THE UNIVERSITY OF BRITISH COLUMBIA
CPSC 110: FINAL EXAM - Part A - June 26, 2014

Last Name: _____ First Name: _____

Signature: _____ UBC Student #: _____

Important notes about this examination

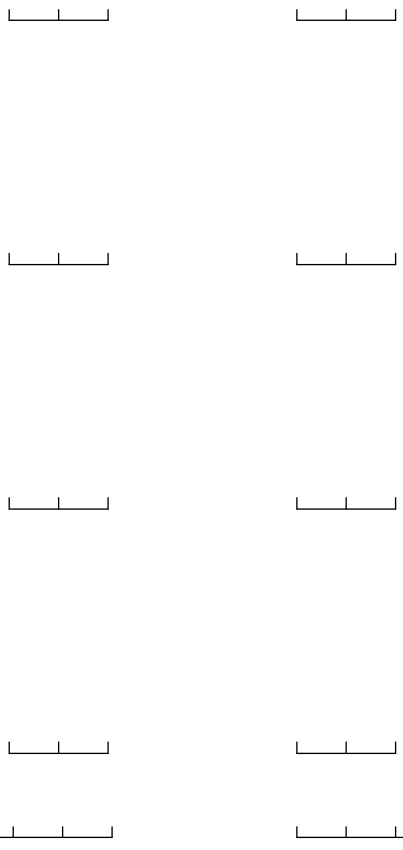
1. This exam has two separate parts. Your time to complete the first part is 30 minutes. After that time, Part A will be collected and Part B distributed. You will then have 120 minutes to complete Part B.
2. This exam will be graded largely on how well you follow the design recipes. You have been given a copy of the Recipe Exam Sheet. Use it!
3. Put away books, papers, laptops, cell phones… everything but pens, pencils, erasers and this exam.
4. Good luck!

Student Conduct during Examinations

1. Each examination candidate must be prepared to produce, upon the request of the invigilator or examiner, his or her UBCcard for identification.
2. No questions will be answered in this exam. If you see text you feel is ambiguous, make a reasonable assumption, write it down, and proceed to answer the question.
3. No examination candidate shall be permitted to enter the examination room after the expiration of one-half hour from the scheduled starting time, or to leave during the first half hour of the examination. Should the examination run forty-five (45) minutes or less, no examination candidate shall be permitted to enter the examination room once the examination has begun.
4. Examination candidates must conduct themselves honestly and in accordance with established rules for a given examination, which will be articulated by the examiner or invigilator prior to the examination commencing. Should dishonest behaviour be observed by the examiner(s) or invigilator(s), pleas of accident or forgetfulness shall not be received.
5. Examination candidates suspected of any of the following, or any other similar practices, may be immediately dismissed from the examination by the examiner/invigilator, and may be subject to disciplinary action:
   i. speaking or communicating with other examination candidates, unless otherwise authorized;
   ii. purposely exposing written papers to the view of other examination candidates or imaging devices;
   iii. purposely viewing the written papers of other examination candidates;
   iv. using or having visible at the place of writing any books, papers or other memory aid devices other than those authorized by the examiner(s); and,
   v. using or operating electronic devices including but not limited to telephones, calculators, computers, or similar devices other than those authorized by the examiner(s)—(electronic devices other than those authorized by the examiner(s) must be completely powered down if present at the place of writing).
6. Examination candidates must not destroy or damage any examination material, must hand in all examination papers, and must not take any examination material from the examination room without permission of the examiner or invigilator.
7. Notwithstanding the above, for any mode of examination that does not fall into the traditional, paper-based method, examination candidates shall adhere to any special rules for conduct as established and articulated by the examiner.
8. Examination candidates must follow any additional examination rules or directions communicated by the examiner(s) or invigilator(s).

Please do not write in this space:

Question 1:

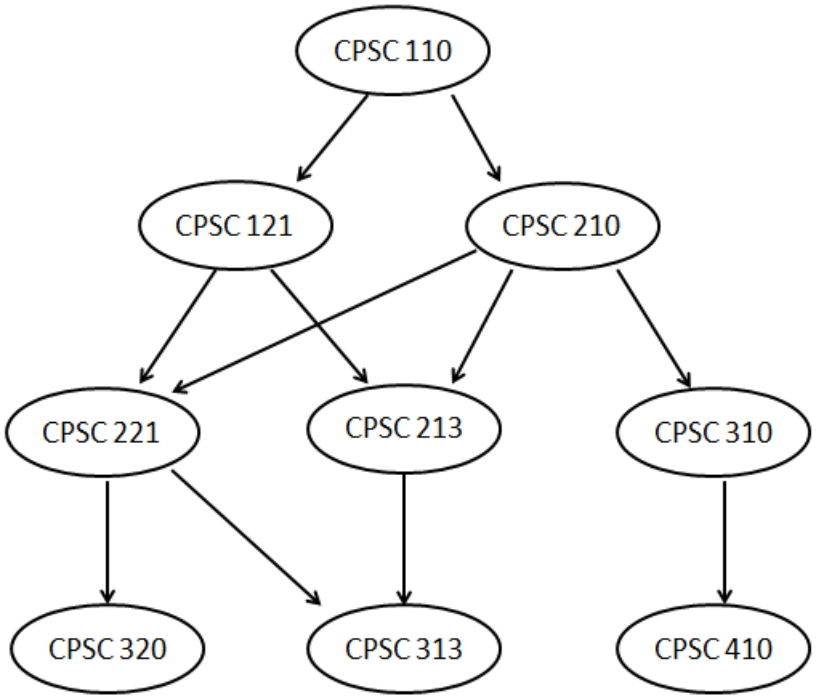


Problem 1:

Below is a list of some of the courses that are offered by the computer science department at UBC.

Course	Course name	Credits
CPSC 110	Computation, Programs and Programming	4
CPSC 121	Models of Computation	4
CPSC 210	Software Construction	4
CSPC 213	Introduction to Computer Systems	4
CPSC 221	Basic Algorithms and Data Structures	4
CPSC 310	Introduction to Software Engineering	4
CPSC 313	Computer Hardware and Operating Systems	3
CPSC 320	Intermediate Algorithm Design and Analysis	3
CPSC 410	Advanced Software Engineering	3

As you know, some of these courses are prerequisites that you must take before you can take other courses. The prerequisite structure is shown in the below diagram. (This structure is simplified and not entirely accurate, but it's what we'll use for this exam.) This diagram shows that you must take CPSC 110 before you take CPSC 121 or CPSC 210, you must take CPSC 210 before you take CPSC 310, etc.



Design one or more data definitions to represent UBC Computer Science courses and their prerequisite structure. You must include define-structs (if necessary), type comments, interpretations, an example that includes at least 110, 121, 210, 213 and 313 from above and a template. If you have more than one type, encapsulate all your templates into a single template function. Your encapsulated template must be tail-recursive.

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