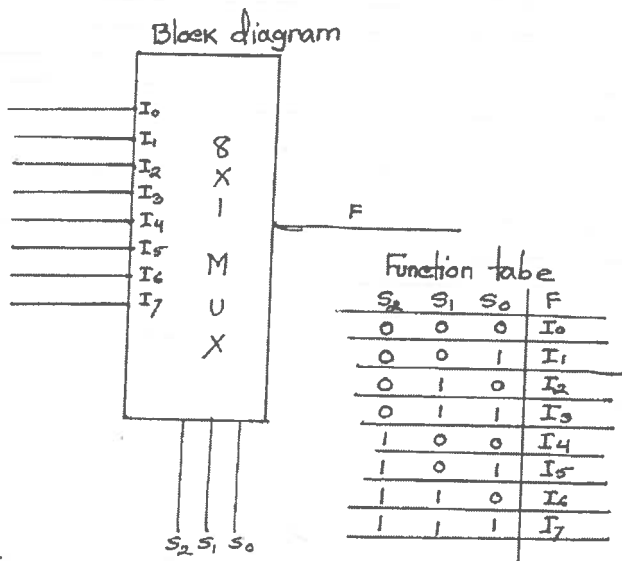You are expected to solve homework problems individually. If needed, you may seek help from your friends. However, do not copy. Show all steps with your solutions for full credit.
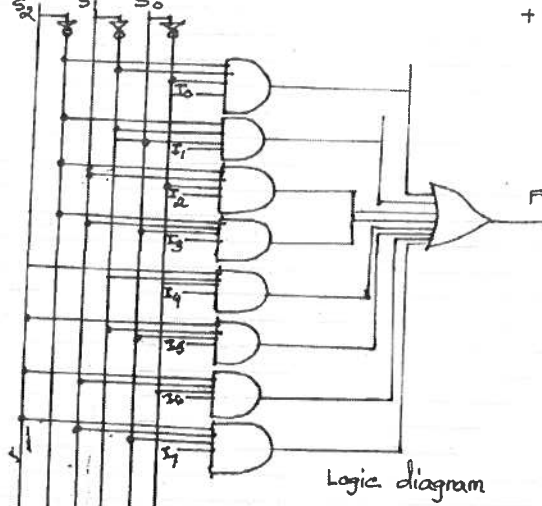
Name: KEY /50

1. (2 + 8+5+5 points) Construct a block diagram and function table for 8X1 Mux. Derive the Boolean expression and draw the logic diagram.
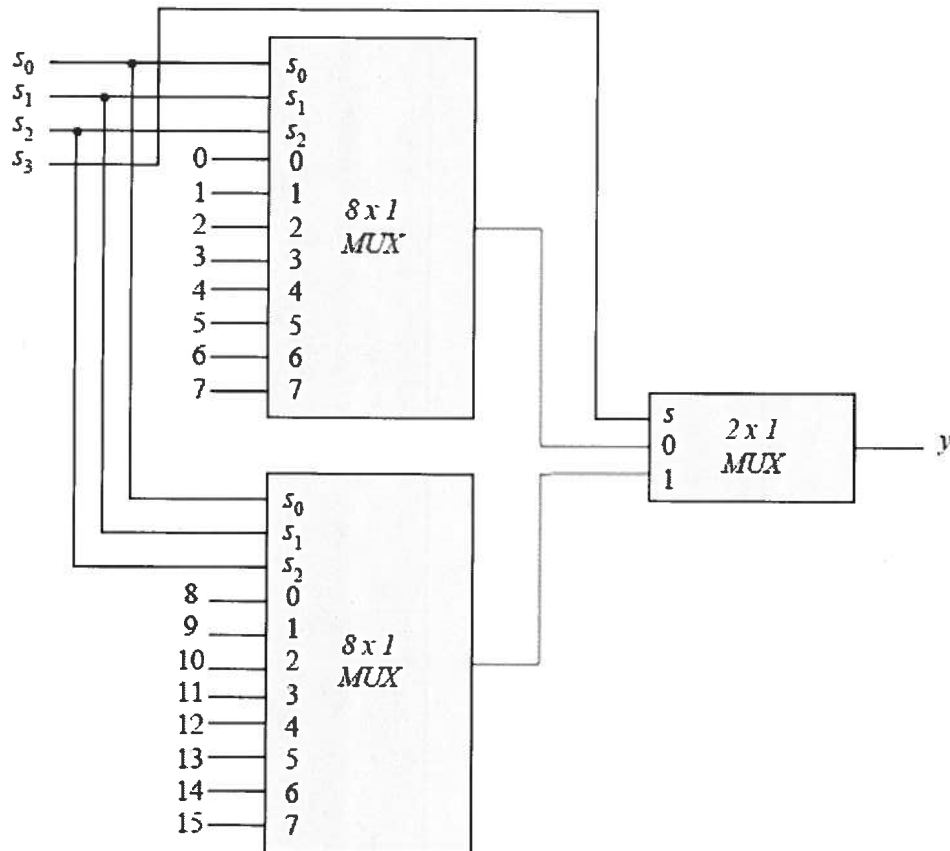
Block diagram

