Lecture No.04
Doubly Linked Lists and Circular Linked Lists

CC-213 Data Structures
Department of Computer Science
University of the Punjab

Slides modified very slightly from the late Dr. Sohail Aslam's lectures at VU

Doubly-linked List

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- To move back one node, we have to start at the head of the singly-linked list and move forward until the node before the current.
- To avoid this we can use *two* pointers in a node: one to point to next node and another to point to the previous node:

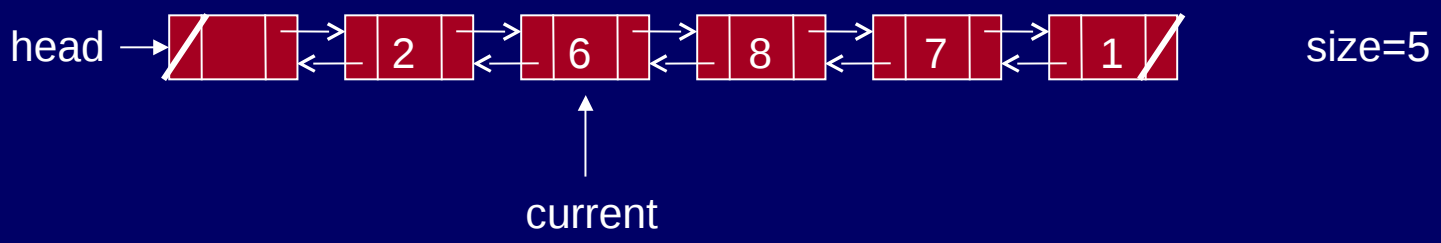
Doubly-Linked List Node

```
class Node {
public:
    int get() { return object; };
    void set(int object) { this->object = object; };

    Node* getNext() { return nextNode; };
    void setNext(Node* nextNode)
          { this->nextNode = nextNode; };
    Node* getPrev() { return prevNode; };
    void setPrev(Node* prevNode)
          { this->prevNode = prevNode; };
private:
    int object;
    Node* nextNode;
    Node* prevNode;
};
```

Doubly-linked List

- Need to be more careful when adding or removing a node.
- Consider add: the order in which pointers are reorganized is important:



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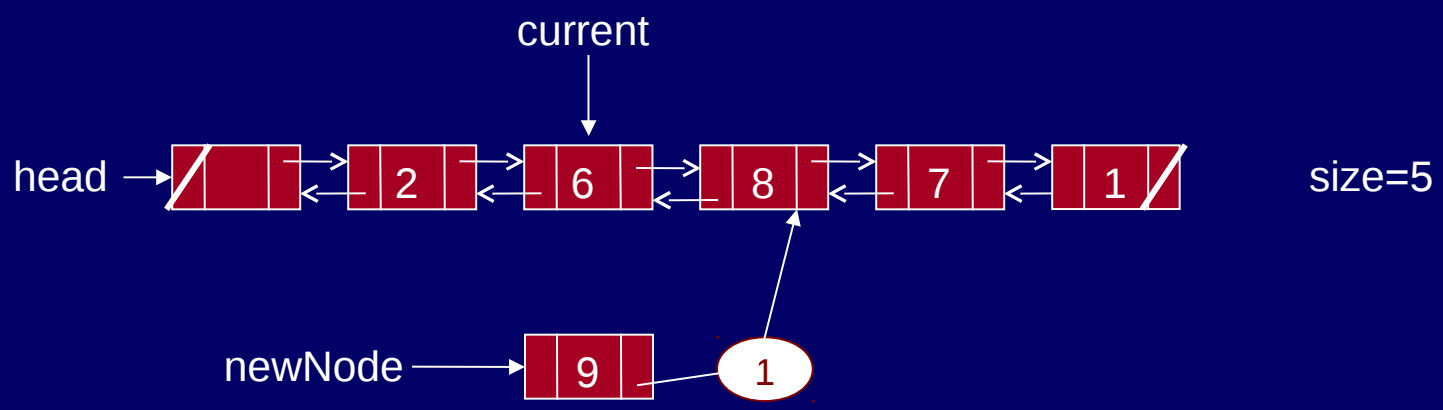

