

22C: 060 Computer Organization

Assignment 3

Sample Solution

Chapter 3, Problem 37

Here is the trace. Call the four Q's (from left to right) Q4 Q3 Q2 Q1:

	Q4 Q3 Q2 Q1
1	0 0 0 0
2	1 0 0 0
3	1 1 0 0
4	1 1 1 0
5	1 1 1 1
6	0 1 1 1
7	0 0 1 1
8	0 0 0 1
9	0 0 0 0

It is called a *twisted ring counter* or a *Johnson counter*. This circuit can count up and down (up to 4).

Chapter 3, Problem 40

The question is awkward, since it forces a value into the Z-input, making the connection from Q to Z a meaningless one. Also, the —O— on the carry output C confuses readers about whether an inversion is implied there (apparently not). I have given points regardless of how you interpreted it.

X Y Z	S Q
0 0 0	0 0
0 0 1	1 0
0 1 0	1 0
0 1 1	0 1
1 0 0	1 0
1 0 1	0 1
1 1 0	0 1
1 1 1	1 1

Chapter 4, Problem 13

Label	Hex address	Instruction	Binary	Hex
	100	Load A	0001 0001 0000 1000	1108
	101	Add One	0011 0001 0000 1001	3109
	102	Jump S1	1001 0001 0000 0110	9106
S2	103	Add One	0011 0001 0000 1001	3109
	104	Store A	0010 0001 0000 1000	2108
	105	Halt	0111 0000 0000 0000	7000
S1	106	Add A	0011 0001 0000 1000	3108
	107	Jump S2	1001 0001 0000 0011	9103
A	108	HEX 0023	0000 0000 0010 0011	0023
One	109	HEX 0001	0000 0000 0000 0001	0001

Chapter 4, Problem 15(a)

- (i) Store 007 (hex address)
- (ii) Jump 10B (hex address)
- (iii) Add 009 (hex address)

Chapter 4, Problem 15(b)

<i>Label</i>	<i>Address</i>	<i>Instruction</i>	<i>Comments</i>
	100	Load X	Load X into the AC
	101	Subt One	AC:= AC-1
	102	Skipcond 800	if AC>0 then skip the next instruction
	103	Jump Endif	Go to the Else part
	104	Load X	AC:= X
	105	Add X	AC:= X+X
	106	Store Y	Store AC into Y
	107	Clear	AC:=0
	108	Store X	X becomes 0 now
Endif.	109	Load Y	Load Y into AC
	10A	Add One	AC:= Y+1
	10B	Store Y	Store AC into Y
End.	10C	Halt	Terminate the program
X	10D	some value	
Y	10E	some value	
One	10F	Dec 1	