

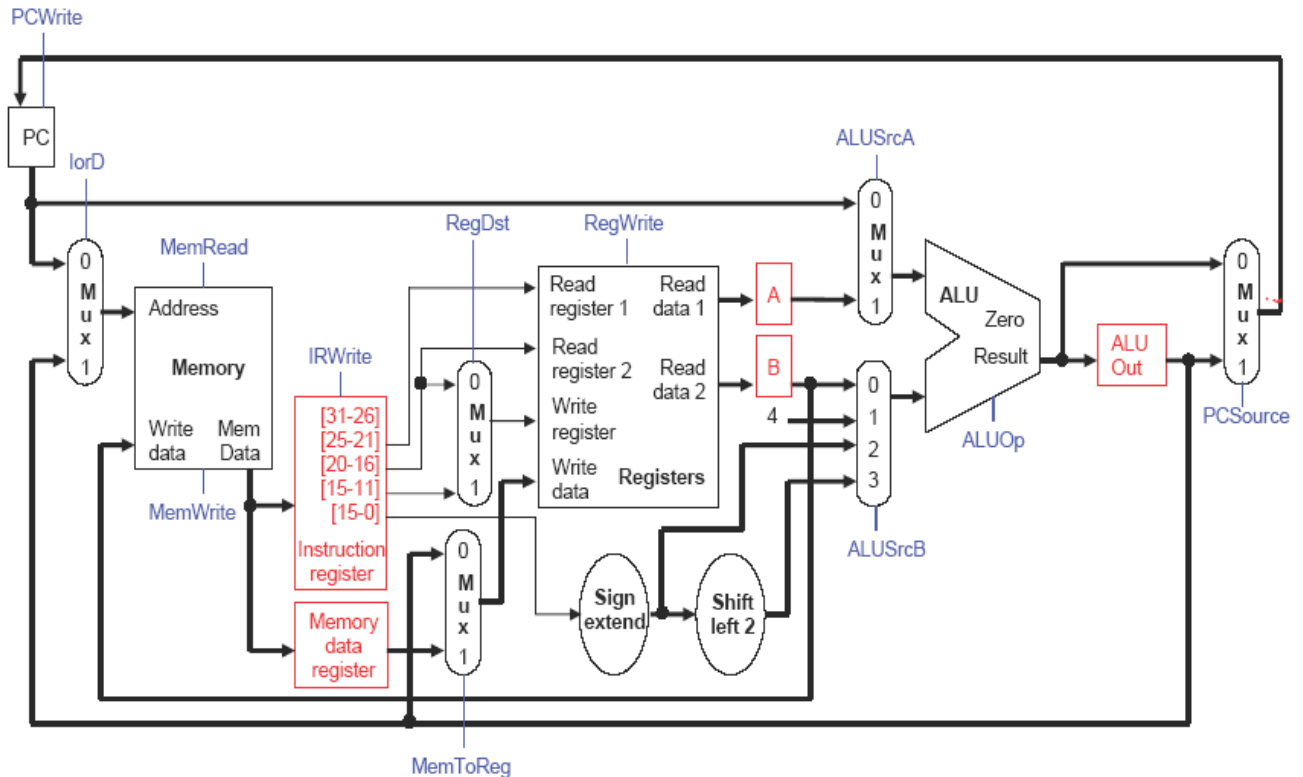
CMPE324

Q1) Consider the MultiCycle datapath shown below. Assume that we wish to add the following new instruction *jm* (jump memory) to this datapath.

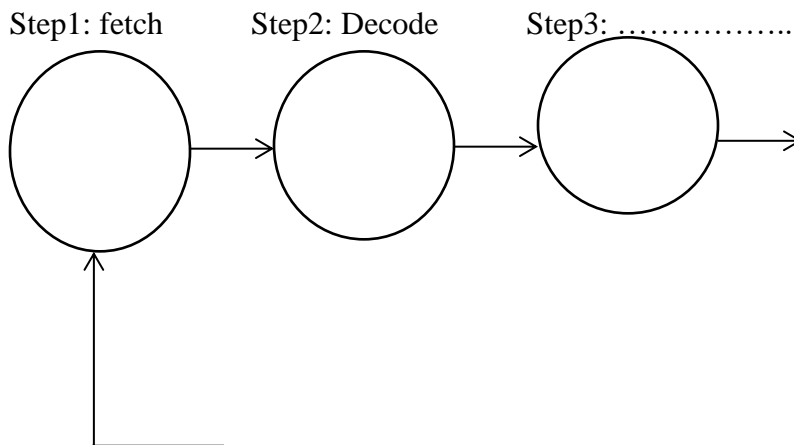
jm offset(\$rs)

The *jm* instruction loads a word from effective address ($\$rs + \text{offset}$), this is similar to *lw* except the loaded word is put in the PC instead of register $\$rt$.

