

## End - Sem - Examination

Name :- Tanishq Chauhan

Roll No. :- 21C3184

Subject :- Digital Electronics (CER3C4)

Semester :- 3<sup>rd</sup> Semester

Branch :- Computer Science & Engineering (CS-B)

Chauhan

## Digital Electronics (CER3C4)

### \* Answer of Q. No. 1. (B)

We have decimal number  $250.3$  and we have to convert it to base  $3$ , base  $4$ , base  $7$ , base  $8$  and base  $16$ .

Decimal Number  $250.3$  to Base  $3$

3	250	1	$0.3 \times 3 = 0.9 \rightarrow 0$
3	83	2	$0.9 \times 3 = 2.7 \rightarrow 2$
3	27	0	$0.7 \times 3 = 2.1 \rightarrow 2$
3	3	0	$0.1 \times 3 = 0.3 \rightarrow 0$
3	3	0	$0.3 \times 3 = 0.9 \rightarrow 0$
3	1	1	
	0		$(100021.02200)_3$

So, The Base  $3$  of Decimal Number :-

$$(250.3)_{10} = (100021.02200)_3$$

Decimal Number  $250.3$  to Base  $4$

4	250	2	$0.3 \times 4 = 1.2 \rightarrow 1$
4	62	2	$0.2 \times 4 = 0.8 \rightarrow 0$
4	15	3	$0.8 \times 4 = 3.2 \rightarrow 3$
4	3	3	$0.2 \times 4 = 0.8 \rightarrow 0$
	0		

$$(3322.1030)_4$$

So, The Base 4 of Decimal Number :-

$$(250.3)_{10} = (3322.1030)_4$$

Decimal Number 250.3 to Base 7

7	250	5	$0.3 \times 7 = 2.1 \rightarrow 2$
7	35	0	$0.1 \times 7 = 0.7 \rightarrow 0$
7	5	5	$0.7 \times 7 = 4.9 \rightarrow 4$
	0		$0.9 \times 7 = 6.3 \rightarrow 6$
			$0.3 \times 7 = 2.1 \rightarrow 2$

$$(505.20462)_7$$

So, The Base 7 of Decimal Number :-

$$(250.3)_{10} = (505.20462)_7$$

Decimal Number 250.3 to Base 8

8	250	2	$0.3 \times 8 = 2.4 \rightarrow 2$
8	31	7	$0.4 \times 8 = 3.2 \rightarrow 3$
8	3	3	$0.2 \times 8 = 1.6 \rightarrow 1$
	0		$0.6 \times 8 = 4.8 \rightarrow 4$
			$0.8 \times 8 = 6.4 \rightarrow 6$
			$0.4 \times 8 = 3.2 \rightarrow 3$

$$(372.231463)_8$$

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So, The Base 8 of Decimal Number :-

$$(250.3)_{10} = (372.231463)_8$$

Decimal Number 250.3 to Base 16

16	250	10 (A)	$0.3 \times 16 = 4.8 \rightarrow 4$
16	15	15 (F)	$0.8 \times 16 = 12.8 \rightarrow 12 \text{ (C)}$
	0		$0.8 \times 16 = 12.8 \rightarrow 12 \text{ (C)}$

$$(1510.41212)_{16}$$

↓

$$(FA.4CC)_{16}$$

So, The Base 16 of Decimal Number :-

$$(250.3)_{10} = (FA.4CC)_{16}$$

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Answer of Q. No. 1 (c)

(1)  $3570 - 2100$

Subtraction using 9's complement

Let,  $A = 3570$ ,  $B = 2100$

First we have to find out 9's complement of B

$$\begin{array}{r} 9 9 9 9 \\ - 2 1 0 0 \\ \hline 7 8 9 9 \end{array}$$

Now, we have to add 9's complement of B to A

$$\begin{array}{r} 3 5 7 0 \\ + 7 8 9 9 \\ \hline \text{Carry-} \rightarrow 1 4 6 9 \end{array}$$

