

Homework 5 – CIT593 Rubric

Book Problems:

4.1 Components of the Von Neumann Model:

- (a) Memory: Storage of information (data/program)
- (b) Processing Unit: Computation/Processing of Information
- (c) Input: Means of getting information into the computer. e.g. keyboard, mouse
- (d) Output: Means of getting information out of the computer. e.g. printer, monitor
- (e) Control Unit: Makes sure that all the other parts perform their tasks correctly and at the correct time.

- **Total: 10. 2 points for each, -1 points each if no explanation**

4.2

Communication between memory and processing unit consists of 2 registers:

- MAR -> Memory Address Register
- MDR -> Memory Data Register

To read,

- The address of location is put in MAR
- The memory is enabled for a read
- The value is put in MDR by memory

To write,

- The address of the location is put in MAR
- The data is put in MDR
- The write Enable Signal is asserted.
- The value in MDR is written to specified location.

- **Total: 10. The student didn't need to go into this amount of detail for the answer. As long as the general process is written, give full points.**

4.3

The program counter does not maintain a count of any sort. The value stored in the program counter is the address of the next instruction to be processed. Hence the name 'Instruction Pointer' is more appropriate for it.

- **10 points for correct answer**

Custom Problem 1:

a)

- Table is worth 20 points
- -0.5 points for each wrong cell. If student gets too much stuff wrong give 5 points for the effort

Clock Cycle	0	1	2	3	4	5	6	7	8	9	10	11
State	#0	#1	#2	#0	#1	#2	#0	#1	#2	#0	#3	#3
+/-	0	0	1	0	0	1	0	0	1	0	X	X
A _{R1}	3	4	3	3	4	3	3	4	3	3	X	X
A _{R2}	0	2	1	0	2	1	0	2	1	0	X	X
WE	0	1	1	0	1	1	0	1	1	0	0	0
A _w	X	4	3	X	4	3	X	4	3	X	X	X
ALUout	3	6	2	2	12	1	1	18	0	0	X	X
R0	0	0	0	0	0	0	0	0	0	0	0	0
R1	1	1	1	1	1	1	1	1	1	1	1	1
R2 ("A")	6	6	6	6	6	6	6	6	6	6	6	6
R3 ("B")	3	3	3	2	2	2	1	1	1	0	0	0
R4 ("C")	0	0	6	6	6	12	12	12	18	18	18	18
Operation	B>0?	C=C+A	B=B-1	B>	C=C+A	B=B	B>0?	C=C+A	B=B	B>0?	LOOP	LOOP

b) 257 and 255

- 5 points for correct answer

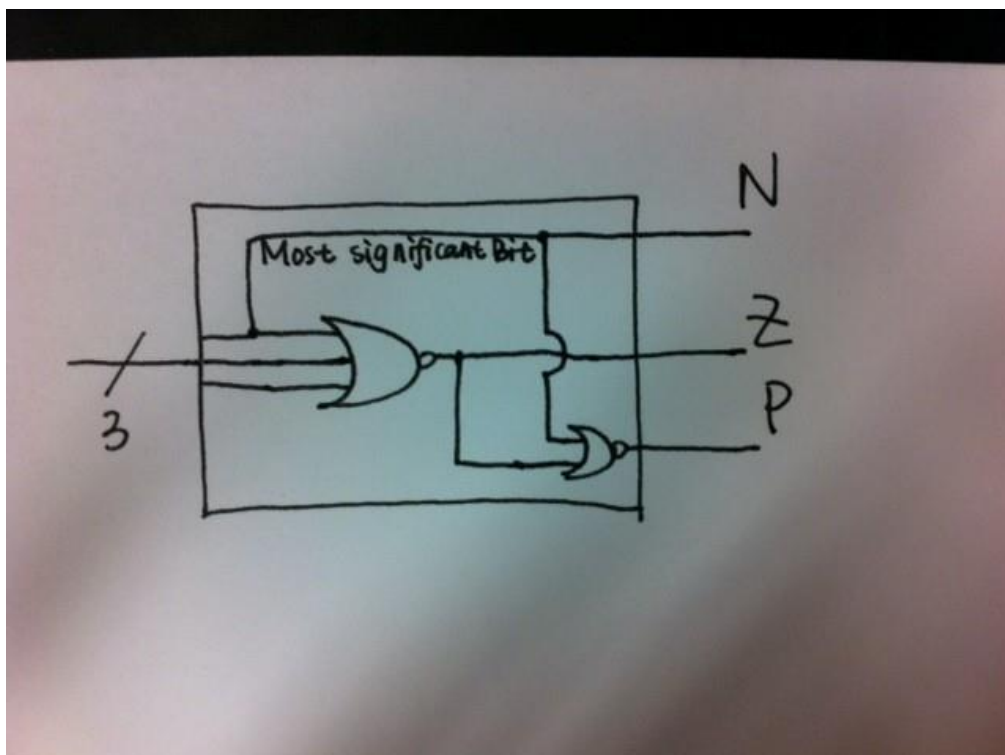
Custom Problem 2:

