

CS2100 Computer Organisation
AY2021/22 Semester 1
Assignment 3 Answer Sheet

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TUTORIAL GROUP:	T02

Question 0. Submission instructions (3 marks)

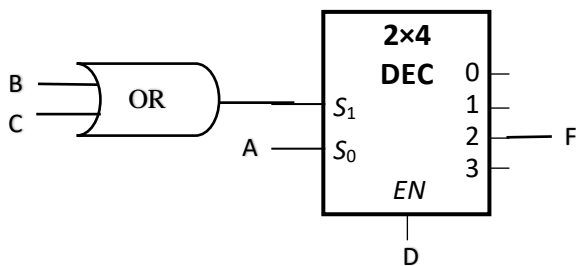
a. Name your file with your student number (eg: AxxxxxxxY>.pdf). (1 mark)	Y / N
b. There is only one PDF file in the submission folder. (1 mark)	Y / N
c. Your submission has your tutorial group number, student number and name. (1 mark)	Y / N

Question 1. MSI Devices (16 marks)

(a) $F(A,B,C,D) = \sum m(3, 5, 7)$

(b) Simplified POS expression for G .

$$G = (A+B+D') \cdot (A+B+C')$$

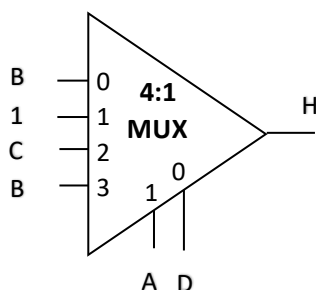


(c) $H(A,B,C,D) = \sum m(1, 3, 4, 5, 6, 7, 10, 13, 14, 15)$

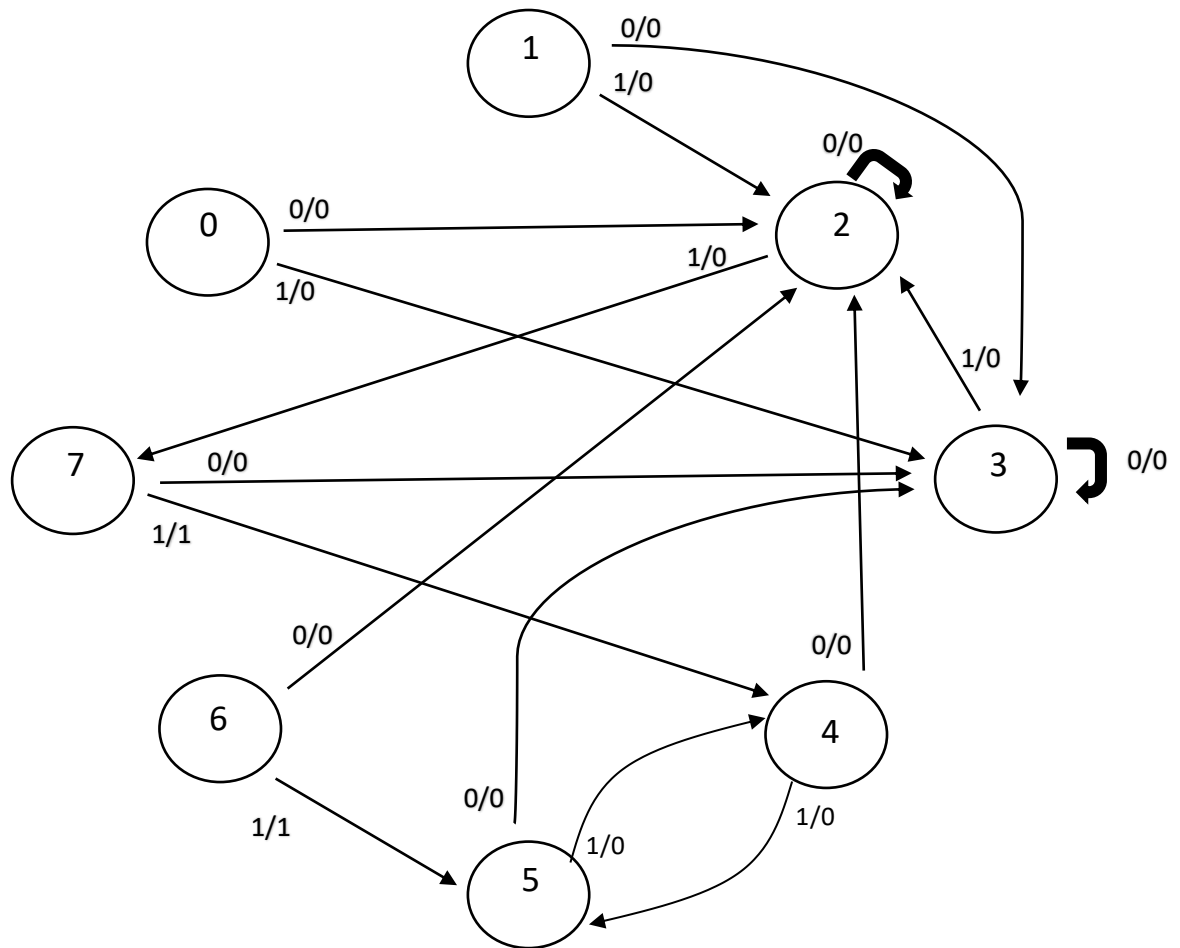
(d) Simplified SOP expressions for J and K .

