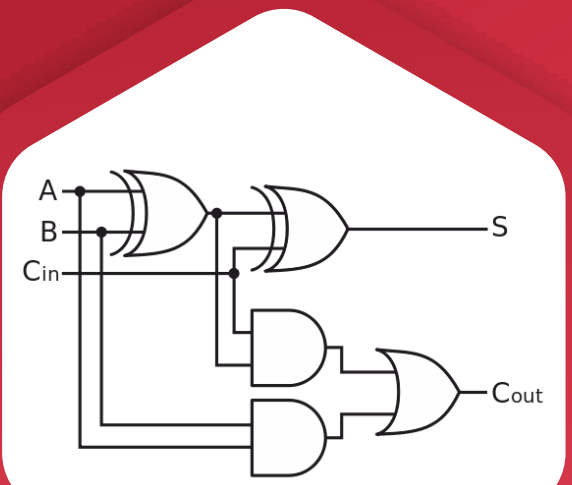
GATE | PSUs

ELECTRICAL ENGINEERING

Digital Electronics and Microprocessors

Text Book : Theory with worked out Examples and Practice Questions



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Digital Electronics & Microprocessors

(Solutions for Volume-1 Class Room Practice Questions)

1. Number Systems

01. Ans: (d)

Sol: $135_x + 144_x = 323_x$

$(1\times x^2 + 3 \times x^1 + 5 \times x^0)+(1\times x^2+4\times x^1+ 4\times x^0)$

$= 3x^2 + 2x^1 + 3x^0$

$\Rightarrow x^2+3x+5+x^2+4x+4 = 3x^2+ 2x + 3$

$x^2 - 5x - 6 = 0$

$(x-6)(x+1) = 0$ (Base cannot be negative)

Hence $x = 6$.

(OR)

As per the given number x must be greater than 5. Let consider x = 6

$(135)_6 = (59)_{10}$

$(144)_6 = (64)_{10}$

$(323)_6 = (123)_{10}$

$(59)_{10} + (64)_{10} = (123)_{10}$

So that x = 6

02. Ans: (a)

Sol: 8-bit representation of

$+127_{10} = 01111111_{(2)}$

1's complement representation of

– 127 = 10000000.

2's complement representation of

– 127 = 10000001.

No. of 1's in 2's complement of

– 127 = m = 2

No. of 1's in 1's complement of

– 127 = n = 1

$\therefore$ m: n = 2:1

03. Ans: (c)

Sol: In 2's complement representation the sign bit can be extended towards left any number of times without changing the value. In given number the sign bit is 'X_3', hence it can be extended left any number of times.

04. Ans: (c)

Sol: Binary representation of $+(539)_{10}$:

2	539	
2	269	–1
2	134	–1
2	67	–0
2	33	–1
2	16	–1
2	8	–0
2	4	–0
2	2	–0
	1	–0

$(+539)_{10} = (10000\ 11\ 0\ 11)_2 = (00100\ 0011011)_2$

2's complement $\rightarrow$ 110111100101

Hexadecimal equivalent $\rightarrow (DE5)_H$

05. Ans: 5

Sol: Symbols used in this equation are 0,1,2,3

Hence base or radix can be 4 or higher

$(312)_x = (20)_x\ (13.1)_x$

$3x^2 + 1x + 2x^0 = (2x+0)\ (x+3x^0+x^{-1})$

$3x^2+x+2 = (2x)\left(x + 3 + \frac{1}{x}\right)$

$3x^2 + x + 2 = 2x^2 + 6x + 2$

$x^2 - 5x = 0$

$x(x-5) = 0$

x = 0(or) x = 5

x must be x > 3, So x = 5

06. Ans: 3

Sol: $123_5 = x8_y$

$1 \times 5^2 + 2 \times 5^1 + 3 \times 5^0 = x.y^1 + 8 \times y^0$

$25 + 10 + 3 = xy + 8$

$\therefore xy = 30$

Possible solutions:

i. x = 1, y = 30

ii. x = 2, y = 15

iii. x = 3, y = 10

$\therefore$ 3 possible solutions exists.

07. Ans: 1

Sol: The range (or) distinct values

For 2's complement $\Rightarrow -(2^{n-1})$ to $+(2^{n-1}-1)$

For sign magnitude

$\Rightarrow -(2^{n-1}-1)$ to $+(2^{n-1}-1)$

Let n = 2 $\Rightarrow$ in 2's complement

$-(2^{2-1})$ to $+(2^{2-1}-1)$

-2 to $+1 \Rightarrow -2, -1, 0, +1 \Rightarrow X = 4$

n = 2 in sign magnitude $\Rightarrow -1$ to $+1 \Rightarrow Y = 3$

X – Y = 1

2. Logic Gates & Boolean Algebra

01. Ans: (c)

Sol: Given 2's complement numbers of sign bits are x & y. z is the sign bit obtained by adding above two numbers. $\therefore$ Overflow is indicated by = $\bar{x}\,\bar{y}\,z + x\,y\,\bar{z}$

Examples

1. A = +7 0111
   B = +7 0111
   14 1110 $\Rightarrow \bar{x}\,\bar{y}\,z$
2. A = +7 0111
   B = +5 0101
   12 1100 $\Rightarrow \bar{x}\,\bar{y}\,z$
3. A = –7 1001
   B = –7 1001
   –14 10010 $\Rightarrow x\,y\,\bar{z}$
4. A = –7 1001
   B = –5 1011
   –12 10100 $\Rightarrow x\,y\,\bar{z}$

02. Ans: (b)

Sol: Truth table of XOR

A	B	o/p
0	0	0
0	1	1
1	0	1
1	1	0

Stage 1:

Given one i/p = 1 Always.