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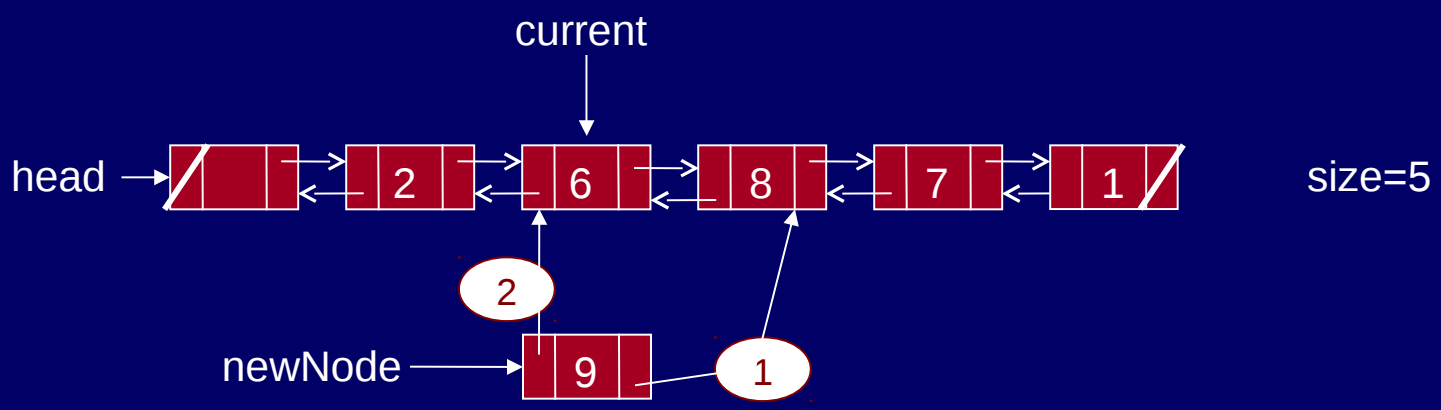

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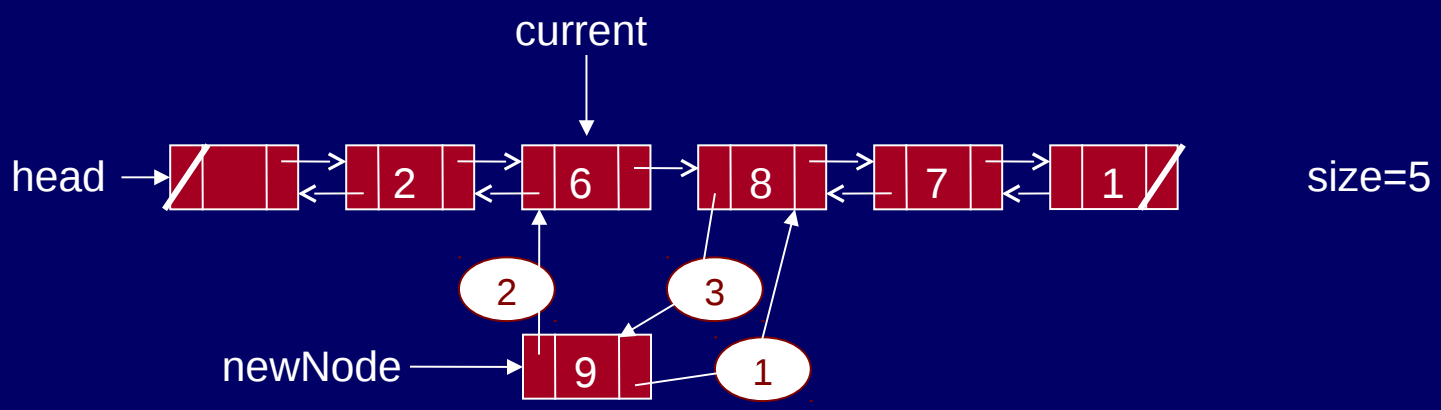

