Solutions - Assignment 3

Assignment Question 2:

Solution Hints:

a.

Operation	RegDst	RegWrite	ALUsrc	ALUop1 ALUop2	MemWrite	MemRead	MemToReg	jump	Branch
add	1	1	0	10	0	0	0	0	0
sub	1	1	0	10	0	0	0	0	0
and	1	1	0	10	0	0	0	0	0
or	1	1	0	10	0	0	0	0	0
lw	0	1	1	00	0	1	1	0	0
sw	x	0	1	00	1	0	x	0	0
beq	x	0	0	01	0	0	x	0	1
j	x	x	x	x	x	x	x	1	x

b.

Operation	ALUop1 ALUop2	FunctionCode	Output
add	10	xx0000	010
sub	10	xx0010	110
and	10	xx0100	000
or	10	xx0101	001
lw	00	xxxxxx	010
sw	00	xxxxxx	010
beq	01	xxxxxx	110
j	xx	xxxxxx	xxx

C.

Operation	Blocks	means
add	IF, ID, EX,WB	PC, Add PC and 4,Instruction memory, Registers, ALU, MUX for writing back in registers, Control, ALU control
sub	IF, ID, EX,WB	PC, Add PC and 4,Instruction memory, Registers, ALU, MUX for writing back in registers, Control, ALU control
and	IF, ID, EX,WB	PC, Add PC and 4,Instruction memory, Registers, ALU, MUX for writing back in registers, Control, ALU control
or	IF, ID, EX,WB	PC, Add PC and 4,Instruction memory, Registers, ALU, MUX for writing back in registers, Control, ALU control
lw	IF, ID, EX, MEM, WB	PC, Add PC and 4,Instruction memory, Registers, ALU, Data memory, MUX for loading in registers,Control, ALU control
sw	IF, ID, EX, MEM	PC, Add PC and 4,Instruction memory, Registers, ALU, Data memory,Control, ALU control
beq	IF, ID, EX	PC, Add PC and 4, Registers, ALU, extra hardware for branch, Control, ALU control
j	IF	PC, Instruction memory, extra hardware for jump,Control

Assignment Question 3:

Solution Hints:

a. pipelined :350ps

non-pipelin: 250ps + 350ps +150ps+300ps+200ps=1250ps

b.pipelined :350ps x 5=1750ps

non-pipelin: 250ps + 350ps +150ps+300ps+200ps=1250ps

c. Single cycle, pipelined :350

Single cycle,non-pipelin: 250ps + 350ps +150ps+300ps+200ps=1250ps Single-cycle execution time is X times pipelined execution time, where X is: 1250 ps/350 ps=3.57

Multi-cycle execution time is X times pipelined execution time, where X is: 0.20x5+0.80x4=4.20