

22341 Computer Organization (Fall 2010)
Second Exam Solution

وقت الشعبة:

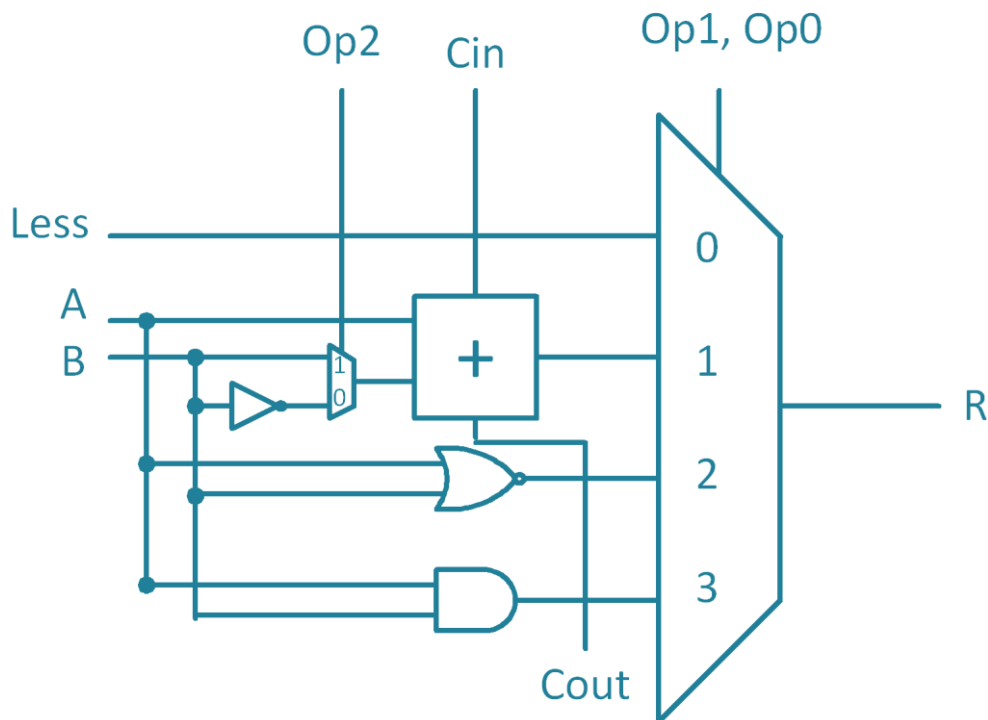
رقم التسجيل:

الاسم:

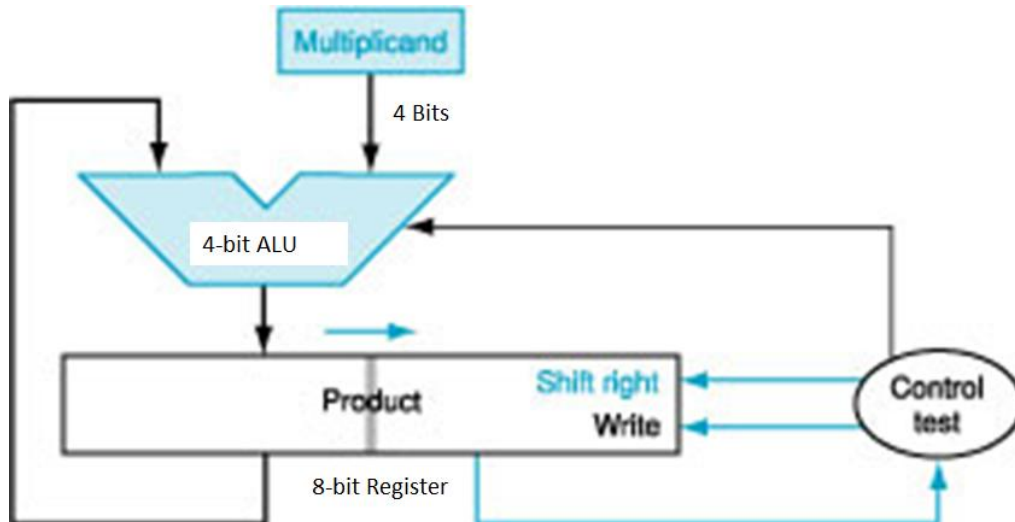
Instructions: Time **50** min. Closed books & notes. No calculators or mobile phones. No questions are allowed. Show your work clearly. Every problem is for 5 marks.

Q1. Draw the logic diagram of a 1-bit ALU slice that implements the following functions. This slice should be suitable for the least significant bits of the ALU. Assume that the inputs to this slice are: Operands *A* and *B*, *Carry_{in}*, *Less*, *Operation₀* through *Operation₂*. Also assume that the output is *R* and *Carry_{out}*.

