Assignment No = 01

Subject = Digital Logic Design

Course Code = CSC-261

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Q1) What is the weight of 7 in 1799_{10}?

Sol:

$= 1 \times 10^3 + 7 \times 10^2 + 9 \times 10^1 + 9 \times 10^0$

$= 1 \times 1000 + 7 \times 100 + 9 \times 10 + 9 \times 1$

$= 1000 + 700 + 90 + 9$

$= 1799$ Ans

Q2) Give the value of each digit in 5436_{10}?

Sol:

$= 5 \times 10^3 + 4 \times 10^2 + 3 \times 10^1 + 6 \times 10^0$

$= 5 \times 1000 + 4 \times 100 + 3 \times 10 + 6 \times 1$

$= 5000 + 400 + 30 + 6$

~~5436_{10}~~

= 5 value 5000, 4 value 400, 3 value 30, 6 value 6.

(23) Convert the following:

a) $11111111_2 = (?)_{10}$

Sol^n

$= 1\times2^7 + 1\times2^6 + 1\times2^5 + 1\times2^4 + 1\times2^3 + 1\times2^2 + 1\times2^1 + 1\times2^0$

$= 128 + 64 + 32 + 16 + 8 + 4 + 2 + 1$

$= (255)$

$\Rightarrow 11111111_2 = (255)_2$ Ans

b) $127_{10} = (?)_2$

2	127
2	63 — 1
2	31 — 1
2	15 — 1
2	7 — 1
2	3 — 1
	1 — 1

$(11111111)_2 \Leftrightarrow (127)_{10}$ Ans

c) $45.25_{10} = (?)_2$

2	45
2	22 – 1
2	11 – 0
2	5 – 1
2	2 – 1
	1 – 0

$0.25 \times 2 = 0.50 \rightarrow 0$

$0.50 \times 2 = 1.00 \rightarrow 1$

$(45.25)_{10} = (101101.01)_2$ Ans

d) $(10000000.1010)_2 = (?)_{10}$

$1\ 0\ 0\ 0\ 0\ 0\ 0\ 0 . 1\ 0\ 1\ 0$

$2^7\ 2^6\ 2^5\ 2^4\ 2^3\ 2^2\ 2^1\ 2^0\ \ 2^{-1}\ 2^{-2}\ 2^{-3}\ 2^{-4}$

$128 + .25 + 0.125$

$(128.625)_{10}$

So, $(10000000.1010)_2 = (128.625)_{10}$

e) $407F_{16} = (?)_2$

4	0	7	F
4	13	7	15
0101	1101	0111	1111

$(407F)_{16} = (0101110101111111)_2$ Ans

d) $128_{10} = (?)_{16}$

Soln

16	128
	8 → 0

Hence, $(128)_{10} = (80)_{16}$ Ans

e) $3A6F_{16} = (?)_2$

Sol.

3	A	6	F
0011	1010	0110	1111

Hence

$3A6F_{16} = 0011101001101111_2$ Ans

f) $6173_8 = (?)_{10}$

Sol.

$6 \times 8^3 + 1 \times 8^2 + 7 \times 8^1 + 3 \times 8^0$

$512 + 64 + 56 + 3$

3195

Hence,

$6173_8 = (3195)_{10}$ Ans

g) $1100001111100101_2 = (?)_{16}$

Sol.

1100	0011	1110	0101
C	3	E	5

Hence,

$1100001111100101_2 = C3E5_{16}$ Ans

h) $169_{10} = (?)_8$

Sol.

8	169
8	21 — 1
	2 — 5

Hence,

$169_{10} = 251_8$ Ans

i) $3740_8 = (?)_2$

Sol.

3	7	4	0
011	111	101	000

Hence,

$(3740)_8 = (011111101000)_2$ Ans

[illegible]

j) $1010110001011111_{(2)} = (?)_8$

Sol.

001	010	110	001	011	111
1	2	6	1	3	7

Hence,

$1010110001011111_2 = (126137)_8$ Ans

k) $2A7D_{16} = (?)_8$

Sol.

2	A	7	D
0010	1010	0111	1101

$$\underset{0}{000}\ \underset{2}{010}\ \underset{5}{101}\ \underset{1}{001}\ \underset{7}{111}\ \underset{5}{101}$$

Hence

$$2A7D_{16} = (25175)_8$$ Ans

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2) $11111111_2 = \pm(?)_{10}$

Sol.

$$1\times2^6 + 1\times2^5 + 1\times2^4 + 1\times2^3 + 1\times2^2 + 1\times2^1 + 1\times2^0$$
$$64 + 32 + 16 + 8 + 4 + 2 + 1$$
$$(127)_{10}$$

Hence,

$$(11111111)_2 = (-127)_{10}$$ Ans

M) $-12_{10} = (?)_2$

Sol.

