Quiz 4 of 4 – Practice Version

Student Number	*Student Name*

This is a closed book exam. No calculators, cellphones, laptops, or other aids are permitted. Answer all questions in the space provided. Show all your work - correct answers presented without justification may receive a mark of zero.

Consider the `xyzzy` algorithm below and answer the questions that follow. This algorithm takes a linear collection (e.g., a list or an array) of size `n` as an argument (i.e., as the input to the algorithm) and produces no return value (i.e., it has no output, but might alter the linear collection). Please note that the implementation of the the `xyzzy` algorithm below requires that you use the unspecified operations `foo`, `bar`, and `qux` - although you don't know what these operations do, you can assume that they all take the same amount of time to complex. You don't need to know anything else about them in order to answer the questions below.

```
define xyzzy(a list of n elements):
     i = 0
     while (i < n):
          foo(list)
          j = 0
          while (j < n):
               bar(list)
               k = 0
               while (k < n):
                    qux(list)
                    k = k + 1
               j = j * 2
          i = i++
```

1. If you were attempting to formally analyze the efficiency of this algorithm, which operation (or operations) from the set `{foo, bar, qux}` would be the best choice for the model of computation?

[2 marks]

Quiz 4 of 4 – Practice Version

Student Number	***Student Name***

This is a closed book exam. No calculators, cellphones, laptops, or other aids are permitted. Answer all questions in the space provided. Show all your work - correct answers presented without justification may receive a mark of zero.

2. If $f(x) = -3x^2 + 6x + 2$, prove that $f(x)$ is $O(x^2)$ using the technique demonstrated in class. Explicitly state the two witnesses (i.e., provide the values for k and c) that you have used for your proof and show all of your work. [5 marks]

3. If $f(x) = 10x^2 + 7$, prove that $f(x)$ is $\Omega(\log(x))$ using the technique demonstrated in class. Explicitly state the two witnesses (i.e., provide the values for k and c) that you have used for your proof and show all of your work. [5 marks]

Student Number	***Student Name***

This is a closed book exam. No calculators, cellphones, laptops, or other aids are permitted. Answer all questions in the space provided. Show all your work - correct answers presented without justification may receive a mark of zero.

4. If $f(x)$ is $O(g(x))$ then $\forall x \geq k_1 \quad f(x) \leq c_1 \cdot g(x)$.
   If $g(x)$ is $\Omega(h(x))$ then $\forall x \geq k_2 \quad g(x) \geq c_2 \cdot h(x)$.

   Assume that:

   $f(x)$ is $O(g(x))$ and $g(x)$ is $\Omega(h(x))$

   and answer the following questions.

   [3 marks]

   a) Does $f(x)$ necessarily have to be $O(h(x))$? If the answer is no you only need to state that it is not, but if the answer is yes, then you must prove it and provide the values for the witnesses (i.e., provide values for k and c).

   b) Does $h(x)$ necessarily have to be $O(g(x))$? If the answer is no you only need to state that it is not, but if the answer is yes, then you must prove it and provide the values for the witnesses (i.e., provide values for k and c).

COMP1805 (Winter 2017) – "Discrete Structures I"

Quiz 4 of 4 – Practice Version

Student Number	***Student Name***

This is a closed book exam. No calculators, cellphones, laptops, or other aids are permitted. Answer all questions in the space provided. Show all your work - correct answers presented without justification may receive a mark of zero.