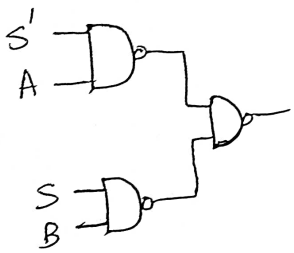
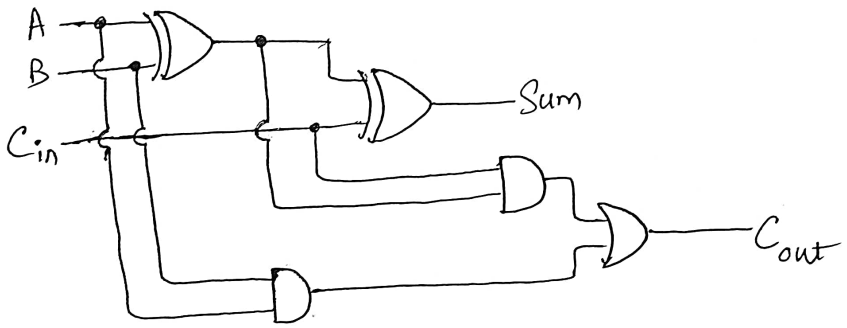
(1) Design an adder-subtractor 8-bit circuit, using any 2-input gates, and count the number of gates required and the delay of the circuit (in 2's complement format)



