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HW2

Pseudocode:

```
static Node createNode(double coeff, int power)
        {
  Create new node with given parameters;
   newNode.next=null;
   return newNode;
        }

static Node addnode(Node head, double coeff, int power)
        {

 Node temp=head;

while(temp.next!=null){
   if(Linkedlist alredy has a node with given power){
     temp.coeff+=coeff;
     return null;
   }
   temp=temp.next;
 }
 if(The last node =power){
     temp.coeff+=coeff;
     return null;
 }
 temp.next=createNode(coeff, power);

 return null;
}

static void sort(Node poly){
   Node temp=poly;
   Node comparator=null;
   int tempPower;
   double tempCoeff;

 while(Linkedlist(temp) has node){

initialize comparator to temp's next
     while(Linkedlist(comparator) has node){
```

```
      if(comparator.power>temp.power){
        tempPower=temp.power;
        tempCoeff=temp.coeff;
        temp.power=comparator.power;
        temp.coeff=comparator.coeff;
        comparator.power=tempPower;
        comparator.coeff=tempCoeff;
       }
       comparator=comparator.next;
     }
     temp=temp.next;
   }
  }



static Node multiply(Node poly1, Node poly2)
          {
    Node sum=null;
    Node temp1=poly1;
    Node temp2=poly2;

    while(temp1 has node){(itereting over )
     temp2=poly2;
     while(temp2 has node){
      if(sum==null){
       sum=createNode(temp1.coeff*temp2.coeff,temp1.power+temp2.power);
       temp2=temp2.next;
      }
     else{
        addnode(sum,temp1.coeff*temp2.coeff,temp1.power+temp2.power);
       temp2=temp2.next;
       }
     }
     temp1=temp1.next;
    }
    sort(sum);
  return sum;
  }


static Node add(Node poly1, Node poly2)
          {
    Node sum=null;
    Node current=null;
    Node temp1=poly1;
    Node temp2=poly2;
```

```
   while(temp1 has nodel){(this loop copies the values of poly1 to sum)
         if (sum == null)
                  {
   sum = createNode(temp1.coeff,temp1.power);
                           current = sum;
                  }
                  else
                  {
                  current.next =createNode(temp1.coeff,temp1.power);
                  current = current.next;
                  }
   temp1=temp1.next;
   }
   while(temp2 has node)  (this loop adds the poly 2 to copy of poly1(sum))
   addnode(sum,temp2.coeff,temp2.power);
   temp2=temp2.next;
   }
   sort(sum);
  return sum;
         }
}
```

Time Complexity Analysis

Function createNode: it just creates a node so its O(1).

Function addnode: It has a while loop which iterates over each element of the given linkedlist on worst case so its O(n).

Function sort: There is a while loop which iterates for each element of the given linkedlist and inside that loop there is a loop that iterates over the nodes that left in iteration, I mean for the first iteration of the outside while loop, inside loop iterates for n-1 times; for the second iteration of outside loop, inside loop iterates n-2 times and it will go on until the temp for head is null, so c + (n-1)+(n-2)+(n-3)+…+(1)=(n-1)*n/2 and that equals to O(n^2).

Function Multiply: There is a outside while loop which iterates for n element of poly1 and there is a loop inside that also iterates for n element of poly2 and inside that, there is addnode method which time complexity has calculated as O(n)above so the time complexity of that function is n*n*n + c = O(n^3).

Function Add: There is a while loop which iterates over poly1 so n from that and there is a while loop which iterates over n element of poly2 and inside that, there is addnode method which time complexity has calculated as O(n) above so n^2 from that, n + n^2 + c=O(n^2)

Space Complexity Analysis

For the createNode function, it will be O(1) because it just creates a node, its like creating 2 integers and a pointer.

For the other functions, most complex data structure for all of them is linkedlist, and in these lists there is just integers that are primitive, and space complexity for linkedlists are O(n), so space complexity for all of them is O(n).

I have completed this assignment individually, without support from anyone else. I hereby accept that only the below listed sources are approved to be used during this assignment:

(i) course textbook,
(ii) All material that is made available to me by the professor (e.g. via blackboard this course, course website, email from professor/TA),
(iii) Notes taken by me during lectures.

I have not used or taken any unpermitted information from any other source. Hence, all effort belongs to me

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