$$J = A' \cdot C$$

$$K = B' \cdot C$$



Question 2. Sequential Circuit (14 marks)



Question 3. Pipelining (7 marks)

(a)

[1 mark]

$$12+5-1 = 16$$

(b)

[2 marks]

inst 4: +1

inst 5: +2

inst 7: +2

inst 8: +2

inst 9: +2

total: +9

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
addi s1	IF	ID	EX	MEM	WB																				
addi s2		IF	ID	EX	MEM	WB																			
addi t0			IF	ID	EX	MEM	WB																		
beq t0 = s2				IF	ID	EX		MEM	WB																
lw t1								IF	ID	EX	MEM	WB													
lw t2									IF	ID	EX	MEM	WB												
sllt t3										IF	ID	EX	MEM	WB											
beq t3 = 0											IF	ID	EX	MEM	WB										
addi s1												IF	ID	EX	MEM	WB									
j out													IF	ID	EX	MEM	WB								
addi t0														IF	ID	EX	MEM	WB							
j loop																			IF	ID	EX	MEM	WB		

(c)

[2 marks]

inst 4: +1

inst 5: +2

inst 7: +1

inst 8: +1

inst 9: +2

total: +7

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
addi s1	IF	ID	EX	MEM	WB																		
addi s2		IF	ID	EX	MEM	WB																	
addi t0			IF	ID	EX	MEM	WB																
beq t0 = s2				IF	ID	EX		MEM	WB														
lw t1								IF	ID	EX	MEM	WB											
lw t2									IF	ID	EX	MEM	WB										
sllt t3										IF	ID	EX	MEM	WB									
beq t3 = 0											IF	ID	EX	MEM	WB								
addi s1												IF	ID	EX	MEM	WB							
j out													IF	ID	EX	MEM	WB						
addi t0														IF	ID	EX	MEM	WB					
j loop																		IF	ID	EX	MEM	WB	

s(d)

[2 marks]

inst 4: +1

inst 7: +1

inst 8: +1

total: +3

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
addi s1	IF	ID	EX	MEM	WB														
addi s2		IF	ID	EX	MEM	WB													
addi t0			IF	ID	EX	MEM	WB												
beq t0 = s2				IF		ID	EX	MEM	WB										
lw t1						IF	ID	EX	MEM	WB									
lw t2							IF	ID	EX	MEM	WB								
slt t3								IF	ID	EX	MEM	WB							
beq t3 = 0									IF				ID	EX	MEM	WB			
addi s1												IF	ID	EX	MEM	WB			
j out													IF	ID	EX	MEM	WB		
addi t0														IF	ID	EX	MEM	WB	
j loop															IF	ID	EX	MEM	WB