THE UNIVERSITY OF ZAMBIA

SCHOOL OF ENGINEERING

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

ASSIGNMENT 4 SOLUTIONS

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COURSE : EEE 3131

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QUESTION 1

i) For a 64-bit adder :

Half Adder = 1

Full Adder = 63

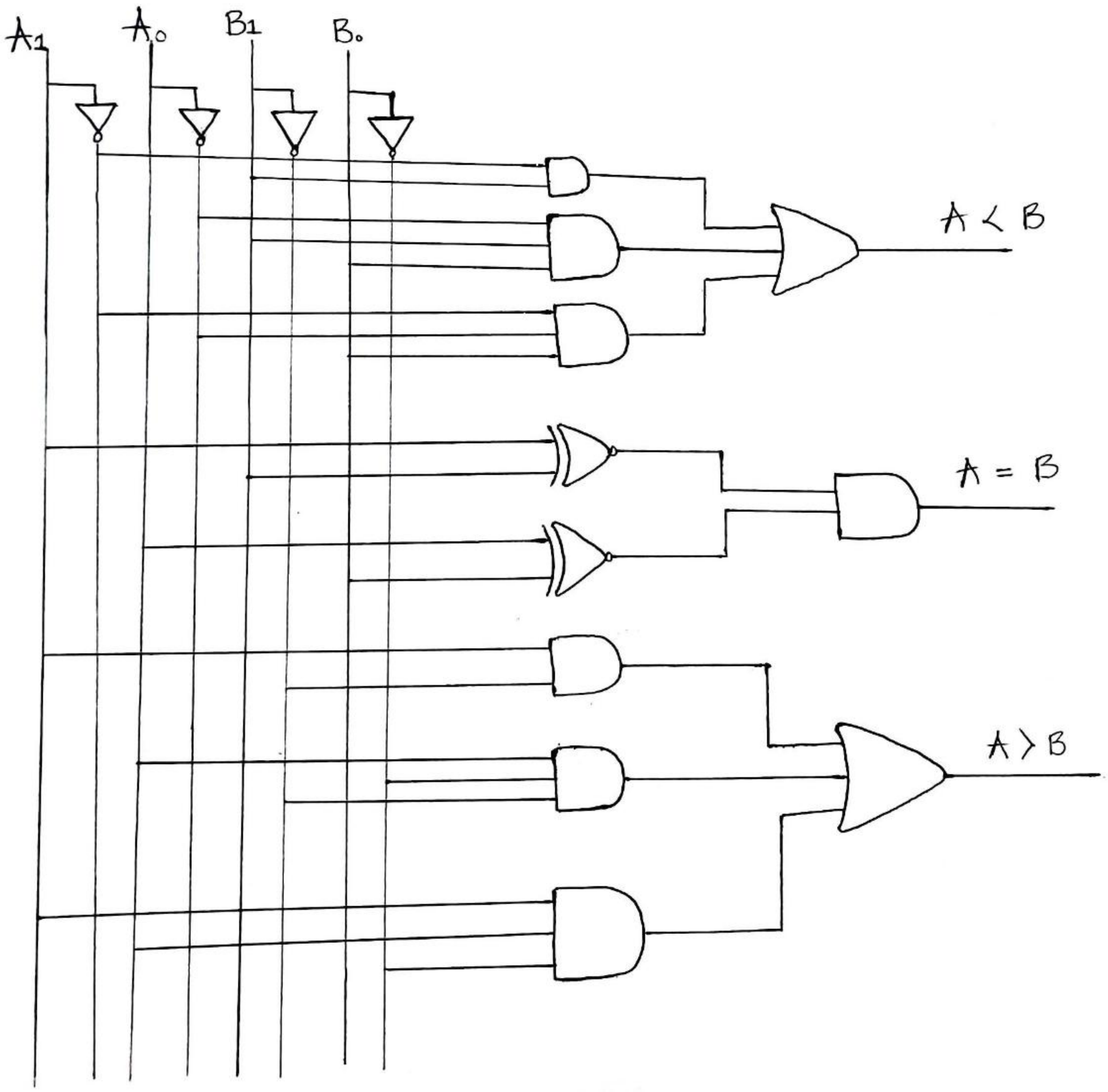
For a 64-bit adder-subtractor :

Half Adder = 1

Full Adder = 63

ii) 64 EX-OR gates

Question 2



2-bit Magnitude comparator

Question 3

In cases where only two binary digits need to be added. A half adder is an arithmetic circuit block that can be used to add two bits. This circuit has only two inputs, representing two bits to be added, and two outputs which are SUM and CARRY.

