CMPU-224 Lab8 Quiz Solutions

Spring 2025

Name: _____

This is a closed book, closed notes quiz. No electronic devices are allowed. You have until 3:30pm to complete the quiz. There are a total of 4 questions and 10 points.

There should be enough space on the quiz for your answers. If you need more space to work out a problem, blank paper will be available, just ask.

If you finish with time remaining, raise you hand and I will come and collect your quiz. You may then work on the lab assignment.

Good Luck!

1. (4 points) The truth table below defines a combinational circuit with three inputs (`A`, `B`, `C`) and two outputs (`X`, `Y`). Using the **Sum of Products** method, derive a Boolean equation for each output. Use C-style notation: `~` for NOT, `|` for OR, and `&` for AND.

A	B	C	X	Y
0	0	0	0	0
0	0	1	0	1
0	1	0	1	0
0	1	1	1	1
1	0	0	0	0
1	0	1	1	0
1	1	0	1	1
1	1	1	0	1

`X =` _____

`Y =` _____

Solution: Write one AND-term (minterm) per row where the output is 1, then OR them all together. Rows where X = 1: (0,1,0), (0,1,1), (1,0,1), (1,1,0). Rows where Y = 1: (0,0,1), (0,1,1), (1,1,0), (1,1,1).

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X = (~A & B & ~C) | (~A & B & C) | (A & ~B & C) | (A & B & ~C)

Y = (~A & ~B & C) | (~A & B & C) | (A & B & ~C) | (A & B & C)
```

2. (2 points) Which of the following best describes the key difference between a **combinational** circuit and a **sequential** circuit?

   A. A combinational circuit requires a clock signal; a sequential circuit does not.

   B. A sequential circuit's output can depend on past inputs (it has memory); a combinational circuit's output depends only on its current inputs.

   C. A combinational circuit can store data in registers; a sequential circuit cannot.

   D. A sequential circuit uses only AND and OR gates; a combinational circuit uses all gate types.

3. (2 points) Which expression is equivalent to `~(A & B)` according to **DeMorgan's Law**?

   A. `~A & ~B`

   B. `~A | ~B`

   C. `A | B`

   D. `~(A | B)`

4. (2 points) An edge-triggered D latch (register) captures and stores its input value at what point in the clock cycle?

   A. Continuously, while the clock signal is high (logic 1)

   B. Continuously, while the clock signal is low (logic 0)

   C. Briefly, on the rising edge of the clock signal

   D. Briefly, on the falling edge of the clock signal