Basic Sorting Programs

CSE 225 - Data Structures and Algorithms

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1 Insertion Sort

```c
#include <stdio.h>
#include <math.h>

int main()
{
    int a[] = {16, 190, 11, 15, 10, 12, 14};
    int n=7;

    for(int i=1;i<n;i++)
    {
            int temp=a[i];
            int j=i-1;

            while((temp<a[j])&&(j>=0))
            {
                a[j+1]=a[j];     //moves element forward
                j=j-1;
            }

            a[j+1]=temp;     //insert element in proper place
    }

    for(int i=0;i<7;i++)
        printf("%d\t",a[i]);

    return 0;
}
```

2 Bubble Sort

```c
#include<stdio.h>

int main()
{
  int a[10],n;
  printf("Enter the number of elements: ");
  scanf("%d",&n);

  printf("Enter the array elements: ");
  for(i=0;i<n;++i)
    scanf("%d",&a[i]);

  for(int i=1;i<n;++i)
  {
    for(int j=0;j<(n-i);++j)
    {
      if(a[j]>a[j+1])
      {
        int temp=a[j];
        a[j]=a[j+1];
        a[j+1]=temp;
      }
    }
  }

  printf("\nArray after sorting: ");
  for(int i=0;i<n;++i)
    printf("%d ",a[i]);
  return 0;
}
```

3 Selection Sort

```c
#include <stdio.h>

#define n 7

int a[n] = {4,6,3,2,1,9,7};

void display() {
   int i;
   printf("\t[");

   for(i = 0;i < n;i++) {  // navigate through all items
      printf("%d ", a[i]);
   }

   printf("]\n\n");
}

void selectionSort() {

   for(int i = 0; i < n-1; i++) {     // loop through all numbers

      int indexMin = i;  // set current element as minimum

      for(int j = i+1;j < n;j++) {     // check the element to be minimum
         if(a[j] < a[indexMin]) {
            indexMin = j;
         }
      }
      if(indexMin != i) {
         printf("Items swapped:\t[ %d, %d ]\n" , a[i], a[indexMin]);

         // swap the numbers
         int temp = a[indexMin];
         a[indexMin] = a[i];
         a[i] = temp;
      }

      printf("Iteration %d#:",(i+1));
      display();
   }
}

int main() {
   printf("Input Array: ");
   display();

   selectionSort();
   printf("\nOutput Array: ");
   display();

}
```

4 Sortings using a Class

```
#include <iostream>
using namespace std;
class Sort {
    int arr[50];
    int n;

  public:
    void userInput();
    void fixedInput();
    void bubble();
    void insertion();
    void selection();
    void display();
};

void Sort::userInput()
{
    cout<<"Enter size of elements:" << endl;
    cin>>n;

    cout<<"Enter " << n << " values" << endl;
    for(int b = 0; b <= n -1; b++) {
        cout << "Value [" << b << "]:";
        cin>>arr[b];
     }
    cout << "Elements of your unsorted list: [ ";
    for(int c = 0; c <= n -1; c++){
        cout << arr[c] << " " ;
    }
    cout << "]" << endl;
}

void Sort::fixedInput()
{
    n=4;
    arr[0]=4;
    arr[1]=2;
    arr[2]=1;
    arr[3]=3;
}

void Sort::bubble()
{
    for(int i=1;i<n;++i) {
        for(int j=0;j<(n-i);++j) {
          if(arr[j]>arr[j+1]) {
            int temp=arr[j];
            arr[j]=arr[j+1];
            arr[j+1]=temp;
          }
        }
```

```
52        }
53  }
54  void Sort::insertion()
55  {
56      for(int i=1;i<n;i++)
57          {
58              int temp=arr[i];
59              int j=i-1;
60              while( (temp<arr[j]) && (j>=0) )
61              {
62                  arr[j+1]=arr[j];     //moves element forward
63                  j=j-1;
64              }
65              arr[j+1]=temp;     //insert element in proper place
66          }
67  }
68
69  void Sort::selection()
70  {
71     for(int i = 0; i < n-1; i++) {
72        int indexMin = i;
73        for(int j = i+1;j < n;j++) {
74           if(arr[j] < arr[indexMin]) {
75              indexMin = j;
76           }
77        }
78
79        if(indexMin != i) {
80           // swap the numbers
81           int temp = arr[indexMin];
82           arr[indexMin] = arr[i];
83           arr[i] = temp;
84        }
85
86     }
87  }
88  void Sort::display()
89  {
90      cout << "Elements of your sorted list: [ ";
91      for(int x = 0; x < n; x++) {
92          cout << arr[x] << " ";
93      }
94      cout << "]";
95  }
96  int main () {
97      Sort mSort;
98      mSort.fixedInput();
99      //mSort.bubble();
100     mSort.insertion();
101     //mSort.selection();
102
103     mSort.display();
104     return 0;
105 }
```

