Spring 2015

BSM 206 Computer Organization

Final Example

Questions:

1) [20 points] [Fill in the blanks questions] There will be some fill in the blanks question in the exam. These questions will be about what affects the performance of a computer and floating point representation.

2) [20 points] [Language of Computers] Consider the following C function:

```
int fact (int n)
{
  if (n < 1) return 1;
  else return n * fact(n - 1);
}
```

i. For this function, MIPS code is given below. The argument n is stored in $a0. Complete the missing instructions and some parts of instructions. For each instruction please insert a comment with your own words. For the first three instructions comments are inserted for you.

```
fact:
    addi $sp, $sp, -8      # adjust stack for 2 items
    sw   $ra, 4($sp)       # save return address
    sw   $a0, 0($sp)       # save argument
    slti $t0, $a0, 1       #
    _____________, L1      #
    addi $v0, $zero, 1     #
    addi $sp, $sp, 8       #
    _____________          #
L1: addi $a0, _______      #
    jal  fact              #
    lw   $a0, 0($sp)       #
    _____________          #
    addi $sp, $sp, 8       #
    mul  $v0, _______      #
    jr   $ra               #
```

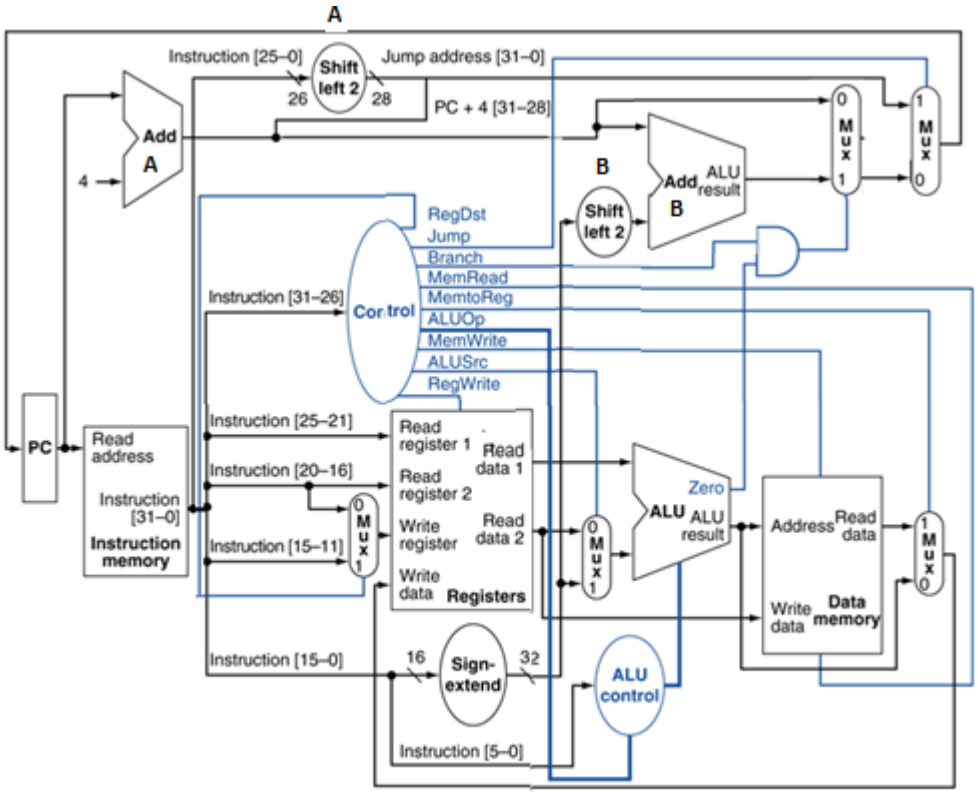
,

ii. For this MIPS code, the machine code is provided below. Complete the missing parts.

Memory	op	rs	rt	rd	shamt	funct
				constant or address		
80000	8	29	29	-8		
80004	43	29	31	4		
80008	43	29	4	0		
80016	10	4	8	1		
80020						
80024	8	2	0	1		
80028	8	29	29	8		
80032						
80036	8					
80040	3					
80044	35	29	4	0		
80048						
80052	8	29	29	8		
80056	0			0	0	24
80060						

3) [60 points] [Processors] Consider the datapath and control units of a processor shown below and the following instructions.

i. The instruction stored in instruction memory 80008 in previous question.
ii. The instruction stored in instruction memory 80020 in previous question.
iii. The instruction stored in instruction memory 80040 in previous question.
iv. The instruction stored in instruction memory 80060 in previous question.



For these instructions answer the following questions.

a) State the main control unit outputs as 1 or 0 to the table below.

	For instruction			
Control output	**i.**	**ii.**	**iii.**	**iv.**
RegDst				
Jump				
Branch				
MemRead				
MemToReg				
MemWrite				
ALUSrc				
RegWrite				

b) Please mark the functionality of the ALU for each specific instructions to the below.

	Instrcution			
Functionality	**i.**	**ii.**	**iii.**	**iv.**
AND				
OR				
add				
substract				
Set-on-less-than				
NOR				

c) Please mark which datapath elements are functional for those instructions.

	Instruction			
Datapath Element	**i.**	**ii.**	**iii.**	**iv.**
PC				
Instruction Memory				
Registers				
ALU				
Data Memory				
Sign Extend				
Adder A				
Shift Left A				
Adder B				
Shift Left B				