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Department of Computer Engineering
Final Examination
EGCI 234: Digital Circuit Design (T2/2021-22)

WebEx Q1 Q2

Date: 4 April 2022
Time: 2 Hours Total Mark: 50 marks

Instruction: Answer all questions and submit to our Google Classroom

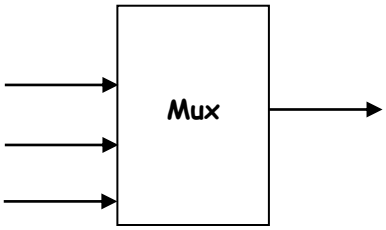
Questions 1 & 2 25 minutes/ 5 & 9 marks (1000-1025) **MSI & Arithmetic Circuits**
- 5 min break –
Questions 3 15 minutes/ 3 & 5 marks (1030-1045) **Flip Flops**
- 5 min break –
Questions 4 20 minutes/ 10 marks (1050-1110) **Sequential Circuit Design**
- 5 min break –
Questions 5 20 minutes/ 4 & 8 marks (1115-1135) **ADC & DAC**
- 5 min break –
Questions 6 10 minutes/ 6 marks (1140-1150) **Digital Circuit Design**

Explanation
Examination will start at 1000. Questions 1 & 2 will be released via Google classroom. Students have 25 minutes to answer the question and submit to Google classroom before deadline (ie. 1025). Followed by 5-minute break. Then questions 3 will be released ..

(14 marks) MSI & Arithmetic Circuits

(5 marks) Q1 Show how to design a 3-bit word 2:1 MUX

$S_0 = 0 \rightarrow I_0$
$S_1 = 1 \rightarrow I_1$



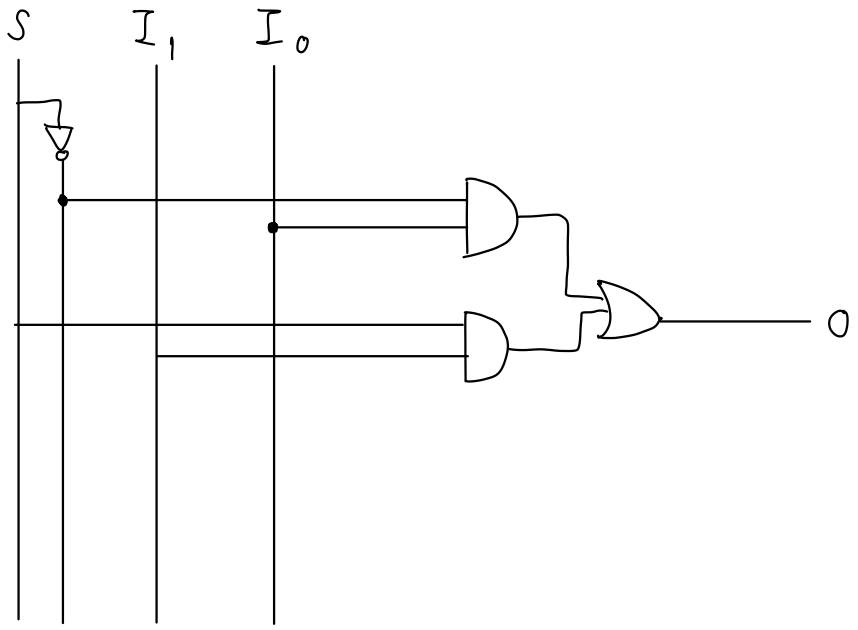
∴ 3-bit word 2 : 1 MUX construct the same as 1-bit word 2 : 1 MUX

S	I_1	I_0	O
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	1

$O = \bar{S} I_0 + S I_1$

S	O
0	I_0
1	I_1

$O = \bar{S} I_0 + S I_1$



(9 marks) Q2 Show how to design a circuit that accepts X_{3210} as inputs and produces Y_{3210} as outputs (see table below).

Inouts ($X_3X_2X_1X_0$)	Outputs ($Y_3Y_2Y_1Y_0$)
0000	0011
0001	0100
0010	0101
0011	0110
0100	0111
1011	1000
1100	1001
1101	1010
1110	1011
1111	1100

From 0-4 Output = input + 3

From 11 - 15 Output = input - 3

$\bar{X}_3\bar{X}_1\bar{X}_0 + \bar{X}_3\bar{X}_2X_1X_0 + X_3X_2\bar{X}_1X_0 + X_3X_2X_1\bar{X}_0$

PS	NS	D_3	D_2	D_1	D_0
0000	0011	0	0	1	1
0001	0100	0	1	0	0
0010	0101	0	1	0	1
0011	0110	0	1	1	0
0100	0111	0	1	1	1
1011	1000	1	0	0	0
1100	1001	1	0	0	1
1101	1010	1	0	1	0
1110	1011	1	0	1	1
1111	1100	1	1	0	0

$D_0 = \bar{X}_0$

$D_3 = X_3$

$D_2 = \bar{X}_3\bar{X}_2X_1 + \bar{X}_3X_2\bar{X}_1X_0 + \bar{X}_3X_2\bar{X}_1\bar{X}_0 + X_3X_2X_1X_0$

0000 → 0011

0010 → 0101

0100 → 0111

1011 → 1000

(9 marks) Q2 Show how to design a circuit that accepts X_{3210} as inputs and produces Y_{3210} as outputs (see table below).

Inouts ($X_3X_2X_1X_0$)	Outputs ($Y_3Y_2Y_1Y_0$)
0000	0011
0001	0100
0010	0101
0011	0110
0100	0111
1011	1000
1100	1001
1101	1010
1110	1011
1111	1100

Input + 3 = output