Data Structures and its Applications

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DATA STRUCTURES AND ITS APPLICATIONS

Queues – Implementation of Josephus Problem

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Queues – Implementation of Josephus Problem

- Josephus Problem : Postulates a group of soldiers surrounded by an overwhelming enemy force. There is no hope of victory without reinforcements. There is one horse available for escape
- The soldiers agree to a pact to determine which of them is to escape and seek help. The soldiers form a circle and a number n is picked from a hat. One of the names is also picked from the hat.
- Beginning with the soldier whose name is picked , they begin to count clockwise around the circle. when the count reaches n, that soldier is removed from the circle and the count begins with the next soldier.
- The process continues so that each time the count reaches n, another soldier is removed from the circle. Any soldier removed from the circle is no longer counted. The last soldier remaining is to take the horse and escape.

Queues – Implementation of Josephus Problem

- The input to the program is the number n and list of names, which is the clockwise ordering of the circle, beginning with the soldier from whom the count is to start.

- The program should print the names in the order that they are eliminated and the name of soldier who escapes.

- For example if n=3 and that there are five solders named A,B,C,D and E. We count three soldiers starting at A, so that C is eliminated first.

- We then begin at D and count D E and back to A. A is eliminated. Then we count B D and E, E is eliminated. And finally B D and B is eliminated.

- D is the one who escapes

Queues – Implementation of Josephus Problem

- Data structure used is a circular list where each node represents one soldier

- To represent the removal of a soldier form the circle, a node is deleted from the circular list.
- Finally one node remains on the list and the result is determined

Queues – Implementation of Josephus Problem

Pseudo code of implementation using circular list

```
read(n)
read(name)
while(all the names are read)
{
          insert name on the circular list
          read(name)
}
while(there is more than one node on the list)
{
          count through n-1 nodes on the list print name in the nth node
          delete the nth node
}
print the name of the only node on the list
```

Queues – Implementation of Josephus Problem

Code of implementation using circular list

```
int survivor(struct node **head, int n)
{
 // head is pointer to first node

    struct node *p, *q; int i;
    q = p = *head;
    while (p->next != p)
      {
            for (i = 0; i < n - 1; i++)
              {
                q = p;
                p = p->next;
              }
            q->next = p->next;
             printf("%d has been killed.\n", p->num);
             free(p);
             p = q->next;
          }
       *head = p;
        return (p->num);
    }
```

Queues – Implementation of Josephus Problem

Pseudo code of implementation using circular queue

```
Enter n
while(all the names are read)
{
  insert name into the queue
  read(name)
}
while( q has one element)
{
   dequeue n-1 names from the queue and enqueue it. dequeue the nth name
   print the nth name
 }
 dequeue the only name of the queue print the name
```

Data Structures and its Applications

Queues – Implementation of Josephus Problem

Assignment :

Implement the Josephus by using circular queue Implement

Josephus Problem by using linked list

Question 1: In the Josephus Problem, how are the soldiers initially arranged?

a) In a straight line.

b) In a square formation.

c) In a circle.

d) Randomly scattered.

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Question 2: According to the Josephus Problem, when the count reaches a specific number 'n', what happens to the soldier at that count?

a) That soldier is moved to the front of the line.

b) That soldier is given the horse and escapes.

c) That soldier is removed from the circle, and the count begins with the next soldier.

d) The count restarts from 1 for the same soldier.

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Question 3: What data structure is explicitly mentioned as being used to implement the Josephus Problem in the presentation?

a) A linear array.

b) A stack.

c) A circular list.

d) A binary tree.

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Question 4: In the pseudo-code for implementing the Josephus Problem using a circular list, when does the process of eliminating soldiers stop?

a) When the count 'n' reaches zero.

b) When all names have been read.

c) When there is more than one node on the list.

d) When there is only one node remaining on the list.

Question 4: In the pseudo-code for implementing the Josephus Problem using a circular list, when does the process of eliminating soldiers stop?

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c) When there is more than one node on the list.

d) When there is only one node remaining on the list.

Multiple Choice Questions (MCQ's)

Question 5: Consider the example given: n=3, soldiers A, B, C, D, E starting at A. What is the order of elimination as described in the presentation?

a) A, B, C, D, then E escapes.

b) C, A, E, B, then D escapes.

c) E, D, C, B, then A escapes.

d) C, B, A, E, then D escapes.

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Multiple Choice Questions (MCQ’s)

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b) C, A, E, B, then D escapes.

c) E, D, C, B, then A escapes.

d) C, B, A, E, then D escapes.

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THANK YOU

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