

Solutions

Q1 (a)

0 0 1	X
0 1 0	Y
0 1 1	Z

0 0 0	S1
0 1 1	C1
/ / /	
0 1 1	C1<<1

0 0 0	S1
0 1 1	C1<<1
1 0 0	U

0 0 1 0	S2
0 1 0 0	C2
/ / / /	
0 1 0 0	C2<<1

0 0 1 0	S2
0 1 0 0	C2<<1
0 0 1 0 1	V

0 1 1 1 1	S3
0 0 0 0 0	C3
/ / / / /	
0 0 0 0 0	C3<<1

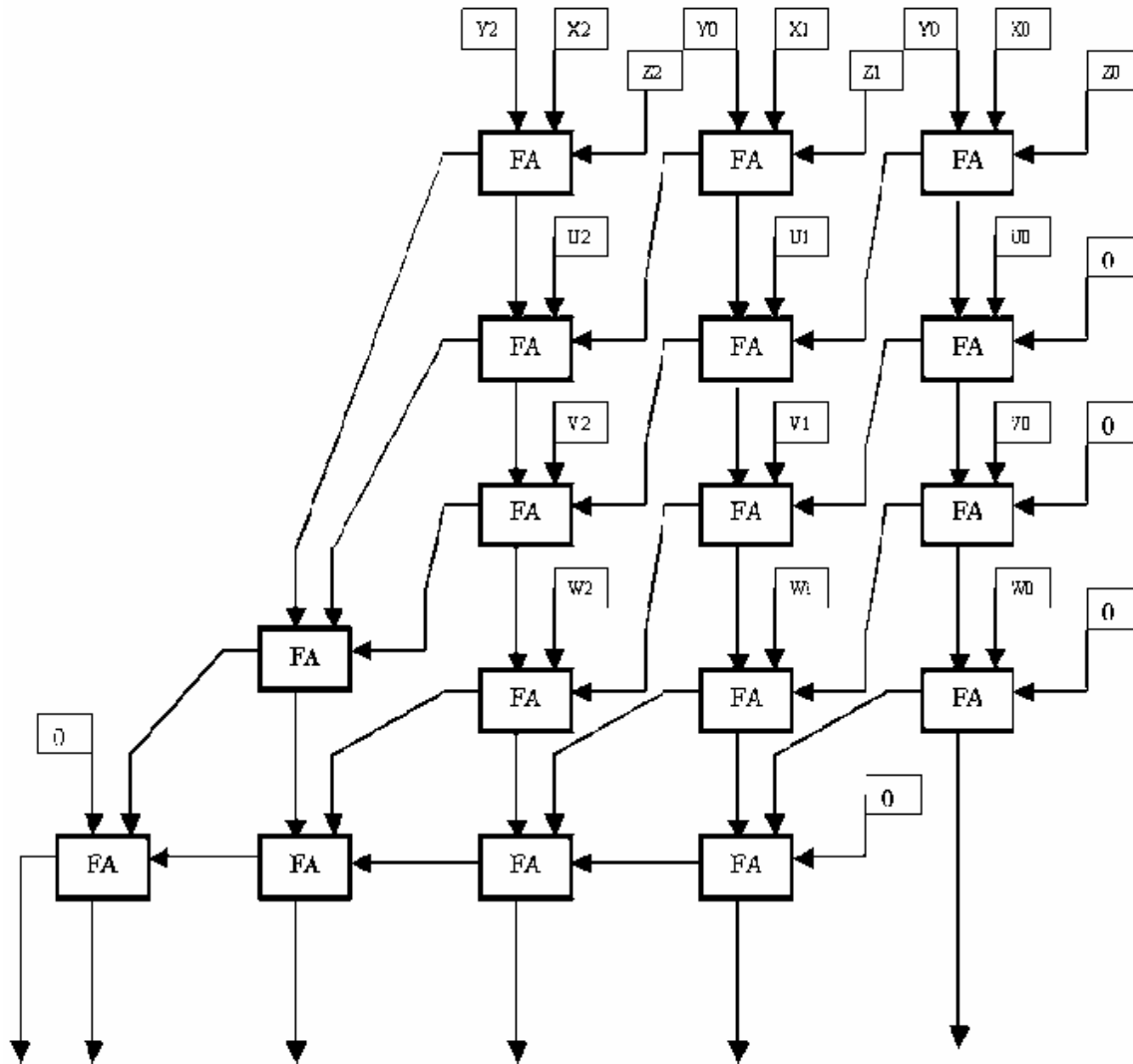
0 1 1 1 1	S4
0 0 0 0 0	C3<<1
0 0 0 1 1 0	W