Function table

S_2	S_1	S_0	F
0	0	0	I_0
0	0	1	I_1
0	1	0	I_2
0	1	1	I_3
1	0	0	I_4
1	0	1	I_5
1	1	0	I_6
1	1	1	I_7

Boolean expressions

$$F = S_2'S_1'S_0'I_0 + S_2'S_1'S_0I_1 + S_2'S_1S_0'I_2 + S_2'S_1S_0I_3 + S_2S_1'S_0'I_4 + S_2S_1'S_0I_5 + S_2S_1S_0'I_6 + S_2S_1S_0I_7$$


Logic diagram

2. (10 points) Construct a 16 x 1 multiplexer with two 8 x 1 and one 2 x 1 multiplexers. Use block diagrams for the Mux.
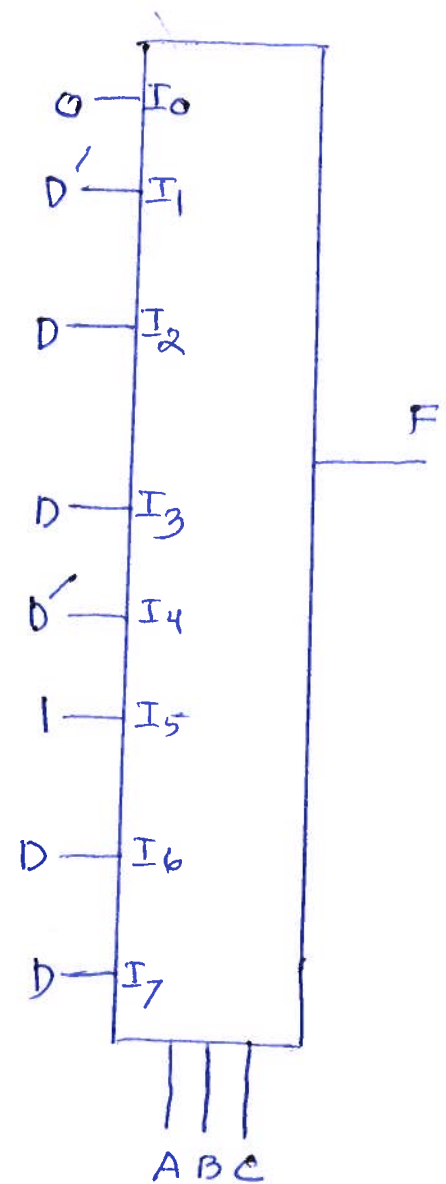
3. (10+5+5 points) A combinational circuit is specified by the following Boolean functions. Design the combinational circuit using a Multiplexer and external gates,