Now, we have to add carry to the result

$$\begin{array}{r} 1 4 6 9 \\ + 1 \\ \hline 1 4 7 0 \end{array}$$

Now, The answer is 1470

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## Subtraction using 10's complement

Let,  $A = 3570$ ,  $B = 2100$

First we have to find out 10's complement of B

$$\begin{array}{r} 9999 \\ - 2100 \\ \hline 7899 \end{array} \rightarrow 9\text{'s complement}$$
$$\begin{array}{r} 7899 \\ + 1 \\ \hline 7900 \end{array} \rightarrow 10\text{'s complement}$$

Now, we have to add 10's complement of B to A

$$\begin{array}{r} 3570 \\ + 7900 \\ \hline \text{carry} \rightarrow 1 \end{array}$$

To get the answer we have to ignore this carry

So, The answer is 1470.

So, The subtraction of 9's complement is 1470  
and The subtraction of 10's complement is 1470.

Answer of Q. No. 1 (c)

(2)  $5250 - 321$

Subtraction using 9's complement

Let,  $A = 5250$ ,  $B = 321$

First we have to find out 9's complement of B

$$\begin{array}{r} 9999 \\ - 0321 \\ \hline 9678 \end{array}$$

Now, we have to add 9's complement of B to A

$$\begin{array}{r} 5250 \\ + 9678 \\ \hline \text{carry} \rightarrow 14928 \end{array}$$

Now, we have to add carry to the result

$$\begin{array}{r} 4928 \\ + 1 \\ \hline 4929 \end{array}$$

So, The answer is 4929

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2163184  
CS-B

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## Subtraction using 10's complement

Let ,  $A = 5250$  ,  $B = 321$

First we have to find out 10's complement of B

$$\begin{array}{r} 9999 \\ - 0321 \\ \hline 9678 \end{array} \rightarrow 9\text{'s complement}$$
$$\begin{array}{r} 9678 \\ + 1 \\ \hline 9679 \end{array} \rightarrow 10\text{'s complement}$$

Now, we have to add 10's complement of B to A

$$\begin{array}{r} 5250 \\ + 9679 \\ \hline \text{carry} \rightarrow 14929 \end{array}$$

To get the answer we have to ignore left most bit of the result is 1, called carry and it is ignored.

So, The answer is 4929

So, The subtraction of 9's complement is 4929 and The subtraction of 10's complement is 4929.

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21C3184  
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Answer of Q. No. 2 (B)

$$F = \sum (1, 3, 5, 7, 13, 15)$$

Binary Conversion  $\rightarrow$

Minterms	Binary Designation
1	0 0 0 1
3	0 0 1 1
5	0 1 0 1
7	0 1 1 1
13	1 1 0 1
15	1 1 1 1

Comparing Different Groups

W X Y Z

1) 0 0 0 0 1

3) 0 0 1 1 1

5) 0 1 0 1 1

7) 0 1 1 1 1

13) 1 1 0 1 1

15) 1 1 1 1 1

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1 W X Y Z

$(1, 3)$  0 0 - 1  
 $(1, 5)$  0 - 0 1

$(3, 7)$  0 - 1 1

$(5, 7)$  0 1 - 1

$(5, 13)$  - 1 0 1

$(7, 15)$  - 1 1 1

$(13, 15)$  1 1 - 1

W X Y Z

$(1, 3, 5, 7)$  0 - - 1

$(1, 5, 3, 7)$  0 - - 1

$(5, 7, 13, 15)$  - 1 - 1

$(5, 13, 7, 15)$  - 1 - 1

Eliminating the repeating terms  $\rightarrow$

0 - - 1  $(1, 3, 5, 7)$  and - 1 - 1  $(5, 7, 13, 15)$

Simplified Boolean Function  $\rightarrow$

$$F = W'Z + XZ$$

$$F = W'Z + XZ$$

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Answer of Q. No. 2 (c)

## BCD to Excess -3 Code Converter

BCD means 8421 code and BCD is weighted code.