1	X	o/p	
1	0	1	= $\bar{X}$
1	1	0	= $\bar{X}$

For First XOR gate o/p = $\bar{X}$

Stage 2:

$\bar{X}$	X	o/p
0	1	1
1	0	1

For second XOR gate o/p = 1.

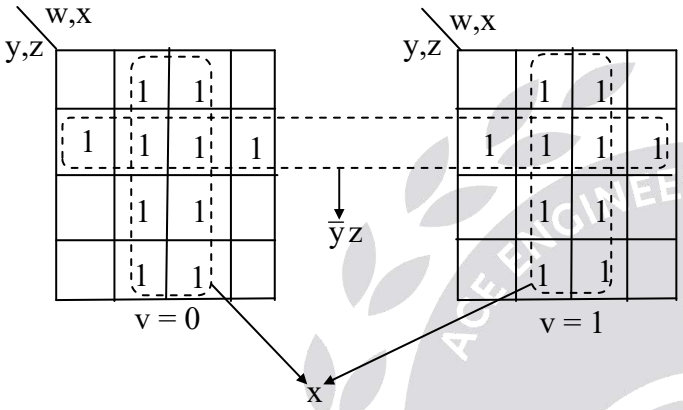
Similarly for third XOR gate o/p = $\overline{X}$ & for fourth o/p = 1

For Even number of XOR gates o/p = 1

For 20 XOR gates cascaded o/p = 1.

03. Ans: (b)

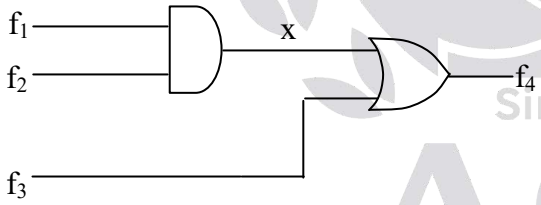
Sol:



Number of min terms = 20

04. Ans: (c)

Sol:



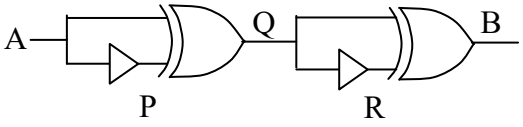
$x = f_1 f_2$

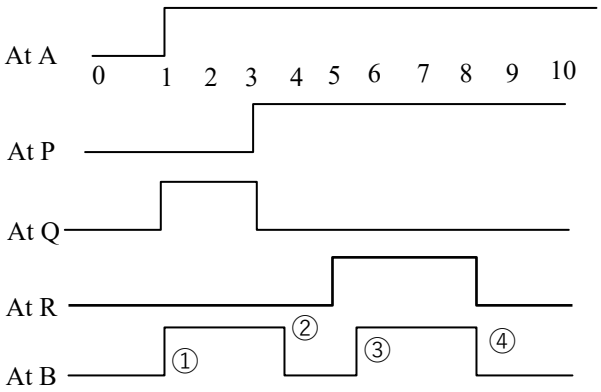
$f_4 = f_1.f_2 + f_3$

$f_2 = \sum m(6, 8)$

05. Ans: (d)

Sol:





06. Ans: (c)

Sol: $\overline{x_1} \oplus \overline{x_3} = \overline{x_1}\, x_3 + x_1 \overline{x_3} = y$

$\overline{x_2} \oplus \overline{x_4} = \overline{x_2}\, x_4 + x_2 \overline{x_4} = z$

$\left(\overline{x_1} \oplus \overline{x_3}\right) \oplus \left(\overline{x_2} + \overline{x_4}\right)$

$= y \oplus z = 0$, when y = z

$\therefore$ option (c) is true

For all cases option A, B, D not satisfy.

07. Ans: (b)

Sol: $M(a,b,c) = ab + bc + ca$

$\overline{M(a,b,c)} = \overline{b}\overline{c} + \overline{a}\,\overline{b} + \overline{a}\,\overline{c}$

$M(a, b, \overline{c}) = ab + b\,\overline{c} + \overline{c}\,a$

$M(\overline{M(a,b,c)}, M(a,b,\overline{c}), c)$

$= \left(\overline{b}\overline{c} + \overline{a}\overline{b} + \overline{a}\,\overline{c}\right)(ab + b\overline{c} + a\overline{c})$

$+ (ab + \overline{b}\overline{c} + \overline{c}a)c + \left(\overline{b}\overline{c} + \overline{a}\overline{b} + \overline{a}\,\overline{c}\right)c$

$= \left(\overline{b}\overline{c} + \overline{a}\overline{b} + \overline{a}\,\overline{c}\right)(ab + b\overline{c} + a\overline{c})$

$+ \left(\overline{b}\overline{c} + \overline{a}\overline{b} + \overline{a}\,\overline{c}\right)(c) + abc$

$= a\overline{b}\overline{c} + \overline{a}bc + abc + \overline{a}\overline{b}c$

$= \overline{c}[a\overline{b} + \overline{a}b] + c[ab + \overline{a}\overline{b}]$

