0907335 Computer Organization (Fall 2014)
Midterm Exam

الاسم: رقم التسجيل: الرقم التسلسلي:

==========

Instructions: Time **70** minutes. Open book and notes exam. No electronics. Please answer all problems in the space provided and limit your answer to the space provided. Numbers are in hexadecimal. **No questions are allowed**.

<Good Luck>

Q1. At the end of executing the following MIPS instruction sequence, specify the contents of the following registers.

<5 points>

```
lui  $s0, 0x3232
ori  $s1, $s0, 0x2323
addi $t0, $zero, 4
slt  $s2, $t0, $s0
sll  $s3, $s2, 3
sw   $t0, 0($s1)
lw   $s4, 0($s1)
```

Register $s0 = ____0x32320000_____

Register $s1 = ____0x32322323_____

Register $s2 = ____1_____

Register $s3 = ____8_____

Register $s4 = ____4_____

Q2. For the following C language loop, what is the corresponding MIPS assembly code? Assume that all variables are one-word signed integers. Also assume that the compiler maps `i` to `$s0` and maps the starting address of Array `A` to Register `$s1`.

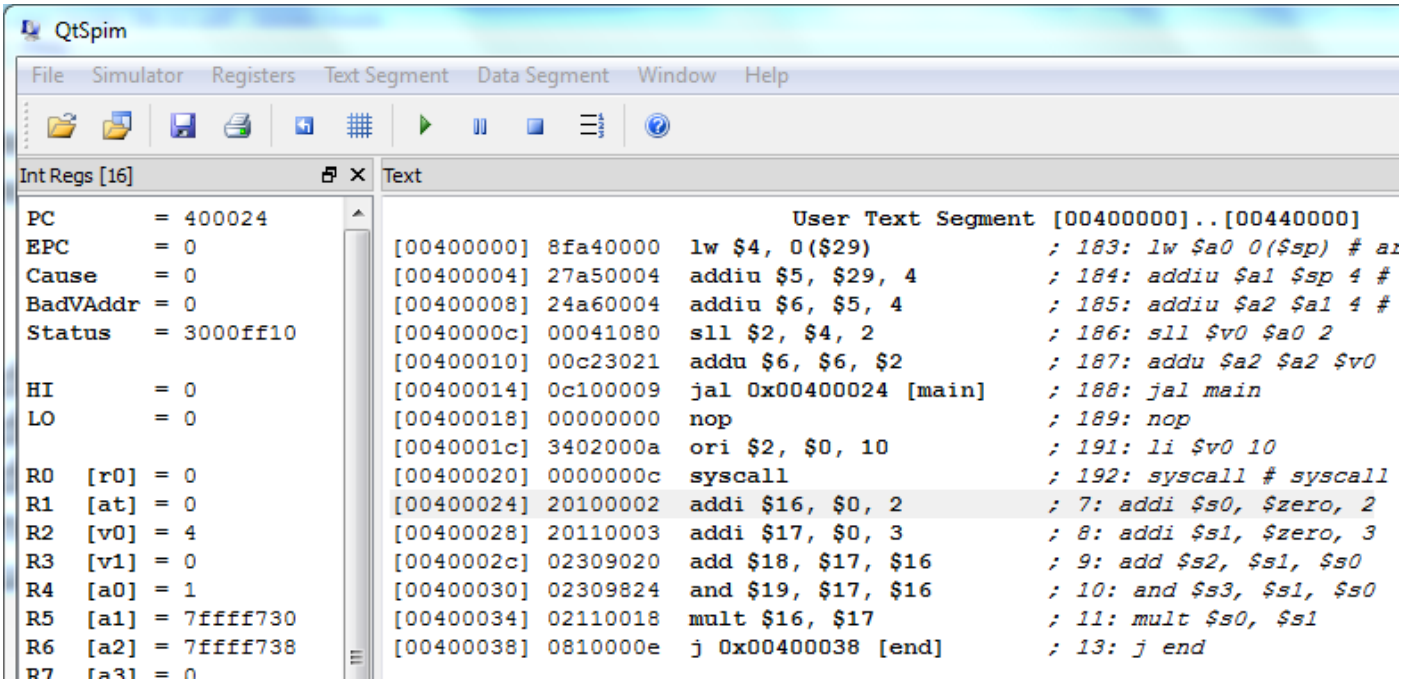
<5 points>

```
for (i=9; i>=0; i--)
    A[i] = 0;
```

```
  addi $s0, $zero, 9
Loop:
  slt  $t0, $s0, $zero
  bne  $t0, $zero, End
  sll  $t1, $s0, 2
  addu $t1, $t1, $s1
  sw   $zero, 0($t1)
  addi $s0, $s0, -1
  j    Loop
End:
```

