

HW3

1. a) $A = 1000 \ 1111 \ 1110 \ 1111 \ 1100 \ 0000 \ 0000 \ 0000$

flip bits: $0111 \ 0000 \ 0001 \ 0000 \ 0011 \ 1111 \ 1111 \ 1111$

add 1: $0111 \ 0000 \ 0001 \ 0000 \ 0100 \ 0000 \ 0000 \ 0000$

$$2^{14} + 2^{20} + 2^{28} + 2^{29} + 2^{30} = 1,880,113,152$$

$$= -1,880,113,152$$

b) $A = \overset{s}{1} \overset{e}{1000} \overset{fraction \ (normalized)}{1111 \ 1110 \ 1111 \ 1100 \ 0000 \ 0000 \ 0000}$

$$= 1.110111111_2 \times 2^{31-127}$$

$$1 + 2^{-1} + 2^{-2} + 2^{-4} + 2^{-5} + 2^{-6} + 2^{-7} + 2^{-8} + 2^{-9} =$$

$$= 1.873046875 \times 2^{-96}$$

$$= -2.3641175 \times 10^{-29}$$

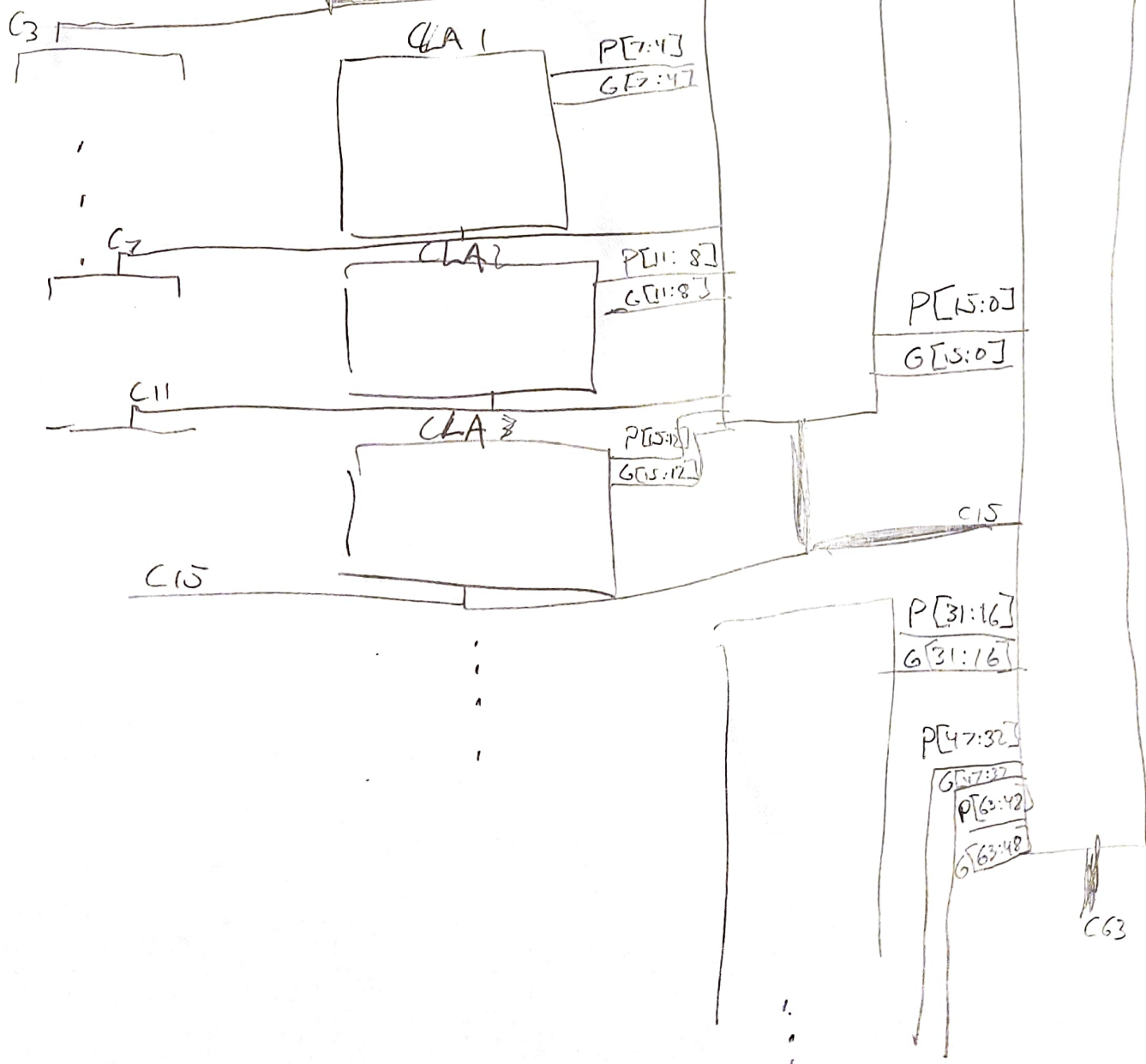
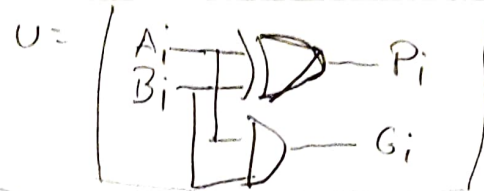
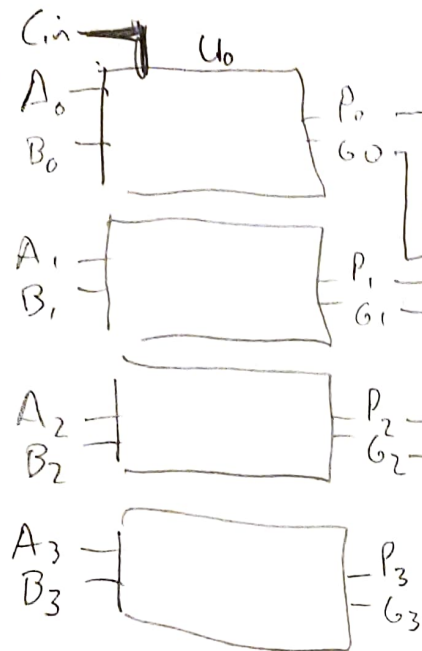
c) $A = \overset{I-type}{1000} \overset{op=lw}{1111} \overset{base}{1110} \overset{dst}{1111} \overset{offset}{1100 \ 0000 \ 0000 \ 0000}$

