THE UNIVERSITY OF BRITISH COLUMBIA

Department of Electrical & Computer Engineering

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EECE 256 – Sections 101 & 102

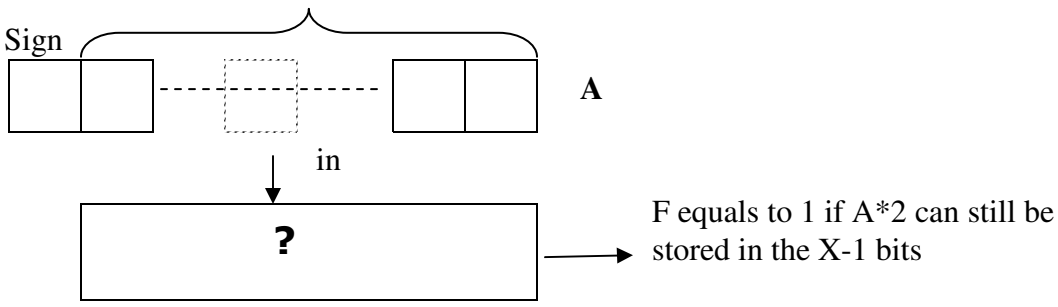
Student name:_____ S#: _____Section:_____

Midterm – 50 minutes

Closed book – No calculators are allowed

1. Consider number A of X bits stored in sign magnitude as shown in the figure below (most significant bit is the sign, X-1 bits magnitude). Design the digital circuit that can inform us (by turning a light on) that if the number stored in this location was to be multiplied by 2, it would result in a number that could still be stored in the X-1 bits (i.e., no overflow would result). Your can assume that in your design you may use "wires" connected directly to the bit locations. Use the **MINIMUM** number of gates.

*(20%) – **show all your work.***



2. Design a combinational circuit that has three inputs, x , y, z and three outputs A, B, C. When the input is from 0 to 3, the output is one greater than the input. For the rest of the input values, the output is one less than the input. Assume that for your circuit you have available only 2-input NAND gates, 2-input ex-OR gates and 2-input ex-NOR gates. Use the minimum number gates for your design (i.e., your circuit may have all of these gates but the total number of gates must be the smallest possible). *(40%)* – ***show all your work (Truth Table, K-Maps, design)***

3. Design a counter that uses JK flip flops and goes through the following repeated sequence: 0, 1, 2, 4, 5. Treat the unused states as don't care conditions.

    a. Show the state diagram (10%)

    b. Show the state table – use don't care conditions for the unused states (10%)

    c. Design the circuit using the minimum number of 2-input gates. (10%)

    d. If by mistake (e.g., interference) your circuit jumps to number 3, is it still going to work? Explain. (*Hint: show what happens if your circuit has state 011*) (10%)

    – ***show all your work***