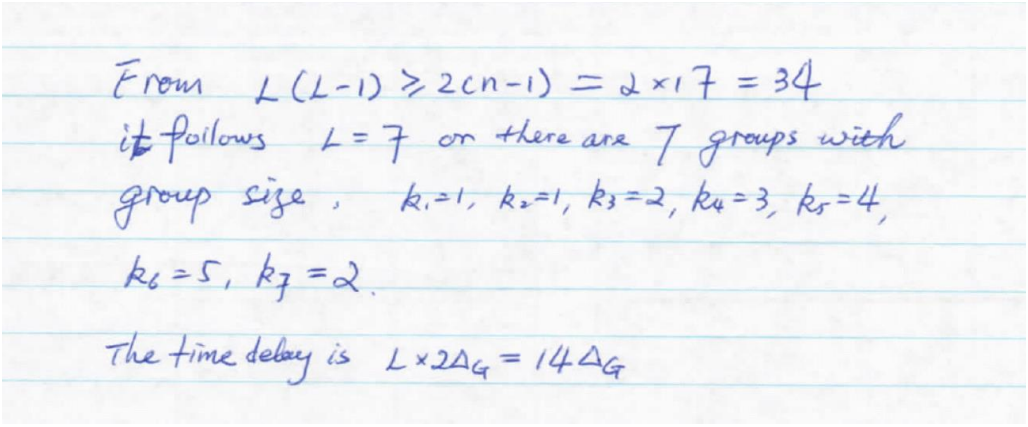
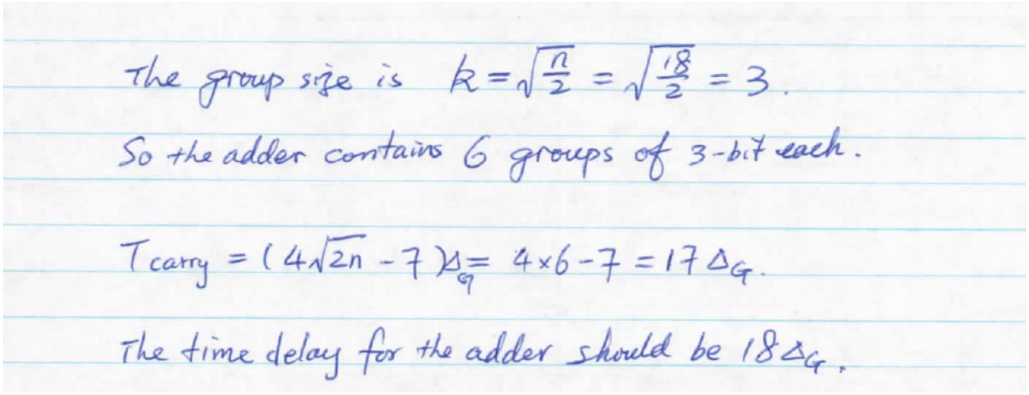
ELEC8550 Computer Arithmetic, Fall 2020

Solution to Assignment 4:

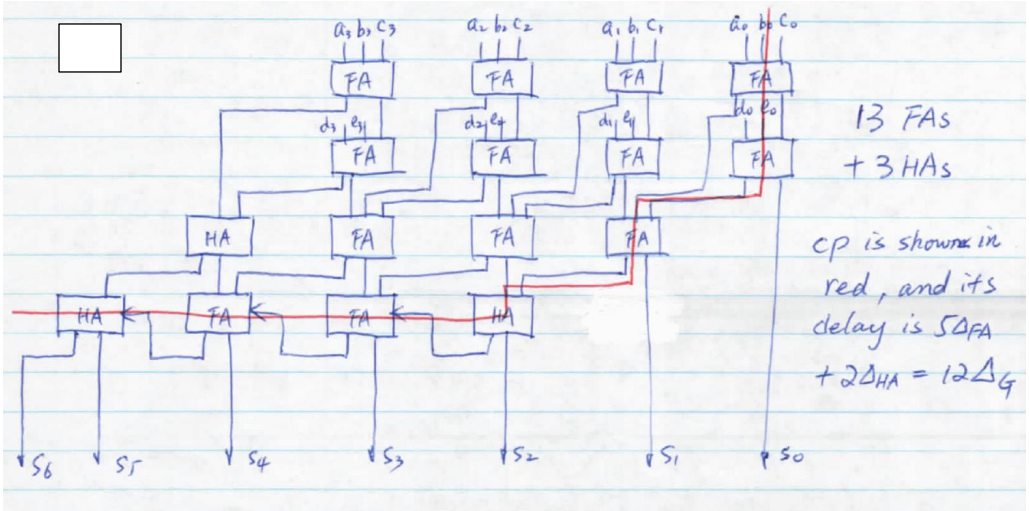
- Problem 1:



- Problem 2:

