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SUBJECT: DIGITAL LOGIC DESIGN

SEMESTER: 3RD

PROGRAMME: BS (SOFTWARE ENGINEERING)

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

Sol:- Writing in weighted form

$(1\times10^3)+(7\times10^2)+(9\times10^1)+(9\times10^0)$

$1000+700+90+9$

The weight of 7 in 1799_{10} is 100

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

Sol:-

In weighted form

$(5\times10^3)+(4\times10^2)+(3\times10^1)+(6\times10^0)$

500 400 30 6

Value of 5 500
Value of 4 400
Value of 3 30
Value of 6 6

Q3 Convert the following

a) $11111111_{(2)} = (?)_{10}$

using weighted notation

$(1\times10^7)+(1\times10^6)+(1\times10^5)+(1\times10^4)+(1\times10^3)$
128 64 32 16 8

$(1\times10^2)+(1\times10^1)$ (1×10^0)
4 2 1

255_{10} Ans

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

Sol:- Using Repeated division by 2

2	127	0
2	63	1
2	31	1
2	15	1
2	7	1
2	3	1
2	1	1

$=(01111111)_2$ Ans

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

Sol:- Using Repeated division for whole number 45

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

$45_{10} = 1101101_2$

Using repeated multiplication for decimal part

$0.25 \times 2 = 0.50 \to 0$
$0.50 \times 2 = 1.00 \to 1$

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

d) $10000000.1010_{(2)} = (?)_{10}$

Sol:- weighted notation

$(1 \times 2^7) + (1 \times 2^{-1}) + (1 \times 2^{-3})$

$128 + 0.5 + 0.125$

$= 128.625_{(10)}$ Ans

e) $4D7F_{(16)} = (?)_{16}$

using weighted notation

$(4 \times 16^{3}) + (13 \times 16^{2}) + (7 \times 16^{1}) + (15 \times 16^{0})$

$10384 + 3328 + 112 + 15$

$(19839)_{10}$ Ans

f) $128_{10} = ?_{16}$

Sol:- using Repeated ~~notation~~ division by 16

$16 | 128$
$16 \quad 8 \quad 0$

$128_{(10)} = 80_{(10)}$ Ans

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

Sol:- by hex-Binary table

3	A	6	F
0011	1010	0110	1111

$= 0011/1010/0110/1111_{(10)}$ Ans

h) 110000 1111 0010 101 = $(?)_{16}$

using group of four

$\underset{C}{\underline{1100}}$ $\underset{3}{\underline{0011}}$ $\underset{E}{\underline{1110}}$ $\underset{5}{\underline{0101}}$

= C3E5(10) Ans

i) 6173 (8) = $(?)_{10}$

Ans using weighted notation

$(6\times8^3) + (1\times8^2) + (7\times8^1) + (3\times8^0)$

3072 + 64 + 56 + 3

$61783_{(8)} = 3195_{(10)}$ Ans

j) 169(10) = $(?)_8$

Sol- by repeated division of 8

8	169	
8	21	1
8	2	5

$(251)_8$ Ans

(k) 3740 (8) = (?) 2

Sol:- Using Octal binary table

3 7 4 0

011 111 100 000

011111100000 (2) Ans

(L) 1010110001011111 (2) = (?) 8

Ans Using Groups of 3

001 010 110 001 011 111

1 2 6 1 3 7

= 126137 (8) Ans

m) 2A7D (16) = (?) 8

Ans First using Hex binary table

2 A 7 D

0010 1010 0111 1101

Now using groups of 3

000 010 101 001 111 101

0 2 7 1 7 5

= 25175 (8) Ans

n) $(7503)_8 = (?)_{16}$

Sol:- Octal Binary table first

7	5	0	3
111	101	000	011

Now using groups of 4.

1111	0100	0011
F	4	3

F 43 (16) Ans

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

Sol:-

Using 2's compliment

$$\begin{array}{rl} & \underline{11111111} \\ & 00000000 \quad 1\text{'s compliment} \\ + & \underline{1} \quad 2\text{'s compliment} \\ & 00000001 \end{array}$$

Now since signed bit in zero

$(1 \times 1) = +1 \; (01)$ Ans

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

Sol:- Finding 12 in Binary

2	12	
2	6	0
2	3	0
2	1	1

12 = 1100 (2)

Taking 2's compliment

00001100

11110011 I's compliment

1 2's compliment

11110100 1

Ans

(j) $156_{(10)} = (?)$ BCD

Sol:-

Using Dec-BCD table

1 5 6

0001 0101 0110

000101010110 Ans

Q7) 1000 0111 0000 BCD = (?)10

Sol:- Using BCD - Dec table

1000 0111 0000
8 7 0

870(10) Ans

Q5) 1001010(2) = (?) Gray

Sol:-

1 → + 0 → + 0 → + 1 → + 0 → + 1 → + 0
↓ ↓ ↓ ↓ ↓ ↓ ↓
1 1 0 1 1 1 1

= 1101111 Gray Ans

Q6 10101111 Gray = (?)2

Sol:-

1 0 1 0 1 1 1 1
↓ + ↓ + ↓ + ↓ + ↓ + ↓ + ↓ + ↓
1 1 0 0 1 0 1 0

11001010(2) Ans

Q) 0100 0000 = (?) ASCII Small

Using ASCII table

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

$64 + 1$

$65_{(10)}$

$65_{(10)}$ = A ASCII elements

Qv) 0110 0000 = (?) ASCII capital

Sol:- Using ASCII table

$(1 \times 2^6) + (1 \times 2^5)$

$64 + 32$

$= 96_{(10)}$

$96_{(10)}$ = (`) ASCII

Qw 111000 = (? 111 000) Even parity

for Even parity

111000 = (1111 000) Even prity

As the number of 1s must be even.