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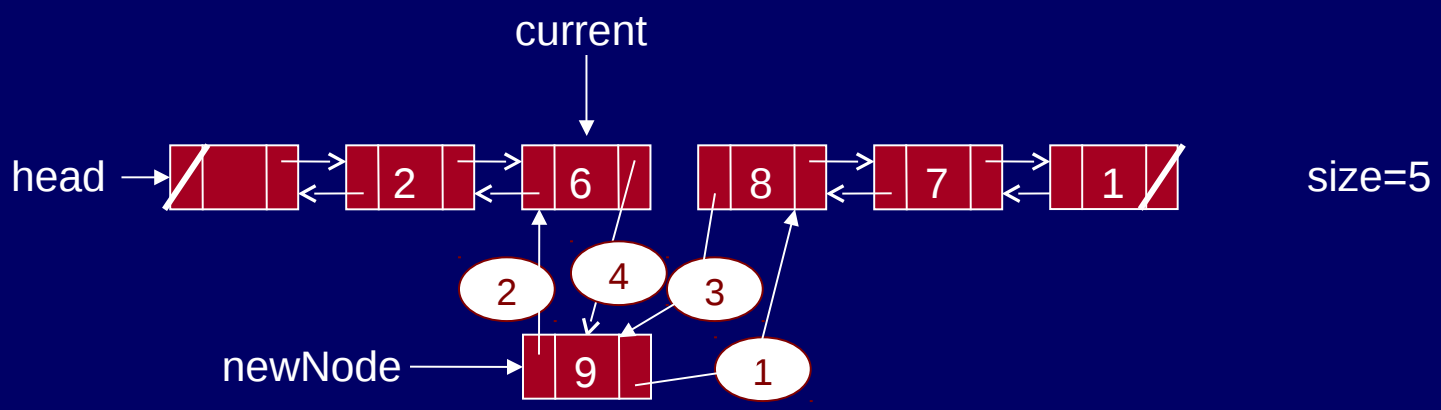

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3.  (current->getNext())->setPrev(newNode);
4.  current->setNext( newNode );
5.  current = newNode;
6.  size++;
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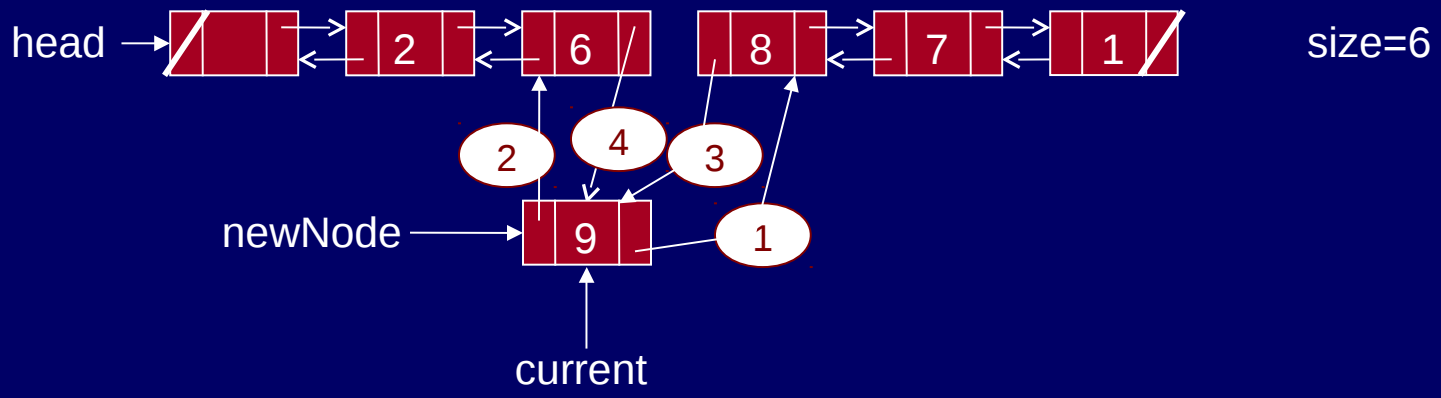

