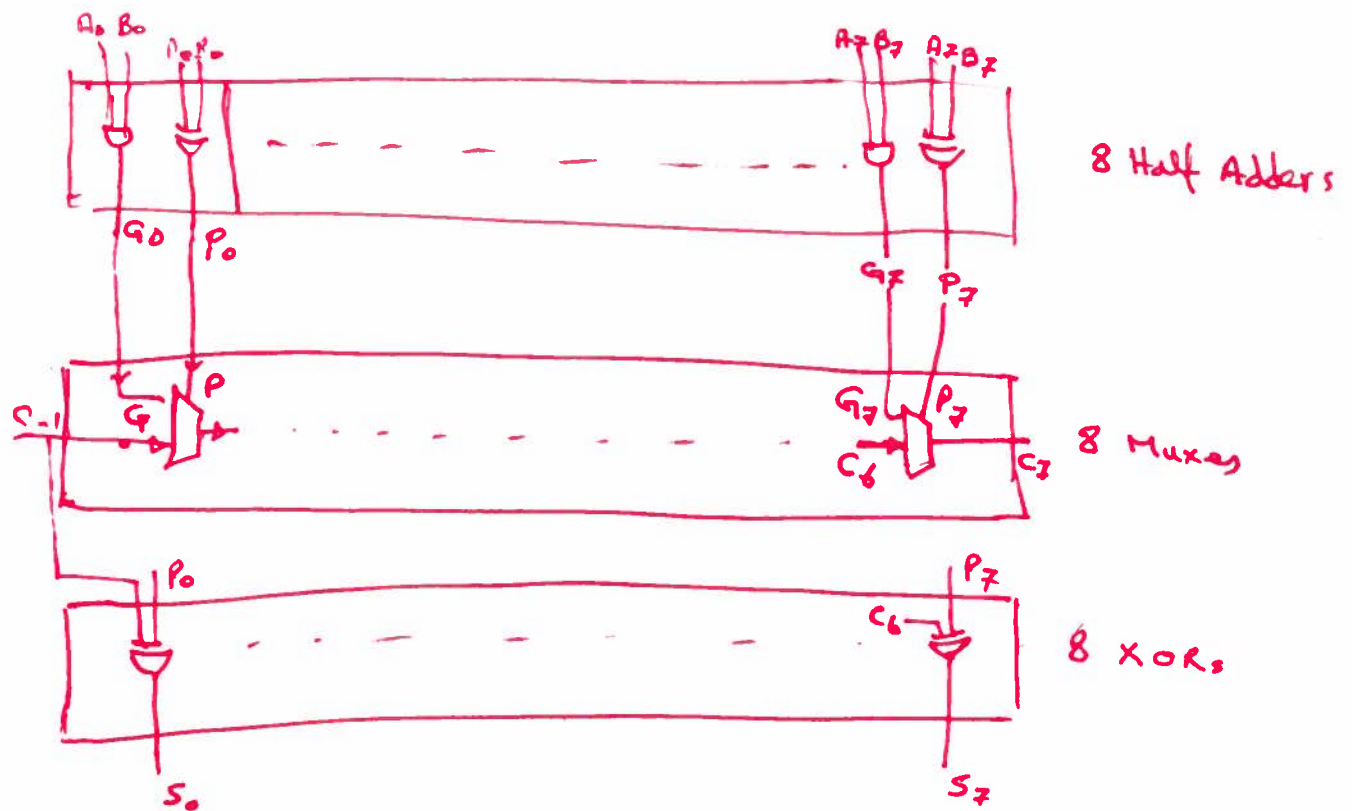


Q1



$$\text{Total Area } 8(3A_G + A_M) = 24A_G + 8A_M$$

$$\text{Total Delay } 1D_G + 8D_M + 1D_G = 2D_G + 8D_M$$

$$\text{Frequency} = \frac{1}{2D_G + 8D_M}$$

2's Complement of 5

$$\begin{array}{c} 5 \\ \hline 0101 \end{array} \rightarrow \begin{array}{c} -5 \\ \hline 1101 \end{array}$$

