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Section: 11

HOMEWORK 9

P1. a) A. Sign = 0, Exponent = 10000011, Mantissa = 0111000.....0
                   +ve                                    $\underbrace{\phantom{000.....0}}_{29}$

B. Sign = 1, Exponent = 10000101, Mantissa = 111111 000.....0
            -ve                                        $\underbrace{\phantom{000.....0}}_{17}$

C. Sign = 1, Exponent = 10000100, Mantissa = 1010 1000.....0
            -ve                                      $\underbrace{\phantom{000.....0}}_{18}$

D. Sign = 0, Exponent = 01111111, Mantissa = 1001100110011001100110l
            +ve

B.)

C. a.)



1

T    Q

CTR    Q̄

T    Q

Q̄

Q_A
LSB

Q_B
MSB

b.)



(T)

D    Q

CTk    Q̄

D    Q

Q̄

1

Q_A
CLSB
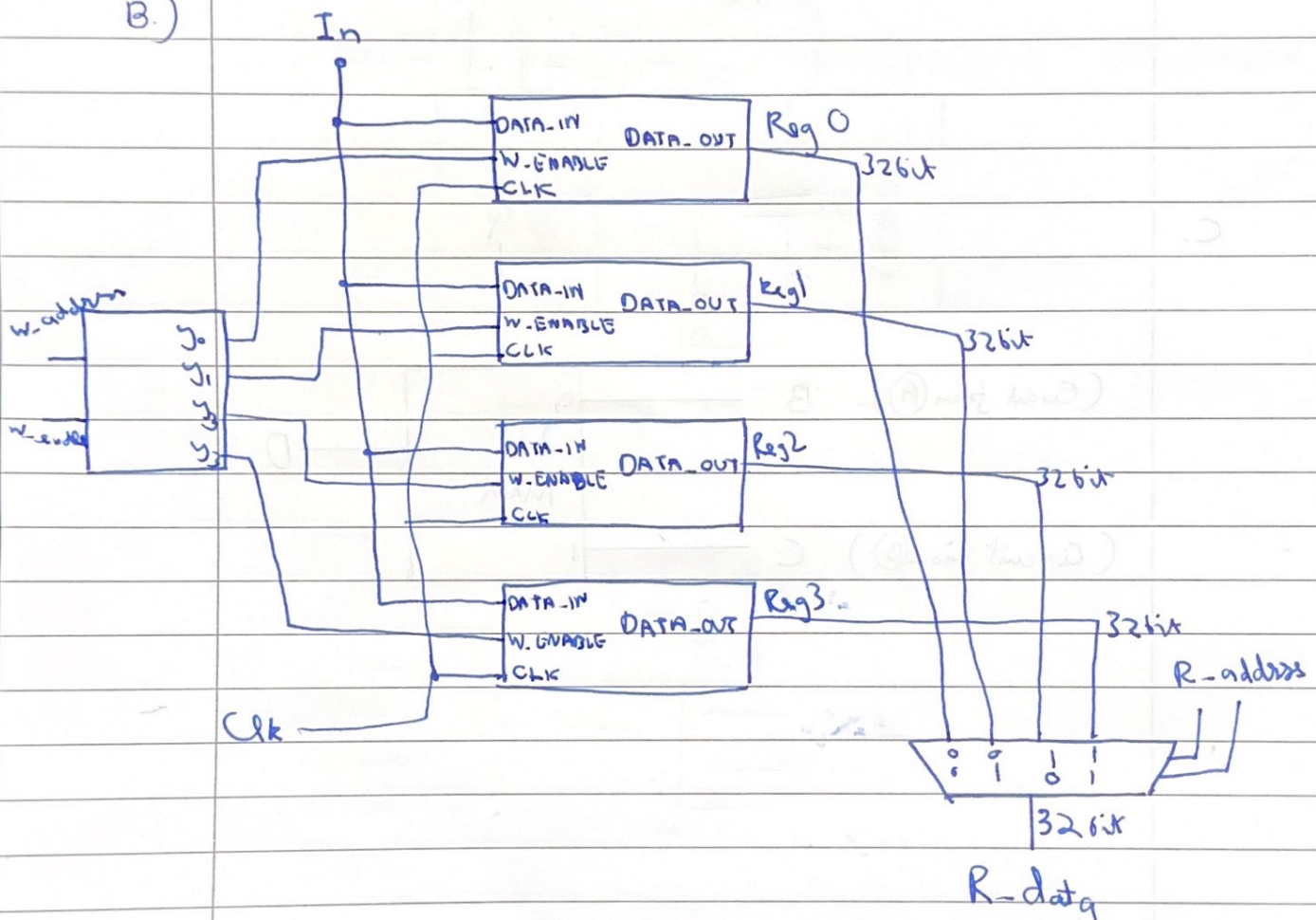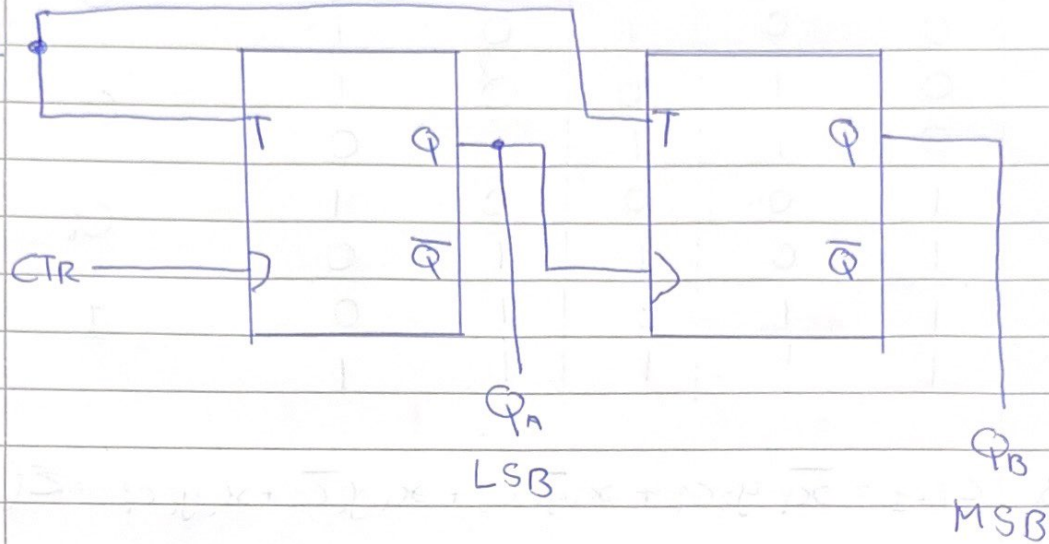
Q_B
MSB
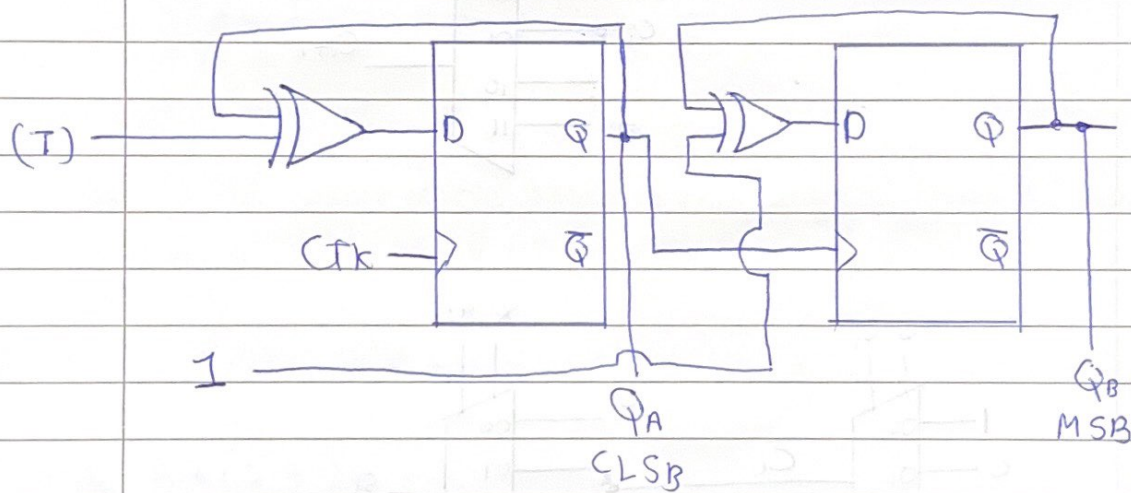
P2. A