2	12
2	6 – 0
2	3 – 0
	1 – 1

$-12_{10} = 00001100_2$

Now 2's complement

$$\begin{array}{r} 00001100 \\ 11110011 \\ \quad\quad\quad 1 \\ \hline 11110100 \end{array}$$

Hence,

$$-12_{10} = (11110100)_2$$ Ans

n) $198_{10} = (?)_{BCD}$

Soln

1	9	8
0001	1001	1000

Hence,

$198_{10} = (000110011000)_2$ A

o) $(100001110000)_{BCD} = (?)_{10}$

Soln

Using BCD-Decimal table

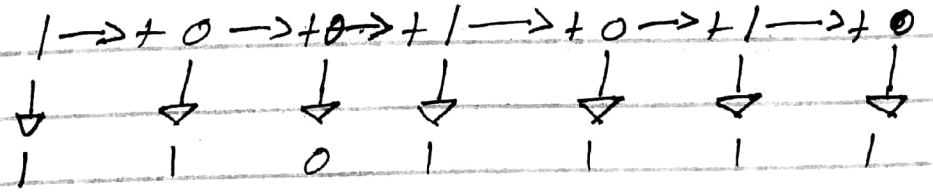
1000	0111	0000
8	7	0

Hence,

$(100001110000)_{BCD} = (870)_{10}$ A

p) $1001010_2 = (?)_{gray}$

Soln

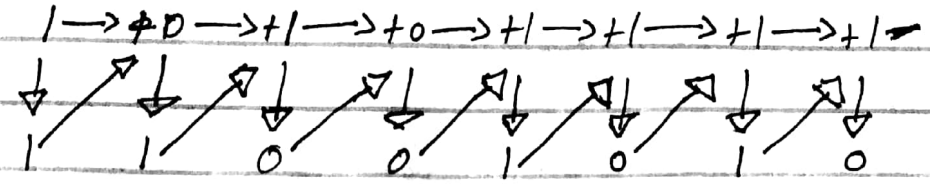


Hence,

$(1001010)_2 = (1101111)_{gray}$

Q) $(10101111)_{gray} = (?)_2$

Sol^n



Hence,

$(10101111)_{gray} = (11001010)_2$ Ans

R) $01000001_2 = (?)_{ASCII}$

Sol^n

Using ASCII table

$1 \times 2^6 + 1 \times 2^0$

$64 + 1$

65

Hence,

$(65)_{10} \Rightarrow 64_{(10)} = (A)$ ASCII character.

S) $111000 = (?111000)_{Even\ Parity}$

Sol^n

Since there has to even amount of 1's is an even parity number. we add 1 to the given number

1 $111000 \Rightarrow 1111000_{(2)}$ Ans

Q2) Calculate each of the following.

a) $11110111_2 + 01011111_2$

Sol^n

```
  1 1 1 1 0 1 1 1
+ 0 1 0 1 1 1 1 1
-----------------
1 0 1 0 1 0 0 1 0
```

discard bit ↙

$01010010_{(2)}$ Ans

b) $10000000 - 01111111$

Sol^n

2's complement

```
  0 1 1 1 1 1 1 1
-----------------
  1 0 0 0 0 0 0 0   1's complement
+               1   2's complement
-----------------
  1 0 0 0 0 0 0 1
```

Now

```
  1 0 0 0 0 0 0 0
+ 1 0 0 0 0 0 0 1
-----------------
1 0 0 0 0 0 0 0 1
```

↙ Discard bit

00000001 Ans

c) $1100_2 \times 11_2$

Soln

$$\begin{array}{r} \times\ 11 \\ \hline 1100 \\ 00 \\ \hline 00 \\ +\ 111 \\ \hline 11 \\ \hline 100100 \end{array}$$

Ans

d) $1100_2 \div 10_2$

Soln

$$\begin{array}{r|l} & 110 \\ \hline 10 & 1100 \\ & 10 \\ \hline & 100 \\ & 10 \\ \hline & 00 \\ & 00 \\ \hline & \times \end{array}$$

