Boise State University
Department of Electrical and Computer Engineering, EE 230 Digital Systems
Test 2, Day: April 4, 2007, Location: ET 103, Time: 10:40am to 11:55am

Name: _____

Instructions: *Show all steps and logic circuits for full or partial credits. It is very important that you write clearly, so that your test can be graded appropriately and fairly. This is a closed book and closed notes test.* ***ABSOLUTELY NO calculator.***

1. (20 points) Design the following function F using: $f = BC + A\overline{B}\overline{C} + AB\overline{C} + AB$, with A as MSB, and C as LSB.
- *a.* one 4-to-1 multiplexer with other necessary basic logic gates,
- *b.* one 2-to-1 multiplexer with other necessary basic logic gates,
- *c.* one 3-to-8 decoder with necessary basic logic gate, and
- *d.* two-input LUTs.

2. (10 points) Convert the following numbers
- *a.* $(215.56)_{10}$ to binary
- *b.* $(00101011.1011)_2$ to decimal

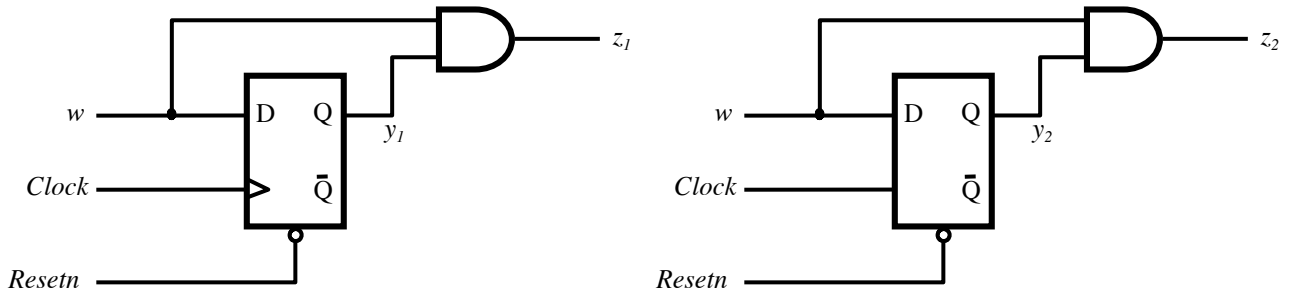
3. (10 points) Carry-lookahead adder versus ripple-carry adder
- *a.* which one uses more resources
- *b.* which one is faster
- *c.* which one is better

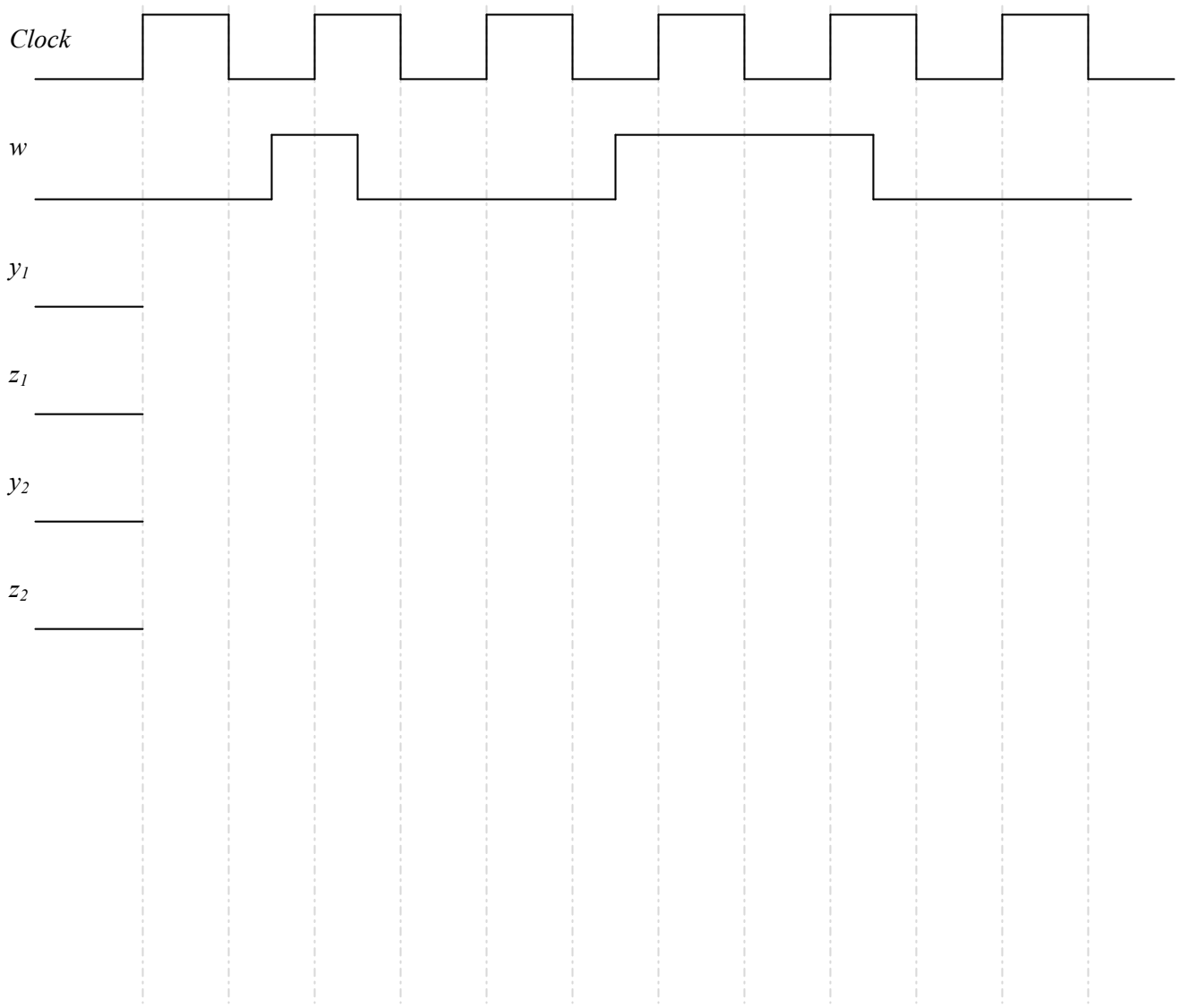
4. (10 points) 2's complement representation is more suitable for use to represent negative numbers. Why?

5. (10 points) How many bits is the result when you ADD two 4-bit numbers? What is an `overflow` signal (*Explain what is overflow without using the word "overflow"*)? How do you generate the `overflow` signal? Assuming this is an unsigned addition.

6. (15 points)
- *a.* what's the main difference between latch and flip-flop?
- *b.* what is flip-flop setup time?
- *c.* what is flip-flop hold time?

7. (25 points) Complete the following timing diagram.




Clock
w
y_1
z_1
y_2
z_2