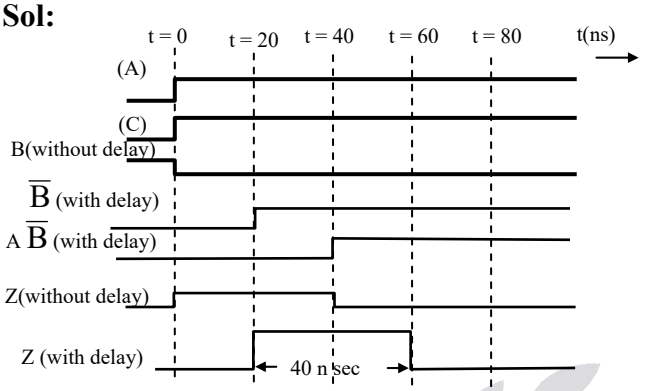
$= \sum m(1,2,4,7)$

$\therefore M(x, y, z) = a \oplus b \oplus c$

Where $x = \overline{M(a,b,c)}$, $y = M(a,b,\overline{c})$, z = c

08. Ans: 40

Sol:



$\therefore$ Z is 1 for 40 nsec

09. Ans: (c)

Sol: Logic gates $\overline{X} + Y = \overline{X\overline{Y}} = \overline{XY_1}$

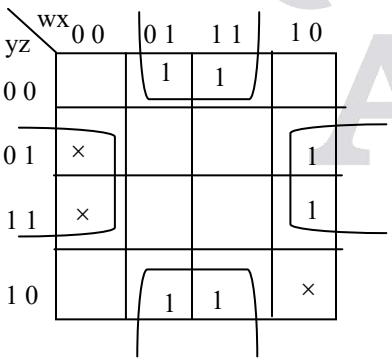
Where $Y_1 = \overline{Y}$

It is a NAND gate and thus the gate is 'Universal gate'.

3. K-Maps

01. Ans: (b)

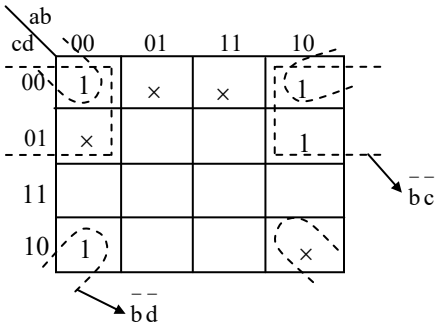
Sol:



$f = \overline{x}z + x\overline{z}$

02. Ans: (b)

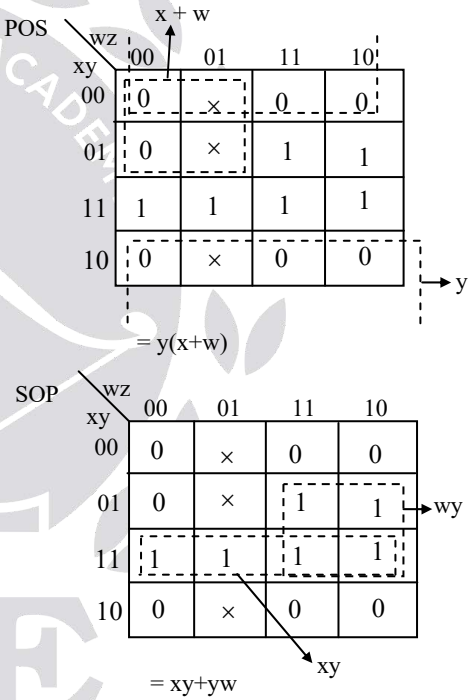
Sol:



$f = \overline{b}\,\overline{d} + \overline{b}\,\overline{c}$

03.

Sol:



SOP: x y + y w

POS: y(x + w)

04. Ans: (a)

Sol: For n-variable Boolean expression,

Maximum number of minterms = 2^n

Maximum number of implicants = 2^n

Maximum number of prime implicants = $\frac{2^n}{2}$

$= 2^{n-1}$

05. Ans: (c)

Sol:

C \ AB	00	01	11	10
0	1	1	0	0
1	0	1	1	0

$F(A, B, C) = \overline{A}\,\overline{C} + BC$

06. Ans: 1

Sol: After minimization = $\left(\overline{\overline{A} + \overline{B} + \overline{C} + \overline{D}}\right)$

= ABCD

$\therefore$ Only one minterm.

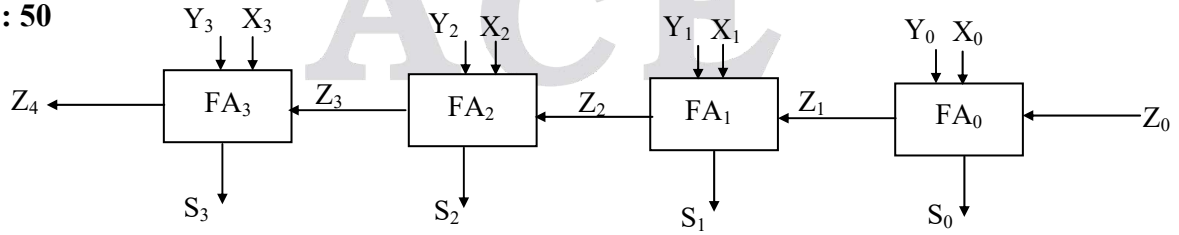
07. Ans: 3

Sol: $\overline{w}\,\overline{z} + \overline{w}\,x\overline{y} + \overline{x}\,yz$

wx \ yz	00	01	11	10
00	1			1
01	1	1		1
11				
10				1

02. Ans: 50

Sol:



Initially all the output values are '0', at t = 0, the inputs to the 4-bit adder are changed to $X_3X_2X_1X_0 = 1100$, $Y_3Y_2Y_1Y_0 = 0100$