Circularly-linked lists

- The next field in the last node in a singly-linked list is set to NULL.
- Moving along a singly-linked list has to be done in a watchful manner.
- Doubly-linked lists have two NULL pointers: prev in the first node and next in the last node.
- A way around this potential hazard is to link the last node with the first node in the list to create a *circularly-linked list*.

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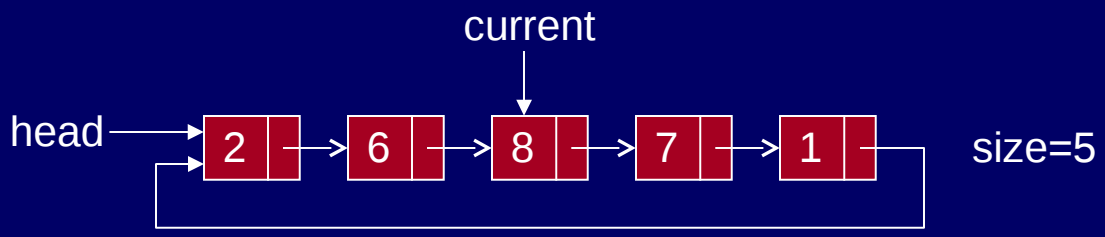
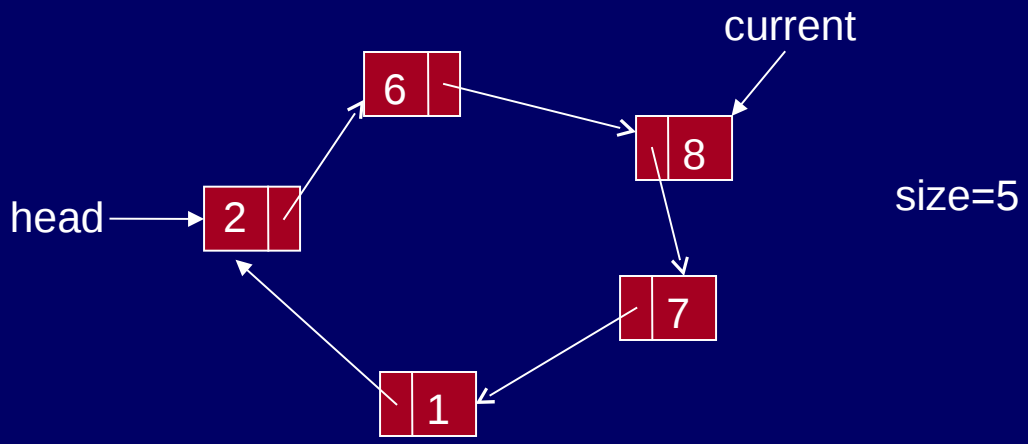
Cicularly Linked List

- Two views of a circularly linked list:





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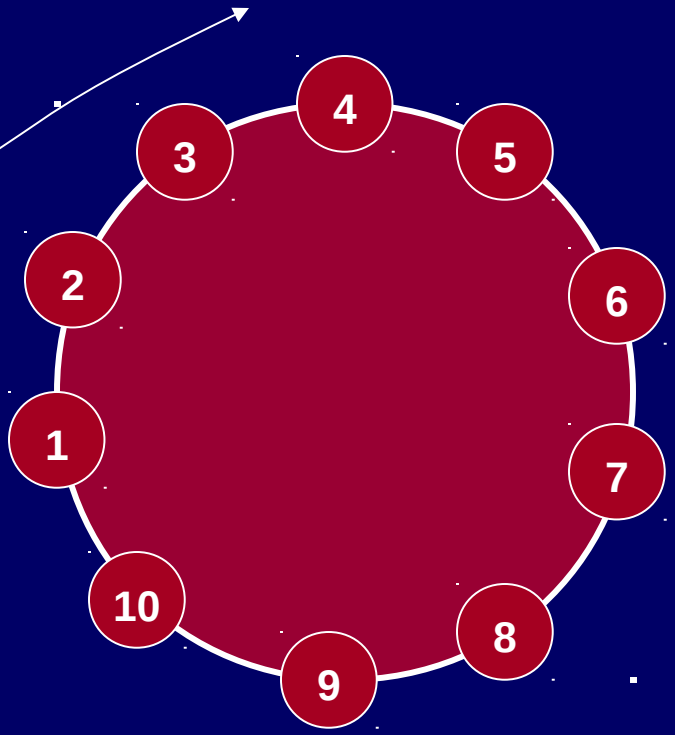

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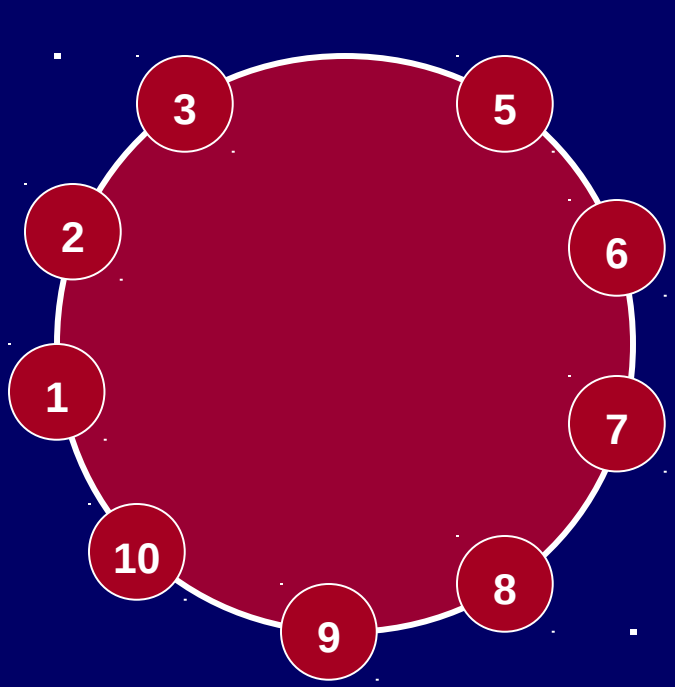

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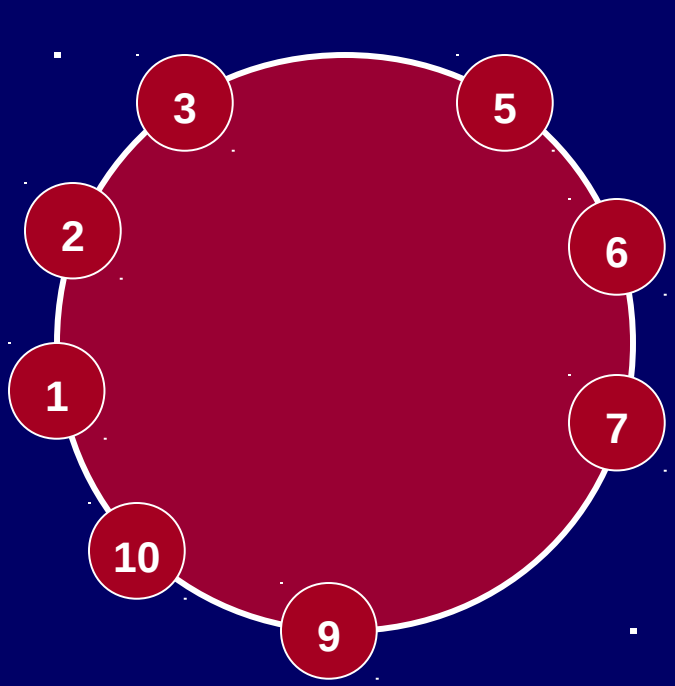