$lw \ \$31 \ \$15 \ 0011 \ 1111 \ 1111 \ 1111$
 $0100 \ 0000 \ 0000 \ 0000$
 $= 2^{14}$

$$lw \ \$15, -16384(\$31)$$

$$lw \ \$+7, -16384(\$ra)$$

2.

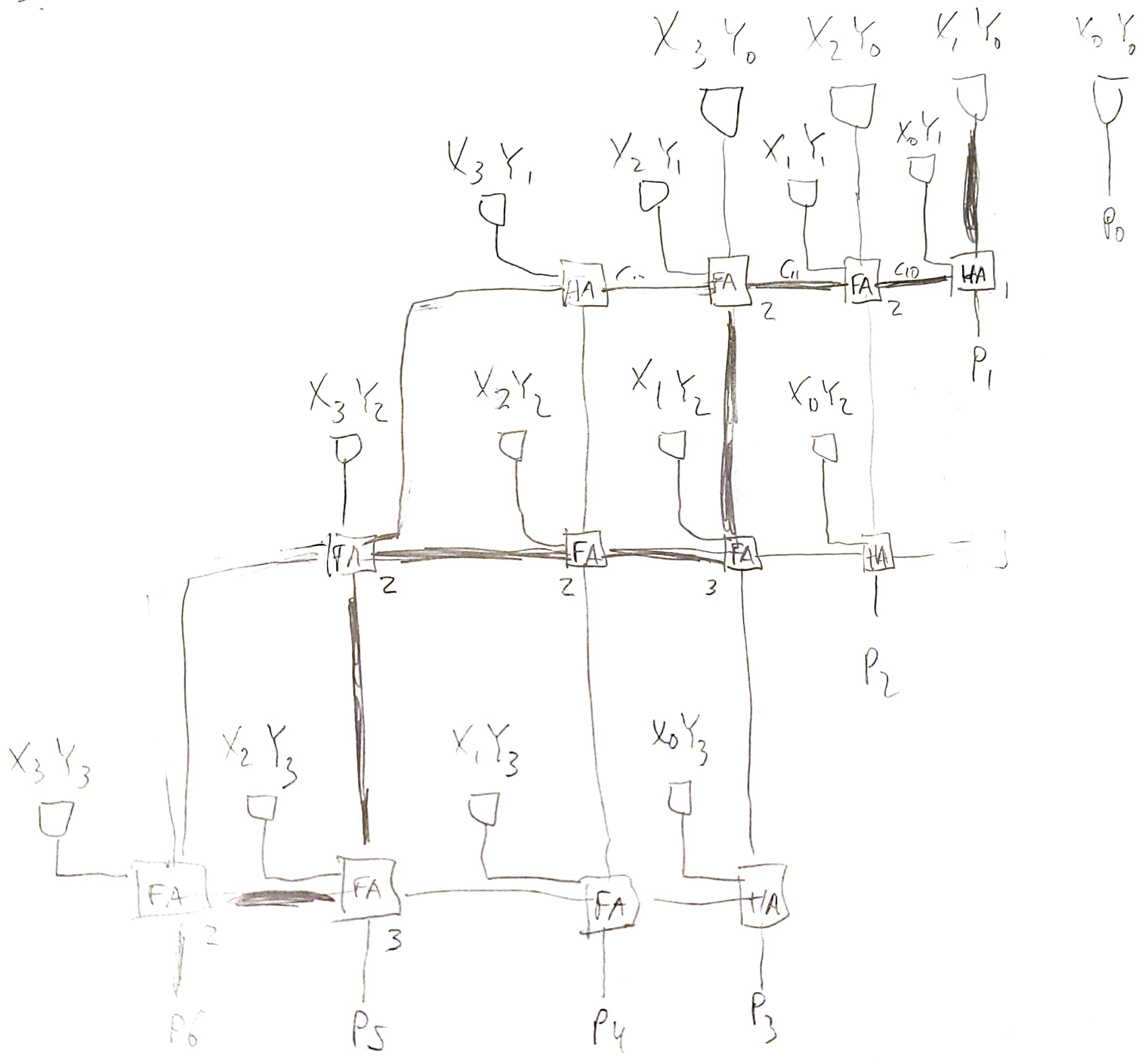


U63

CLA 15

Delay: 13 gates

3.



$$1 + 2 + 2 + 3 + 2 + 2 + 3 + 2 =$$

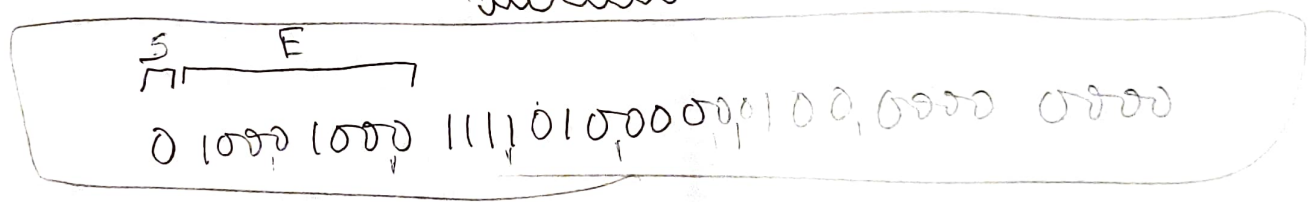
$$5 \times 2 + 2 \times 3 + 1 = \boxed{17}$$

