//Applying insertion, shell and radix sort to sort student data according to their roll number and name

```
#include <iostream>
using namespace std;
class Student{
   private:
      int num;                              //roll number of student
      string name;
      float SGPA;
   public:
      Student(){};
      Student(int n, string s, float sgpa ){
         num = n;
         name = s;
         SGPA = sgpa;
      }

      int get_id(){
         return num;
      }
      string get_name(){
         return name;
      }
      float get_sgpa(){
         return SGPA;
      }

     //Display method to print the output
      void display(){
         cout<< "Roll no. : "<<num<<", " ;
         cout<<"Name : " << name<<", ";
         cout<<"SGPA : " << SGPA;
      }

   //Code for insertion sort to sort students data by roll number
      void insertion_sort(Student arr[], int n){
         for(int i = 1; i < n; i++){
            Student key = arr[i];
            int j ;
           for( j = i-1; j >= 0; j--){
            if(arr[j].num > key.num){
               arr[j+1] = arr[j];
             }
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            else{
                break;
             }
           }
          arr[j+1] = key;
         }
       }


      //code for shell sort to sort students data by name

       void shell_sort(Student arr[], int n){
          int gap = n / 2;
          while(gap >= 1){
          for(int i = gap; i < n; i++){
             Student key = arr[i];
             int j = i - gap;
             for(; j >= 0; j -= gap){
                if(arr[j].get_name() > key.get_name()){
                   arr[j + gap] = arr[j];
                }
                else{
                   break;
                }
             }
             arr[j+gap] = key;

          }
          gap /= 2;
          }
       }


//code for count sort to perform radix sort

    void count_sort(int exp, Student arr[], int n){
    //initialize a count array with 0 having size 10 because we have to sort decimal number
          int count_arr[10] = {0};
    //declare a output array to store output
          Student output_arr[n];
 //modify the count array by counting how many numbers in array are having the number similar
to index of count array
//In first function call we are considering unit's place , in next call 10's place and so on upto
length of largest number
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            for(int i = 0; i < n; i++){
                count_arr[(arr[i].get_id()/exp) % 10]++;
            }
//modify count array
            for(int i = 1; i < 10; i++){
                count_arr[i]+=count_arr[i-1];
            }
//fill the output array and modify the count array accordingly
            for(int i = n - 1; i >= 0; i--){
                output_arr[count_arr[(arr[i].get_id() / exp) % 10] - 1] = arr[i];
                count_arr[(arr[i].get_id()/exp) % 10]--;
            }
//copy the output array in original array
            for(int i = 0; i < n; i++){
                arr[i] = output_arr[i];
            }



        }

    //code of radix sort to sort roll number

        void radix_sort(Student arr[], int n){
            int max = arr[0].get_id();
            for(int i = 0; i < n;i++){
                if(arr[i].get_id() > max)
                    max = arr[i].get_id();
            }
            for(int ex = 1;max/ex > 1; ex*=10)
              count_sort(ex, arr, n);
        }

        };
int main() {
        int n = 15;
        Student arr[n] ;
// Input students information
        for(int i = 0; i < n; i++){
            int id;
            string name;
            float sgpa;
            cout<<"Enter details of student "<<i+1<<endl;
            cout<<"id : ";
            cin>>id;
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            cout<<"name : ";
            cin>>name;
            cout<<"sgpa : ";
            cin>>sgpa;

            arr[i] = Student(id, name, sgpa);
        }
        cout<<endl;
        cout<<"Before any sorting : \n";
        for(int i = 0; i < n; i++){
            arr[i].display();
            cout<<"\n";
        }
        cout<<"\n";
        cout<<"After sorting by roll numbers using insertion sort : \n";
        arr[15].insertion_sort(arr,n);
        for(int i =0; i < n; i++){
            arr[i].display();
            cout<<"\n";
        }

        cout<<endl;
        cout<<"After sorting by names using shell sort : \n";
        arr[15].shell_sort(arr,n);
        for(int i =0; i < n; i++){
            arr[i].display();
            cout<<"\n";
        }

        cout<<endl;
        cout<<"After sorting by roll number using radix sort : \n";
        arr[15].radix_sort(arr,n);
        for(int i =0; i < n; i++){
            arr[i].display();
            cout<<"\n";
        }
    return 0;
}
```