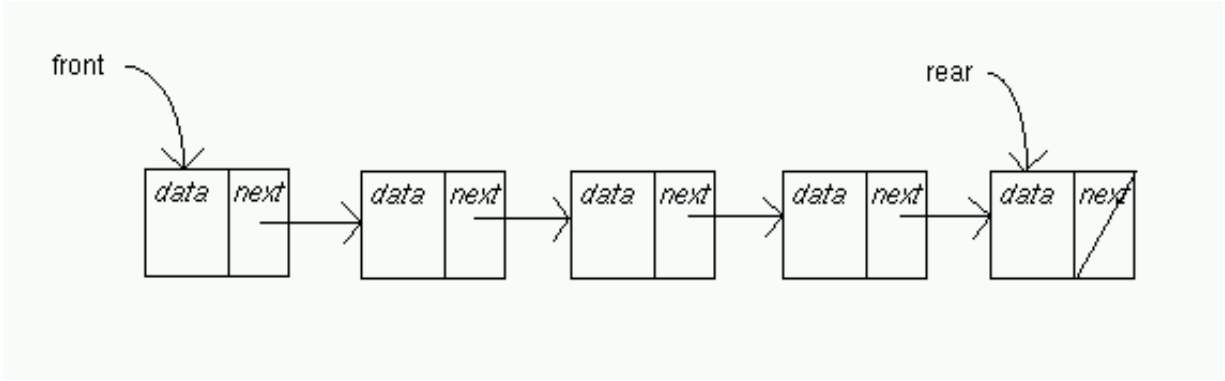
Queues - Linked list Implementation

In a linked list implementation two pointers are maintained : front and rear .

- front points to the first item of the queue
- rear points to the last item of the queue



Queues - Linked list Implementation

Operations :

- Insert() : adds a new node after the rear and moves rear to the next node
- Remove() : removes the first node and moves front to the next node
- Empty() : Checks if the queue is empty

Queues - Linked list Implementation

Structure of queue

```
struct node
{
  int data;
  struct node *next;
};
struct queue
{
   struct node * front; struct node *rear;
};

Struct queue q;
q.front=q.rear = NULL;
```

Queues - Linked list Implementation – Operations

Insert operation

```
Insert(q,x)

p=getnode();
initialise the node
if(q.rear=NULL)
   q.front=p;
else
  next(q.rear) =p;
q.rear = p;
```

Remove operation

```
remove(q)
If(empty(q)
   print empty queue
else
 p=q.front; x=info(p);
 q.front = next(p);
 if(q.front =NULL)
 q.rear=NULL
 freenode(p);
 return x;
```

Data Structures and its Applications

Queues - Linked list Implementation – Operations

Insert operation of queue implemented by a linked list

```
void qinsert(struct node * q, int x)
  {
   struct node *temp;

   temp=(struct node*)malloc(sizeof(struct node));
   temp->data=x;
   temp->next=NULL;

    //if this is the first node
   if(q->front==NULL)
     q->front=q->rear=temp;
      else //insert at the end
      {
         q->rear->next=temp; q->rear=temp;
       }
  }
```

Queues - Linked list Implementation – Operations

remove operation of a queue implemented by a linked list

```
int qremove(struct queue * q)
  {
      struct node *p; int x;
      p=q->front;
      if(p==NULL)
       {
        printf("Empty queue\n");
        return -1;
       }
else
       {
        x=q->data;
        if(q->front==q->rear) //only one node
          q->front=q-
        >rear=NULL; else
        {
        q->front=q->next; // move front to next
        node
        return x;
        }
       free(q);
       }
}
```

Queues - Linked list Implementation – Operations


```
void qdisplay(struct queue q)
    {
      struct node * f, *r;
     if(q.front==NULL) printf("Queue
     Empty\n"); else
      {
       f=q.front; r=q.rear;
       while(f!=r)
       {
         printf("%d-> ",f->data);
         f=f->next;
       }
     printf("%d-> ",f->data); // print the last node
     }
   }
```

Queues - Linked list Implementation – Operations

Insert operation in an alternate way

```
void qinsert(int x, struct node **f, struct node **r)
//f and r are pointers to variables front and rear of a queue
   {
    struct node *temp;

    temp=(struct node*)malloc(sizeof(struct node));
    temp->data=x; temp->next=NULL;

     //if this is the first node
    if(*f==NULL)
      *f=*r=temp;
    else //insert at the end
      {
       (*r)->next=temp;
        *r=temp;
      }
   }
```

Queues - Linked list Implementation – Operations

Remove operation in an alternate way

```
int qdelete(struct node **f, struct node **r)
  {
      struct node *q;
      int x;
      q=*f;
      if(q==NULL)
       {
        printf("Empty queue\n");
        return -1;
       }
else
      {
       x=q->data;
       if(*f==*r) //only one node
         *f=*r=NULL;
       else
       {
       *f=q->next;
       return x;
       }
      free(q);
     }
}
```

Disadvantages of representing queue by a linked list

- A node in linked list occupies more storage than the corresponding element in an array.
- Two pieces of information per element is necessary in a list node, where as only one piece of information is needed in an array implementation

Multiple Choice Questions (MCQ's)

Question 1: In a linked list implementation of a queue, how many pointers are typically maintained to manage the queue?

a) One pointer.

b) Two pointers.

c) Three pointers.

d) No pointers are needed.

Multiple Choice Questions (MCQ's)

Question 1: In a linked list implementation of a queue, how many pointers are typically maintained to manage the queue?

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Multiple Choice Questions (MCQ's)

Question 2: Which operation in a linked list queue adds a new node after the rear and then moves the rear pointer to this new node?

a) Remove().

b) Empty().

c) Insert().

d) Search()

Multiple Choice Questions (MCQ's)

Question 2: Which operation in a linked list queue adds a new node after the rear and then moves the rear pointer to this new node?

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c) Insert().

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Multiple Choice Questions (MCQ's)

Question 3: What is the initial state of the front and rear pointers when a queue is implemented using a linked list, as defined in the struct queue?

a) front = 0, rear = 0.

b) front = NULL, rear = NULL.

c) front = -1, rear = -1.

d) front points to the first node, rear points to the last node.

Multiple Choice Questions (MCQ's)

Question 3: What is the initial state of the front and rear pointers when a queue is implemented using a linked list, as defined in the struct queue?

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d) front points to the first node, rear points to the last node.

Question 4: When performing a qremove operation on a linked list queue, if the queue has only one node, what happens to both q->front and q->rear after the removal?

a) Only q->front becomes NULL.

b) Only q->rear becomes NULL.

c) Both q->front and q->rear become NULL.

d) They remain pointing to the removed node.

Multiple Choice Questions (MCQ's)

Question 4: When performing a qremove operation on a linked list queue, if the queue has only one node, what happens to both q->front and q->rear after the removal?

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c) Both q->front and q->rear become NULL.

d) They remain pointing to the removed node.

Question 5: What is considered a disadvantage of representing a queue using a linked list compared to an array implementation?

a) Linked lists have a fixed size, leading to overflow.

b) Linked list nodes occupy more storage than corresponding array elements.

c) It is harder to implement Insert() and Remove() operations.

d) Linked lists do not support dynamic memory allocation.

Multiple Choice Questions (MCQ's)

Question 5: What is considered a disadvantage of representing a queue using a linked list compared to an array implementation?

a) Linked lists have a fixed size, leading to overflow.

b) Linked list nodes occupy more storage than corresponding array elements.

c) It is harder to implement Insert() and Remove() operations.

d) Linked lists do not support dynamic memory allocation.

THANK YOU

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