Excess -3 binary code is a unweighted self-complementary BCD code

The 4-bit input BCD code (A, B, C, D) and the corresponding output Excess -3 code (W X Y Z) numbers are shown in the conversion table below.

Decimal	BCD Code				Excess -3 Code			
	A	B	C	D	W	X	Y	Z
0	0	0	0	0	0	0	1	1
1	0	0	0	1	0	1	0	0
2	0	0	1	0	0	1	0	1
3	0	0	1	1	0	1	1	0
4	0	1	0	0	0	1	1	1
5	0	1	0	1	1	0	0	0
6	0	1	1	0	1	0	0	1
7	0	1	1	1	1	0	1	0
8	1	0	0	0	1	0	1	1
9	1	0	0	1	1	1	0	0

Table 2.1(c) : BCD to Excess -3 code converter

Drawing K-maps for the outputs (W X Y Z) in terms of the inputs A, B, C and D and simplifying them as shown

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Karnaugh Map for  $W$  :  $W = \Sigma(5, 6, 7, 8, 9)$

AB		CD			
		00	01	11	10
00	0	1	3	2	
01	4	5	7	6	
11	X	X	X	X	
10	12	13	15	14	
	8	9	11	10	

$$W = A + BD + BC$$

$$W = A + B(C + D)$$

Karnaugh Map for  $X$

$$\text{Right output} = 1, 2, 3, 4, 9$$

$$X = \Sigma(1, 2, 3, 4, 9)$$

AB		CD			
		00	01	11	10
00	0	1	3	2	
01	4	5	7	6	
11	X	12	13	14	
10	8	9	11	10	

$$X = B'C + B'D + BC'D'$$

Karnaugh Map for Y

Right Output = 0, 3, 4, 7, 8

$$Y = \Sigma(0, 3, 4, 7, 8)$$

AB \ CD	00	01	11	10
00	1	0	1	1
01	1	4	5	7
11	X	12	13	X
10	1	8	9	X
	8	9	11	10

$$Y = C'D' + CD$$

Karnaugh Map for Z

Right Output = 0, 2, 4, 6, 8

$$Z = \Sigma(0, 2, 4, 6, 8)$$

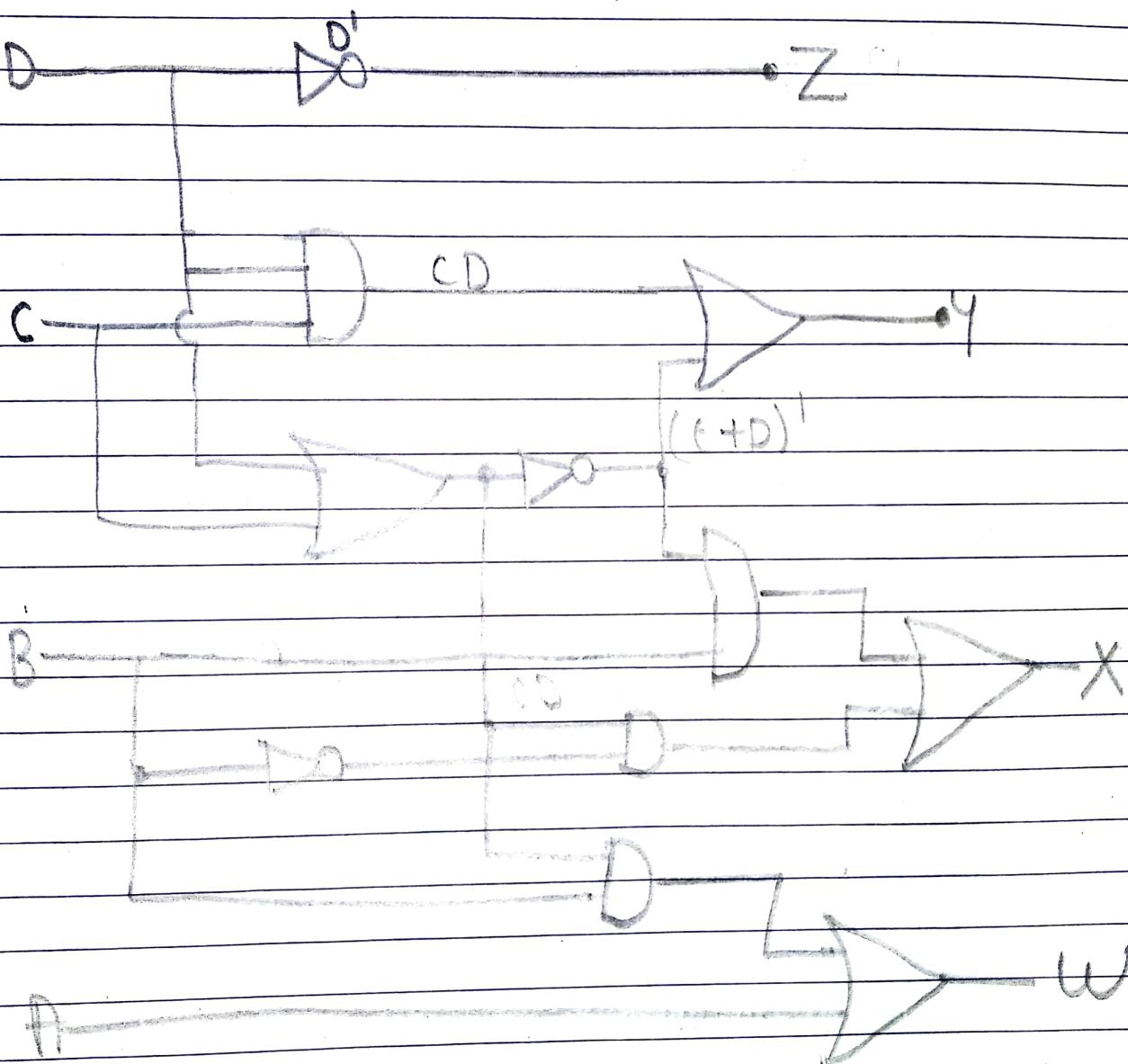
AB \ CD	00	01	11	10
00	1	0	1	3
01	1	1	5	7
11	X	12	13	15
10	1	8	9	X
	8	9	11	10

Tanishq Chauhan  
21C3184  
CS-B

tanishqchauhan@gmail.com  
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$$Z = D'$$

Circuit Diagram



### Answer of Q. No. 4 (c)

A number of FFs connected together such that data may be shifted.

As a flip flop (FF) can store only one bit of data at a time, it is referred to as a single bit register.

A register is a set of FFs used to store binary data.

The storage capacity of a register is the number of bits (1s and 0s) of digital data it can retain.

Loading a register means setting or resetting the individual FFs, i.e. inputting data into the register so that their states correspond to the bits of data to be stored. Loading may be serial or parallel.

In serial loading, data is transferred into the register in serial form, i.e. one bit at a time.

In parallel loading, the data is transferred into the register in parallel form meaning that all the FFs are triggered into their new states at the same time.

### Types of Register

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1. Buffer Register
2. Shift Register
3. Bidirectional Shift Register
4. Universal Shift Register.

## Answer of Q. No. 4 (A)

A number of FFs connected together such that data may be shifted into and shifted out of them is called a shift register.

Data may be shifted into or out of the register either in serial form or in parallel form.