0 0 1 0 0 1	S4
0 0 0 1 1 0	C4
/ / / / / /	
0 0 0 1 1 0	C4<<1

0 0 1 0 0 1	S5
0 0 0 1 1 0	C4<<1

0 0 1 0 1 0 1	Result

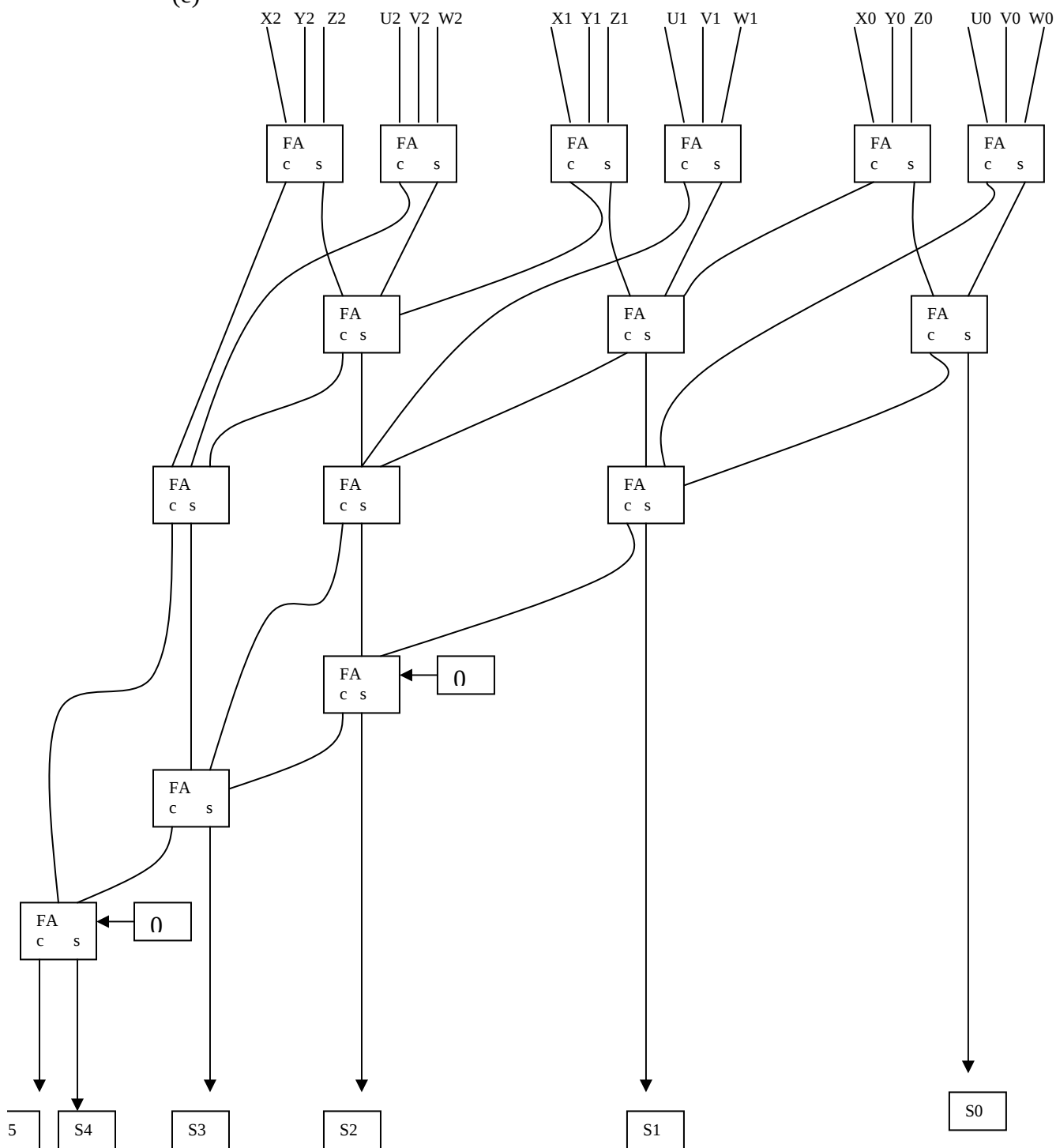
(b)&(c)



(d)

Longest Path is 8 FA
 Delay = $8 * 20 = 160$ ns

(e)



