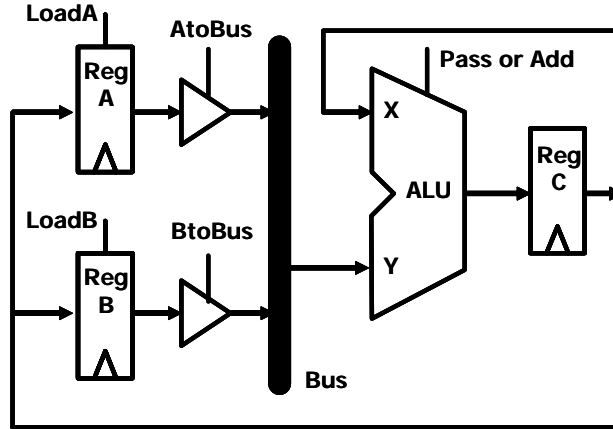


CSE370 Quiz 4 (7 March)

Name _____ Solution _____

You are given the data-path below. Note that there are three registers. Two of these have a load control input, while the other loads a new value on every clock cycle. There are two tri-state drivers that connect the outputs of registers A and B to a common bus. Finally, there is an ALU that can perform two operations: pass Y or $X + Y$. X is always the output of register C, while Y is the value on the bus.



(a) Show the register-transfer operations needed to implement an instruction that swaps the contents of the A and B registers (SWAP A, B). Use as many cycles as you need to implement the instruction (up to 4) and note the value of each control signal in each cycle. Assume the instruction is already in the instruction register so there is no need to worry about fetching the instruction or incrementing a program counter.

cycle	register-transfer operations	AtoBus	BtoBus	ALU	LoadA	LoadB
1	$C \leftarrow A$	1	0	Pass	0	0
2	$B \leftarrow C; C \leftarrow B$	0	1	Pass	X	1
3	$A \leftarrow C$	0	0	X	1	0

Comment: This can be a don't care since we load A on the next cycle and don't need its current value any longer.

Comment: Can't be don't cares because both could end up being 1 and that could be damaging!

(b) Show the register-transfer operations needed to implement an instruction that doubles the contents of the A register (TWOX A). Use as many cycles as you need to implement the instruction (up to 4) and note the value of each control signal in each cycle. Assume the instruction is already in the instruction register so there is no need to worry about fetching the instruction or incrementing a program counter.

cycle	register-transfer operations	AtoBus	BtoBus	ALU	LoadA	LoadB
1	$C \leftarrow A$	1	0	Pass	0	0
2	$C \leftarrow C + A$	1	0	Add	X	0
3	$A \leftarrow C$	0	0	X	1	0

Comment: The values in this column should not be don't cares because even though we don't use the value of B for this instruction, we shouldn't change it in case it is being used for something else.

Comment: This can be a don't care for the same reason as in the instruction above.

Comment: Can't be don't cares because both could end up being 1 and that could be damaging!