CSC B58 Winter 2017 Midterm Test
Duration — 1 hour and 50 minutes
Aids allowed: none

Student Number: |_|_|_|_|_|_|_|_|_|_|_|_|_|

UTORid: |_|_|_|_|_|_|_|_|_|_|_|_|_|

Last Name: _____ **First Name:** _____

Question 0. [1 MARK]

Read and follow all instructions on this page, and fill in all fields appropriately.

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*Do **not** turn this page until you have received the signal to start.*
(Please fill out the identification section above, **write your name on the back of the test**, and read the instructions below.)
Good Luck!

This midterm is double-sided, and consists of 9 questions on 14 pages (including this one). When you receive the signal to start, please make sure that you have all pages.

- If you use any space for rough work, indicate clearly what you want marked.
- Do not remove any pages from the exam booklet.
- Draw a smiley face in the bottom right corner of this page
- You may use a pencil; however, work written in pencil will not be considered for remarking.

0: _____/ 1
1: _____/ 7
2: _____/ 3
3: _____/12
4: _____/12

TOTAL: _____/35

[Use the space below for rough work. This page will not be marked unless you clearly indicate the part of your work that you want us to mark.]

Question 1. [7 MARKS]

Answer the following questions in the space provided. When providing a written answer, please write **as clearly and legibly as possible**. Marks will not be awarded to unreadable answers.

(a) What are the minimum and maximum values you can represent with a **signed** 7-bit binary number (give your answers in both decimal and binary format)

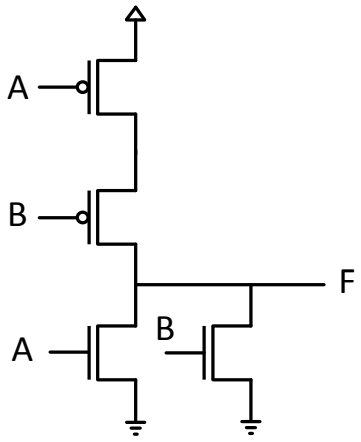
(b) What are the minimum and maximum values you can represent with a **unsigned** 7-bit binary number (give your answers in both decimal and binary format)

(c) Compute the value of 75 - 131 by converting both numbers to binary, and using 2s compliment addition. Show all your work.

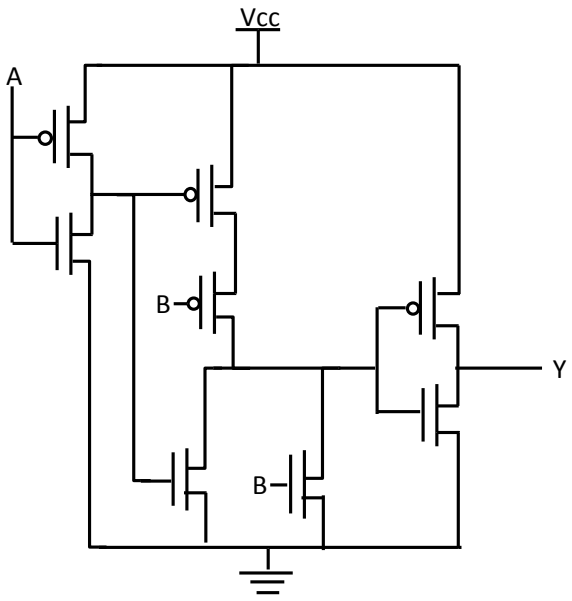
[Use the space below for rough work. This page will not be marked unless you clearly indicate the part of your work that you want us to mark.]

Question 2. [3 MARKS]

(d) Complete the truth tables of the following circuits in the space provided



A	B	Y
0	0	
0	1	
1	0	
1	1	



A	B	Y
0	0	
0	1	
1	0	
1	1	

[Use the space below for rough work. This page will not be marked unless you clearly indicate the part of your work that you want us to mark.]

Question 3. [12 MARKS]

Consider the following description:

> The circuit should have 3 inputs A, B and C, and an output X. When A is high, the output should act as an XOR for B and C. When A is low, The output should be high whenever C is on, and low otherwise.

(a) Draw the truth table for the circuit described above

(b) Write the expression for the circuit above as a sum of minterms

[Use the space below for rough work. This page will not be marked unless you clearly indicate the part of your work that you want us to mark.]

(c) Draw the Karnaugh map for the circuit

(d) Provide a reduced expression for the circuit

(e) Draw the circuit in the space below using only NOR and NOT gates.

[Use the space below for rough work. This page will not be marked unless you clearly indicate the part of your work that you want us to mark.]

Question 4. [12 MARKS]

The Pan Am Centre has a walking track, and they want to make sure people always walk around the track in the same direction. One day they walk clockwise and the next they walk counter-clockwise. They've asked you to build them a digital sign that will display the direction to walk. Each time a change signal is sent, it should alternate between a right and a left arrow (if no change signal is sent, it should stay in whatever state it is in). There is also a closed signal that will cause the sign to turn into an X, and stay in that state regardless of the change signal. Once the closed signal disappears, on the next change signal it will always go back to clockwise (a left arrow).

(a) Draw the FSM for the sign

(b) Draw the state table for the sign.

[Use the space below for rough work. This page will not be marked unless you clearly indicate the part of your work that you want us to mark.]

(c) Assign flip-flop configurations to each state, and re-draw the state table showing the flip-flop values.

(d) Produce a series of boolean expressions for the sign

Last Name: _____ **First Name:** _____