2(a)

$$A = 1010, \quad a = 0101$$

$$B = 1100, \quad b = 0011$$

$$X \times Y = A \times B \times 2^{a+b}$$

$$a + b = 0101 + 0011 = 1000$$

$$A \times B = 1010$$

$$1100$$

$$0000$$

$$0000$$

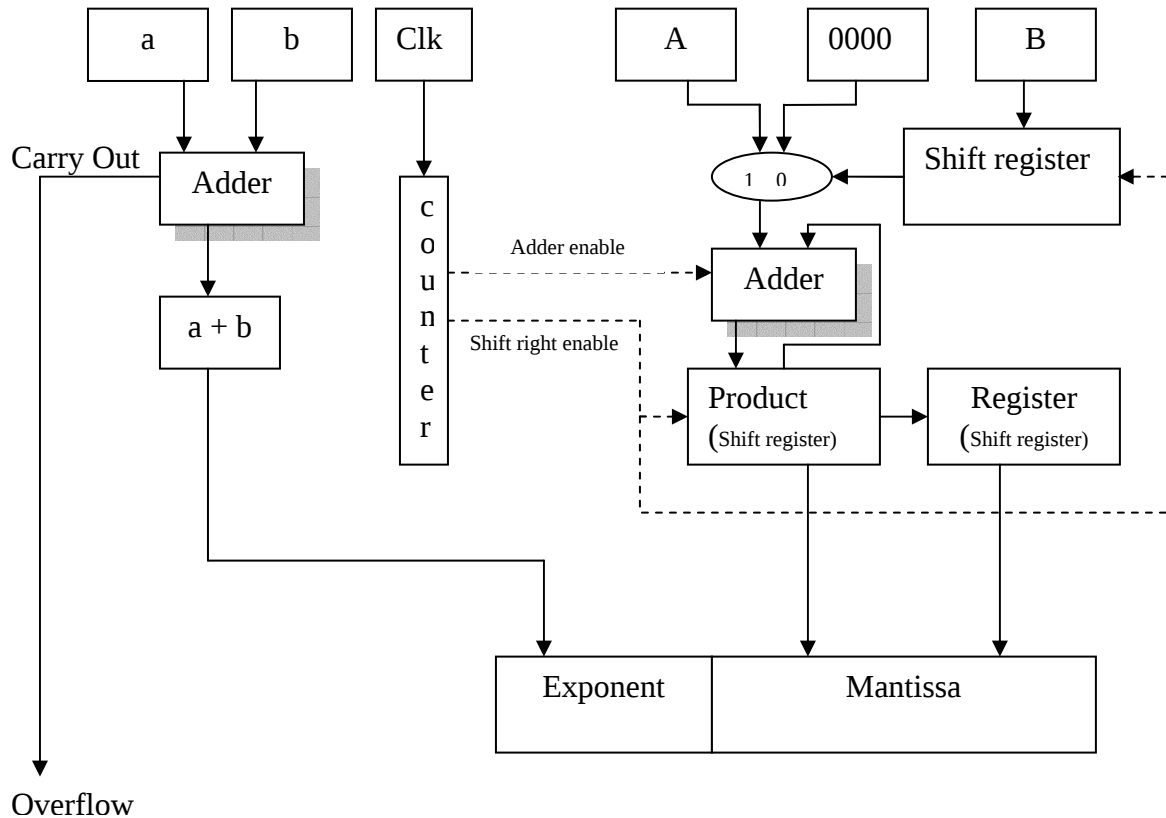
$$1010$$

$$1010$$

$$1111000$$

$$\text{Answer} = 1111000 \times 2^{1000}$$

2(b)



2(c)

Overflow should be checked with the exponent field i.e. $2^{(a+b)}$, you need to check the carry bit of the exponent addition ($a + b$). To avoid exception you could use 2 four bit registers for the exponent addition.

2(d)

It will take 80ns to multiply the given data because you need to do 4 times shift right and 4 times add so
 $4(10 + 10) = 80\text{ns}$.

Q3.

(a)

$$\begin{array}{r} (+22) \ 010110 \\ + \\ (-11) \ 101011 \\ \hline \end{array}$$

01011

➔ result is $(001011)_2 = (+11)_{10}$

(b)

$$\begin{array}{r} (+22) \ 010110 \\ + \\ (-11) \ 110100 \\ \hline \end{array}$$

001010

➔ result is $(001010+1)_2 = (001011)_2 = (+11)_{10}$

(c)

$$\begin{array}{r} (+22) \ 010110 \\ + \\ (-11) \ 110101 \\ \hline \end{array}$$

001011

➔ result is $(001011)_2 = (+11)_{10}$