| $x_i$ | $y_i$ | $c_i$ | $c_{i+1}$ | $S_i$ | $c_{i+1}$ | $S_i$ |
|-------|-------|-------|-----------|-------|-----------|-------|
| 0 | 0 | 0 | 0 | 0 | 0 | $c_i$ |
| 0 | 0 | 1 | 0 | 1 | | |
| 0 | 1 | 0 | 0 | 1 | $c_i$ | $\bar{c_i}$ |
| 0 | 1 | 1 | 1 | 0 | | |
| 1 | 0 | 0 | 0 | 1 | $c_i$ | $\bar{c_i}$ |
| 1 | 0 | 1 | 1 | 0 | | |
| 1 | 1 | 0 | 1 | 0 | 1 | $c_i$ |
| 1 | 1 | 1 | 1 | 1 | | |

B.  $$c_{i+1} = \bar{x_i}\, y_i c_i + x_i \bar{y_i}\, c_i + x_i\, y_i\, \bar{c_i} + x_i\, y_i\, c_i = \Sigma(3,5,6,7)$$

$$S_i = \bar{x_i}\, \bar{y_i} c_i + \bar{x_i}\, y_i\, \bar{c_i} + x_i \bar{y_i}\, \bar{c_i} + x_i y_i\, c_i = \Sigma(1,2,4,7)$$

C.
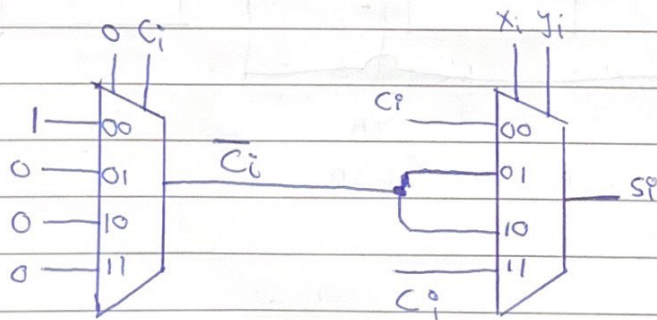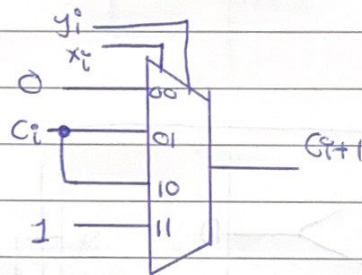
P3.

A.
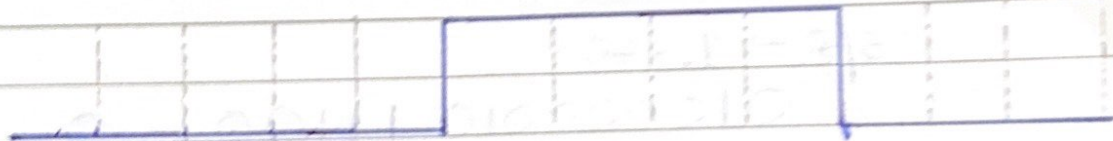
B.
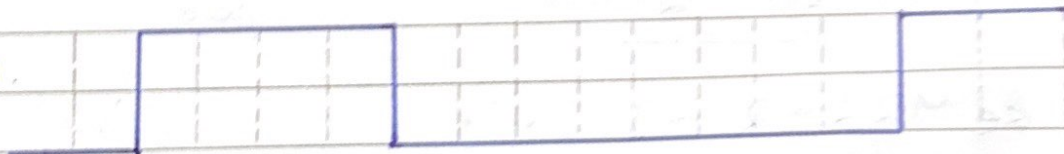
C.
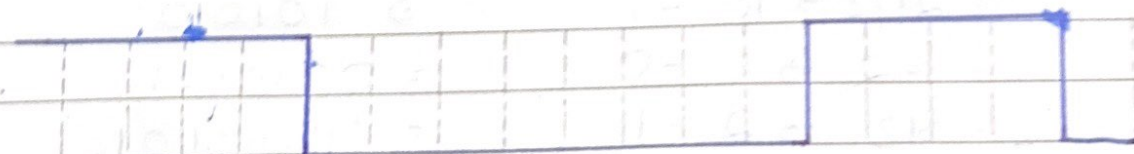
D.
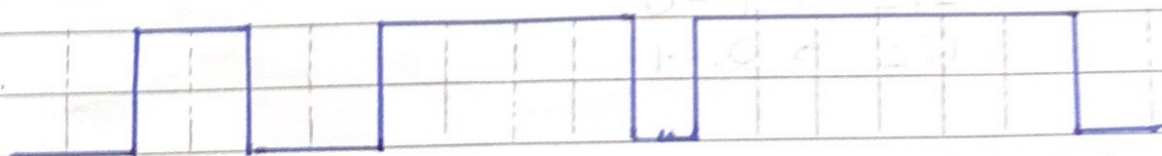
P4. a) $163/2 \to 81 - 1$

