SINGAPORE POLYTECHNIC

2018/2019 S1 MID-SEMESTER TEST

SAS code: **MST**

MODULE: DIGITAL ELECTRONICS MOD. CODE: ET1004

COURSE/YEAR: DASE/DCEP/DESM/DCPE/ DEEE 1FT SET BY: Goh BH

No	SOLUTION	MARKS	TOTAL MARKS
	SECTION – A (10 MCQ, 3 marks each)	3 marks each	30 marks

A1 (c)
A2 (d)
A3 (c)
A4 (d)
A5 (a)
A6 (a)
A7 (b)
A8 (b)
A9 (d)
A10 (d)

	A	B	C	D
A1			✓	
A2				✓
A3			✓	
A4				✓
A5	✓			
A6	✓			
A7		✓		
A8		✓		
A9				✓
10				✓

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SOLUTIONS

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No	SOLUTION	MARKS	TOTAL MARKS
B1 a)	**SECTION – B (20 marks each)** Add $+34_{10}$ to $+63_{10}$ sign 64 32 16 8 4 2 1 **+56 = 0 0 1 1 1 0 0 0** ←---------- **+23 = 0 0 0 1 0 1 1 1** ←---------- **+79 = 0 1 0 0 1 1 1 1** ←---------- Subtract +33 from +72 = **Add -33 to +72** sign 64 32 16 8 4 2 1 **+33 = 0 0 1 0 0 0 0 1** ←---------- **-33 = 1 1 0 1 1 1 1 1** ←---------- **+72 = 0 1 0 0 1 0 0 0** ←---------- **+39 = 1 0 0 1 0 0 1 1 1** ←----------	1 mark 1 mark 2 marks 1 mark 1 mark 2 marks 1 mark 2 marks	
b)	Range is given by $+2^N-1$ to -2^N For a 12-bit system, N = 11 Hence +ve limit = $+2^{11}-1$ = **+2047** - ve limit = -2^{11} = **-2048** Therefore Range = +2047 to -2048 decimal	2 marks 2 marks	15 marks

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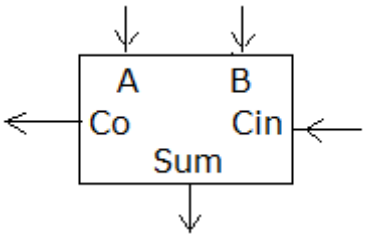
B2 (a)		3 marks	
(b)	<table><tr><td>A</td><td>B</td><td>Cin</td><td>Cout</td><td>Sum</td></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td><td>1</td><td>0</td></tr><tr><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table>	4 marks	
	Marks distribution: ½ mark for each correct combination		
	$Sum = \overline{A}\,\overline{B}\,Cin + \overline{A}\,B\,\overline{Cin} + A\,\overline{B}\,\overline{Cin} + A\,B\,Cin$	2 marks	
	$Cout = \overline{A}\,B\,Cin + A\,\overline{B}\,Cin + A\,B\,\overline{Cin} + A\,B\,Cin$	2 marks	
(c)	$Sum = \overline{A}\,\overline{B}\,Cin + \overline{A}\,B\,\overline{Cin} + A\,\overline{B}\,\overline{Cin} + A\,B\,Cin$ $= \overline{A}\,(B\,\overline{Cin} + \overline{B}\,Cin) + A\,(\overline{B}\,\overline{Cin} + B\,Cin)$ $= A\,(B \oplus Cin) + A\,(\overline{B \oplus Cin})$ $= A \oplus (B \oplus Cin)$ $= A \oplus B \oplus Cin$	4 marks	15 marks

