CSC465/2104 Test 1 2022 October 20, 4:10pm-5pm

1 page, 4 questions, 42 marks, 50 minutes
Aids allowed: one letter-sized page, both sides
and the laws from the textbook, 14 pages

The value of each question is indicated in square brackets.
A blank answer is worth about one-third of the marks;
to that, marks will be added for readable and relevant and correct information,
and marks will be subtracted for unreadable or irrelevant or incorrect information.

0[9] Let the variables be x, y: *int* . Write a program to refine specification $\neg ok$. Prove your refinement.

1 Let n and d be *nat* variables. Here is a refinement.

$n' = n + d\times(d-1)/2 \Leftarrow$

if $d=0$ **then** ok **else** $d := d-1.\ n := n+d.\ n' = n + d\times(d-1)/2$ **fi**

(a)[6] Insert appropriate time increments according to the recursive measure, and write an appropriate timing specification and refinement.

(b)[12] Using your timing specification from part (a), prove the timing refinement.

2[9] Let x and y be integer variables, and let L be a list of integers. What is the exact precondition for $\exists y\cdot L\ y < x'$ to be refined by $x := y+1$?

3[6] The specification

var x: *nat*$\cdot\ x := -1$

introduces a local variable and then assigns it a value that is out of bounds. Is this specification implementable? (Proof required.)