$81/2 \to 40 - 1$  $\Rightarrow 10100011$

$40/2 \to 20 - 0$

$20/2 \to 10 - 0$  $= (110100011)_2 = -163_{10}$

$10/2 \to 5 - 0$

$5/2 \to 2 - 1$

$2/2 \to 1 - 0$

$1/2 \to 0 - 1$

b) $\underset{128 \quad (2 \quad 16 \quad 8 \sim 2 \quad 1}{1\ 100\ 0001\ 0001\ 0000\ 1000\ 0000\ 0000\ 0000\ 0000}$

$-ve \quad 2^{131-127}$  $(1 + 0.0625)$

$= (-1) \times 2^4 \times (1.0625) = -17_{10}$

c. $15/8 \rightarrow 1.875$

$= 0|10000010|11100\underbrace{\ldots 0}$

+ve $\quad 2^{130-127}$

$\underbrace{\qquad\qquad}_{20\,0's}$

d. $53/2 \rightarrow 26 \rightarrow 1$

$26/2 \rightarrow 13 \rightarrow 0$

$13/2 \rightarrow 6 \rightarrow 1$

$6/2 \rightarrow 3 \rightarrow 0$

$3/2 \rightarrow 1 \rightarrow 1$

$1/2 \rightarrow 0 \rightarrow 1$

$= 1 1 0 1 0 1$

$= 0 0 1 1 0 1 0 1$

$\Rightarrow (1 1 0 0 1 0 1 1_2)$

#e $42/2 \to 21 - 0$

$21/2 \to 10 - 1$          $\Rightarrow 101010$

$10/2 \to 5 - 0$          $= 00101010$

$5/2 \to 2 - 1$          $= (110101 01_2)$

$2/2 \to 1 - 0$

$1/2 \to 0 \quad 1$

P5.   2' Complement Range:

$- 2^{N-1}$ to $+ 2^{N-1} - 1$

$2^{N-1} - 1 = 25$

$- 2^{N-1} = 24$

at $N = 5$,   $2^4 = 24$

$16 < 24$ (NOT SATISFIED)

at $N = 6 = 2^5 = 24$,   $32 > 24$ ( SATISFIED)

$\therefore$  Size of Register $= 6$ bits.

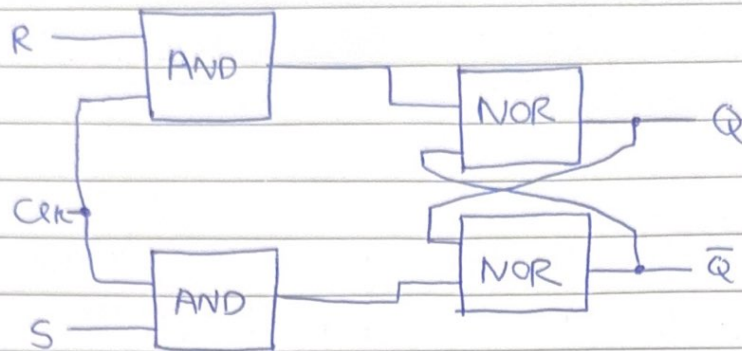A.   Size of LD_DATA bus $= 6$ bits

B.   Width of each register $= 6$ bits

C.   Width of RA bus $\to$ 32 register $\to$ 5 bits

D.   Width of WA bus $\to$ 6 bit register $\to$ 5 bits

E.   $32 \times 5 = 160$ DFF's

F.   5-32 Decoder is used

P6. a)



R ── [AND] ──┐
             ├── [NOR] ──● ── Q
Clk ●────────┘      ╳
             ┌── [NOR] ──● ── $\overline{Q}$
S ── [AND] ──┘

Name : Gated Latch with NOR Gates

b)



$C_i$ ──────────● ── [XOR] ──── $S_i$

$X_i$ ──● ── [XOR] ──┐
$Y_i$ ──┐           [AND] ── [OR] ── $C_{i+1}$
        └── [AND] ──┘

Name : FULL ADDER