2x1 MUX



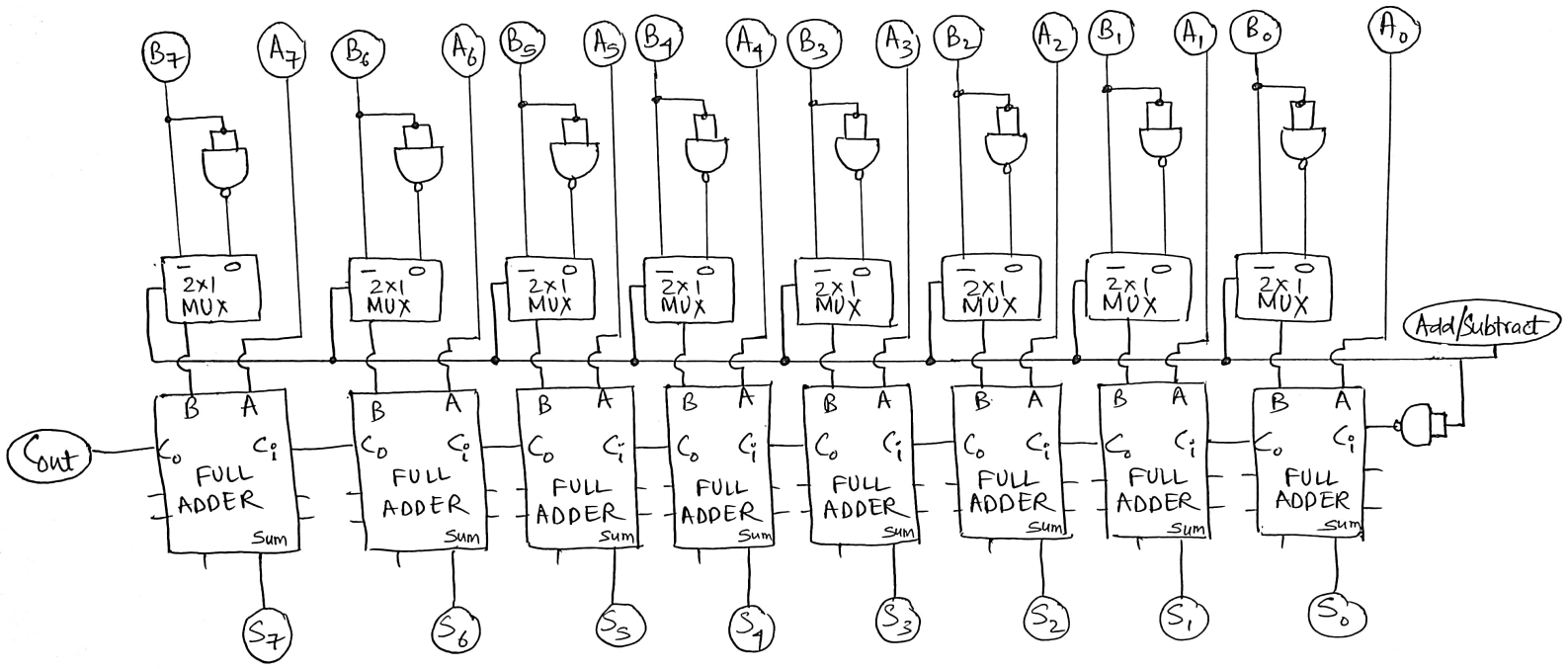
1-bit FULL ADDER

No. of gates in a 2x1 MUX = 3

No. of gates in a 1-bit FULL ADDER = 5

Delay in a 2x1 MUX = 2 td

Delay in a 1-bit FULL ADDER = 3 td



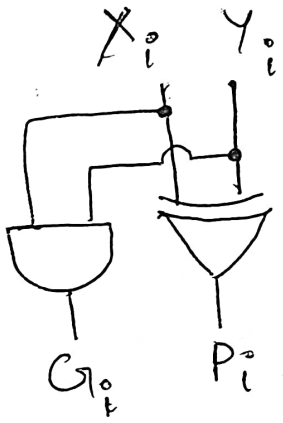
8-bit adder–subtractor circuit

Total no. of gates = 9 + 8(3) + 8(5) = 73

Delay = 3 + 8(3) = 27 td

(2) Design a carry look-ahead 8-bit adder which outputs a 9-bit number. Check that the second method would be much faster.

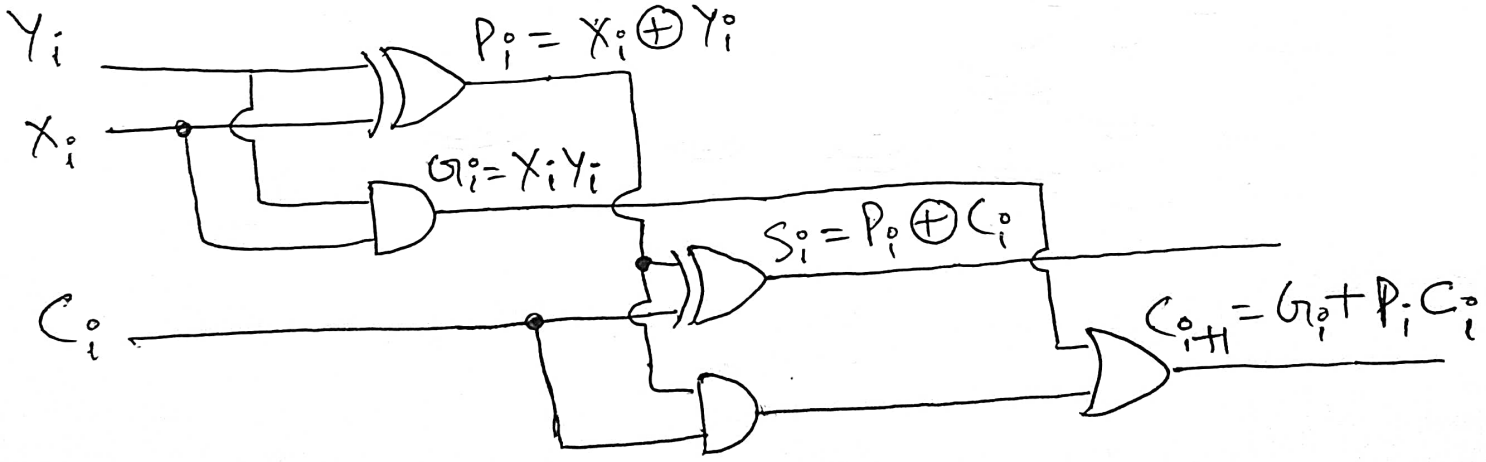
Ans:

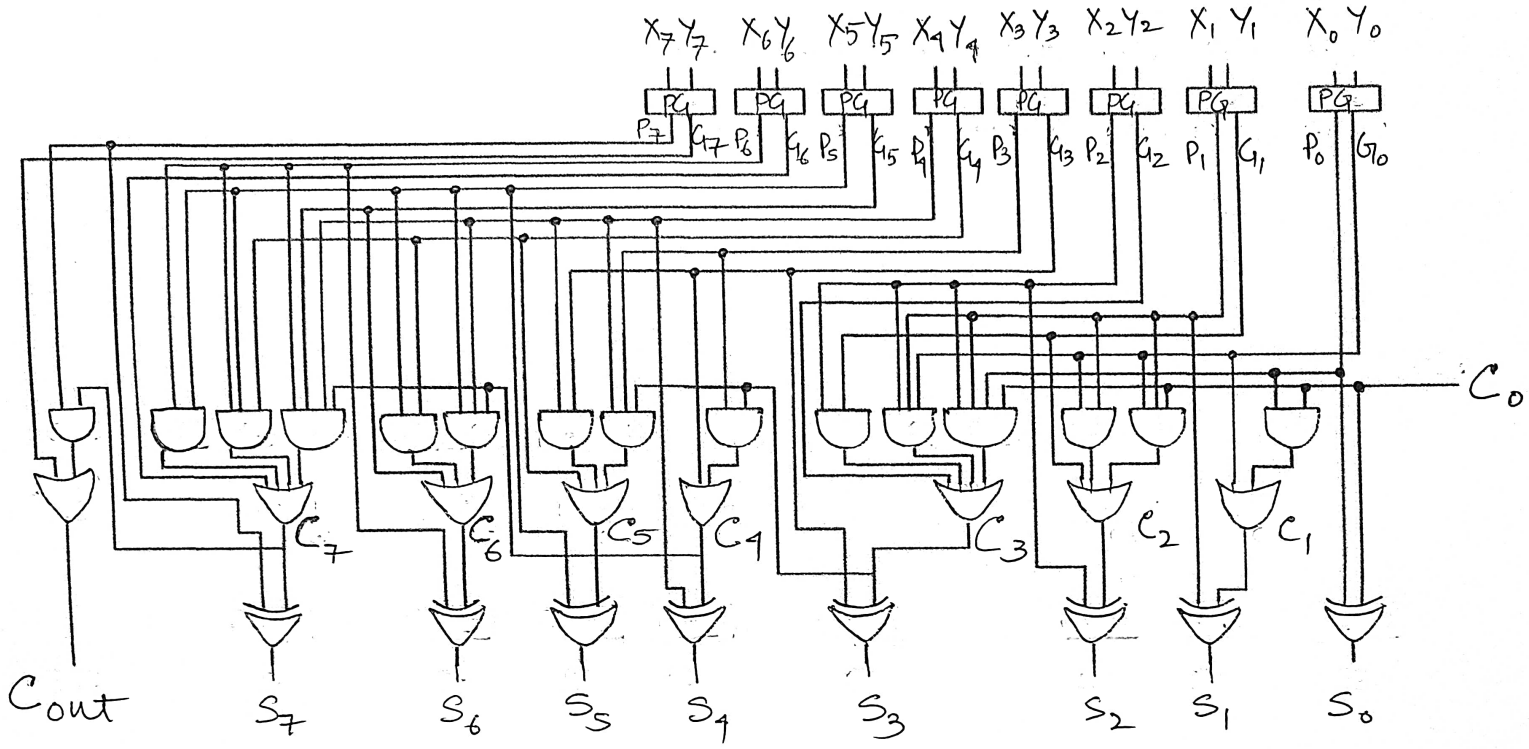


No. of gates in PG-Block = 2

Delay in PG-Block = 1td

PG-Block





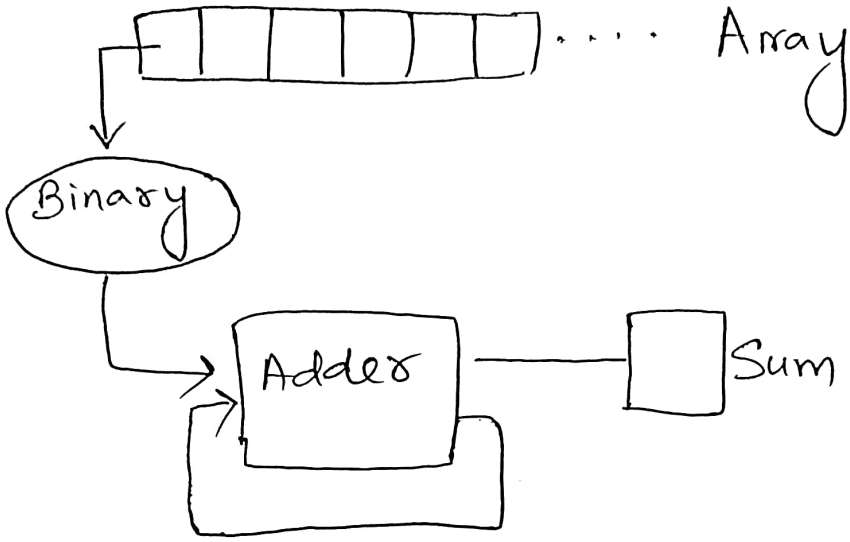
8-bit CLA.

Total no. of gates = 8(2) + 15 + 8 + 8 = 47

Delay = 4 td

Hence CLA is much faster.

(3) Give the circuit idea for adding the values of all the elements of an array.



We first convert the array elements into 8-bit binary representation. Then we will take the 1st element of array & add it to 0^8 through 8-bit adder and s be the result. Then we will take the 2nd element of the array & add it to s through 8-bit adder and modify s to be the result. Like this we will continue. Finally s will have the sum of all the elements of the array.