Worth: 3%   **Due:** By 12 noon on Tuesday 24 January.

Remember to write the the *full name* and *student number* of each member of your group prominently on your submission. Your submission must be a PDF file named e1.pdf and it must be handed-in using the MarkUs system. You may create the PDF file using a typesetting system (export to PDF) or by scanning in handwritten work to create a PDF file.

Each exercise may be completed in groups of 1 – 2 students who are in the **same** tutorial section.

*Please read and understand the policy on Collaboration given on the Course Information Sheet. Then, to protect yourself, list on the front of your submission **every** source of information you used to complete this homework (other than your own lecture and tutorial notes, and materials available directly on the course webpage). For example, indicate clearly the **name** of every student with whom you had discussions, the **title** of every additional textbook you consulted, the **source** of every additional web document you used, etc.*

For each question, please write up detailed answers carefully. Make sure that you use notation and terminology correctly, and that you explain and justify what you are doing. Marks **will** be deducted for incorrect or ambiguous use of notation and terminology, and for making incorrect, unjustified, ambiguous, or vague claims in your solutions.

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1. NOTE: **This is not a question about the course material.**

   The course CSC 165 H1S is part of the Faculty of Arts & Science's *Writing Instruction for TAs (WIT) Project* — see `http://www.artsci.utoronto.ca/main/newsitems/wit/` for some details. In order to assess the success of this project, anonymized copies of your homework (*i.e.*, copies where your name and student number have been removed) may be used to help improve the effectiveness of teaching in the Department of Computer Science.

   To answer this question, please write out *exactly one* of the following sentences, to indicate whether or not you accept to participate in this project.

   - *I hereby **give** permission for any of my written work from CSC 165 H1S to be used anonymously in the WIT Project.*
   - *I hereby **withhold** permission for any of my written work from CSC 165 H1S to be used anonymously in the WIT Project.*

   Note that your participation in this project is completely voluntary and will in no way affect your standing in the course.

2. Consider the following database about computers and the operating systems that they have installed:

Computer	Windows 7	Ubuntu	Mac OS X
1	Yes	Yes	No
2	No	No	Yes
3	Yes	No	No
4	Yes	Yes	No
5	No	No	No
6	No	Yes	No

   State whether each statement below is true or false. Justify your answer.

   (a) The computers run at least one operating system.

   (b) The computers that run Mac OS X do not run any other operating system.

   (c) The computers don't run Ubuntu without also having Windows 7.

3. Consider the set of students who are taking CSC165. And consider the statement:

   (S1) If a CSC165 student does their homework, they will get a good mark in the course.

   (a) Rewrite (S1) in precise symbolic notation. Use implication. Clearly define any predicates and sets that you use.

   (b) Rewrite (S1) in precise symbolic notation **without** using implication. Use the same predicates and sets defined in (a).

   (c) Write the contrapositive of (S1) in:
       i. English
       ii. precise symbolic notation

   (d) Write the converse of (S1) in:
       i. English
       ii. precise symbolic notation

4. Consider the following statements:

   (S2) Every computer on a network has an IP address.
   (S3) If a computer has an IP address, it can share files.

   (a) Using English, rewrite (S2) so that it uses implication explicitly and not universal quantification.

   (b) Rewrite (S2) using precise symbolic notation. Clearly define any predicates and sets that you use.

   (c) Using precise symbolic notation and clearly defined predicates, rewrite (S3).

   (d) Assume that x is a computer and that x is on a network. What, if anything, can you conclude from this? Explain your reasoning.

   (e) Assume that x is a computer and that x does not have an IP address. What, if anything, can you conclude from this? Explain your reasoning.