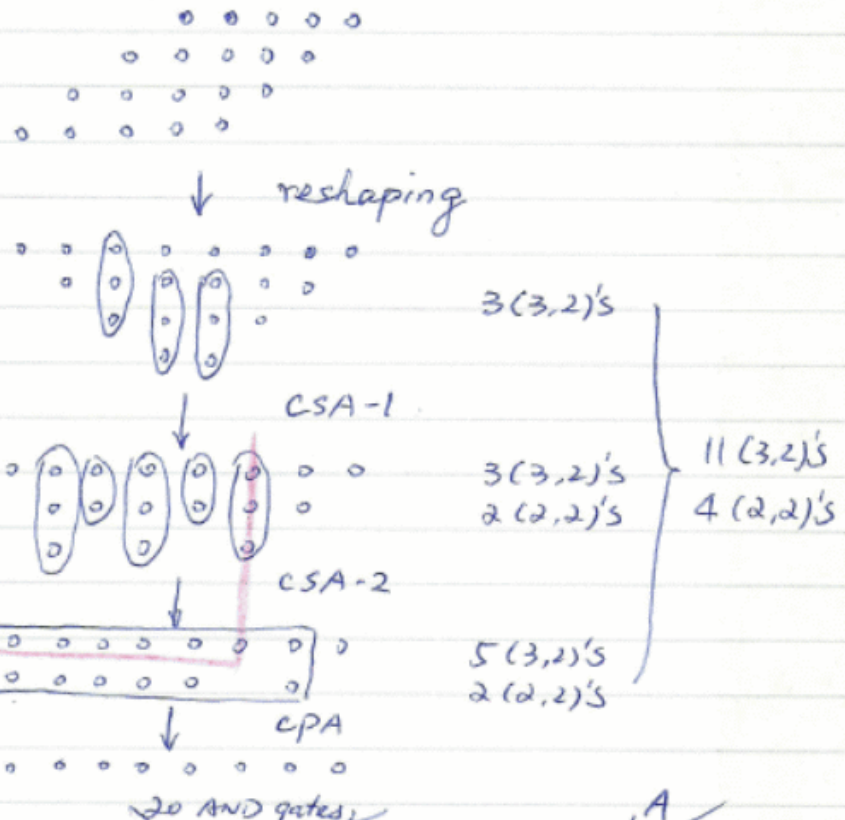


- Problem 3



- Problem 4

There are two steps in the multiplication operation.
The first step generates $5 \times 4 = 20$ partial product bits, which uses 20 AND gates.

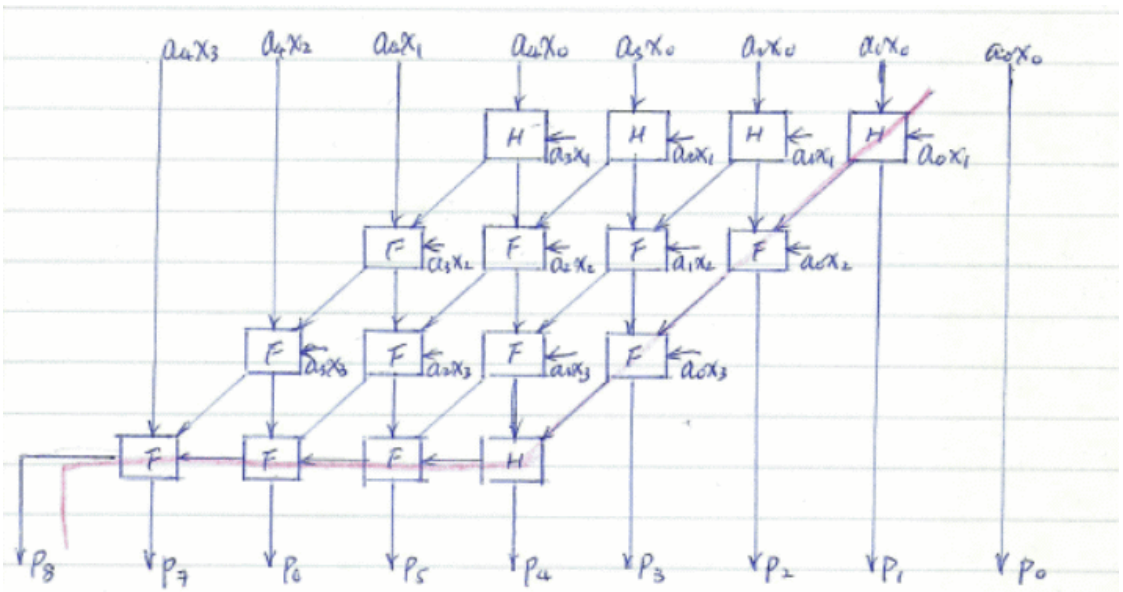


20 AND gates,
In total we used 11 (3,2)'s and 4 (2,2)'s. A critical path is shown in red and the delay is

$$\Delta_G + 6\,\Delta_{(3,2)} + \Delta_{(2,2)} = 14\,\Delta_G.$$

Note that the first Δ_G is for generating the partial product bits.

- Problem 5



Let all the partial products be generated with 20 AND gates. Then from the above diagram, we have

$C = 11\ FAs + 5\ HAs + 20\ AND$

$T = 5\Delta_{FA} + 2\Delta_{HA} + \Delta_G = 13\Delta_G$

- Problem 6
  a) $M = 15 \times 14 \times 13 = 2730$.
  b) $A = 19_{10} = (4, 5, 6)_{RNS(15,14,13)}$
     $B = 22_{10} = (7, 8, 9)_{RNS(15,14,13)}$
     $C = A \times B = (13, 12, 2)_{RNS(15,14,13)}$
  c) It requires $3 \times 4 = 12$ bits.