a)

N	Z	P	Explain
0	0	0	Always return false
0	0	1	Return true if the output of ALU is positive
0	1	0	Return true if the output of ALU is zero
0	1	1	Return true if the output of ALU is ≥ 0
1	0	0	Return true if the output of ALU is negative
1	0	1	Return true if the output of ALU is not equal to zero
1	1	0	Return true if the output of ALU is ≤ 0
1	1	1	Always return true

- Total of 10 points, 1.25 for each correct row

b)



- Total of 10 points, many answers are possible so check the logic

Custom Problem 3:

b) II.

$R0 = 0$

$R1 = 1$

$R0 - R7$ stores first eight numbers

$R2 = R1 + R0$

$R3 = R2 + R1$

$R4 = R3 + R2$

$R5 = R4 + R3$

$R6 = R5 + R4$

$R7 = R6 + R5$

	+/-	ARI	AR2	AW	WE	NZP	NextPC	Opt
000	0	001	000	010	I	000	X	$R2 = R1 + R0$
001	0	010	001	011	I	000	X	$R3 = R2 + R1$
010	0	011	010	100	I	000	X	$R4 = R3 + R2$
011	0	100	011	101	I	000	X	$R5 = R4 + R3$
100	0	101	100	110	I	000	X	$R6 = R5 + R4$
101	0	110	101	111	I	000	X	$R7 = R6 + R5$
110	X	X	X	X	0	111	110	LOOP

- Worth 15 points. 5 for correct algorithm, 10 for table

III

Cycle	0	1	2	3	4	5	6
PC	#0	#1	#2	#3	#4	#5	#6
+/-	0	0	0	0	0	0	X
ARI	1	2	3	4	5	6	X
AR2	0	1	2	3	4	5	X
WE	I	I	I	I	I	I	0
AW	2	3	4	5	6	7	X
ALUOut	1	2	3	5	8	13	X
R0	0	0	0	0	0	0	0
R1	1	1	1	1	1	1	1
R2	0	1	1	1	1	1	1
R3	0	0	2	2	2	2	2
R4	0	0	0	3	3	3	3
R5	0	0	0	0	5	5	5
R6	0	0	0	0	0	8	8
R7	0	0	0	0	0	0	13
Opt	$R2 = R1 + R0$	$R3 = R2 + R1$	$R4 = R3 + R2$	$R5 = R4 + R3$	$R6 = R5 + R4$	$R7 = R6 + R5$	LOOP

- Worth 10 points, 0.25 for each incorrect cell.

Extra Credit c)

R0 = 0

R1 = 1

R2 = A = 0

R3 = B = 1

R4 = C = 0

R7 = 6 -> counter

```
while (R7 > R0) {
    R4 = R2 + R3
    R2 = R3
    R3 = R4
    R7 = R7 - R1
}
```

- Any correct algorithm works. Worth 1 points

Extra Credit d)

	+/-	AR1	AR2	AW	WE	NZP	NextPC	Opt
000	I	III	000	X	0	110	DA	R7 > R0
001	0	010	011	100	1	000	X	R4=R2 + R3
010	0	011	000	010	1	000	X	R2=R3
011	0	100	000	011	1	000	X	R3=R4
100	1	111	001	111	1	111	000	R7 = R7 - R1
101	X	X	X	X	0	000	X	LOOP

- If table is correct regarding student's algo, give the 1 point.