Unlike a full adder which adds three binary digits, A Half adder adds only two binary digits.

Question 4

A half adder is defined as a basic four terminal digital that adds two binary bits, which are the inputs. The two outputs are SUM and CARRY binary bit, which is either '0' or '1'.

To get the SUM, an Exclusive-OR gate is used. An AND gate is used to produce the CARRY

For the input, four combinations are possible;

0 + 0 = 0 Carry 0

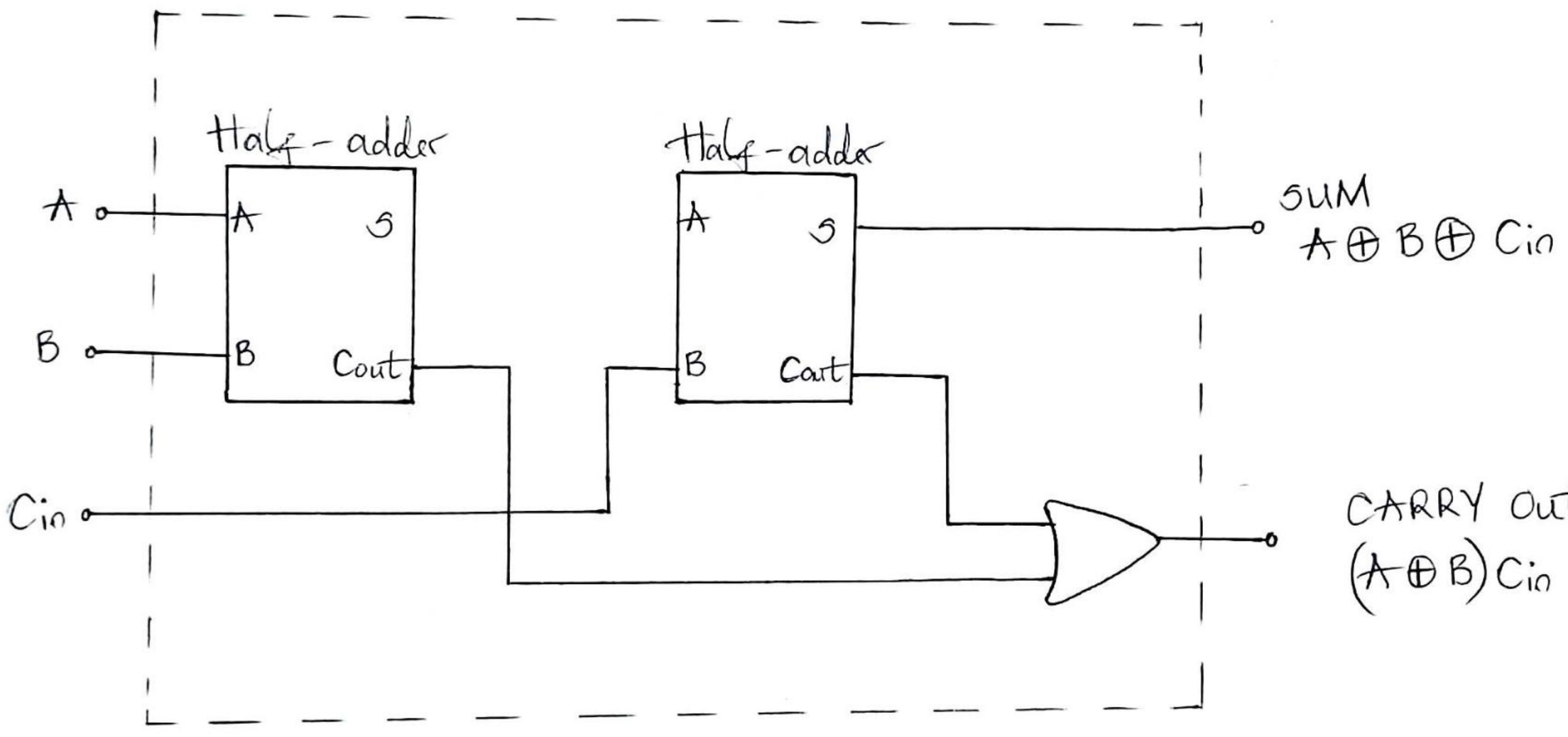
0 + 1 = 1 Carry 0

1 + 1 = 0 Carry 1

1 + 0 = 1 Carry 0

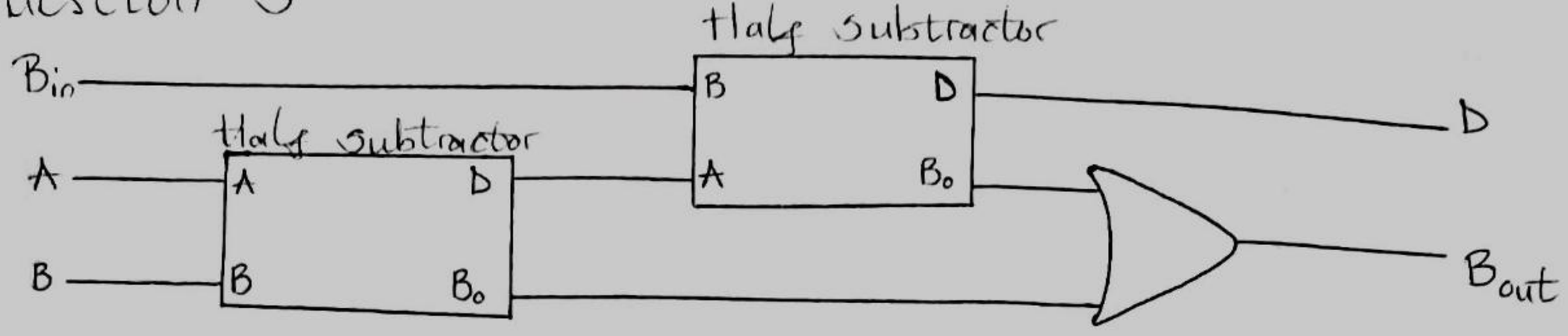
Truth table

A	B	A+B	SUM (A ⊕ B)	CARRY (AB)
0	0	0	0	0
0	1	1	1	0
1	1	0	0	1
1	0	1	1	0



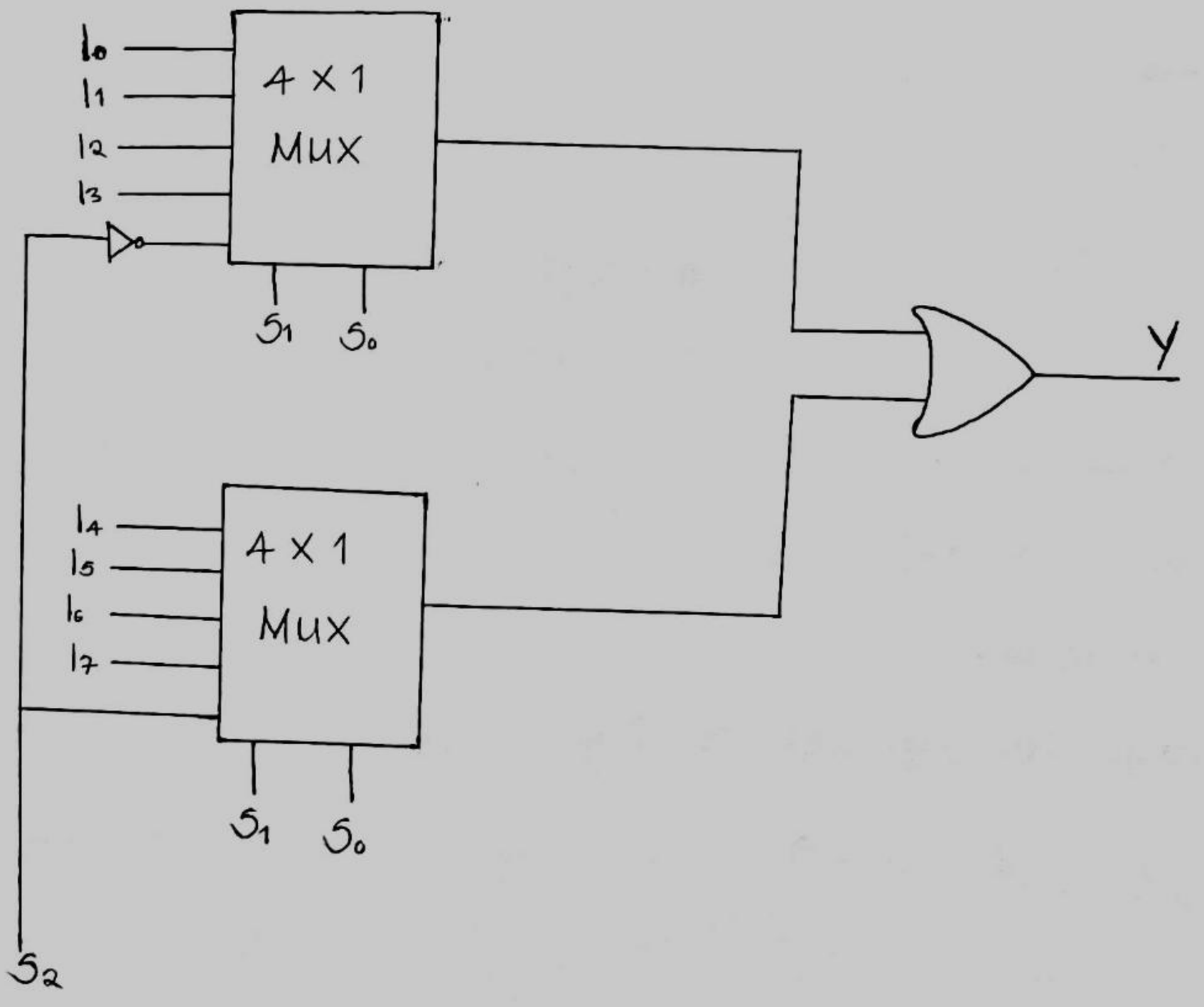
FULL ADDER using Half Adders

Question 5



Minuend (A)	Subtrahend (B)	Borrow in (Bin)	Difference (D)	Borrow out (Bout)
0	0	0	0	0
