COMP108 Data Structures and Algorithms

Week 06 Lab Exercises

Due: 10 March 2023, 5:00pm

(Late submission accepted until Monday 9:00am)

Information

- Submission: Submit the file **COMP108W06.java** on Canvas
  Late submission is only accepted until Monday 9:00am.
- Submission of lab/tutorial exercises contributes to 10% of the overall module mark. Submission is marked on a pass/fail basis - you will get full marks for submitting a *reasonable attempt*.
- Individual feedback will not be given, but solutions will be posted promptly after the deadline has passed.
- These exercises aim to give you practices on the materials taught during lectures and provide guidance towards assignments.
- Relevant lectures: Lectures 4 & 7

1. **Programming — Preparation**

   You have been asked to prepare your programming environment in Week 1. If you haven't done that yet, follow the discussion on Canvas:

   https://liverpool.instructure.com/courses/61186/pages/compiling-and-running-java-programs

   You can use web IDE: https://ide.cs50.io/ if you haven't setup your own environment.

   (a) Download the following java files "COMP108W06App.java", "COMP108W06.java" from Canvas via the link "Labs & Tutorials".

   (b) Open the files with a text editor (e.g., notepad++ or web IDE editor).
   Beware of where you have saved the java file and open it from the correct folder. Do NOT use MS Word!

   (c) COMP108W06App.java takes care of data input. The algorithms to be implemented are in the file COMP108W06.java.

   (d) Open a command prompt (cmd) and change to the folder where you saved the programs.

   (e) Refer to instructions in Week 04 on how to compile the programs.

2. **COMP108W06App.java and COMP108W06.java**

   (a) **The Scenario we work with:**

      i. **IMPORTANT:** Considering the following scenario. We have a database of movies (stored as integer ID) and some requests from customers who want to watch movies (again stored as integer ID). We want to answer two questions:

         A. Which requested movies do not exist in the database? Report this in the same order of the requests.

         B. For each movie in the database, how many times it has been requested by the customers? Report this in the same order of the database.

         We will need to write nested loop to answer these questions.

      ii. For simplicity, the input have been hard-coded in COMP108W06App.java.
      The database contains 70, 20, 60, 40, 50, 30, 10, 80
      The requests contains 5, 10, 60, 70, 15, 50, 30, 20, 20, 20, 25, 15, 20, 10, 20, 5, 70, 70, 10, 10

   (b) **Task 2.1**

      i. As stated above in 2(a)i, we want to look at each movie ID in the requests and report if it does not exist in the database. We can do this by nested loops: the outer loop iterates through the requests one by one and the inner loop iterates through the database one by one and report the movie ID if it does not exist in the database.
      Remember: you will need TWO different index variables, e.g., i and j, for the outer and inner loops.

      ii. Implement the method in **notExists()** of COMP108W06.java. This method takes 4 parameters: the first is the array storing the requests and the second is the size of this array; the third is the array storing the database and the fourth is the size of this array.

      iii. **Expected output:** Based on the given database and requests, your method is expected to print out: **5 15 25 15 5**

      iv. What is the time complexity of your algorithm? Justify your answer. Give your answer in the comment section at the beginning of COMP108W06.java.

   (c) **Task 2.2**

      i. This time we would like to go through each element of the database and **count** how many times it appears in the requests. We also do this using nested loops and you will have to decide which array the outer and the inner loops each iterate through.

      ii. Implement the method in **count()** of COMP108W06.java. The order of the 4 parameters is the same as Task 2.1.

      iii. **Expected output:** Your method should print: **3 5 1 0 1 1 4 0**

      iv. What is the time complexity of your algorithm? Justify your answer. Give your answer in the comment section at the beginning of COMP108W06.java.