addition

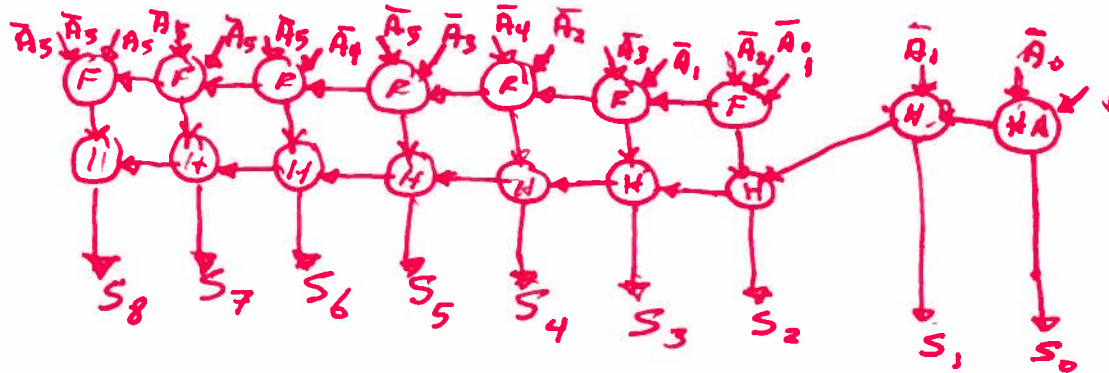
Therefore Multiplier is $\begin{matrix} 0 & -1 \\ -1 & -1 & 0 \end{matrix}$

$$\begin{array}{ccccccccccc} \bar{A}_5 & \bar{A}_5 & \bar{A}_5 & \bar{A}_5 & \bar{A}_4 & \bar{A}_3 & \bar{A}_2 & \bar{A}_1 & \bar{A}_0 & & \\ \bar{A}_5 & \bar{A}_5 & \bar{A}_4 & \bar{A}_3 & \bar{A}_2 & \bar{A}_1 & \bar{A}_0 & 0 & 1 & & \end{array}$$

$$S_8 \ S_7 \ S_6 \ S_5 \ S_4 \ S_3 \ S_2 \ S_1 \ S_0$$

Generate complement of A

$$\begin{array}{cccccc} A_5 & A_4 & A_3 & A_2 & A_1 & A_0 \\ \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\ \bar{A}_5 & \bar{A}_4 & \bar{A}_3 & \bar{A}_2 & \bar{A}_1 & \bar{A}_0 \end{array}$$



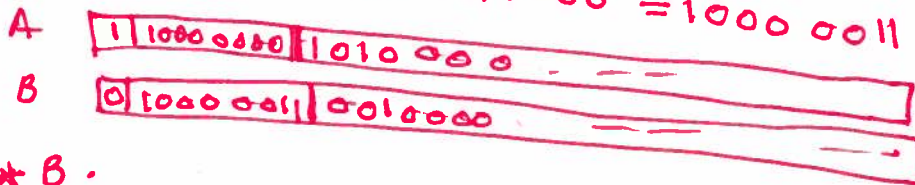
$$\text{Delay} = 7 D_{FA} + 1 D_{HA}$$

$$Area = 7A_{FA} + 9N_{HA} + 6inv$$

Q3

$$\begin{cases} A = -3.25 = -11.01 = 1.101 \times 2^1 \\ \text{exp}_A = 1 + 127 = 128 = 0111\ 1111 + 1 = 1000\ 0000 \end{cases}$$

$$\begin{cases} B = 18.0 = 010010.0 = 1.0010 \times 2^4 \\ \text{exp}_B = 4 + 127 = 131 = 0111\ 1111 + 100 = 1000\ 0011 \end{cases}$$



$A * B$:

XOR right bit $1 \oplus 0 = 1$;

Add exponent $\text{exp}_R = \text{exp}_A + \text{exp}_B = 1000 + 1000\ 0011 = 0111\ 1111 = 1000\ 01$

Multiply significant

$$\begin{array}{r} 1.101 \\ 1.001 \\ \hline 1101 \\ 1101 \\ \hline 1.110101 \end{array}$$

Result



Rounding: When $R(M_0 + 5)$ is true, then $\text{significant} = \text{significant} + 0.01$

In table format this is

$x0.00 \rightarrow x0.$	$x1.00 \rightarrow x1.0$
$x0.01 \rightarrow x0$	$x1.01 \rightarrow x1.0$
$x0.10 \rightarrow x0$	$x1.10 \rightarrow x1 + 1$
$x0.11 \rightarrow x1$	$x1.11 \rightarrow x1 + 1$

