

C335 Homework #6

Points:	: 40 points
Due Date:	: April 2 nd (no late submissions)
Submissions:	: Hardcopy (please type or write your solution clearly)

PART I (9 POINTS)

Assume that X consists of 2 bits, x_1 and x_0 , and Y consists of 2 bits, y_1 and y_0 . Write logic functions that are true if and only if

- (A) $X < Y$, where X and Y are thought of as unsigned binary numbers
- (B) $X < Y$, where X and Y are thought of as signed (two's complement) numbers
- (C) $X = Y$

PART II (12 POINTS)

Describe the effect that a single stuck-at-0 fault (i.e., regardless of what it should be, the signal is always 0) would have for the signals shown below, in the single-cycle datapath (shown in the figure in Part IV). Which instructions (R-type, lw, sw, or beq), if any, will not work correctly? Explain why.

Consider each of the following faults separately:

- A) RegWrite = 0
- B) ALUOp0 = 0
- C) ALUOp1 = 0
- D) Branch = 0
- E) MemRead = 0
- F) MemWrite = 0

PART III (12 POINTS)

This exercise is similar to Part II, but this time consider stuck-at-1 faults. Describe the effect that a single stuck-at-1 fault (i.e., regardless of what it should be, the signal is always 1) would have for the signals shown below, in the single-cycle datapath (shown in the figure in Part IV). Which instructions (R-type, lw, sw, or beq), if any, will not work correctly? Explain why.

Consider each of the following faults separately:

- A) RegWrite = 1
- B) ALUOp0 = 1
- C) ALUOp1 = 1
- D) Branch = 1
- E) MemRead = 1
- F) MemWrite = 1

PART IV (7 POINTS)

We wish to add the instructions jr (jump register) to the single-cycle datapath described in the lectures. Add any necessary datapaths and control signals to the single-cycle datapath shown in the Figure below. Then fill the table that demonstrates the setting of the control lines.