Q3. The following screen capture shows the QtSpim after loading a simple MIPS program and execution to the point shown.

<5 points>



Specify the contents of the following registers after executing the "Single Step" function five times.

Register `$s2` = ____**5**_____

Register `$s3` = ____**2**_____

Register `HI` = ____**0**_____

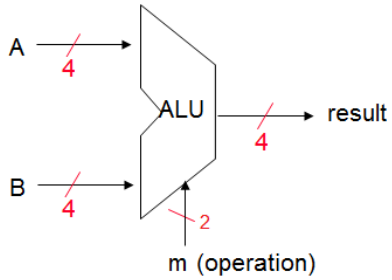
Register `LO` = ____**6**_____

Register `PC` = ____**0x00400038**_____

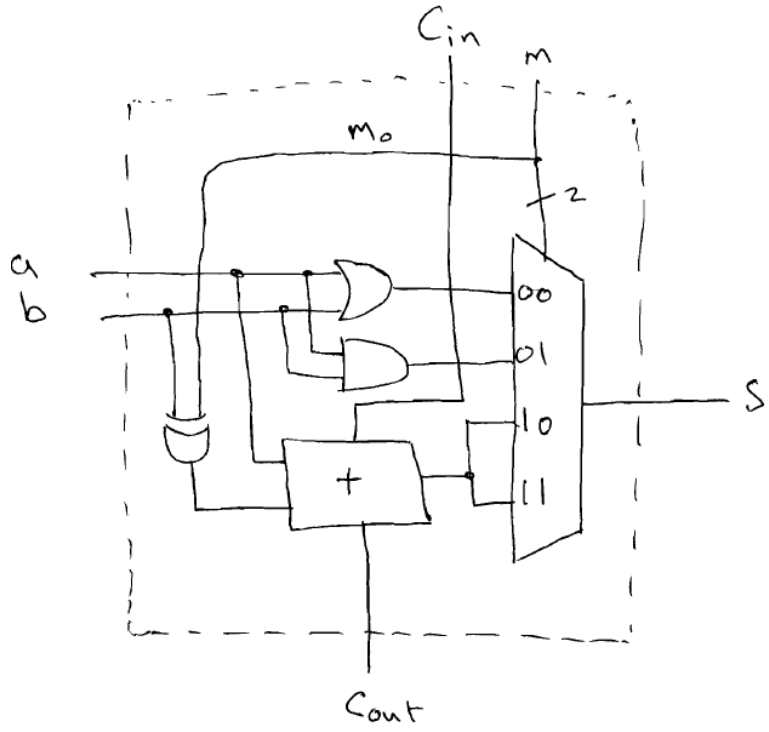
Q4. It is required to design a 4-bit ALU that can perform the operations specified in the following table. This ALU has the interface specified to the right.