5 Sortings using a Class (with Template)

```
#include <iostream>
using namespace std;
template <typename ItemType>
class Sort {
    ItemType arr[50];
    int n;

  public:
    void userInput();
    void fixedInput();
    void bubble();
    void insertion();
    void selection();
    void display();
};

template <typename ItemType>
void Sort<ItemType>::userInput()
{
    cout<<"Enter size of elements:" << endl;
    cin>>n;

    cout<<"Enter " << n << " values" << endl;
    for(int b = 0; b <= n -1; b++) {
        cout << "Value [" << b << "]:";
        cin>>arr[b];
     }

    cout << "Elements of your unsorted list: [ ";
    for(int c = 0; c <= n -1; c++){
        cout << arr[c] << " " ;
    }
    cout << "]" << endl;
}

template <typename ItemType>
void Sort<ItemType>::fixedInput()
{
    n=4;
    arr[0]=4.3;
    arr[1]=2.2;
    arr[2]=1.6;
    arr[3]=3.2;
}

template <typename ItemType>
void Sort<ItemType>::bubble()
{
    for(int i=1;i<n;++i)
      {
        for(int j=0;j<(n-i);++j)
```

```
52          {
53            if(arr[j]>arr[j+1])
54            {
55              ItemType temp=arr[j];
56              arr[j]=arr[j+1];
57              arr[j+1]=temp;
58            }
59          }
60        }
61 }
62
63 template <typename ItemType>
64 void Sort<ItemType>::insertion()
65 {
66     for(int i=1;i<n;i++)
67     {
68         ItemType temp=arr[i];
69         int j=i-1;
70
71         while( (temp<arr[j]) && (j>=0) )
72         {
73             arr[j+1]=arr[j];     //moves element forward
74             j=j-1;
75         }
76
77         arr[j+1]=temp;     //insert element in proper place
78     }
79 }
80
81 template <typename ItemType>
82 void Sort<ItemType>::selection()
83 {
84    for(int i = 0; i < n-1; i++)
85    {
86
87       int indexMin = i;
88
89       for(int j = i+1;j < n;j++) {
90          if(arr[j] < arr[indexMin]) {
91             indexMin = j;
92          }
93       }
94
95       if(indexMin != i) {
96          // swap the numbers
97          ItemType temp = arr[indexMin];
98          arr[indexMin] = arr[i];
99          arr[i] = temp;
100      }
101
102    }
103 }
104
105 template <typename ItemType>
```

```
106 void Sort<ItemType>::display()
107     {
108         cout << "Elements of your sorted list: [ ";
109         for(int x = 0; x < n; x++) {
110             cout << arr[x] << " ";
111         }
112         cout << "]";
113     }
114 
115 int main () {
116     Sort<float> mSort;
117     mSort.fixedInput();
118     mSort.bubble();
119     //mSort.insertion();
120     //mSort.selection();
121 
122     mSort.display();
123     return 0;
124 }
```

6 Sortings using a Class (with ItemType Object)

```
#include <iostream>
using namespace std;

class ItemType{
    public:
        int id;
        float result;
};

class Sort {
    ItemType arr[50];
    int n;

  public:
    void userInput();
    void fixedInput();
    void bubble();
    void insertion();
    void selection();
    void display();
};

void Sort::userInput()
{
    cout<<"Enter size of elements:" << endl;
    cin>>n;

    cout<<"Enter " << n << " values" << endl;

    for(int b = 0; b <= n -1; b++) {
        cin>>arr[b].id;

        cout << "Value [" << b << "] (result):";
        cin>>arr[b].result;
    }

    cout << "Elements of your unsorted list: [ ";
    for(int c = 0; c <= n -1; c++){
        cout << "("<<arr[c].id<<","<<arr[c].result<<") " ;
    }
    cout << "]" << endl;

}

void Sort::fixedInput()
{
    n=4;
    arr[0].id=1; arr[0].result=5.5;
    arr[1].id=2; arr[1].result=2.1;
    arr[2].id=3; arr[2].result=3.7;
    arr[3].id=4; arr[3].result=4.2;
```

```
52 }
53
54 void Sort::bubble()
55 {
56
57     for(int i=1;i<n;++i)
58       {
59         for(int j=0;j<(n-i);++j)
60         {
61           if(arr[j].result>arr[j+1].result)
62           {
63             ItemType temp=arr[j];
64             arr[j]=arr[j+1];
65             arr[j+1]=temp;
66           }
67         }
68       }
69 }
70
71 void Sort::insertion()
72 {
73     for(int i=1;i<n;i++)
74     {
75         ItemType temp=arr[i];
76         int j=i-1;
77
78         while( (temp.result<arr[j].result) && (j>=0) )
79         {
80             arr[j+1]=arr[j];     //moves element forward
81             j=j-1;
82         }
83
84         arr[j+1]=temp;     //insert element in proper place
85     }
86 }
87
88 void Sort::selection()
89 {
90    for(int i = 0; i < n-1; i++)
91    {
92       int indexMin = i;
93
94       for(int j = i+1;j < n;j++) {
95          if(arr[j].result < arr[indexMin].result) {
96             indexMin = j;
97          }
98       }
99
100      if(indexMin != i) {
101         // swap the numbers
102         ItemType temp = arr[indexMin];
103         arr[indexMin] = arr[i];
104         arr[i] = temp;
105      }
```

```
106
107         }
108 }
109 void Sort::display()
110 {
111         cout << "Elements of your sorted list: [ ";
112         for(int c = 0; c < n; c++) {
113             cout << "("<<arr[c].id<<","<<arr[c].result<<") " ;
114
115         }
116         cout << "]";
117 }
118
119 int main() {
120         Sort mSort;
121         mSort.fixedInput();
122         mSort.bubble();
123         //mSort.insertion();
124         //mSort.selection();
125
126         mSort.display();
127         return 0;
128 }
```