- - - - - - indicates critical path delay to get the output

$\therefore$ Total number of prime implicants of the function 'f' is 3

4. Combinational Circuits

01. Ans: (d)

Sol: Let the output of first MUX is "F_1"

$F_1 = AI_0 + AI_1$

Where A is selection line, I_0, I_1 = MUX Inputs

$F_1 = \overline{S}_1.W + S_1.\overline{W} = S_1 \oplus W$

Output of second MUX is

$F = \overline{A}.I_0 + A.I_1$

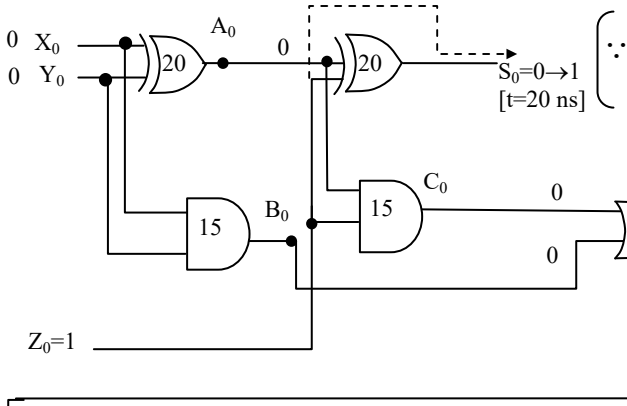
$F = \overline{S}_2.F_1 + S_2.\overline{F}_1$

$F = S_2 \oplus F_1$

But $F_1 = S_1 \oplus W$

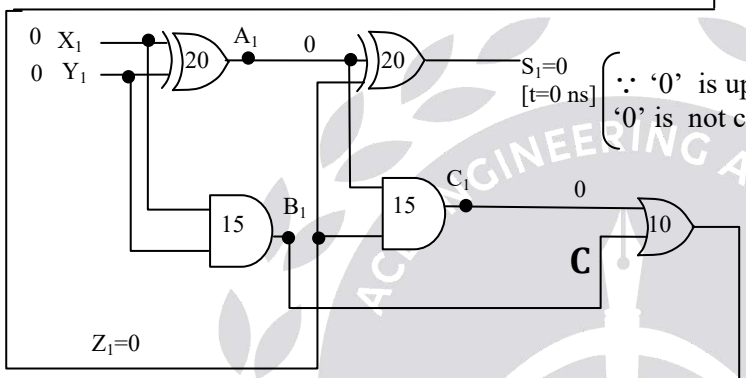
$F = S_2 \oplus S_1 \oplus W$

i.e., $F = W \oplus S_1 \oplus S_2$



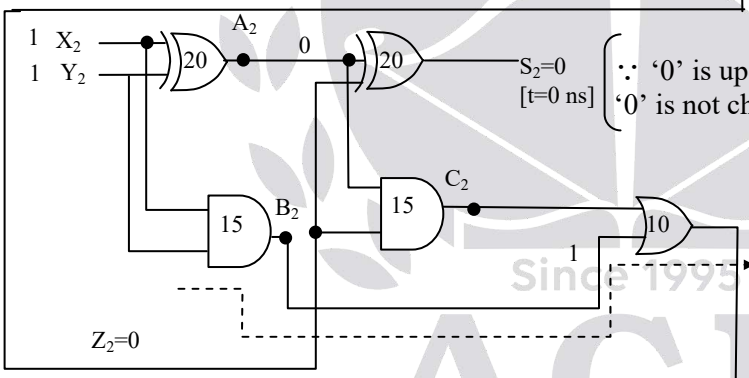
∵ '0' is updated as '1' after 20ns

∵ '0' is updated again to '0' (or) '0' is not changed, i.e. Z_1 is available @ t= 0 ns



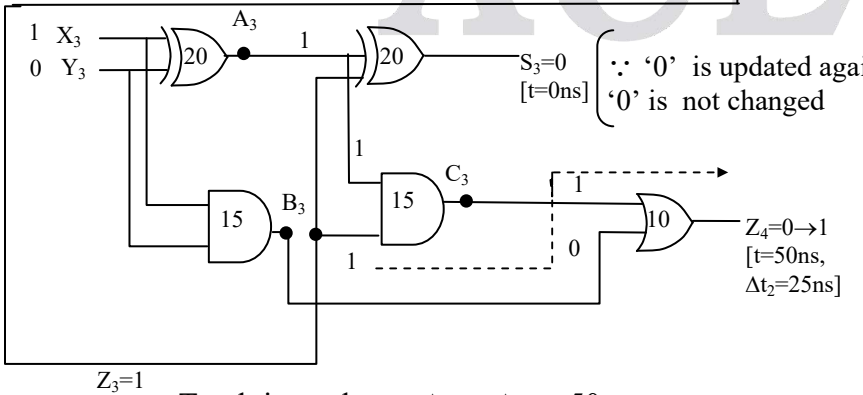
∵ '0' is updated again to '0' (or) '0' is not changed

∵ '0' is updated again to '0' (or) '0' is not changed, i.e. Z_2 is available @ t= 0 ns



∵ '0' is updated again to '0' (or) '0' is not changed

∵ '0' is updated to '1' after 25 ns



∵ '0' is updated again to '0' (or) '0' is not changed

∵ '0' is updated as '1' after 25ns when Z_3 is arrived

Total time taken = $\Delta t_1 + \Delta t_2 = 50$ ns

i.e. critical time (or) maximum time is taken for Z_4 to get final output as '1'

03. Ans: (a)

Sol: The given circuit is binary parallel adder/subtractor circuit. It performs A+B, A–B but not A + 1 operations.