So, there are four basic types of shift register:

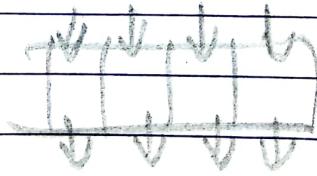
1. Serial-In, Serial Out
2. Serial-In, Parallel Out
3. Parallel-In, Serial Out
4. Parallel-In, Parallel Out

Data may be rotated left or right. Data may be shifted left to right or right to left at will i.e. in bidirectional way.

Also, data may be shifted in serially (in either way) or in parallel and shifted out serially (in either way) or in parallel.



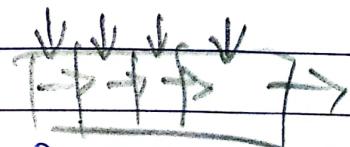
Serial -In Serial Out



Parallel -In Parallel Out

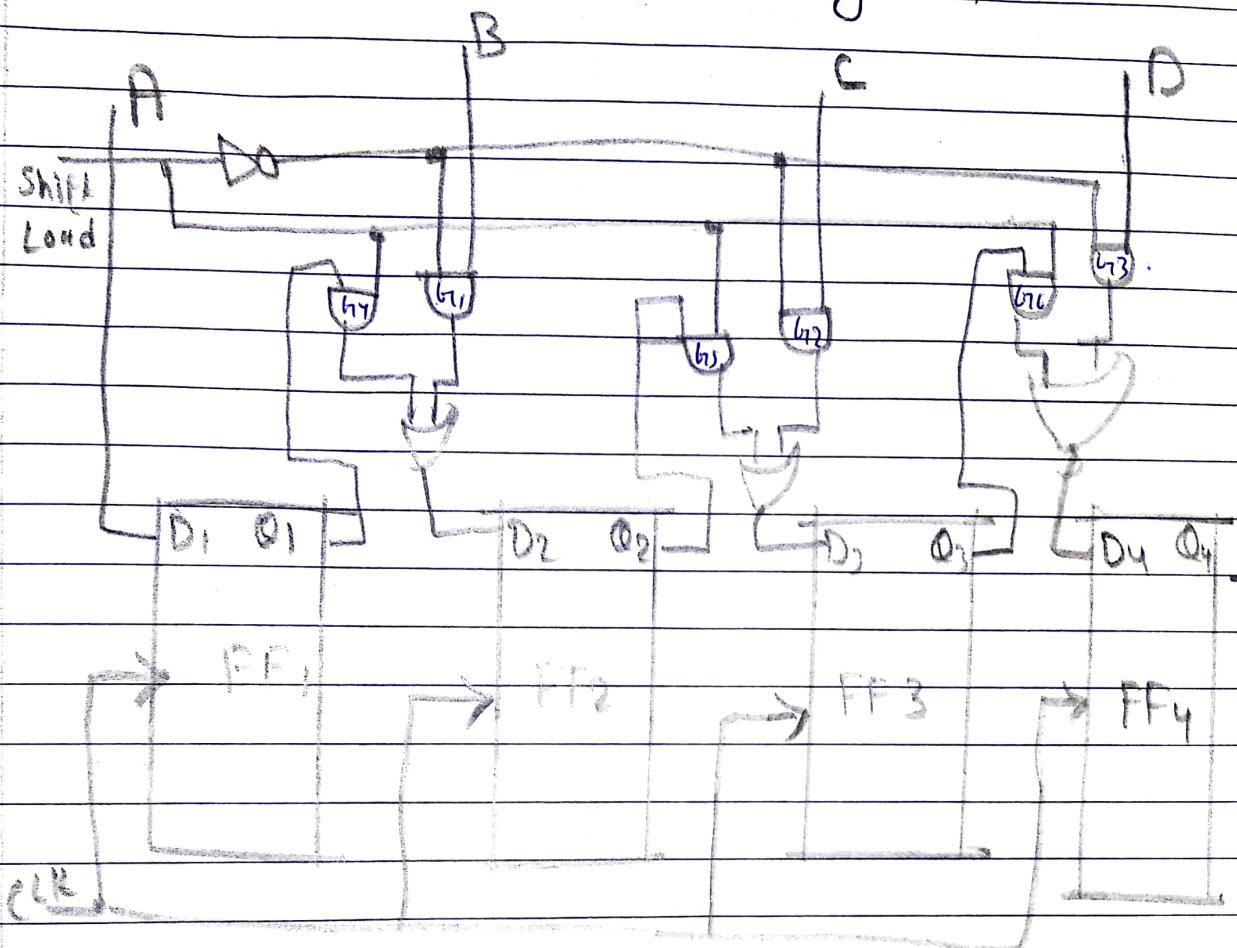


Serial In, Parallel Out



Parallel In Serial Out

## Parallel-In Serial Out Shift Register



There are four data lines A, B, C, and D through which the data is entered into the register in parallel form.

The shift / LOAD allows (a) the data to be entered in parallel form into the register and (b) the data to be shift out serially from terminal Q4.

When shift / LOAD line is HIGH, gates G1, G2, and G3 are disabled, but gates G4, G5, and G6 are enabled allowing the data bits to shift right from one stage to the next.

When Shift / LOAD line is low, gates G<sub>4</sub>, G<sub>5</sub>, and G<sub>6</sub> are disabled, whereas gates G<sub>1</sub>, G<sub>2</sub> and G<sub>3</sub> are enabled allowing the Data input to appear at the D inputs of the respective FFs.

When a clock pulse is applied, these data bits are shifted to the Q outputs terminals of the FFs and therefore, data is inputted in one step

The OR gate allows either the normal shifting operations or the parallel data entry depending on which NAD gates are enabled by the level on the shift / LOAD input.

### Timing Diagram

Clock

## Answer of Q. No. 5 (A)

RAM :- RAM stands for Random Access Memory.

It is also called read-write memory the main memory or the primary memory.

The programs and data that the CPU requires during the execution of a program are stored in this memory.

It is a ~~voltal~~ volatile memory as the data lost when the power is turned off.

RAM is further classified into two types -  
SRAM (Static Random Access Memory) and  
DRAM (Dynamic Random Access Memory).

