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Student ID:

EHB205E Introduction to Logic Design
Homework 1

Deadline: 5/11/2021 (before 9:30)

1. CONVERSION BETWEEN NUMBER REPRESENTATIONS

Perform the following number conversions:

a) Binary $(100111,10111)_2$ to decimal, octal and hexadecimal.

b) Octal $(72,6)_8$ to decimal, binary and hexadecimal.

c) Hexadecimal $(C3,AD5)_{16}$ to decimal, binary and octal.

2. SIMPLIFIED SUM OF PRODUCT (SOP) EXPRESSIONS

Express the following Boolean functions in SOP forms with using minimum number literals. Write down the total **number of literals** for your simplified expressions (for example, $x_1\overline{x_2}x_3 + x_1\overline{x_3}$ has 5 literals).

a) $f_1 = \overline{x_1x_2 + x_2x_3 + x_3x_4}$

b) $f_2 = \overline{\overline{x_1}x_2x_3 + x_1x_4}$

c) $f_3 = \overline{x_1\overline{x_2}x_3 + x_1\overline{x_4} + x_2x_3\overline{x_4}}$

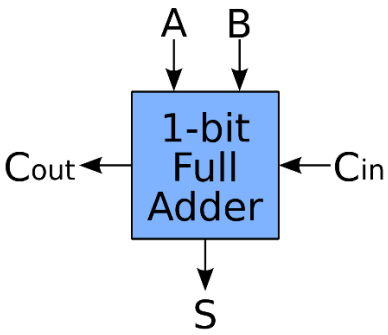
d) $f_4 = \overline{x_1x_2\overline{x_3} + x_1\overline{x_2}x_3 + \overline{x_1}x_2x_3 + \overline{x_1}\,\overline{x_2}\,\overline{x_3}}$

3. DESIGNING A 4-INPUT & 1-OUTPUT CIRCUIT

Consider a circuit with 4 inputs and 1 output such that a transition (0-to-1 or 1-to-0) in one of the inputs always results in a transition at the output (0-to-1 or 1-to-0). Derive the **truth table** of this circuit.

4. DESIGNING A 1-BIT FULL ADDER

Consider a 1-bit full adder with its circuit symbol and truth table shown below. Derive **Boolean functions both in SOP and SOP forms of the outputs in terms of the inputs, and simplify them**. There should be total of 4 expressions.



Inputs			Outputs	
A	B	Cin	Cout	S
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	0
1	1	1	1	1

5. DESIGNING A 2-BIT by 2-BIT MULTIPLIER

The multiplier has two 2-bit inputs and a 4-bit output. **Design the circuit using 1-bit full adders and NAND gates**. Try to use minimum number of adders and NAND gates.

Grading: 1a)3%, 1b)2%, 1c)2%; 2a)7%, 2b)7%, 2c)7%, 2d)7%; 3)15%; 4)25%; 5)25%

Note: *Return a hard-copy of your homework.*