SP21 CSCI 113 Assignment 7 15 pts due: 04/06 (T)

Practice for CPU implementation

For all questions, please show your work clearly.

1. CPU – single-cycled implementation
   Consider the following time delays shown in each component (RED colored) and disregard all other times.

   (a) Show the series of component times for all paths for add instruction. 3; 6-4-5-4

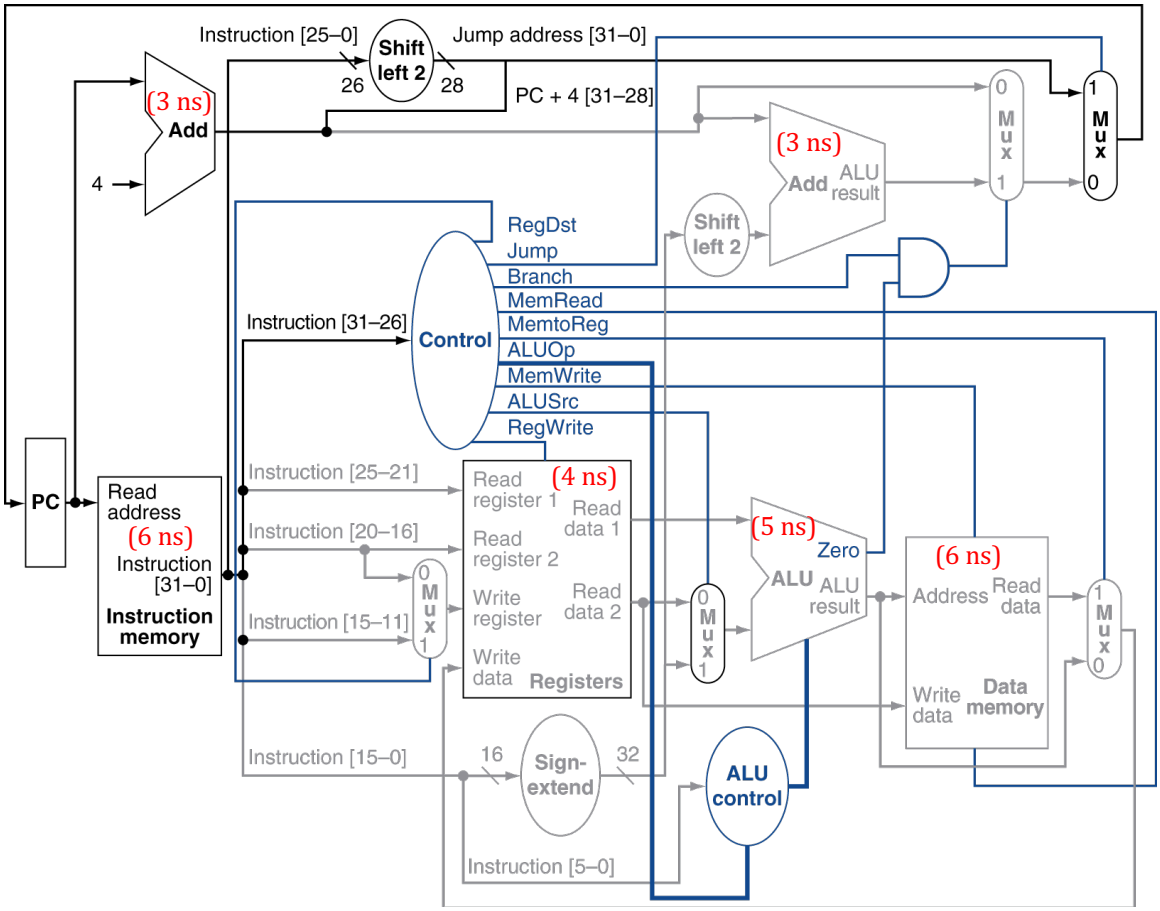
   (b) Show the series of component times for all paths for lw instruction. 3; 6-4-5-6-4

   (c) Show the series of component times for all paths for sw instruction. 3; 6-4-5-6

   (d) Show the series of component times for all paths for beq instruction. 3-3; 6-4-5

   (e) What will be the system clock cycle time? Answer in ns and justify your answer. 25ns (lw)

   (f) For a j (jump) instruction, what is the longest path time? Answer in ns and justify your answer. ==> 6 (since two independent paths 3; 6)



2. CPU – multi-cycled implementation

Consider the following time delays shown in each component (RED colored) and disregard all other times.

(a) What will be the system clock cycle time? Answer in ns and justify your answer. ==> 6ns

(b) For the following series of instruction executions, compute the speedup of using the multi-cycled implementation over the single-cycled implementation.

add; lw; sw; beq; j(jump);

==> single-cycled: lw(6-4-5-6-4 = 25), so cct=25ns; 5*25 = 125ns

multi-cycled: cct=6ns; (6*4)+(6*5)+(6*4)+(6*3)+(6*3) = 114ns

==> 125ns vs. 114ns ==> sp = 125/114 = 1.096..x

(c) Show the datapath and control used in the 3rd cycle of executing a beq instruction. You should draw a subdiagram with only needed parts.

(d) Show the datapath and control used in the 4th cycle of executing a lw instruction. You should draw a subdiagram with only needed parts.

(e) Show the datapath and control used in the 3rd cycle of executing a j (jump) instruction. You should draw a subdiagram with only needed parts.