K	C_0	Operation
0	0	A+B (addition)
0	1	A+B+1(addition with carry)
1	0	A+ $\overline{B}$ (1's complement addition)
1	1	A+ $\overline{B}$ +1(2's complement subtraction)

04. Ans: (d)

Sol: It is expansion of 2:4 decoders to 1:8 demultiplexer A_1, A_0 must be connected to S_1, S_0 i.e.., $R = S_0$, $S = S_1$

Q must be connected to S_2 i.e., $Q = S_2$

P is serial input must be connected to D_{in}

05. Ans: 6

Sol: T = 0 → NOR → MUX 1 → MUX 2

2ns 1.5ns 1.5ns

Delay = 2ns + 1.5ns + 1.5ns = 5ns

T = 1 → NOT → MUX 1→NOR→ MUX 2

1ns 1.5ns 2ns 1.5ns

Delay = 1ns + 1.5ns + 2ns + 1.5ns = 6ns

Hence, the maximum delay of the circuit is 6ns

06. Ans: –1

Sol: When all bits in 'B' register is '1', then only it gives highest delay.

∴ '–1' in 8 bit notation of 2's complement is 1111 1111

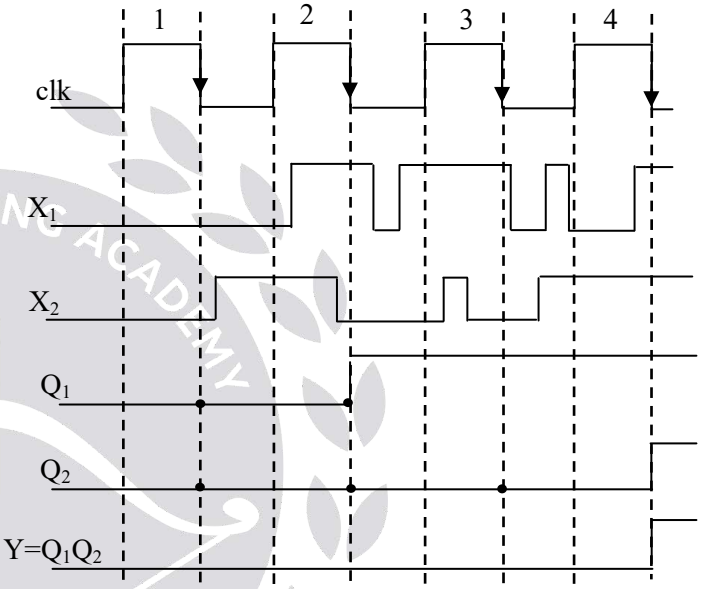
5. Sequential Circuits

01. Ans: (c)

Sol: Given Clk, X_1, X_2

Output of First D-FF is Q_1

Output of Second D-FF is Q_2



02. Ans: 4

Sol: In the given first loop of states, zero has repeated 3 times. So, minimum 4 number of Flip-flops are needed.

03. Ans: 7

Sol: The counter is cleared when

$Q_DQ_CQ_BQ_A = 0110$

Clk	Q_D	Q_C	Q_B	Q_A
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1

4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	0	0	0

As the clear input is given to be synchronous so it waits upto the next clock pulse to clear the counter & hence the counter get's cleared during the 7^{th} clock pulse.

$\therefore$ mod of counter = 7

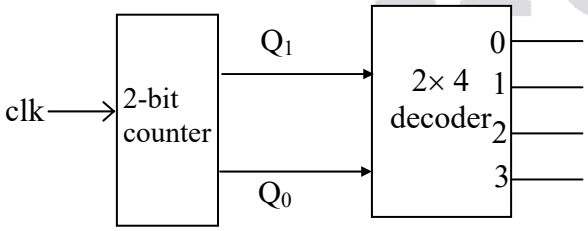
04. Ans: (b)

Sol: The given circuit is a mod 4 ripple down counter. Q_1 is coming to 1 after the delay of $2\Delta t$.

CLK	Q_1	Q_0
	0	0
1	1	1
2	1	0
3	0	1
4	0	0

05. Ans: (c)

Sol: Assume n = 2



Outputs of counter is connected to inputs of decoder

Counter outputs		Decoder inputs		Decoder outputs			
Q_1	Q_0	a	b	d_3	d_2	d_1	d_0
0	0	0	0	0	0	0	1
0	1	0	1	0	0	1	0
1	0	1	0	0	1	0	0
1	1	1	1	1	0	0	0

The overall circuit acts as 4-bit ring counter

n = 2

$\therefore k = 2^2 = 4$, k-bit ring counter

06. Ans: (b)

Sol:

CLK	Serial in= $B \oplus C \oplus D$	A B C D
0		1 0 1 0
1	1	1 1 0 1
2	0 →	0 1 1 0
3	0 →	0 0 1 1
4	0 →	0 0 0 1
5	1 →	1 0 0 0
6	0 →	0 1 0 0
7	1 →	1 0 1 0
	→	

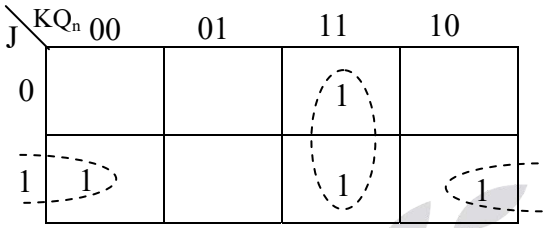
$\therefore$ After 7 clock pulses content of shift register become 1010 again.

