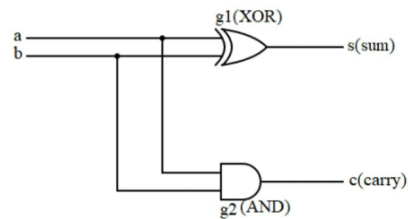


Summary Report - Assign 1

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PART-1

1 a) Circuit diagram:

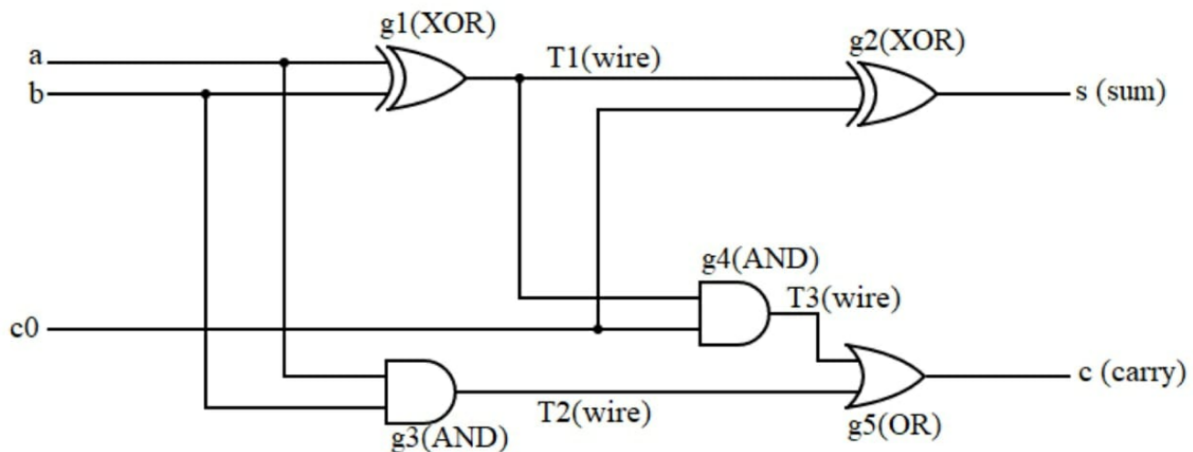


Half adder truth table

A	B	Carry	Sum
0	0	0	0
0	1	0	1
1	0	0	1
1	1	1	0

Longest Delay in half adder- 1.066ns

1 b) Circuit Diagram



Full adder truth table

A	B	Cin	Cout	Sum
0	1	0	0	1
0	0	0	0	0
0	1	1	1	0
0	0	1	0	1
1	1	1	1	1
1	0	1	1	0
1	1	0	1	0
1	0	0	0	1

Longest Delay in full adder- 1.246ns

1 c)

Adder Name	8-bit Adder	16-bit Adder	32-bit Adder	64-bit Adder
Delay	5.908ns	11.236ns	21.892ns	43.204ns

Delay of the 16 bit adder is approximately 2 times the 8 bit adder and the 32 bit adder is 2 times the 16 bit adder and so on.

1 d) n - bit Subtractor

- To subtract b from a we need to convert b to 2's complement.
- Now give this modified b as one input of rca and the other as a.
- It is like $a + [-b] = a - b$, here -b being 2's complement of b as input

PART-2

2 a) Boolean equations of the Look-ahead carry generation for the 4 carry bits :

- $C_1 = C_0 P_0 + G_0$
- $C_2 = C_0 P_0 P_1 + G_0 P_1 + G_1$
- $C_3 = C_0 P_0 P_1 P_2 + G_0 P_1 P_2 + G_1 P_2 + G_2$
- $C_4 = C_0 P_0 P_1 P_2 P_3 + G_0 P_1 P_2 P_3 + G_1 P_2 P_3 + G_2 P_3 + G_3$

Equations for the corresponding generate and propagate signals.

- Generate Signal $G_i = A_i B_i$
- Propagate Signal $P_i = A_i \oplus B_i$

2 b) Longest Delay in 4- bit CLA - 1.994ns

Longest Delay in 4-bit CLA (with PG,GG output ports) - 3.083ns

Longest Delay in 4-bit RCA - 3.244ns

We had considered 4- bit CLA with PG,GG as if we have to use it for 16-bit CLA Delay but when it comes to comparing delay we have to do it if they are functionally same so without PG,GG as outputs we got a delay of 1.994ns in CLA adder which is less than the delay in RCA.

2 c)

- The total LUT units for 16-bit RCA are 32 i.e, of LUT3
- The total number of I/O buffers in 16-bit RCA are 50 with a break up of IBUF : 33 and OBUF : 17
- The total LUT units for 16-bit CLA with Carry lookahead unit are 38 with a breakup of LUT2 : 15 , LUT3 : 6 ,LUT5 : 2 and LUT6 : 15
- The total number of I/O buffers in 16-bit CLA with Carry lookahead unit are 52 with a break up of IBUF : 33 and OBUF : 19
- The total LUT units for 16-bit CLA with carry rippled in are 26 with a breakup of LUT2 : 14 , LUT3 : 4 ,LUT5 : 5 and LUT6 : 3
- The total number of I/O buffers in 16-bit CLA with carry rippled in are 50 with a break up of IBUF : 33 and OBUF : 17

So,the LUT cost follows the order :

16-bit CLA with carry rippled in < 16-bit RCA < 16-bit CLA with Carry lookahead unit