YOUR NAME: ____________________________ YOUR TA’s NAME: ____________

LAST FOUR DIGITS OF YOUR UF-ID: ___ ___ ___ ___ Please Print Clearly (Block Letters)

Date Assigned: 14 January 2016 IN CLASS
Date Due: 26 January 2016 AT BEGINNING OF CLASS

This homework assignment must be completed by you alone. You may not copy from others.
However, you may study with others or use external references to determine general solutions.
Then you must complete the problems as your own work, not copying others’ work.

Questions about this homework should be addressed to your TA first. You can find your TA’s email at the class website: http://www.cise.ufl.edu/~mssz/CompOrg/TA-hours.html

This homework has three parts: (I) Regular Questions, (II) Problems to Solve, (III) Extra Credit.
Complete all the work you can – there is no penalty for guessing.

Part I. Regular Questions [20 points total]

1. Vocabulary: (terms you need to know to discuss the subject intelligently) – Define the following terms using 1-3 sentences (and a diagram, if needed): [3 points each]
   a. Boolean numbers – what are they and how are they used?
   b. D flip-flop – what is it and how is it used in computers?
   c. Idempotency Laws (for Boolean logic) – What are they and why are they important?
   d. Moore’s Law – what does it say, and why is this important in computer science/engineering?
   e. What is the von Neumann bottleneck and why does it occur?

2. Concept Discussion: Digital Clock & its Duty Cycle – (a) what is it (draw a picture) and (b) why is it important and/or useful in computing? [2 pts for a), 3 pts for b)]

Part II. Problems to Solve (DO NOT MINIMIZE CIRCUITS) [20 points total]

3. Logic Equation, Truth Table, and Circuit: (a) Draw the truth table of the following logic equation that has input variables x, y, and z:

   \[ f(x,y,z) = (x \text{ NOR } y) \text{ NAND } (\text{NOT}(z) \text{ OR } y) \]

   Then (b) draw the SOP logic circuit representation using NOT, AND, OR gate representations as in the viewgraphs for Lectures #2 & #3. [3 pts for a), 3 pts for b)]
Part II. Problems to Solve (continued)

4. **Logic Equation, Truth Table, and Transformation:** (a) Draw a truth table of the following logic equation that has Boolean input variables \( x, y, \) and \( z \):
\[
g(x, y, z) = (x \text{ AND} (y \text{ NOR} z)) \text{ NAND} \text{ NOT}(z),
\]
then (b) derive the **product-of-sums (POS) form of the logic equation** like we did in recitation sections. (Hint: The resulting equation might (or might not) be simple …)

[3 pts for a), 3 pts for b)]

**Hint:** For part b), you should transform the above equation for the logic function \( g \) using the table of transformations for Boolean logic presented in the Lecture #2 viewgraphs. **Do not use minimization to produce or simplify the result equation.**

5. **Logic Equation and Circuit from Truth Table:** Given the following truth table entries for a logical function \( h(x, y, z) \) of input variables \( x, y, \) and \( z \):
\[
h(0,1,1) = 1; \quad h(1,0,1) = 0; \quad h(1,1,0) = 1
\]
(a) use the truth table to write out only the sum-of-products (SOP) minterms and SOP equation for which the function \( h \) gives a result of 1 (logical true). Then, (b) transform the SOP equation to POS (product-of-sums) form; and (c) draw the POS logic circuit using only NOT, AND, OR gates.

[2 pts for a), 3 pts for b), 3 pts for c]]

Part III. Extra Credit

6. **Performance Measurement:** (a) What does benchmarking and performance measurement tell us about a computer? (b) What does SPEC mean, and why do we use benchmarks from www.spec.org to measure system performance? (c) What type of benchmark results do we combine using the arithmetic mean operator?

*Justify each answer to get full credit.*

[5 points for each part a), b), and c)]