Assignment 5.1
Heads On a Roll

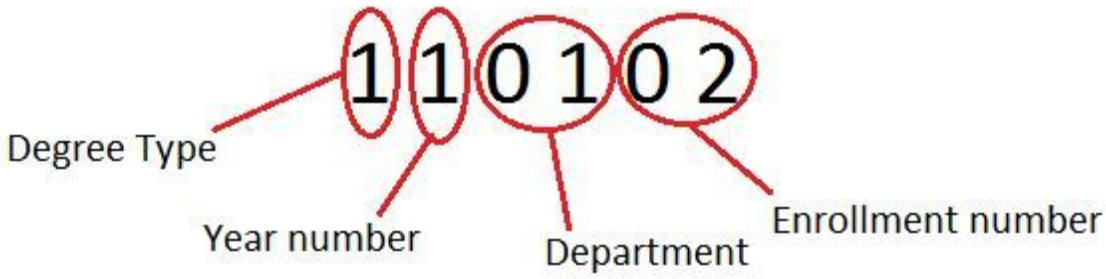
Introduction:

Many a times a complex problem becomes easier to solve if you have the appropriate data structure at hand. More so when the input size involved is very large. Skip List is one such simple data structure which will help you efficiently solve problems where ordering is required or dictionaries are required.

Description:

Given multiple skip lists containing the details of students enrolled in different subjects and a master list (containing all the students' details), you need to provide answers to different queries (described in later sections), display the number of comparisons taken for the same and produce the trace for the path taken as a graphviz DOT File.

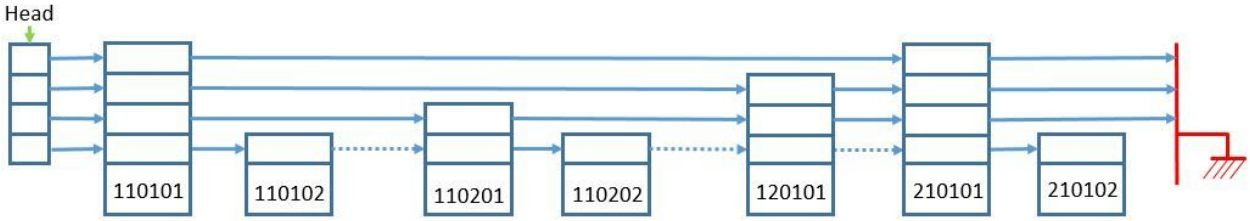
Each student will be represented by a unique ID (key), where each circled part of the ID represents different entities about the student, which is described as follows:



Degree Type: 1 - B.Tech, 2 - M.Tech, 3 - PhD
Year number: 1 to 5
Department: Between 01 and 09
Enrollment number: Between 01 and 99

Each of the above mentioned entity will represent a height in the skip list in descending order. Whenever there is a change in the value of an entity, then the student is made

the ‘head’, by having height’s till the entity’s level (from the bottommost level to entity’s height). For example, in the given figure, student with ID “110101” represents the **first student** of B.Tech, the **first student** of 1st year,the **first student** of 1st department **in the given list**, and hence the height will be 4. Similarly, ID “120101” is a B.Tech student, the **first student** of 2nd Year and **first student** of 1st department **in the given list** and will have height as 3. Further student with ID “110201” represent a student of B.Tech 1st year and the **first student** of 2nd department **in the given list**, and hence the height will be 2. Other students, which do not represent as the first student of any entity will have height 1.



NOTE: It is NOT necessary that the first student of any degree, any branch or any department will have enrollment number as 01. For example, ID “110101” may not have been enrolled in Algorithms subject. In essence if there is change in an entity value from the previous one, then node for the given ID will have pointers till the level of the particular entity. Please refer the sample input file provided in moodle, where the height is specified.

Master List:

The master list contains all the students from different degrees and years and departments.

Subject-wise Lists:

There are two subject-wise lists namely Algorithms list and Information Retrieval (IR) list. These lists will only contain the students enrolled in the respective subject.

Task:

Using the above skip lists, answer the following queries:

Q1. Find all the B.Tech 4th year students who are in the 2nd and 3rd department.
Q2. Find all the students who are enrolled in Algorithms but not in IR and is a student of 3rd, 4th or 5th Department
Q3. Find the number of students who have taken both Algorithms and IR.
Q4. Find the number of students who have taken either Algorithms or IR.

Deliverables

You will submit your C/C++ program along with the makefile, doxy file, DOT file traces (4, one for each query with the trace line being red in colour) as a single **rollno_a5-1.tar.gz** file in the moodle submission link. You may print the number of comparisons in the screen, after each run. It is mandatory that your code should follow proper indentation and commenting style. There will be deductions in the awarded marks, if you fail to do so. If you are using C++, the use of STL is not permitted.