

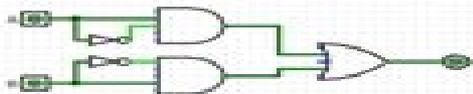
# Computer Architecture 1 Final Exam

ELE319, Hanyang University, 2019 Spring.  
ID: \_\_\_\_\_ Name: \_\_\_\_\_

Department: \_\_\_\_\_

The first two problems are mandatory. If you fail to answer the questions, you will not receive any credit.

- (5pt) Specify the 5-stage pipeline and explain what operation is performed at each stage.
- (5pt) Specify three hazards in processor pipelining and explain hardware and software approaches to solve the hazards.
- (5pt) Write the output value (C) for the given circuits if  $A=1$  and  $B=1$ .



- (5pt) We construct a 2-bit multiplier using Mux as following. Two inputs are provided to a selector in Mux. For instance,  $01 * 01 = 0001$  and  $00 * 00 = 0000$  in the following figure. Fill the remained constant input values in the Mux to complete the multiplier. (1.5pt)



- (5pt) Similarly, we are constructing a divider using a ROM as following. In the example, if dividend is 5 and divisor is 2 then quotient is 2 and remainder is 1. Hence,  $0x21$  is stored at address  $0x52$ . What value should be stored at address  $0x53$  in the ROM to support the divider? (1.5pt)



- (5pt) What is the difference between latch and flip-flop? (5pt)
- (5pt) For the following arithmetic unit, we want to compute  $A-B$  where 2's complement number is used. Determine proper values for  $S1, S0, Cin$  to make  $F = A-B$ .



- (24pt) The following figure shows single cycle implementation for datapath and control path for MIPS architecture.



Fill 0, 1 or X(don't care) in the following table to implement for the architecture.

Instruction	ALU Op	MEMOp	Reg Write	Mem Read	Mem Write	Branch
R-type instruction	(1)	(2)	(3)	(4)	(5)	(6)
Load	(7)	(8)	(9)	(10)	(11)	(12)
Store	(13)	(14)	(15)	(16)	(17)	(18)
branch	(19)	(20)	(21)	(22)	(23)	(24)

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**Christian Drosten**



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