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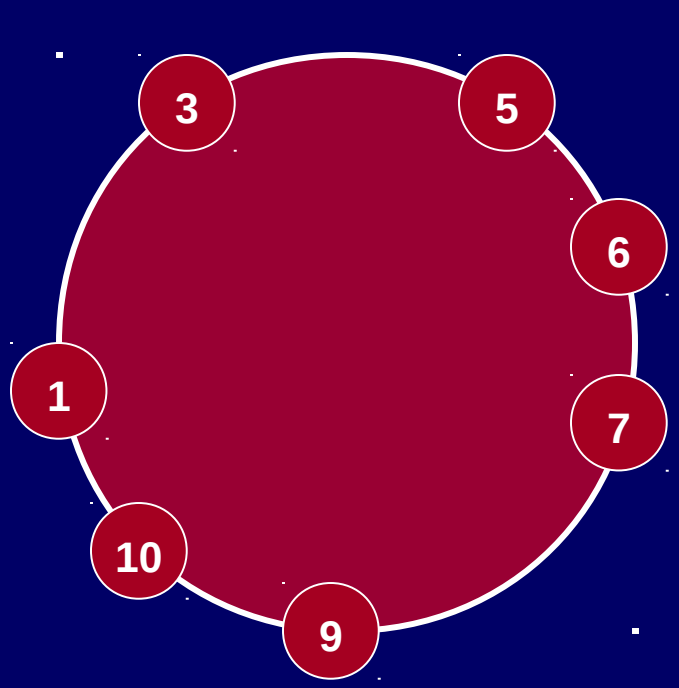

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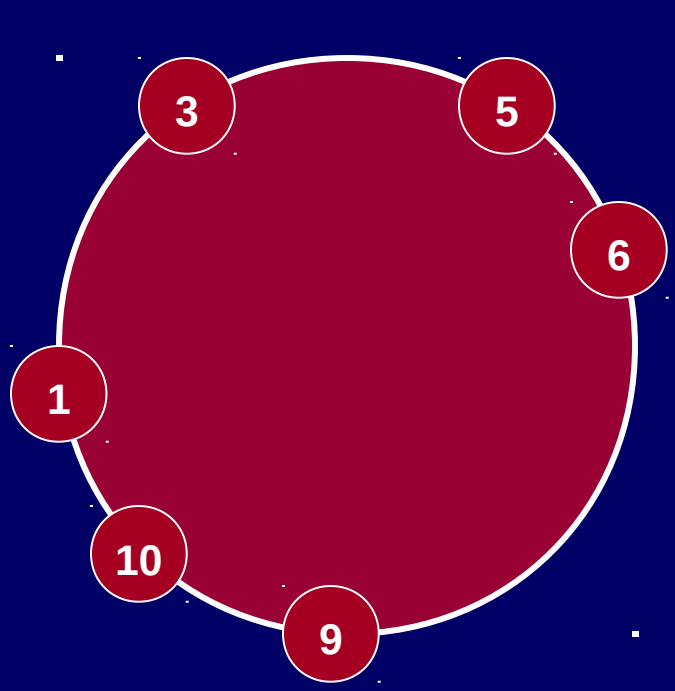

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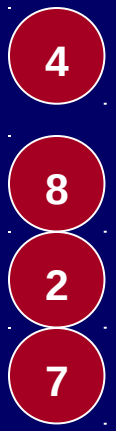

