Faculty of Computer Science, IBA

Linked List

Objective

The objective of this lab is to understand the circular Linked list as well as to understand the data structure design for polynomial expressions.

Task

1. Create a circular singly link list to solve the Josephus problem. Among various variations of the Josephus problem, you have to build a musical object passing game. Do the following to build this game:
   a. Insert players in a circular linked list.
   b. Play music and pass an object among players for a while and then stop.
   c. Delete the player with an object, when the music stops.

   Repeat steps a. and c. till one player is left and this player will be the winner of this game.

   Hint: To perform step b., Move the pointer in the list by selecting a counter using random number R.

```
class node {
String name;
node next;
//constructor
}

Public class Game{
   node head;

  Public void insert(String player) { code here }

  Public String playGame(){

      while(head.next!=head){

          // R=generate random number
          //move pointer in list R time
          // delete node where pointer stop
      }

        return head.data;  // winner
  }

  Public void delete(node prev, node temp){ code here }

  Public String toString(){ code here    }
}
```

2. Design and implement the data structure to store polynomial expressions.
   For example, below P(x) and Q(x) are polynomial expressions with variable x.

$$P(x) = 6x^2 - 3x + 4 \qquad and \qquad Q(x) = 4x^2 + 5x + 1,$$

One possible data structure is as follows while you can suggest your representation of data structure. Each node will store coefficient and power. To store whole polynomial expression multiple nodes can be created and link together as a list.

Prev	Coeff	power	next

Here suppose P(x) shown above can be represented as follows

| null | 6 | 2 | → | | -3 | 1 | ← | | 4 | 0 | null |
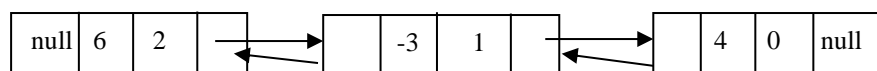
Now implement a method that adds two polynomial expressions.
For example, there are two polynomials $P(x) = 6x^2 - 3x + 4$ and $Q(x) = 4x^2 + 5x + 1$, where addition of $P(x)+Q(x) = 10x^2 + 2x + 5$.

Code structure

```
Class Node {                        Public Class polynomial {


int coefficient;                      Node Head;
int power;
Node prev;                          Public void insert(int c, int p){
Node next;                                  //code here
                                     }
Public node(int c, int p){          Public void addition(polynomial p1,
    coefficient=c;                  polynomial p2){
    power=p;                                // code here
  }                                 }
}                                   Public void displayequation() {
                                            // code here
                                    }}
```

```
Main(){
      polynomial p1=new polynomial();
      polynomial p2=new polynomial();
      polynomial result=new polynomial();
  //**********3x^2 + 4x +10 *******// insert polynomial expression p1
          p1.insert(3, 2);
          p1.insert(4, 1);
          p1.insert(10, 0);
 //***********2x^2 - 2x +4 *******// insert polynomial expression p2
          p2.insert(2, 2);
          p2.insert(-2, 1);
          p2.insert(4, 0);

 //******* now add polynomials p1 and p2********
          result.addition(p1, p2);

     // ***********display the result of addition***********
          result.display();
      }}
```