Function	Operation
slt	000
sub	001
add	101
nor	110
and	111



Q2. Show the contents of the two registers of the optimized multiplication hardware shown below when multiplying X=1011 by Y=0110 over the 4 multiplication steps.



Cycle	Multiplicand	Product
0	1011	0000 0110
1	1011	0000 0011
2	1011	1011 0011 0101 1001
3	1011	10000 1001 1000 0100
4	1011	0100 0010

Q3. The following two numbers are single-precision floating-point numbers in the IEEE 754 format. Add them using the algorithm described in the class and write the result in the space provided below using the same format.

$$X_1 = \quad 0 \ 10000010 \ 010100000000000000000000$$

$$X_2 = \quad 1 \ 10000000 \ 011000000000000000000000$$

1) Alignment

$$X_1 = (-1)^0 * 1.0101 * 2^{130} = + 1.0101 * 2^{130}$$

$$X_2 = (-1)^1 * 1.011 * 2^{128} = - 0.01011 * 2^{130}$$

2) Addition

$$\begin{array}{r} 1.01010 \\ - 0.01011 \\ \hline 0.11111 \end{array}$$

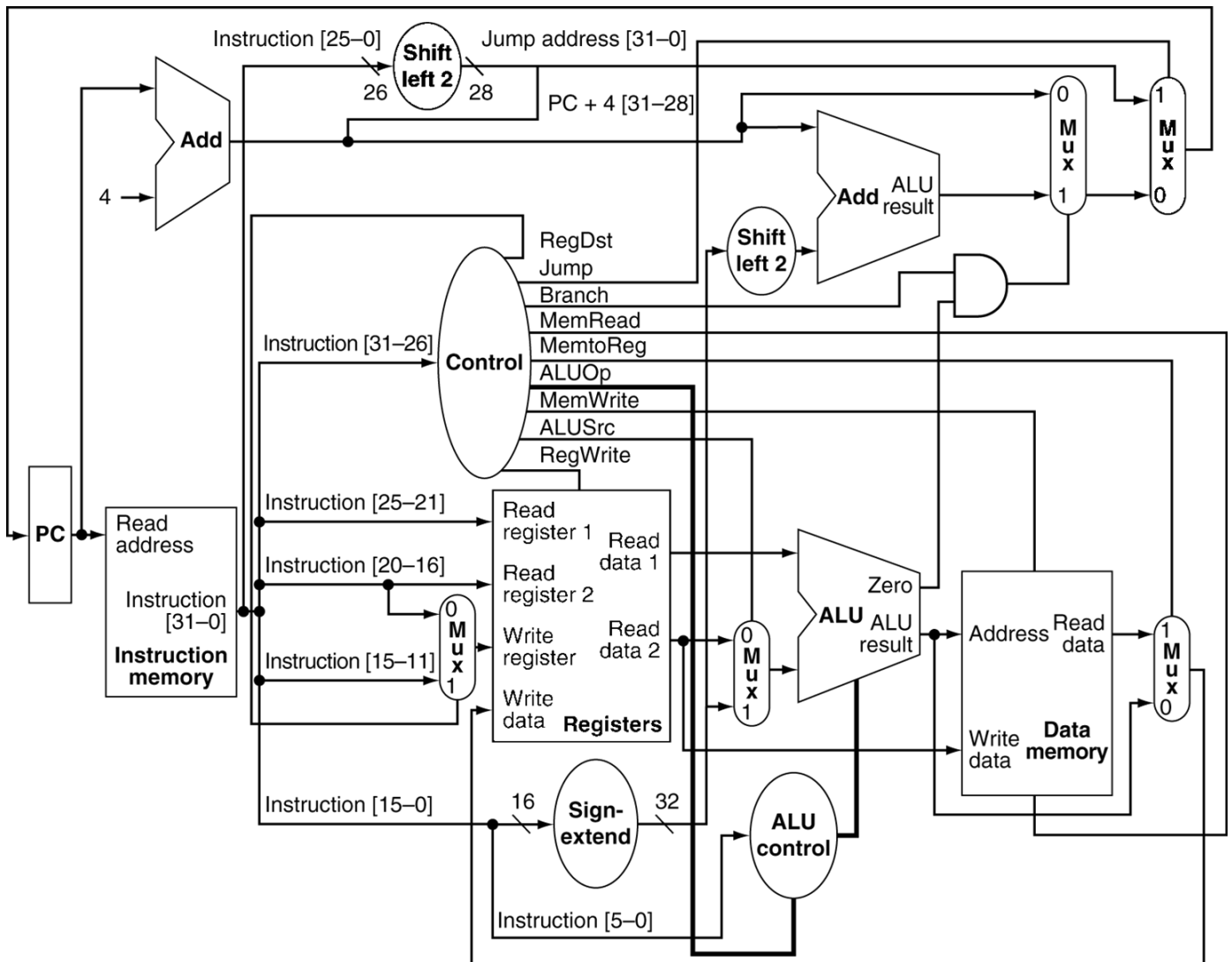
3) Normalization

$$X_1 + X_2 = 0.11111 * 2^{130} = (-1)^0 * 1.1111 * 2^{129}$$

$X_1 + X_2 =$

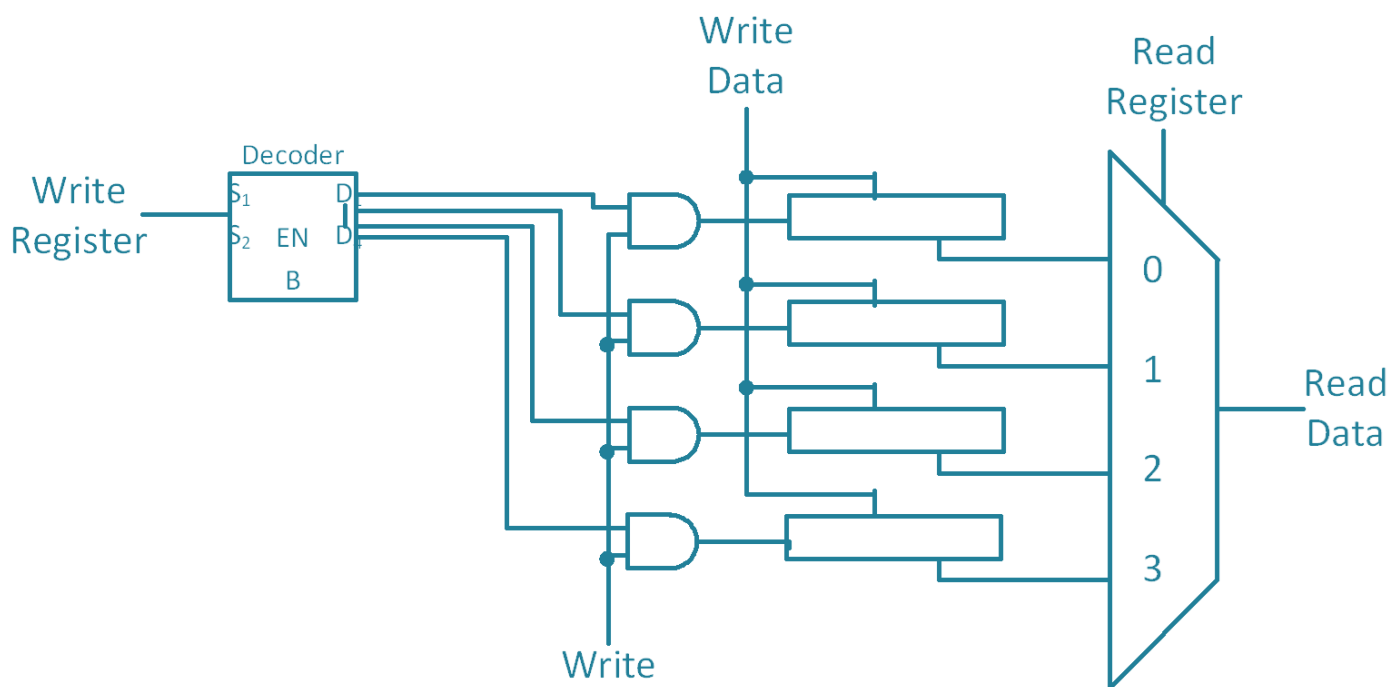
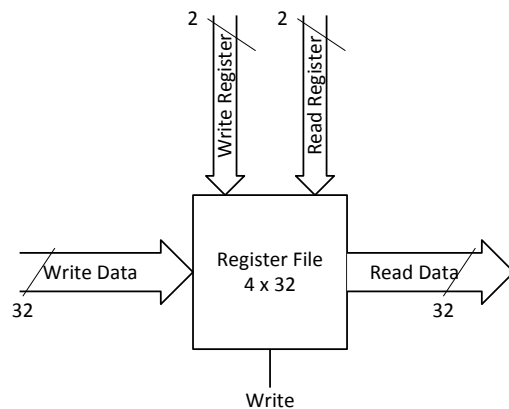
0	1000 0001	111 1000 0000 0000 0000 0000
----------	------------------	-------------------------------------

Q4. On the figure shown below, specify the values of the control signals to execute the `beq` instruction.
 For the ALU control, just specify the operation that the ALU must perform.



RegDst	x
Jump	0
Branch	1
MemRead	0
MemtoReg	x
ALU control	Subtraction
MemWrite	0
ALUSrc	0
RegWrite	0

Q5. Design a two-port register file that contains four 32-bit registers. This register file should have one output port and one input port and has the block diagram shown below.



<Good Luck>