Name:_____**CSC 101 - Midterm Exam**

Answer **all** of the questions in Part 1, **three** of the questions in Part 2, and **all** of the questions in Part 3.

Part 1

TRUE or FALSE?
(Each question is worth 1.5 point.)

(a) If the bit pattern `001001100` appears at multiple places in a computers memory, the pattern is guaranteed to refer to the same value each time.

(b) The binary value 1101_2 represents the decimal number 27.

(c) When a Web page is loaded into a Web browser, JavaScript code in that page, is executed by a JavaScript intepreter that is embedded in the browser.

(d) When a message is broken into packets for transmission over the Internet, it is guaranteed that all packets will take the same route from source to destination.

(e) The Turing Test was proposed by Alan Turing as a means of determining whether an artificially intelligent machine has been constructed.

(f) Suppose you have been given a sorted list of 100 names and need to find a particular name in that list. Using binary search, you might have to look at every location in the list before finding the desired name.

(g) Private key encryption algorithms require the sender and the recipient of a message to agree upon a secret key for encoding and decoding the message.

(h) As computer programs can be complex and difficult to write, they are known as "hardware".

(i) Vacuum tubes, as they have no moving parts, enable the switching of electrical signals at speeds far exceeding those of relays.

(j) `142.120.350.231` is an example of an IP address.

Part 2

(Pick **three**. Each question is worth 15 points.)

(a) What decimal value is represented by the binary number 01101001_2. Show all the steps involved in the conversion.

(b) Suppose you have been given an $\mathcal{O}(N)$ algorithm that averages student grades, where N is the number of grades. If it takes one minute to average 100 grades using the algorithm, how long would you expect it to take to average 200 grades? 400 grades? Justify your answer.

(c) What is the difference between a compiler and an interpreter?

(d) How does caching improve the performance of a Web browser?

Part 3

(Each question is worth 20 points.)

(a) Internet communications are defined by a set of protocols called TCP/IP. What do TCP and IP stand for, and what is the role of each protocol in transmitting and receiving information?

(b) Suppose you needed to look up a number in your local phone book that has $1073741824 (= 2^{30})$ entries. How many checks would be required, in the worst case, to find the phone number using sequential search? How many checks would be required, in the worst case, to find the phone number using binary search?

(c) Using 32 bits to represent integers, the largest positive value that can be represented is $2^{31} - 1$, whereas the smallest negative value is -2^{31}. Why aren't these ranges symmetric? That is, why is there one more negative integer than there are positive integers?