

Problem 7: Problems on Sorting and Searching

Data Structures Lab (CS111)

Hogwarts School of Witchcraft and Wizardry wants to maintain students records with the following information. Each student has a 6 digit roll number where first two digits of the roll number denote the student's house. Numbers 10, 11, 12, and 13 at the 1st two digits of the roll number denote that the student belongs to "Gryffindor", "Hufflepuff", "Ravenclaw", and "Slytherin" house respectively. Along with roll number, they also store their marks (integer, out of 100) in the subjects "defence against the dark arts" (subject code 001), "charms" (subject code 002), and "potions" (subject code 003). You need to define an array of structure to maintain student records with all these information. You need to maintain marks and corresponding subject code also. The whole problem statement has following parts:

1.
 - (a) Implement quick sort algorithm to sort the student record sorted according to the roll numbers and print the student record.
 - (b) Now let the user wants to insert 3 more records at a time in this already sorted array. In this scenario, add those records at the end of the previous list and implement the insertion sort algorithm to sort this almost sorted array. Note that the user can add bunch of 3 records multiple times.
 - (c) You need to support searching in the student record. If the user wants to search one record, he/she provides one roll number. You need to print the whole record corresponding to that student. Implement binary search to support this operation.
2.
 - (a) If any student scores more than 70 in "charms" and less than 40 in "defence against the dark arts" subject, then the student is a potential death eater. So the school administration wants to send them for special treatment. They maintains another array of structures to maintain these potential death eaters (PDE) record with their roll number and marks obtained in "charms" , "defence against the dark arts". You need to print roll numbers of students in the potential death eater list of different houses according to their house. You need to print the roll number of students in the same house in sorted order.

You need to populate all the information in the initial record through a file and insert a record only when the roll number is a valid one, i.e. the first two digits are in {11, 12, 13, 14}. The first line of the file is the number of student records to be inserted. From the 2nd line onwards 1st column is the roll number of the student, 2nd column is marks obtained in “defence against the dark arts”, 3rd column is marks obtained in “charms” and 4th column is marks obtained in “potions”. File will be given in the following format:

```
6
100001 85 72 76
110002 80 71 46
120001 39 72 96
130011 35 92 44
150011 35 92 44
130012 35 92 44
```

While reading from the file and inserting you need to discard the invalid roll numbers and show some error message. You need to insert the rest of the inputs. Your output for the problem 1 should be in the following format:

```
100001 Gryffindor 85(001) 72(002) 76(003)
110002 Hufflepuff 80(001) 71(002) 46(003)
120001 Ravenclaw 39(001) 72(002) 96(003)
130011 Slytherine 35(001) 92(002) 44(003)
130012 Slytherine 35(001) 92(002) 44(003)
```

Your output for the problem 2 should be in the following format:

```
PDE 120001 Ravenclaw 39(001) 72(002)
PDE 130011 Slytherine 35(001) 92(002)
PDE 130012 Slytherine 35(001) 92(002)
```

Marks Distribution: Populating the records from file input [**5 marks**], Sorting the initial record using quick sort [**5 marks**], Sorting the newly inserted records [**4 marks**], Searching and implementation of binary search [**5 marks**], Populating and printing the potential death eater list according to houses [**6 marks**]