COMP273 Assignment 1 - Fall 2015, Prof. Kry

School of Computer Science, McGill University
Available: September 15
Due date: 2:00 PM September 29
Submit electronically via MyCourses

1 Number Representation (6 marks)

Show your work in the following questions to get full credit.

1. Convert 1101001 from binary to decimal and hexadecimal.

2. Convert 0.101101 from binary to decimal and hexadecimal.

3. Convert 5.25 from decimal to binary and hexadecimal.

4. Convert 0xBEEF from hexadecimal to decimal and binary.

5. Convert 2752.740064 from octal to binary and hexadecimal.

6. Represent the base 10 number -4128785 as a 24 bit signed binary number using two's complement format, and also write your answer as a 6 digit hexadecimal.

2 Floating Point Number Representation (2 marks)

1. Represent 2.71828 as an IEEE single precision floating point number. Is the representation exact? Show your work. Give your answer in both binary and hexadecimal.

2. Represent 1.0×10^{-12} as an IEEE single precision floating point number. Hint: use log to convert 10^{-12} to an integer power of two multiplied by a factor. Show your work and give your answer in both binary and hexadecimal.

3 Boolean Algebra (2 marks)

1. Prove that a two-input multiplexor is universal by showing how to build the AND, OR, and NOT gates using a multiplexor.

2. Write a truth table to check a 4 bit sequence for odd parity. That is, the function should be true if the bit sequence has an odd number of 1s. Write down a sum of products expression for the function.

4 Circuit Design (10 Marks)

In this question you will build a 4 multiplication circuit. You must build your circuit in the Logisim software using only the AND, OR, and NOT gates provided in the built in library. Use wiring and organize your solution into sub-circuits using clear names and labels. Use the provided file to start your circuit, as it already defines the 4 bit inputs *a* and *b*, and the 8 bit output *product*. Furthermore, the filename, circuit name, and sub-circuit appearance (right-most toolbar button in logisim) must remain unchanged to allow for testing.

You will likely want to create half adder and full adder sub-circuits, and furthermore, take inspiration from the carry save adder circuit presented in Appendix C of the book. Use the Project → Get Circuit Statistics tool to evaluate the complexity of your circuit. Sum the number of NOT AND and OR gates in the recursive column, and receive one mark bonus if you can use less than 105 gates in a correct solution (you must only use 2 input AND and OR gates, and furthermore, you must use NOT gates rather than negating inputs in the properties of other gates).

Submission Instructions

All work must be your own, and must be submitted by MyCourses. Include your name and student number in all documents submitted, that is, in your Logisim circuit, and in your submission of other written answers. Written answers should be scanned (must be legible) and submitted as PDF. Alternatively it is also acceptable to typeset the answers and submit as PDF, RTF, or TXT, however, the written portion of the assignment should be submitted as a single file. Your circuits should be submitted as a CIRC file, and must respect the filename, circuit name, and circuit layout specified so that we can run tests. Use a zip archive to bundle your submitted files (do not use other types of archives). You should not include any directory structure in your submitted zip file (i.e., submit the two files). Be sure to check your submission by downloading your submission from the server and checking that it was correctly submitted. You will not recieve marks for work that is incorrectly submitted.