4. SP:

$$\begin{array}{r}
 1050 = 2^9 + 2^8 + 2^7 + 2^6 + 2^5 \\
 \quad + 2^3 \\
 \hline
 512 \\
 488 \\
 \hline
 - 256 \\
 \hline
 232 \\
 \hline
 - 128 \\
 \hline
 104 \\
 \hline
 - 64 \\
 \hline
 40 \\
 \hline
 - 32 \\
 \hline
 8
 \end{array}$$

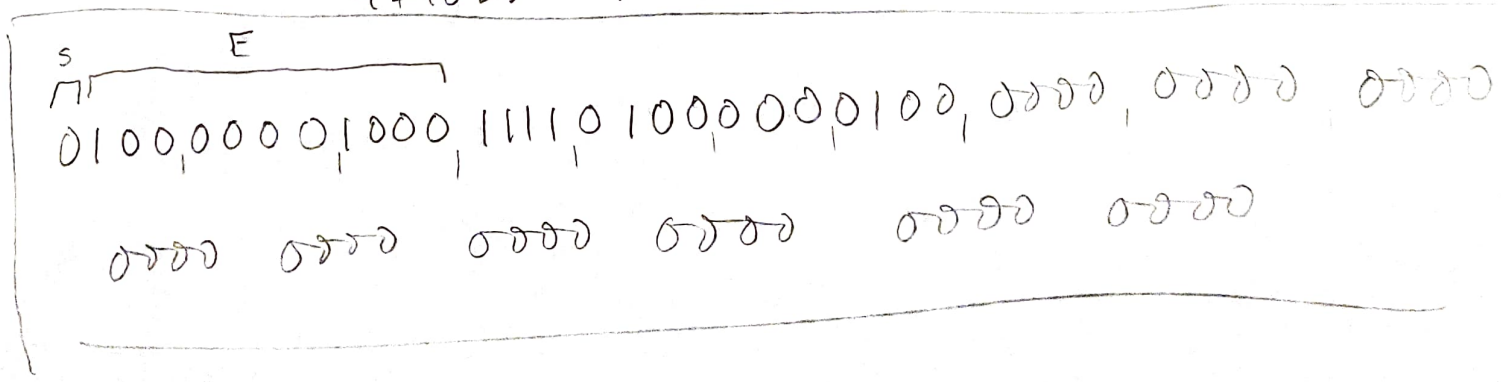
$$\begin{array}{r}
 0.0625 \\
 \times 2 \\
 \hline
 0.1250 \\
 \times 2 \\
 \hline
 0.25 \\
 \times 2 \\
 \hline
 0.5 \\
 \times 2 \\
 \hline
 1 \\
 0.0625 = 0.0001
 \end{array}$$

$111101000,0001$
 $9+127=136$



DP:

$9+1023 = 1032 =$



4. 5. $1.001_2 \times 2^2 =$

$129 = 10000001$

I. A: $\overset{5}{0} \overset{E}{\overbrace{10000001}^5} 001 0000 0000 0000 0000 0000$

B: $0.10000000 010 0000 0000 0000 0000 0011$

II

right shift B 1:

A: $0 \overbrace{10000001}^5 001 0000 0000 0000 0000 0000$
 + B: $0 \overbrace{10000001}^5 001 0000 0000 0000 0000 0001(1)$
 $10.010 0000 0000 0001 0000 0001(1)$

$0 1000 0010 010 0000 0000 0000 0000(1)(1)$

(a) $01000 0010 010 0000 0000 0000 0000 0001$

b $01000 0010 010 0000 0000 0000 0000 0000$