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CSCI113 - Assignment 7

(1)

a) Add instruction: $(3ns) \rightarrow (3ns)$
   ↳ $6ns + 4ns + 5ns + 4ns = 19ns$

b) lw instruction: $(3ns) \rightarrow (3ns)$
   ↳ $6ns + 4ns + 5ns + 6ns + 4ns = 25ns$ #

c) sw instruction: $(3ns) \rightarrow (3ns)$
   ↳ $6ns + 4ns + 5ns + 6ns = 21ns$ #

d) beq instruction: $(3ns) \rightarrow (3ns)$
   ↳ $6ns + 4ns + 5ns + 3ns = 18ns$ #

e) The system clock cycle time would be 25ns as it is the highest. The instruction with the highest clock cycle time is the lw instruction.

f) j (jump) instruction: $(3ns) \rightarrow (3ns)$
   ↳ $6ns \rightarrow 6ns$ is the longest path time because it passes through the instruction memory which is 6ns.

②

a) The system clock cycle time is the highest time and in this case it would be the lw instruction. The clock cycle time given out by the instruction is 21ns.

b) add instruction: → 6ns + 4ns + 5ns + 4ns = 19ns ✗
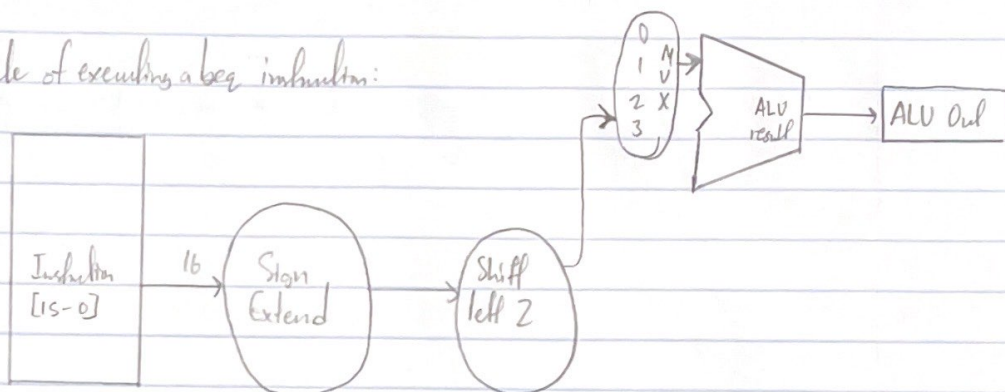
lw instruction: → 6ns + 4ns + 5ns + 6ns = 21ns ✗

sw instruction: → 6ns + 4ns + 5ns = 15ns ✗

beq instruction: → 6ns + 4ns + 4ns = 14ns ✗

j (jump) instruction: → 6ns ✗

(2)

c) 3rd cycle of executing a beq instruction:

Instruction [15-0] → 16 → Sign Extend → Shift left 2 → [0 1 2 3] MUX → ALU result → ALU Out

d) 4th cycle of executing a lw instruction:

A → [0 1] MUX

Instruction [15-0] → Sign Extend → 32 → [0 1 2 3] MUX → ALU Result → ALU Out
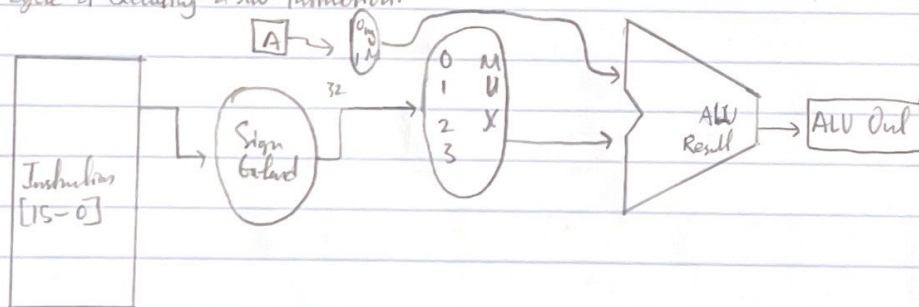
e) 3rd cycle of executing a j (jump) instruction:

Instruction [25-21] → Read register 1 → Read data 1 → A

Instruction [20-16] → Read register 2 → Read data 2 → B