Ryerson University
Department of Computer Science
CPS213 – Computer Organization I
Spring 2016
Final Exam
June 28, 2016 at 9:40 PM - Duration: 120 minutes
No Aids Allowed.

Examiner: Hamid Timorabadi

Family Name: _____ Given Name: _____

Student #: _____

INSTRUCTIONS:

- The value of each question is indicated in the square brackets.
- All work is to be done on these sheets.
- Use the back of the pages if you need more space.
- Show details of your solutions for all questions.

Signature: _____

Questions	Marks
1	**/15**
2	**/15**
3	**/10**
4	**/10**
Total	**/50**

1 – Part A: [7 Marks**]** Find the minimal algebraic functions for the following functions.

i. **F(A, B, C, D) = Π(2, 3, 7, 10, 13, 14)**
d(A, B, C, D) = Σ(0, 4, 8, 12, 15)

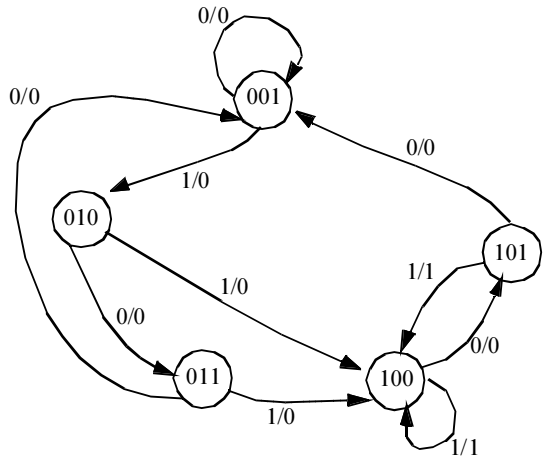
ii. **f(a, b, c, d) = Σ(0, 2, 8, 9, 10, 15)**
d(a, b, c, d) = Σ(7)

1 – Part B: [8 Marks] Design a one-input (x), one-output (y) 2's complementer. The circuit can be reset asynchronously.

2 – Part A: [7 Marks**]** Build a T flip-flop from a D flip-flop.

2 – Part B: [8 marks] Design a circuit that compares two 2-bit numbers, a (a_1a_0) and b (b_1b_0), and outputs 1if $a<b$, 0 otherwise.

3 – [10 Marks] Using D flip-flops design a circuit that implements the following state diagram. Provide the minimized algebraic equations. Do not draw the circuit diagram.



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4- [10 Marks] Draw the timing diagram for the following circuit for three points of ***A, B,*** and ***C*** with initial condition of ***zeros*** and provided the reset signal.
Note that all the flip-flops are edge-triggered.