   a. $F(A, B, C, D) = \sum m(0, 2, 5, 11, 12, 13, 14, 15)$. Implement this function with 4X1 MUX and external gates if needed.
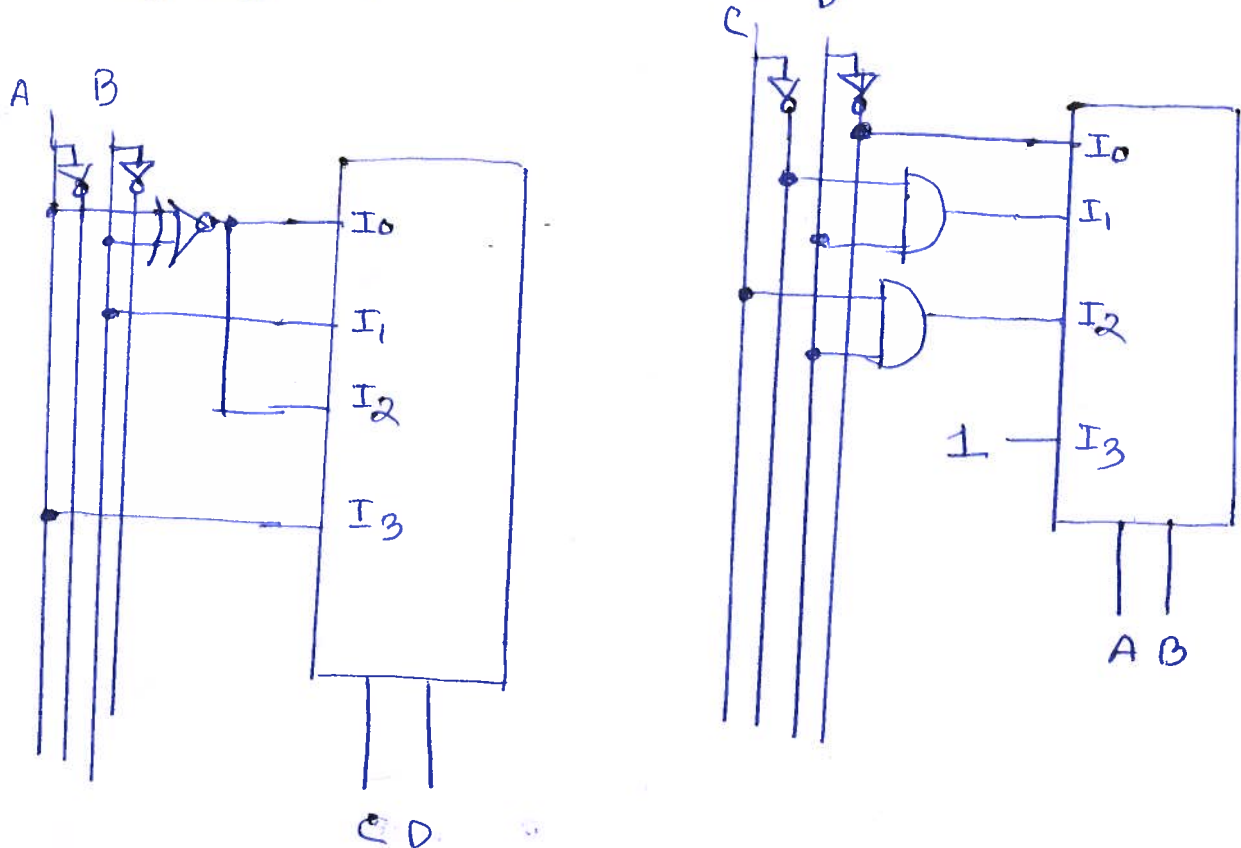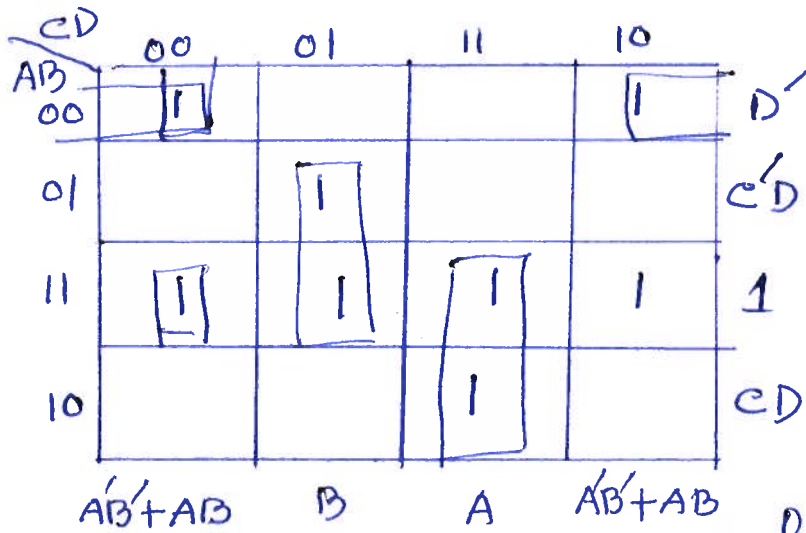
b. *F (A, B, C, D)* = $\sum$m (2, 5, 7, 8, 10, 11, 13, 15). Implement this function with 8X1 MUX and external gates if needed.

A	B	C	D	F
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	0
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	1
1	0	0	0	1
1	0	0	1	0
1	0	1	0	1
1	0	1	1	1
1	1	0	0	0
1	1	0	1	1
1	1	1	0	0
1	1	1	1	1

MUX connections:

$0 \to I_0$
$D' \to I_1$
$D \to I_2$
$D \to I_3$
$D' \to I_4$
$1 \to I_5$
$D \to I_6$
$D \to I_7$

Output: F

Select lines: A B C

c. F3 (A, B, C, D) = $\sum$m (0, 2, 4, 6, 8, 9, 10, 15). Implement this function with 16X1 MUX and external gates if needed.