A/ Add any necessary datapaths and justify the need for the modifications, if any.



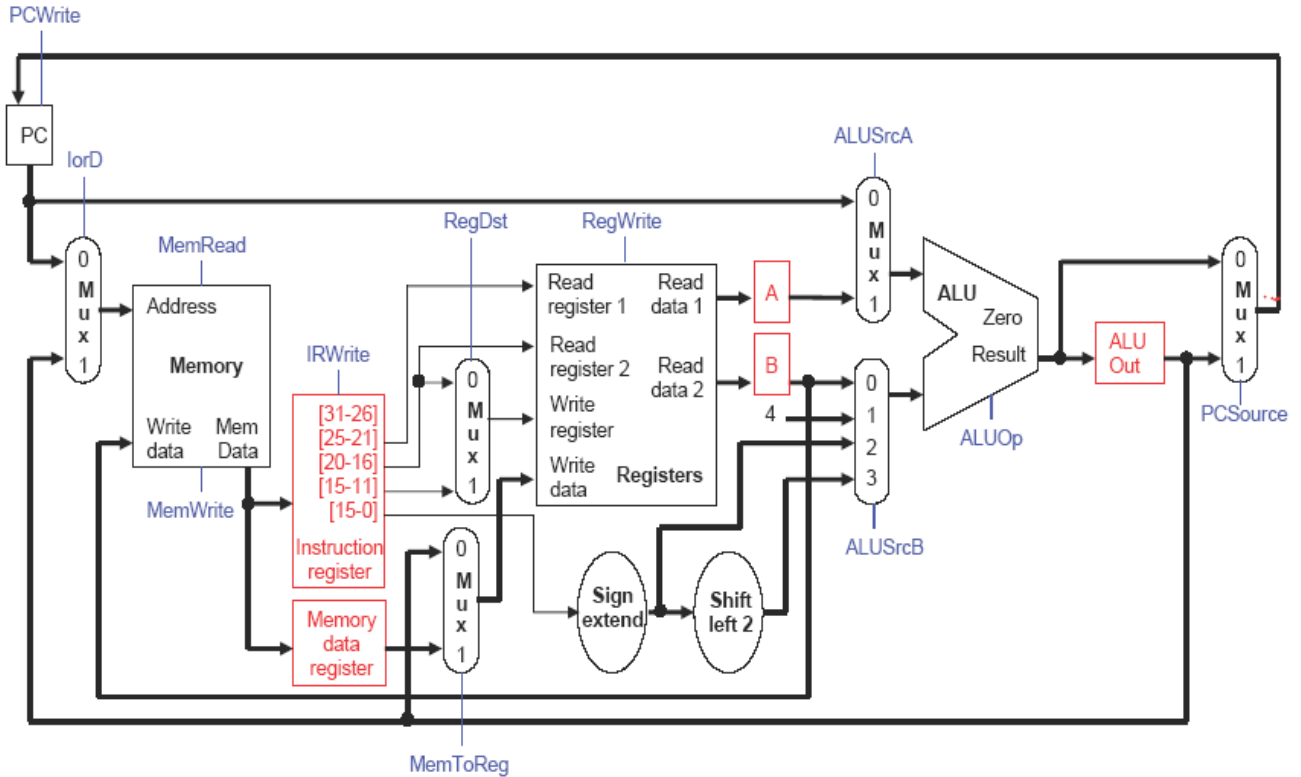
B/ Provide the finite state diagram for executing this instruction. Specify the required control lines values starting from the 3rd step.