0	0	1	1	1
0	1	0	1	1
0	1	1	0	1
1	0	0	1	0
1	0	1	0	0
1	1	0	0	0
1	1	1	1	1

Question 6



S_2	S_1	S_0	Y
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

An 8 : 1 multiplexer shown above is designed using two 4 : 1 multiplexers and an AND gate.

A multiplexer is a combinational circuit that has multiple input lines, multiple selection lines but has only one output line.

An 8 : 1 multiplexer consists of eight data inputs, which are I_0 to I_7, and has three input selection lines, S_0 to S_2, and has only a single output line, Y.

The multiplexer will select the inputs depending on the select line combinations.

The output always corresponds to the inputs. For example, If $S_0 = 0$, $S_1 = 1$ and $S_2 = 0$ then, the output is D_2

Question 6 cont.

Multiplexer	Encoder
- Has only one output pin, irrespective of the number of input pins	Has 'n' outputs if it has 2^n input pins
If it has 2^n input lines, then it has n selection lines	does not have any selection input lines
It is used to multiplex one of its input signals into its output depending on the selection input	It is used to encode a particular set of binary sequences into another set of binary sequence of a smaller number of bits
Is a combinational circuit element that channels one of it's many inputs to it's only one output depending on the selection inputs	Is a combinational circuit element that encodes a set of binary codes into another set of binary codes containing a smaller number of bits
Parallel to serial converter, digital switch, signal multiplexing, etc, are the examples of the applications	8-bit code to BCD, 16-bit code to 4-bit binary code, etc are the examples of applications of the encoder