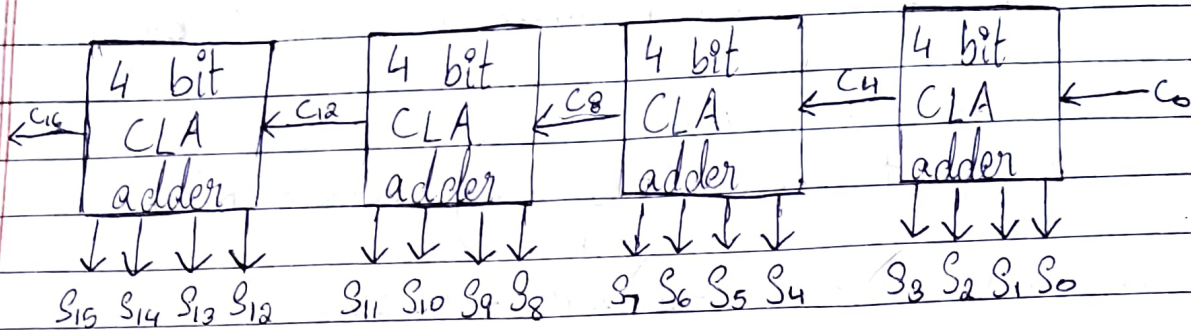


Assignment 3

Date _____ Page _____

1.



Here every 4 bit CLA has a carry which is passed on to the next 4 bit CLA. The carry is a ripple carry so the process is a little slower but not as slow as Ripple Carry Adder. The overall carry $C_{16} = 12$ gate delays and for sum $S_{16} = 13$ gate delays.

2. The propagate p_{ij} indicates an incoming carry propagates from bit position i to j . The generate signal g_{ij} indicates that a carry is generated at bit position j , or if a carry out is generated at a lower bit position and propagates to position j .

Prefix Adders minimize the delay by first computing G and P for pairs of columns, then for blocks of 4, then for blocks of 8 and so on until the generate signal for every column is known. The sums are computed from these generate signals. In other words, prefix adders compute the carry in C_{i-1} for each column i as quickly as possible, then to compute the sum using $S_i = (A_i \oplus B_i) \oplus C_{i-1}$.

3. 21 4-bit CLA blocks are required to construct 64-bit adder

Time delay for the CLA:

$$\text{Formula: } t_{pg} + t_{pg\text{-block}} + \left(\frac{N}{k} - 1\right) t_{AND-OR} + k T_{FA}$$

$$= 200 + 6(200) + \left(\frac{32}{4} - 1\right) \times 400 + (4 \times 250)$$

$$= 3200 \text{ ps} = 5.2 \text{ ns}$$

4.

5. $M = 12 = 1100$

$Q = 15 = 1111$

	M	C	A	Q	
	1100	0	0000	1111	
1 st cycle	1100	0	1100	1111	$A = A + M$
	1100	0	0110	0111	RS
2 nd cycle	1100	1	0010	0111	$A = A + M$
	1100	0	1001	0011	RS

Value of Accumulator = 1001

Value of carry-bit = 0

6. $0 \times C0000000$

$= 1100 \ 0000 \ 0000 \ 0000 \ 0000 \ 0000 \ 0000 \ 0000$

$S = 1, -ve$

$E = 10000000$

$= 128 - 127 = 1$

$M = 0$

$= (-1)^1 \times (1+0) \times 2^1$

$= -2$

$$7. \text{ Multiplicand} = +13 = 01101$$

$$\text{Multiplier} = -6 = 11010$$

$$-M = 10011$$

$$\begin{array}{r} \cancel{+} \cancel{0} \cancel{+} \cancel{0} \boxed{0} \\ 0 \cancel{0} \cancel{-} 1 \cancel{-} 1 \cancel{0} \\ \hline 0 \quad -1 \quad -2 \end{array}$$

$$M = 01101$$

$$\begin{array}{r} 0 \quad -1 \quad -2 \\ \hline 1'1'1'1'0'0'1'1'0 \\ 11110011-- \\ 000000-- \\ \hline 1110110010 \end{array}$$

Two's complement: 1110110010

$$0001001101$$

$$+ \quad \quad \quad 1$$

$$\hline 0001001110$$

$$= (-) (64 + 8 + 4 + 2) = -78$$

8. Dividend = 14, Divisor = 3

$$M = 00011 \quad Q = 1110$$

$$-M = 11101$$

n	M	A	Q
	00011	00000	1110
4		00001	110 - LS
		11110	110 - A = A - M
		11110	1100 q[0] = 0
		00001	1100 A = A + M
3		00011	100 - LS
		00000	100 - A = A - M
		00000	1001 q[0] = 1
2		00001	001 - LS
		11110	001 - A = A - M
		11110	0010 q[0] = 0
		00001	0010 A = A + M
1		00010	010 - LS
		11111	010 - A = A - M
		11111	0100 q[0] = 0
		00010	0100 A = A + M

Remainder = 2

Quotient = 4

9. Prefix Adder Delay Formula: $t_{pg} + \log_2^N(t_{pg} - \text{prefix}) + t_{xor}$

$$\begin{aligned}
 &= \cancel{[200 + \log_2^{32}(400) + 200]} \\
 &= 200 + (\log_2^{32})(400) + 200 \\
 &= 2400 \text{ ps} = 2.4 \text{ ns}
 \end{aligned}$$

	S	E	M
10. 45.125	0	10000100	011010010000000000000000
45 = 101101	4	2	3 4 8 0 0 0
0.125	= 42348000		
x 2			
0.25 - 0			
x 2			
0.5 - 0			
x 2			
1 - 10			
= 101101.001			
= 1.01101001 x 2 ⁵			
E = 127 + 5 = 132			
= 10000100			

71.215

71 = 1000111

0.215

$\times 2$

0.43 - 0

$\times 2$

0.86 - 0

$\times 2$

1.72 - 1

0.72

$\times 2$

1.44 - 1

0.44

$\times 2$

0.88 - 0

$\times 2$

1.76 - 1

0.76

$\times 2$

1.52 - 1

0.52

$\times 2$

1.04 - 1

0.04

$\times 2$

0.08 - 0

0.08

$\times 2$

0.16 - 0

$\times 2$

0.32 - 0

$\times 2$

0.64 - 0

$\times 2$

1.28 - 1

0.28

$\times 2$

0.56 - 0

$\times 2$

1.12 - 1

0.12

$\times 2$

0.24 - 0

$\times 2$

0.48 - 0

= 1000111.00110111000010100

= 1.00011100110111000010100 $\times 2^6$

E = 127 + 6 = 133

= 10000101

~~S E M~~
~~0 10000101 0001100110111000010100~~
~~7 3 4 1 4~~

S E M

0 10000101 0001100110111000010100
4 2 8 E 6 E 1 4

= 428E6E14