ROM :- ROM stands for Read Only Memory

Stores crucial information essential to operate the system, like the program essential to boot the computer.

If is not volatile

Always retains its data

Used in embedded systems or where the programming needs no change.

Used in calculators and peripheral devices.

ROM is further classified into 4 types -  
MROM, PROM, EPROM, and EEPROM.

## Difference

### Difference

### RAM

### ROM

1. Data Retention	RAM is a volatile memory which could store the data as long as the power is supplied.	ROM is a non-volatile memory which could retain the data even when power is off.
2. Working Type.	Data stored in RAM can be retrieved and altered.	Data stored in ROM can only be read.
3. Speed	It is a high-speed memory.	It is much slower than the RAM.
4. Cost	RAM is costly.	ROM is cheap.
5. Size	Larger size with higher capacity.	Small size with less capacity.

## Answer of Q No. 3 (A)

### Asynchronous Counter

In this type of counter FFs are connected in such a way that the output of first FF drives the clock for the second FFs; the output of the second drives the clock of the third and so on.

All the FFs are not clocked simultaneously.

Design and implementation is very simple even for more number of states.

Main drawback of these counters is their low speed as the clock is propagated through a number of FFs before it reaches the last FFs.

### Synchronous Counter

In this type of counter there is no connection between the output of first FF and clock input of next FF and so on.

All the FFs are clocked simultaneously.

Design and implementation becomes tedious and complex as the number of states increases.

Since clock is applied to all the FFs simultaneously the total propagation delay is equal to the propagation delay of only one FF. Hence, they are faster.

In this type of counter FFs are connected in such a way that the output of first FF drives the clock for the second FF; the output of the second drives the clock of the third and so on.

In this type of counter there is no connection between the output of first FF and clock input of next FF and so on.