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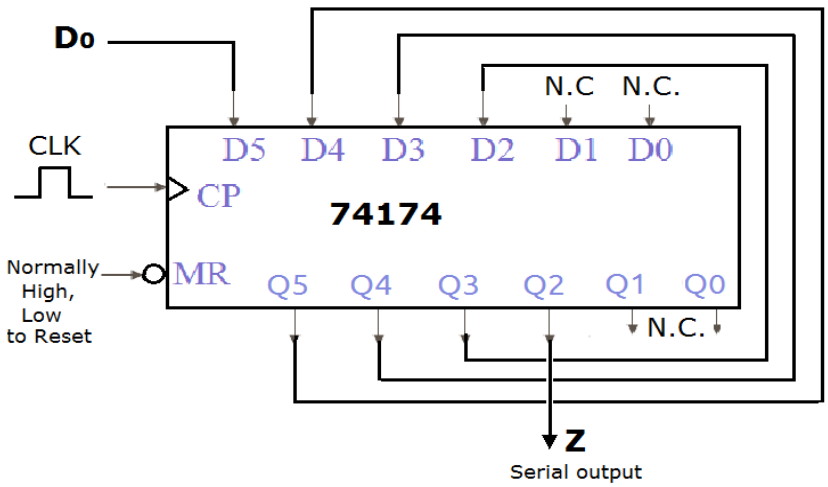
No	SOLUTION	MARKS	TOTAL MARKS
B3 (a)	(i) Period = 2 + 8 = 10uS	2 marks	
	(ii) Frequency = 1/10uS = 100000 Hz or 100 kHz	2 marks	
	(iii) Duty cycle = 2/10 * 100% = 20%	2 marks	
(b)	 Marks distribution: Use of 4 flip-flops→ 1 mark Correct connection between flip-flops → 3 marks Correct Serial input Do → 1 mark Correct Serial output Z → 2 marks Correct logic level at MR → 2 marks **NB: Any 4 Flip-flops can be used so alternate solutions are possible. Please mark accordingly.**	9 marks	15 marks

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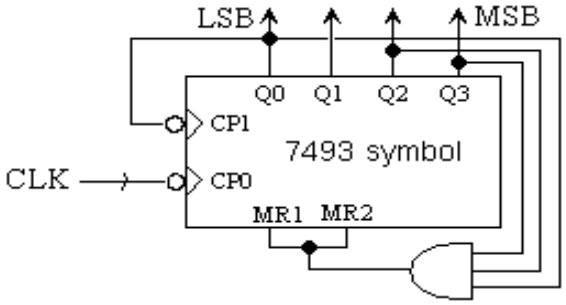
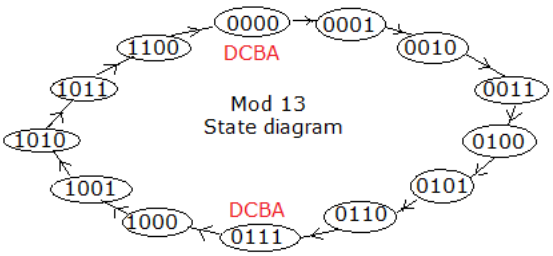
No	SOLUTION	MARKS	TOTAL MARKS
C1 (a)	 Marks distribution Q0 to CP1 connection for 4 flip-flops → 2 marks CLK to CP0 input → 1 mark MSB and LSB indication at outputs → 2 marks Feedback from Q0, Q2, Q3 & AND to MR1/MR2 → 3 marks NB: Alternate Solutions possible. Please mark accordingly.	8 marks	
(b)	 State diagram of Mod-13	4 marks	
(c)	Given starting values = 0000, 145 clock cycles are applied, 145 – (11 * 13) = 2 clock cycle. Therefore State of counter will be 2_{10} = 0010	3 marks	15 marks

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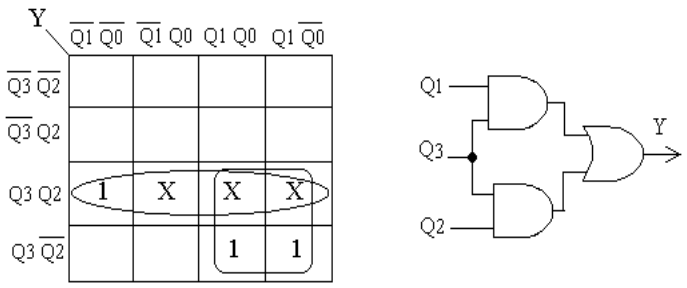
No	SOLUTION	MARKS	TOTAL MARKS
C1 (d)		6 marks	25 marks

Q3	Q2	Q1	Q0	Y
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	X
1	1	1	0	X
1	1	1	1	X

Marks distribution

2 marks each for outputs = 0's, 1's and X's



$Y = Q_3 Q_2 + Q_3 Q_1$

4 marks

Marks distribution

K-map = 2marks

Equation = 1 mark

Circuit = 1 mark

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