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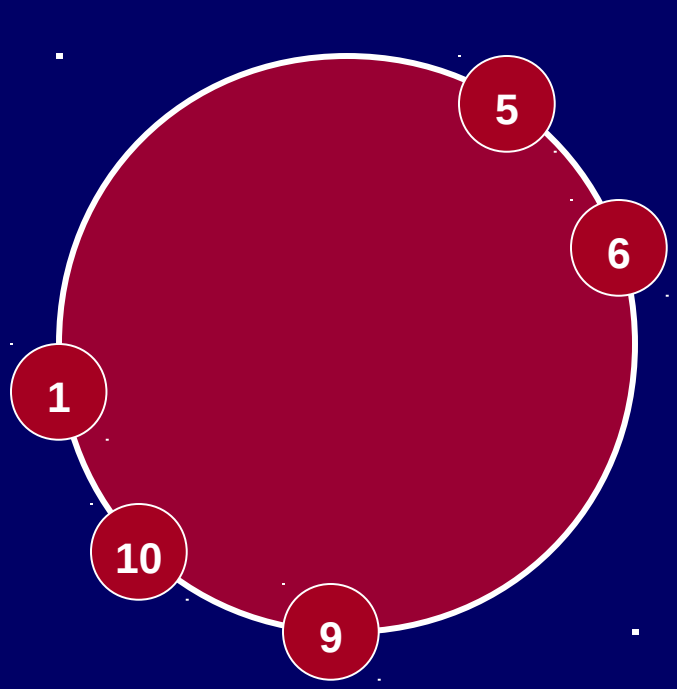

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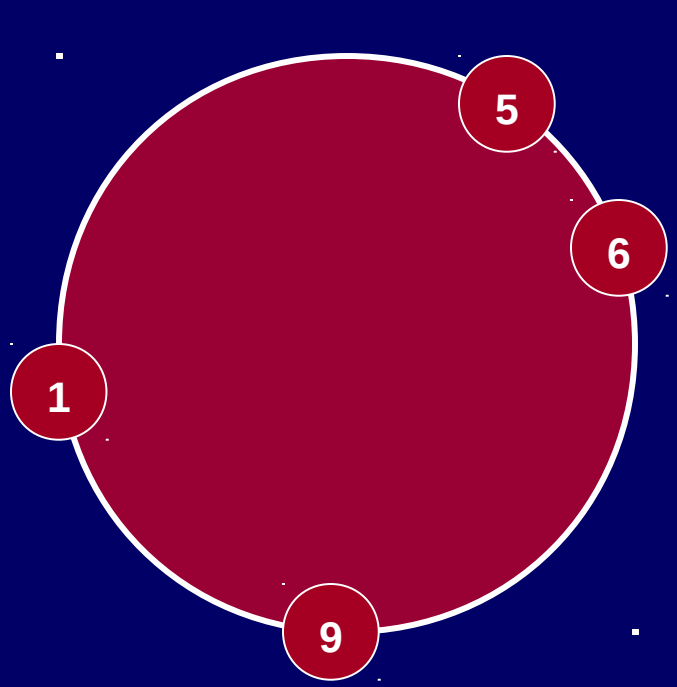

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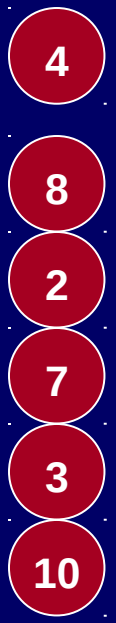