07. Ans: (b)

Sol:

J	K	Q	$\overline{Q}_n$	$T = (J + Q_n)(K + \overline{Q}_n)$	Q_{n+1}
0	0	0	1	0.1 = 0	0
0	0	1	0	1.0 = 0	1 } Q_n
0	1	0	1	0.1 = 0	0
0	1	1	0	1.1 = 1	0 } 0

1	0	0	1	1.1 = 1	1 }
1	0	1	0	1.0 = 0	1 } 1
1	1	0	1	1.1 = 1	1 }
1	1	1	0	1.1 = 1	0 } $\overline{Q}_n$



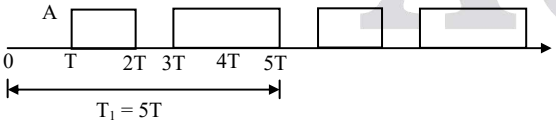
$T = J\,\overline{Q_n} + KQ_n = (J+Q_n)\,(K+\overline{Q_n})$

08. Ans: 1.5

Sol:

Clk	Q_1	Q_2	Q_3	Q_4	Q_5	$Y = Q_3 + Q_5$
0	0	1	0	1	0	0
1	0	0	1	0	1	1
2	1	0	0	1	0	0
3	0	1	0	0	1	1
4	1	0	1	0	0	1
5	0	1	0	1	0	0

The waveform at OR gate output, Y is [A = +5V]



Average power

$$P = \frac{V_{Ao}^2}{R} = \frac{1}{R}\left[\underset{T_1\to\infty}{Lt}\frac{1}{T_1}\int_o^{T_1} y^2(t)\,dt\right]$$

$$= \frac{1}{RT_1}\left[\int_T^{2T} A^2 dt + \int_{3T}^{5T} A^2 dt\right]$$

$$= \frac{A^2}{RT_1}\left[(2T-T)+(5T-3T)\right]$$

$$= \frac{A^2.3T}{R(5T)} = \frac{5^2.3}{10\times 5} = 1.5\,mW$$

6. A/D and D/A Converters

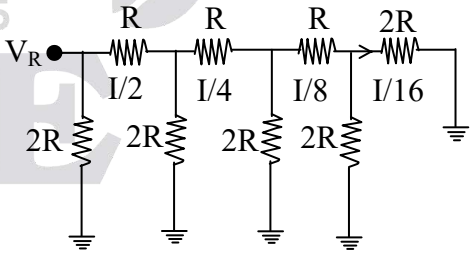
01. Ans: (b)

Sol:

CLK	Counter			Decoder				V_0
	Q_2	Q_1	Q_0	D_3	D_2	D_1	D_0	
1	0	0	0	0	0	0	0	0
2	0	0	1	0	0	0	1	1
3	0	1	0	0	0	1	0	2
4	0	1	1	0	0	1	1	3
5	1	0	0	1	0	0	0	8
6	1	0	1	1	0	0	1	9
7	1	1	0	1	0	1	0	10
8	1	1	1	1	0	1	1	11

02. Ans: (b)

Sol:



$R_{equ} = (((((2R||2R)+R)||2R)+R)||2R)+R)||2R)$

$R_{equ} = R = 10k\Omega$.

$$I = \frac{V_R}{R} = \frac{10V}{10k} = 1mA.$$

Current division at $\frac{I}{16}$

$$= \frac{1\times10^{-3}}{16} = 62.5\,\mu A$$

03. Ans: (c)

Sol: Net current at inverting terminal,

$$I_i = \frac{I}{4} + \frac{I}{16} = \frac{5I}{16}$$

$$V_0 = -I_i R = -\frac{5I}{16}\times 10k\Omega$$

$$= \frac{-5\times1\times10^{-3}\times10\times10^{3}}{16} = -3.125V$$

04. Ans: (d)

Sol: Given that $V_{DAC} = \sum_{n=0}^{3} 2^{n-1} b_n$ Volts

$$V_{DAC} = 2^{-1}b_0 + 2^0 b_1 + 2^1 b_2 + 2^2 b_3$$

$$\Rightarrow V_{DAC} = 0.5b_0 + b_1 + 2b_2 + 4b_3$$

Initially counter is in 0000 state

Up counter o/p	V_{DAC}(V)	o/p of comparator
$b_3\ b_2\ b_1\ b_0$		
0 0 0 0	0	1
0 0 0 1	0.5	1
0 0 1 0	1	1
0 0 1 1	1.5	1
0 1 0 0	2	1
0 1 0 1	2.5	1
0 1 1 0	3	1
0 1 1 1	3.5	1
1 0 0 0	4	1
1 0 0 1	4.5	1
1 0 1 0	5	1
1 0 1 1	5.5	1
1 1 0 0	6	1
1 1 0 1	6.5	0

When V_{DAC} = 6.5 V, the o/p of comparator is '0'. At this instant, the clock pulses to the counter are stopped and the counter remains in 1101 state.

$\therefore$ The stable reading of the LED display is 13.