110 Ans

e) $01101010_2 \times 11110001_2$

Sol

2's Complement

11110001

1's complement ← 00001110

2's complement ← 1

00001111

Now

00001111

01101010

00000000

00001111x

000000000xx

00001111xxx

0000000000xxxx

00001111xxxxx

000011111xxxx

0000.0000xxxxxx

00001100011010

Taking 2's complement

11000110

00111001 1's complement

+ 1 2's Complement

00111010

11100101 Ans

f) $10001000_{(2)} \div 00100010_{(2)}$

Sol

Taking 2's complement

$$\begin{array}{r} 00100010 \\ 11011101 \quad \text{1's complement} \\ \underline{\qquad\qquad 1} \quad \text{2's complement} \\ 11011110 \end{array}$$

Quotient = 00000000

substracting divisor by divident 2's complement

$$\begin{array}{r} 10001000 \\ +\,11011110 \\ \hline 101100110 \end{array} \quad \text{discard} \leftarrow 1$$

Add 1 to Quotient = 00000001

Again

$$\begin{array}{r} 01000100 \\ \underline{11011110} \\ 100100010 \end{array} \quad \text{discard} \leftarrow 1$$

Add 1 to Quotient = 00000011

Again

$$\begin{array}{r} 00100010 \\ +\,11011110 \\ \hline 100000000 \end{array} \quad \text{discard} \leftarrow 1$$

Add 1 to Quotient = 00000100 Ans

h) $FC_{16} + AE_{16}$

Sol^n

$$\begin{array}{r} F\ C \\ +\ A\ E \\ \hline 1\ A\ A \end{array}$$

$1AA$ Ans

i) $F1_{10} - A6_{10}$

Sol^n

Using 2's complement

$$\frac{A}{1010} \qquad \frac{6}{0110}$$

$$\begin{array}{r} 1\,0\,1\,0\,0\,1\,1\,0 \\ 0\,1\,0\,1\,1\,0\,0\,1 \\ \hline \qquad\qquad\qquad 1 \quad \text{2's complents} \\ 0\,1\,0\,1\,1\,0\,1\,0 \end{array}$$

$$\frac{F}{1111} \qquad \frac{C}{1100}$$

Now,

$$\begin{array}{r} 1\ 1\ 1\ 1 \\ 1\,1\,1\,1\,1\,1\,0\,0 \\ +\ 0\,1\,0\,1\,1\,0\,1\,0 \\ \hline \text{discard} - 1\,0\,1\,0\,1\,0\,1\,0 \end{array}$$

$$\frac{0101}{5} \qquad \frac{0110}{6} \quad \Rightarrow 56 \text{ Ans}$$

j) $60_{16} - 3F_{16}$

Sol

2's complement

3 F

0011 1111

0011 1111

1100 0000

1 2's complement

1100 0001

6 0

0110 1101

Adding

0110 1101

+ 1100 0001

discard — 1 0010 1110

0010 1110

2 E

2E Ans:

k) $0\,0\,0\,1\,0\,1\,1\,0_{BCD} + 0\,0\,0\,1\,0\,1\,0\,1_{BCD}$

Sol

$$\begin{array}{r} 0001 \quad 0110 \\ +\ 0001 \quad 0101 \\ \hline 0010 \quad 1010 \end{array} \rightarrow \text{invalid due } (>9)$$

Add to invalid Code

$$\begin{array}{r} 0010 \quad 1010 \\ \quad\quad\quad 0110 \\ \hline 0010 \quad 0001 \end{array}$$ Ans

Q5) Apply Module -2 to $1100_2 + 1011_2$

Sol

$$\begin{array}{r} 1101 \\ 0011 \\ \hline 0111 \end{array}$$

0111 Ans

Q6) Apply CRC to the data bits 10110010_2 using the generator code 1010_2 to produce the transmitted CRC code

Sol

$D = 11010011_2$

$G = 1010$

$D' = 11010011000$

using Module-2 operation

$D' = 11010011000$

G 1010

1110
1010
0100
1010
0111
1010
0010
0000
0010

Again by adding reminder to data bit

11010011010

1010
1110
1010
1000
1010
0110
1010
0011
1010
0010
1010
0000

Hence, 11010011010 is transmitted CRC

Q7) Assume that the code produced in problem Q.6 incurs an error in the most significant bit during transmission. Apply CRC to detect the error.

Soln

Recieved data = D' = 0101001101100

B = 1010

Using module-2 operation

```
0101001101100
1010
----
1111
1010
----
1010
1010
----
 0110
 1010
 ----
 1100
 1010
 ----
 1101
 1010
 ----
 1000
 1010
 ----
   10  -> ≠ 0
```

Hence error has occured.