CMPUT 101 – Solutions
Quiz 1 (50 minutes)
October 19, 2000

Last Name: _____

First Name: _____

Student ID: _____

Section: A6

Instructor: Yngvi Bjornsson

Instructions: Read carefully before proceeding.

No calculators, books or other aids are permitted for this test.

1. Write your name and ID number in the provided space above.
2. Wait until you are told to start working on the test (**don't flip the pages yet**).
3. Write your ID number on top of all remaining pages in the test, only then start answering the questions. Put all your answers on the test paper, no additional sheets of papers can be handed it. You can use the back of the pages for your scratch notes and calculations.
4. When you are told that the time is up, stop working on the test.

Good luck!

Marks: (don't write anything below)

1	2	3	4	Total
10	30	5	5	50

A

Part I (Multiple choice) Circle the letter of the best choice (only one)

1. (2 mark) Which one of the following properties is NOT necessarily true for an algorithm:
    a. the order in which the steps are executed is well defined
    b. each step is unambiguous and effectively computable
    c. it produces a result
    d. it has at least one Get statement
    e. it stops

2. (2 marks) How many comparisons on average does it take for a *sequential search* to locate a name in a list of *n* names?
    a. 1
    b. n/2
    c. n
    d. 2n
    e. n^2

3. (2 marks) How many comparison does it take *binary search* to locate the name Kim in the following list of names: Ann, Bob, Garry, Jill, Kim, Mary, Sid
    a. 1
    b. 2
    c. 3
    d. 4
    e. 5

4. (2 marks) Two algorithms A and B are given, of order $O(n)$ and $O(n^2)$ respectively. What does that say us about the algorithms?
    a. Given input of size 10, algorithm A will perform 10 steps.
    b. Given input of size 10, algorithm B will perform 100 steps.
    c. Algorithm B always performs more work than algorithm A.
    d. All of the above.
    e. None of the above.

5. (2 mark) A logic gate is
    a. an electronic device that produces output of a Boolean operation
    b. always has 1 output
    c. always has 2 inputs
    d. a and b above
    e. a, b, and c above

Part II: Algorithms

1. (4 marks) We are given two algorithms, A and B.

   Algorithm A   Algorithm B

   Get values for *a* and *b*   Get values for *a* and *b*
   Repeat until *a* > *b*   While *a* < *b* do
      Print the values of *a*, *b*   Print the values of *a*, *b*
      Add 1 to *a*   Add 1 to *a*
   End loop   End loop
   Stop   Stop

   What do the two algorithms print out when given the input a=2 and b=4?

   a) Output for algorithm A   b) Output for algorithm B

   2   4   2   4
   3   4   3   4
   4   4

2. (8 marks) Use s*election sort* to order the following list of numbers in an ascending order (the algorithm is given below): 4, 3, 1, 2

   1. Get values for *n* and the *n* list items
   2. Set the marker for the unsorted section at the end of the list
   3. Repeat steps 4 through 6 until the unsorted section of the list has one element
   4.   Select the largest number in the unsorted section of the list
   5.   Exchange this number with the last number in the unsorted section of the list
   6.   Move the marker for the unsorted section forward (left) one position.
   7. Stop

a) Show the list after each exchange:

INITIAL LIST: **4, 3, 1, 2**
                       2, 3, 1, 4
                       2, 1, 3, 4
                       1, 2, 3, 4

b) How many comparisons of the elements in the list did the algorithm do in total?

   3+2+1 = 6

c) How many exchanges of the elements in the list did the algorithm do in total?

   3

3. (3 marks) Write an algorithm that reads in 2 numbers and prints out the value of the larger one. For example, if given the input values 8 and 6 the algorithm outputs 8.

Get values for a, b
If a > b then
    Print a
Else
    Print b
Stop

4. (5 marks) Write an algorithm that reads in 5 numbers and prints out their sum. Use a loop to read in the numbers and sum them up.

Set sum to 0
Set i to 1
Repeat until i > 5
    Get value for n
    Add n to sum
    Add 1 to i
End loop
Print sum

5. (8 marks) Write an algorithm that goes through a list of 10 numbers and prints out an element if it is equal to the element preceding it in the list. For example, if given the input: 1, 5, 3, 3, 5, 2, 2, 2, 6, 1 the algorithm would print out

        3
        2
        2

You may assume that the numbers have already been read in by the algorithm and are stored in variables N_1, N_2, … N_{10}. Use a loop.

Set i to 2
While i < 11 do
    If $N_i = N_{i-1}$ then
        Print N_i
    Add 1 to i
End loop

6. (2 marks) An algorithm that is O(n) takes 10 seconds to execute on a particular computer when the input size n is 200. How long would you expect it to take when n = 600? Briefly explain the reason for your answer.

30 sec. We expect the amount of work to grow proportionally with the size of the input for a O(n) algorithm. *(An answer different from 30 sec. might also be considered correct if a consistent explanation is provided.)*

Part III: Data Representation

1. (1 mark) Convert the binary number 11010 to decimal. Show your work.

16 + 8 + 2 = 26

2. (2 marks) Convert the decimal number 19 to a binary notation. Show your work.

16 8 4 2 1
1 0 0 1 1   = 10011

3. (1 mark) Show how an 8-bit computer using sign/magnitude notation to represent negative integers stores the decimal value –19.

1	0	0	1	0	0	1	1

4. (1 mark) Use the ASCII table supplied on the next page to help you find out what 3 letter English word the following binary code stands for (note: it is important to distinguish between upper- and lower case characters).

01000011 01100001 01110100 =   **C a t**

Part IV: Boolean Logic and Gates.

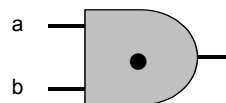1. (3 marks) Are these Boolean expressions True or False, when X=10, Y=15?

a) (X>5) AND (NOT (Y=10))   __**T**__ (T/F)

b) (X<Y) AND ((X<Y) OR (NOT (Y=15)))   __**T**__ (T/F)

c) (X=15) AND (X<Y) AND (Y=15)   __**F**__ (T/F)

2. (2 marks) Following is a picture of a logic gate:

a) What type of gate is this? **AND gate**

b) Fill in the truth table describing the output of the gate:

A	b	output
0	0	**0**
0	1	**0**
1	0	**0**
1	1	**1**