<10 marks>

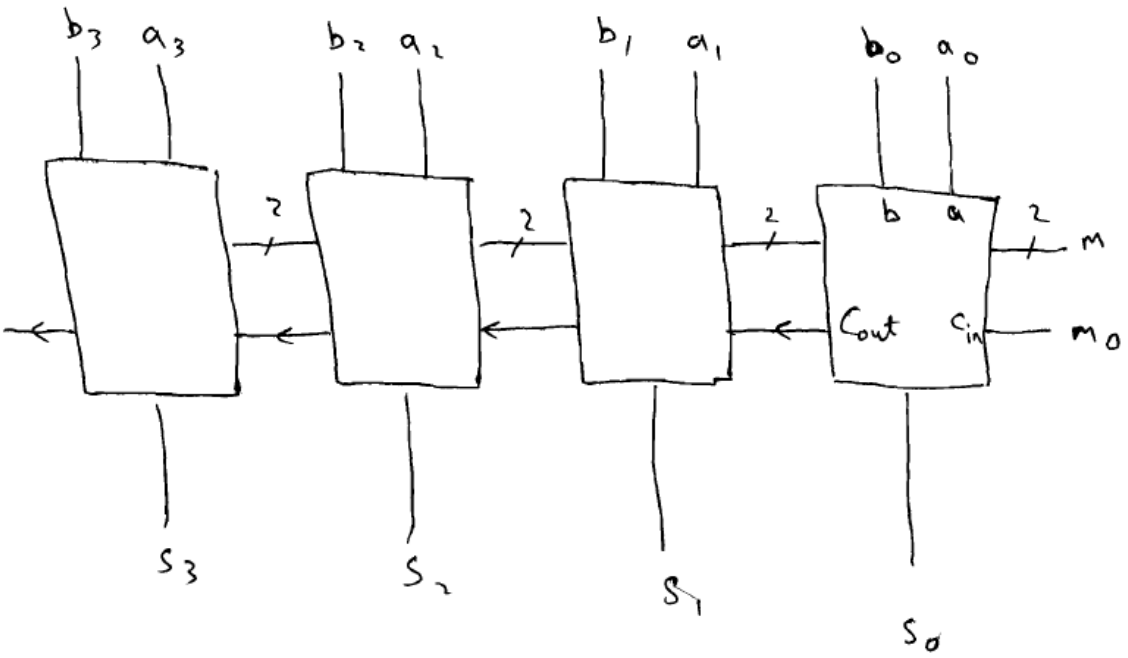
Operation	Function
00	or
01	and
10	add
11	sub



a) Design a one-bit ALU slice that performs these four operations. Use full adder, multiplexer, and basic logic gates as your building blocks.

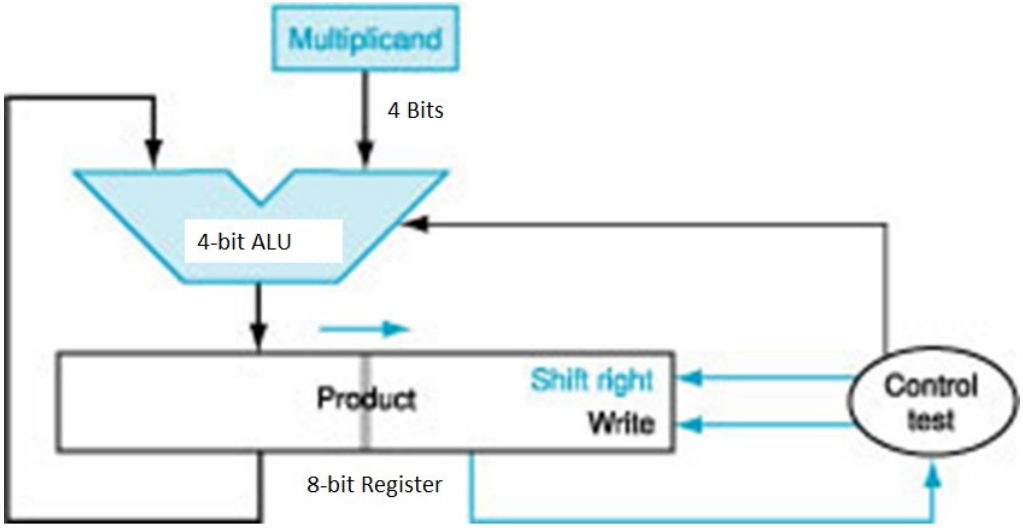


b) Connect four of these one-bit slices to get the required 4-bit ALU.



Q5. Show the contents of the two registers of the optimized multiplication hardware shown below when multiplying the multiplicand 1010_2 by the multiplier 1110_2 over the 4 multiplication steps.

<5 points>



Cycle	Multiplicand	Product
0	1010	0000 1110
1	1010	0000 0111
2	1010	1010 0111 0101 0011
3	1010	1111 0011 0111 1001
4	1010	10001 1001 1000 1100