05. Ans: (b)

Sol: The magnitude of error between V_{DAC} & V_{in} at steady state is $|V_{DAC} - V_{in}| = |6.5 - 6.2|$

$= 0.3$ V

06. Ans: (a)

Sol: In Dual slope

ADC $\Rightarrow V_{in}T_1 = V_R.T_2$

$$\Rightarrow V_{in} = \frac{V_R T_2}{T_1}$$

$$= \frac{100\,mV\times370.2\,ms}{300\ ms}$$

DVM indicates = 123.4

07. Ans: (d)

Sol: Ex: f_{in} = 1 kHz $\rightarrow$ f_s = 2 kHz

f_{in} = 25 kHz $\leftarrow$ f_s = 50 kHz

1. Max conversion time = $2^{N+1}T = 2^{11}.1\ \mu s$

$= 2048\ \mu s$

2. Sampling period = $T_s \geq$ maximum conversion time

$T_s \geq 2048\ \mu s$

3. Sampling rate $f_s = \frac{1}{T_s} \le \frac{1}{2048\times10^{-6}}$

$f_s \le 488 \quad f_s \le 500$ Hz

4. $f_{in} = \frac{f_s}{2} = 250$ Hz

08. Ans: (d)

Sol: In an ADC along with S-H circuit (sample and hold) circuit, to avoid error at output, voltage across capacitor should not drop by more than $\pm\Delta/2$, where Δ is step size.

Here, $\Delta = \frac{10-0}{(2^{10}-1)} = 9.775\times10^{-3}$ V

Hence $\frac{\Delta}{2} = 4.8875\times10^{-3}$ V

So conversion time (maximum) should be such that the drop across capacitor voltage must reach maximum value $\Delta/2$.

Hence, time taken for this

$$t = \frac{\Delta/2}{\text{drop rate}} = \frac{4.8875\times10^{-3}}{10^{-4}\text{ V/msec}}$$

$t \cong 49$ msec

7. Architecture, Pin Details 8085 & Interfacing with 8085

01. Ans: (a)

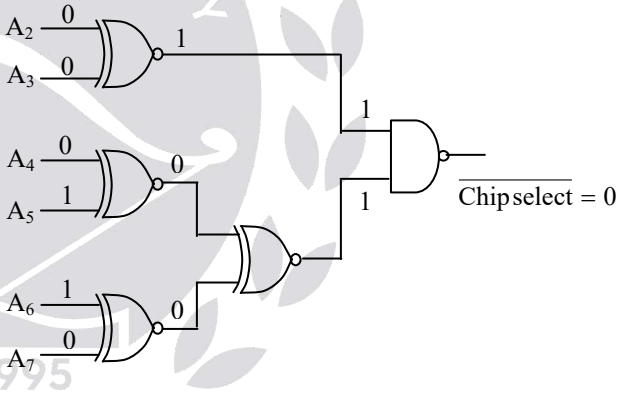
Sol: chip select is an active low signal for $\overline{\text{chipselect}} = 0$; the inputs for NAND gate must be let us see all possible cases for $\overline{\text{chipselect}} = 0$ condition

	A_7	A_6	A_5	A_4	A_3	A_2	A_1	A_0	
0		0	0	0	0	0	X	X	
0		0	1	1	0	0	X	X	
0		1	0	1	0	0	X	X	
0		1	1	0	0	0	X	X	→ 60H (A_1A_0=00)
1		0	0	1	0	0	X	X	
1		0	1	0	0	0	X	X	
0		0	0	0	1	1	X	X	
0		0	1	1	1	1	X	X	
0		1	0	1	0	0	X	X	→63H(A_1A_0=11)
0		1	1	0	0	0	X	X	
1		0	0	1	0	0	X	X	
1		0	0	0	0	0	X	X	

The only option that suits hare is option(a)

A_0 & A_1 are used for line selection

A_2 to A_7 are used for chip selection



∴ Address space is 60H to 63H

A_o to A_{11} are used for line selection

A_{12} to A_{15} are used for chip selection

A_{15} A_{14} A_{13} A_{12}	A_{11} - - - - - A_0	
1 1 1 0	0 - - - - - - - 0	=E000H
1 1 1 0	1 - - - - - - - - 1	=EFFFH

02. Ans: (d)

Sol:
- Both the chips have active high chip select inputs.
- Chip 1 is selected when $A_8 = 1$, $A_9 = 0$
  Chip 2 is selected when $A_8 = 0$, $A_9 = 1$
- Chips are not selected for combination of 00 & 11 of A_8 & A_9
- Upon observing A_8 & A_9 of given address Ranges, F800 to F9FF is not represented

03. Ans: (d)

Sol: The I/O device is interfaced using "Memory Mapped I/O" technique.

The address of the Input device is

A_{15}	A_{14}	A_{13}	A_{12}	A_{11}	A_{10}	A_9	A_8	A_7	A_6	A_5	A_4	A_3	A_2	A_1	A_0	
1	1	1	1	1	0	0	0	1	1	1	1	1	0	0	0	$=F8F8_H$

The Instruction for correct data transfer is = LDA F8F8H

04. Ans: (b)

Sol: Out put 2 of 3×8 Decoder is used for selecting the output port. ∴Select code is 010

A_{15}	A_{14}	A_{13}	A_{12}	A_{11}	A_{10}	--	A_0
0	1	0	1	0	0	--- -	0

$\Rightarrow$ 5000H

This mapping is memory mapped I/O

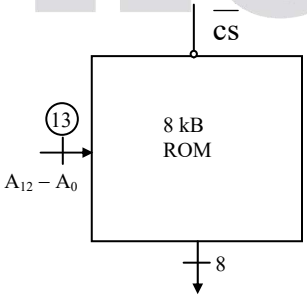
05. Ans: (d)

Sol:

A_{15}	A_{14}	A_{13}	A_{12}	A_{11}	A_{10}	A_9 - - - - A_0	
0	0	0	0	1	0	0 - - - - 0	=0800H
			⋮			⋮	⋮
0	0	0	0	1	0	1 - - - - 1	=0BFFH
0	0	0	1	1	0	0 - - - - 0	=1800H
			⋮			⋮	⋮
0	0	0	1	1	0	1 - - - - 1	=1BFFH
0	0	1	0	1	0	0 - - - - 0	=2800H
			⋮			⋮	⋮
0	0	1	0	1	0	1 - - - - 1	=2BFFH
0	0	1	1	1	0	0 - - - - 0	=3800H
			⋮			⋮	⋮
0	0	1	1	1	0	1 - - - - 1	=3BFFH

06. Ans: (a)

Sol: Address Range given is



	A_{15}	A_{14}	A_{13}	A_{12}	A_{11}	A_{10}	A_9	A_8	A_7	A_6	A_5	A_4	A_3	A_2	A_1	A_0
1000H →	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2FFFH →	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1

To provide $\overline{cs}$ as low, The condition is

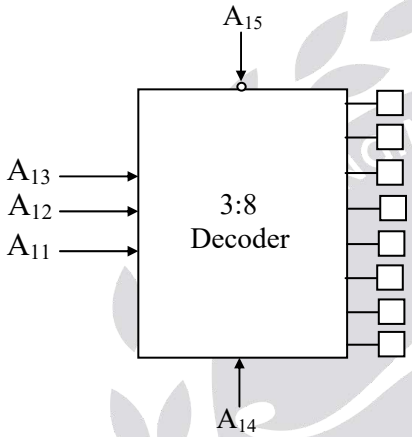
$A_{15} = A_{14} = 0$ and $A_{13}\ A_{12} = 01$ (or) (10)

i.e $A_{15} = A_{14} = 0$ and $A_{13}\ A_{12}$ shouldn't be 00, 11.

Thus it is $A_{15} + A_{14} + [A_{13}A_{12} + \overline{A_{13}}\ \overline{A_{12}}]$

07. Ans: (a)

Sol:



A_{15}, A_{14} are used for chip selection

A_{13}, A_{12}, A_{11} are used for input of decoder

A_{15} A_{14}	A_{13} A_{12} A_{11}	A_{10} ------ A_0
Enable of decoder	Input of decoder	Address of chip

Size of each memory block = 2^{11} = 2K

8. Instruction set of 8085 & Programming with 8085

01. Ans: (c)

Sol: 6010H : LXI H,8A79H ; (HL) = 8A79H

6013H : MOV A, L ; (A)←(L) = 79

6014H : ADD H ; (A) = 0111 1001

+

; (H) = 1000 1010

; (A) = 0000 0011

CY = 1, AC = 1

6015H : DAA ; 66 Added to (A) since CY=1 & AC =1

; (A) = 69H

6016H : MOV H,A ; (H)←(A) =69H

6017H : PCHL ; (PC)←(HL) = 6979H

02. Ans: (c)

Sol: 0100H : LXI SP, 00FFH ; (SP) = 00FFH

0103H : LXI H, 0107 H ; (HL) = 0107H

0106H : MVI A, 20H ; (A) = 20H

0108H : SUB M ; (A)←(A)-(0107)

; (0107) = 20H

; (A) = 00H

The contents of Accumulator is 00H

03. Ans: (c)

Sol: SUB1 : MVI A, 00H A← 00H

CALL SUB2 → program will shifted to SUB 2 address location

A

SUB 2 : INR A → 01H

RET → returned to the main program

∴ The contents of Accumulator after execution of the above SUB2 is 02H.

04. Ans: (c)

Sol: The loop will be executed until the value in register equals to zero, then,

Execution time

=9(7T+4T+4T+10T)+(7T+4T+4T+7T)+7T
= 254T

05. Ans: (d)

Sol: H=255 : L = 255, 254, 253, ----0
H=254 : L = 0, 255, 254, -------0
|
H=1 : L = 0,255,254,253,---0
H=0 : ——

→ In first iteration (with H=255), the value in L is decremented from 255 to 0 i.e., 255 times

→ In further remaining 254 iterations, the value in L is decremented from 0 to 0 i.e., 256 times

∴ 'DCRL' instruction gets executed for
$\Rightarrow [255 + (254 \times 256)]$
$\Rightarrow 65279$ times

06. Ans: (a)

Sol: "STA 1234H" is a 3-Byte Instruction and it requires 4 Machine cycles (Opcode fetch, Operand1 Read, Operand2 Read, Memory write). The Higher order Address (A_{15} – A_8) sent in 4 machine cycles is as follows
Given "STA 1234" is stored at 1FFEH
i.e., Address Instruction

1FFE, 1FFF, 2000 : STA 1234H

Machine cycle	**Address (A_{15}-A_0)**	**Higher order address (A_{15}-A_8)**
1. Opcode fetch	1FFEH	1FH
2. Operand1 Read	1FFFH	1FH
3. Operand2 Read	2000H	20H
4. Memory Write	1234H	12H

i.e. Higher order Address sent on A_{15}-A_8 for 4 Machine Cycles are 1FH, 1FH, 20H, 12H.

07. Ans: (d)

Sol: The operation SBI BE_H indicates A-BE → A where A indicates accumulator Thus the result of the subtraction operation is stored in the accumulator and the contents of accumulator are changed.

08. Ans: (c)

Sol: If the content in register B is to be multiplied with the content in register C, the contents of register B is added to the accumulator (initial value of accumulator is 0) for C times.