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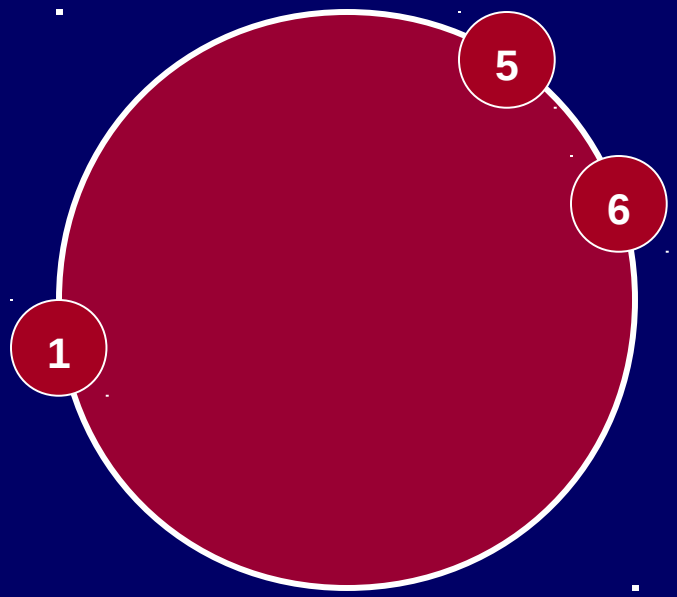

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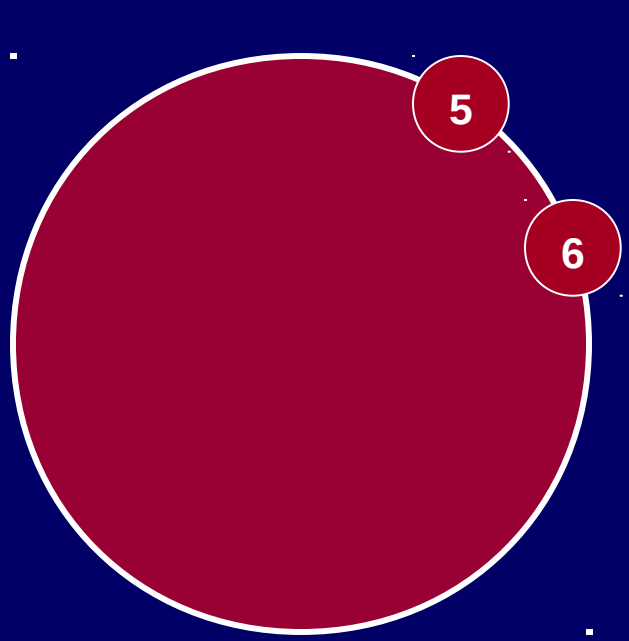

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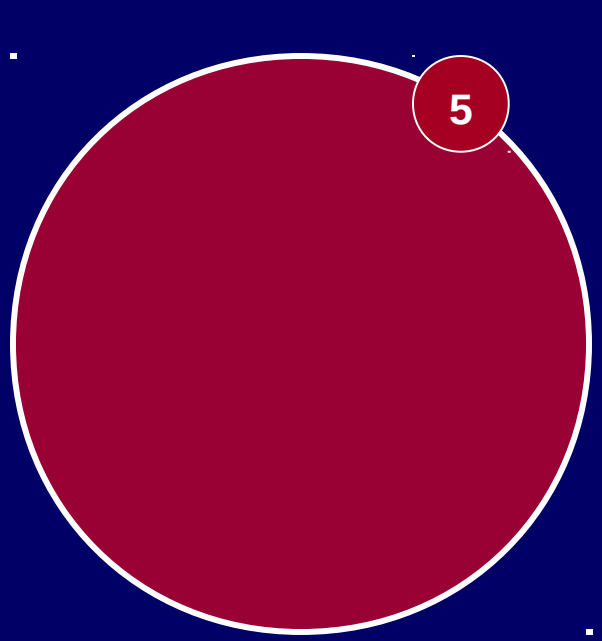

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void main(int argc, char *argv[])
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   CList list;
   int i, N=10, M=3;
   for(i=1; i <= N; i++ ) list.add(i);

   list.start();
   while( list.length() > 1 ) {
       for(i=1; i <= M; i++ ) list.next();
       cout << "remove: " << list.get() << endl;
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