Q1) 101101 = (? 10 11 01) add parity

for odd parity

101101 = (1101101) add parity

As number of ones unit must be odd

Q2) Calculate each of the following

a) $11110011_{(2)} + 01011111_{(2)}$

Sol:-

$$
\begin{array}{r}
11110011 \\
+\ 01011111 \\
\hline
101010010
\end{array}
$$

Discarded bit

$01010010_{(2)}$ Ans

b) 1000 0000 - 01111111

Sol:-

Taking 2's compliment

$$
\begin{array}{r}
01111111 \\
\hline
10000000 \\
1 \\
\hline
10000001
\end{array}
$$

1's compliment
2's compliment

Now

$$
\begin{array}{r}
10000000 \\
10000001 \\
\hline
100000000
\end{array}
$$

Discarded bit

00000001 Ans

c) 110000 × 1100

Sol:-

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

Ans

Qd) 1100 ÷ 10(2)

Sol:-

```
        110
  10 ) 1100
        10
        100
         10
         00
         00
          x
```

(110) Ans

Qe 01111111(2) - 00000111(2)

Sol:- Taking 2's compliment

```
   00000111
   11111000
 +        1   1's compliment
   11111001   2's compliment
```

Now

```
   1 0 1111111
 + 1 1111001
   1 0 1111000
```

Discarded bit

01111000(2) Ans

Q) 01101010 (2) × 11110001 (2)

Ans Taking 2's compliment

11110001
00001110 1's compliment
\+ 1 2's compliment
00001111

Now

00001111
01101010
00000000
100001111x
00000000xx
00001111xxx
00001111xxxx
00001111xxxxx
00001111xxxxxx
0000000xxxxxxxx

0000110000110110

Taking 2's compliment again

11 000 11 0110
00 111 00 1001 1's complime
\+ 1 2's compli
00111001010
00 111 001010 Ans
11100 1010

Q9 $1000\,1000_{(2)} \div 00100010_{(2)}$

Sol:-

Taking 2's compliment

$$\begin{array}{r} 00100010 \\ \hline 11011101 \\ 1 \\ \hline 11011110 \end{array}$$

1's compliment

2's compliment

Quotient = 0000 0000

Subtracting devisor from divident with 2's compliment

$$\begin{array}{r} 10001000 \\ +\ 11011110 \\ \hline 101100110 \end{array}$$

Discard →

Add 1 to quotient = 00000001

Subtracting devisor from first partial remainder

$$\begin{array}{r} 01100110 \\ +\ 11011110 \\ \hline 101000100 \end{array}$$

Discard →

Add 1 to Quotient = 00000010

Again
$$\begin{array}{r} 01000100 \\ +\ 11011110 \\ \hline 100100010 \end{array}$$
Discard →

Add 1 to quotient = 00000011

Again
$$\begin{array}{r} 00100010 \\ 11011110 \\ \hline 1\ 00000000 \end{array}$$
Discard ←

Add 1 to quotient = 00000100 Ans

Qh) $FC_{10} + AE_{16}$

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

1AA Ans

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

Sol:-

Using 2's compliment

$$\underset{1010}{A} \quad \underset{0110}{6}$$

10100110
01011001
+ 1 2's compliment

01011010

F C
1111 1100

1111
11111100
+01011010

10101 0110

Discard

0101 0110
5 6

56 Ans

Q) $6D_{10} - 3F_{10}$

Sol:-

Using 2's compliment

$$\frac{3}{0011} \quad \frac{F}{1111}$$

$$
\begin{array}{r}
00111111 \\
+\ \underline{11000000} \\
\underline{1} \\
11000001
\end{array}
$$ 2's compliment

$$\frac{6}{0110} \quad \frac{D}{1101}$$

Adding:-

$$
\begin{array}{r}
0110\,1101 \\
+\ \underline{11\,000\,001} \\
100101110
\end{array}
$$

Discard ←

$$\frac{0010}{2} \qquad \frac{1110}{E}$$

2E Ans

Q4) 00010110 BCD + 00010101 BCD

Sol:-

	0001	0110	
+	0001	0101	
	0010	1010	→ invalid due to (<9)

Add 6 to invalid code

0010	1010	
	0110	
0010	0001	Ans

Q5) Apply Modulo-2 to 1100_2 + 1011_2

Sol:-

1101	
1011	
0111	Ans

Q6 Apply CRC to the Date bits 10110010₂ using generator code 1010 (2)

Sol:-

$D = 11010011_2$

$G = 1010$

$D = 11010011\,0000$

using module-2 operation

$$\frac{D'}{G} = 110100110000$$

```
110100110000
1010
----
 1110
 1010
 ----
  1000
  1010
  ----
   1011
  -1010
   ----
    1000
    1010
    ----
     100
```

← Non-zero

here 110100110100 is Transerted err

Q7 Assume that the code produces in Q5. includes an error in the most significient bit Apply crc to detect error.

Sol:-

Recieved dat = $D' = 0101001101100$

$G = 1010$

using module 2

```
0101001101100
 1010
 1111
 1010
 1010
 1010
      0110
      1010
      1100
      1010
       1101
       1010
        1110
        1010
         1000
         1010
           10 -> 0
```

hence error has accured