

CSC 165H1 S February Midterm 2004

L0301

Duration — 50 minutes

Aids allowed: none

Student Number: \_\_\_\_\_

Last Name: \_\_\_\_\_ First Name: \_\_\_\_\_

Tutorial Section: BA-1160  
Alex  
Levinshtein

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*Do **not** turn this page until you have received the signal to start.*  
(Please fill out the identification section above,  
and read the instructions below.) *Good Luck!*

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This midterm consists of 4 questions on 5 pages (including this one).  
*When you receive the signal to start, please make sure that your copy is complete.*

For 1 bonus mark write your student number at the bottom of pages 2-5  
of this test.

# 1: \_\_\_\_\_/ 6

# 2: \_\_\_\_\_/ 8

If you use any space for rough work, indicate clearly what you want  
marked.

# 3: \_\_\_\_\_/ 3

# 4: \_\_\_\_\_/ 8

If you are unable to answer a question (or part of a question), you will  
get 20% of the marks for the question (or part of the question) if you state  
clearly that you do not know how to answer. Note that you will *not* get  
those marks if your answer contains contradictory statements (such as “I do  
not know how to answer” followed or preceded by parts of a solution that  
have not been crossed off).

TOTAL: \_\_\_\_\_/25

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**Question 1.** [6 MARKS]

Consider the statement:

(i) If A then B or C.

**Part (a)** [1 MARK]

What can be concluded from (i), if B is true?

**Part (b)** [1 MARK]

What can be concluded from (i), if A is true?

**Part (c)** [2 MARKS]

Write an English sentence that is equivalent to (i), without using “or” (and without using a word that means “or”).

**Part (d)** [2 MARKS]

Draw a Venn diagram with sets for A, B and C. Make sure that the sets overlap to divide the diagram into 8 regions. Shade in the regions corresponding to where (i) is true, and put an “X” in the regions where it is not true.

**Question 2.** [8 MARKS]

Let  $P$  = the set of people

Let  $T(x, y)$  = person  $x$  is taller than person  $y$

Rewrite the following English sentences using precise symbolic notation:

**Part (a)** [2 MARKS]

Someone is taller than everyone.

**Part (b)** [2 MARKS]

Nobody is taller than him/herself.

**Part (c)** [2 MARKS]

Everyone is taller than someone.

**Part (d)** [2 MARKS]

Terry is not taller than anyone.

**Question 3.** [3 MARKS]

Rewrite the following Java code without using “if” and without using variants like “?:”, “while” and “switch”.

```
if (A) {
    if (B) {
        return true;
    } else {
        return false;
    } else {
        return (C && D);
    }
}
```

**Question 4.** [8 MARKS]

Let  $\mathbb{N}$  = the set of nonnegative integers 0, 1, 2, ...

Consider the sentence:

$$(S4) \forall i \in \mathbb{N}, \exists j \in \mathbb{N}, a_j > i \wedge j \leq i$$

about the sequence  $a_0, a_1, a_2, \dots$

**Part (a)** [2 MARKS]

Express its negation, moving the “not” inside as much as possible.

**Part (b)** [4 MARKS]

For each of the following sequences, state whether (S4) is true or false. Also, if an example or counterexample justifies your claim, give it.

- 5, 6, 6, 7, 7, 7, 8, 8, 8, 8, 9, 9, ...
- 2, 4, 8, 16, 32, 64, 128, 256, ...

**Part (c)** [2 MARKS]

Give the direct proof structure outline for (S4).

Use this page for rough work.

**You can tear this page off, but we will collect it. You must fill in your student number if you tear it off, and you will lose 20% if you keep this page.**

Total Marks = 25

Student #: \_\_\_\_\_

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END OF EXAMINATION