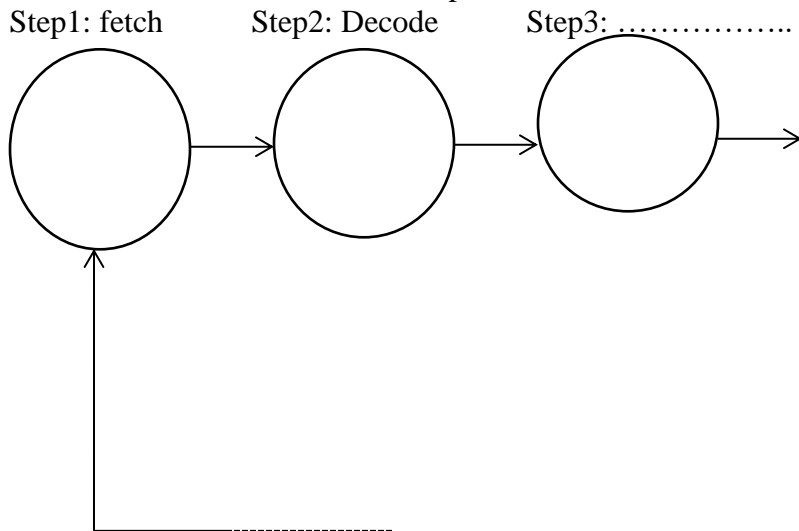
Q2) Assume that it is required to add the **MemInd rt,offset(rs)** instruction to the multicycle data path shown below. This instruction employs the following operation:

rt=Memory[Memory[offset+rs]]

- a) In how many cycles this instruction will be executed.
- b) Add any necessary datapaths and justify the need for the modifications, if any.



c) Provide the finite state diagram for executing this instruction. Specify the required control line values from the 3rd step.



Q4) Given a 2 GHz Multi-Cycle Processor (Cycle time 0.5ns). What would be the exact CPU time of the following code segment that clears a string of length 25bytes?

```

Bzero :
    beq $a1, $zero, end
Loop :
    sb $zero, 0($a0)          # sb store byte in memory
    add $a0, $a0, 1
    sub $a1, $a1, 1
    bne $a1, $zero, Loop
End   : jr $ra
    
```

.....

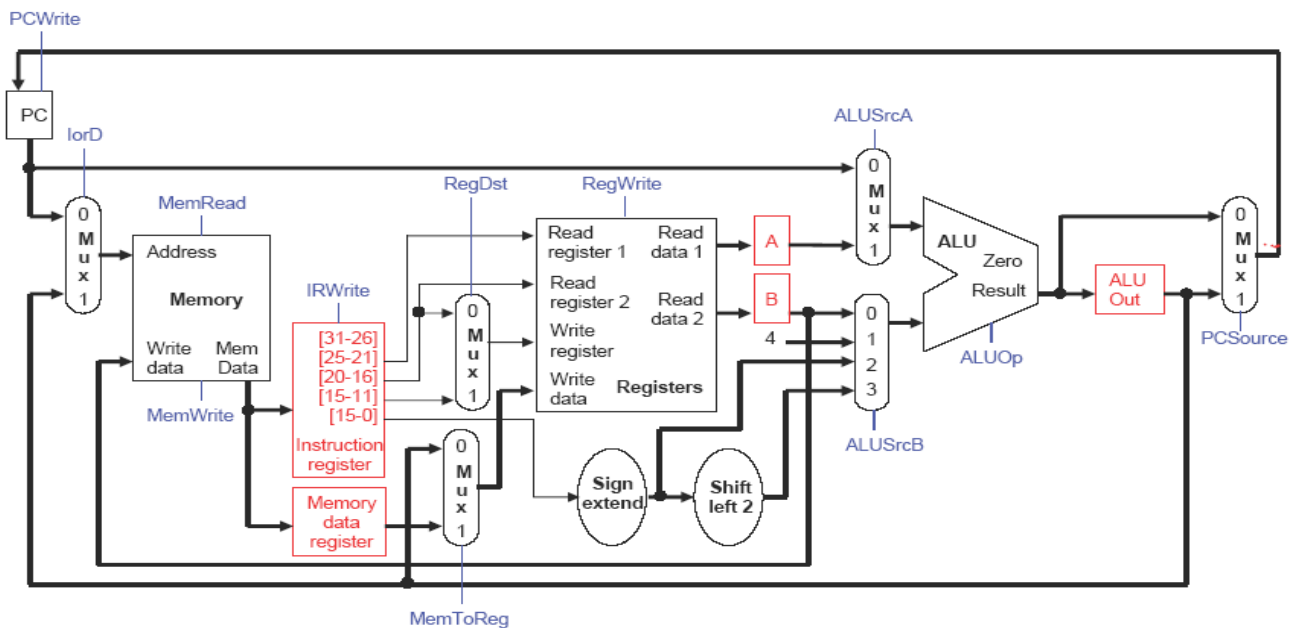
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Q5) Assume that it is required to add the following instruction

```

Lwd $rd, $rs, $rt    #R[$rd]=Mem[ R[$rs] + R[$rt] ]
    
```

to the multicycle data-path shown below.



a) Provide the finite state diagram for executing this instruction. Specify the required control lines values starting from the 3rd step.

