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20P-0153

Section

BSCS-2B#2

DLD Assignment #2.

Submitted to:

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Q#1

Decimal	BCD	Hexa	Octal
$(98)_{10}$	$(1001\,1000)_2$	$(62)_{16}$	$(142)_8$
$(98)_{10}$	$(10011000)_2$	$(62)_{16}$	$(142)_8$
$(1467)_{10}$	$(0001\,0100\,0110\,0111)_2$	$(5BB)_{16}$	$(2673)_8$
$(43981)_{10}$	$(0100\,0011\,1001\,1000\,0001)_2$	$(ABCD)_{16}$	$(127715)_8$

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Q#2. Multiplication

a) 01101010 by 11110001

01101010 by 11110001

Now take multipliers 2's complement

11110001 ⟶ 00001111

$$
\begin{array}{r}
(01101010)_2 \\
\times (00001111)_2 \\
\hline
01101010 \\
01101010\times \\
\hline
10011111\,10 \\
01101010\times\times \\
\hline
10111100110 \\
01101010\times\times\times \\
\hline
(11000110110)_2
\end{array}
$$

Verification:-

$(01101010)_2 = 106_{10}$

$(00001111)_2 = 15_{10}$

$$
\begin{array}{r}
106 \\
\times 15 \\
\hline
1590
\end{array}
$$

where

$(11000110110)_2 =$

$1\times2^9+0\times2^8+0\times2^7+0\times2^6+1\times2^5+1\times2^4+0\times2^3+1\times2^2+1\times2^1+0\times2^0$

$+1\times2^{10}$

$1024+512+0+0+0+32+16+0+4+2 = (1590)_{10}$

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Q#2 b) 219 by 15

Solution:- 219 by 15

$(219)_{10} = (11011011)_2$

$(15)_{10} = (00001111)_2$

$$
\begin{array}{r}
1\,1\,0\,1\,1\,0\,1\,1_2 \\
\times\ 0\,0\,0\,0\,1\,1\,1\,1_2 \\
\hline
1\,1\,0\,1\,1\,0\,1\,1 \\
1\,1\,0\,1\,1\,0\,1\,1\,\times \\
\hline
1\,0\,1\,0\,0\,1\,0\,0\,0\,1 \\
1\,1\,0\,1\,1\,0\,1\,1\,\times\,\times \\
\hline
1\,0\,1\,1\,1\,1\,1\,1\,0\,1 \\
1\,1\,0\,1\,1\,0\,1\,1\,\times\,\times\,\times \\
\hline
1\,1\,0\,0\,1\,1\,0\,1\,0\,1\,0\,1_2 \\
\hline
\end{array}
$$

Verification:-

$$
\begin{array}{r}
219 \\
\times\ 15 \\
\hline
3285_{10}
\end{array}
$$

$(110011010101)_2 =$

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

$= 1\times2^{11} + 1\times2^{10} + 0\times2^9 + 0\times2^8 +$

$\therefore$ ~~2048~~ $1024 + 0 + 0 + 128 + 64 + 0 + 16 + 0 + 4 + 0 + 1$

$+2048 = (3285)_{10}$

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Q#3 Divide?

a) 10001000 by 00100010

10001000 by 00100010

Now take divisors 2's complement

00100010 → $(11011110)_2$

```
   1 0 0 0 1 0 0 0
   1 1 0 1 1 1 1 0
  ----------------
1| 0 1 1 0 0 1 1 0
   1 1 0 1 1 1 1 0
  ----------------
1| 0 1 0 0 0 1 0 0
   1 1 0 1 1 1 1 0
  ----------------
1| 0 0 1 0 0 0 1 0
   1 1 0 1 1 1 1 0
  ----------------
1| 0 0 0 0 0 0 0 0
```

Discard all carries

```
Quotient = 00000000
                 +1
           --------
           00000001
                 +1
           --------
           00000010
                 +1
           --------
           00000011
                 +1
           --------
           00000100
```

$(0000\ 0100)_2$

Q#3 a) 20P-0153

Verification.

$(10001000)_2 =$ 136

$(11011110)_2 =$ 34

$$\begin{array}{r|l} & 4 \\ \hline 34 & 136 \\ & 136 \\ \hline & 0 \end{array}$$

And. $(00000100)_2 = \underline{4}$

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Q#3(b) -145 by 5:-

Solution:-

-145 by 5:-

-145 = 10010001

Now divisors compliment

5 = 11111011 After 2's comp

		Quotient:
	10010001	00000000
	11111011	+1
1	10001100	00000001
	11111011	+1
1	10000111	00000010
	11111011	+1
1	10000010	00000011
	11111011	+1
1	01111101	00000100
	11111011	+1
1	01111000	00000101
	11111011	+1
1	01110011	00000110
	11111011	+1
1	01101110	00000111
	11111011	+1
1	01101001	00001000
	11111011	+1
		00001001

Q#3 -b 20P-0153

1 | 0 1 1 0 0 1 0 0   0 0 0 0 1 0 0 1

1 1 1 1 1 0 1 1   +1

1 | 0 1 0 1 1 1 1 1   0 0 0 0 1 0 1 0

1 1 1 1 1 0 1 1   +1

1 | 0 1 0 1 1 0 1 0   0 0 0 0 1 0 1 1

1 1 1 1 1 0 1 1   +1

1 | 0 1 0 1 0 1 0 1   0 0 0 0 1 1 0 0

1 1 1 1 1 0 1 1   +1

1 | 0 1 0 1 0 0 0 0   0 0 0 0 1 1 0 1

1 1 1 1 1 0 1 1   +1

1 | 0 1 0 0 1 0 1 1   0 0 0 0 1 1 1 0

1 1 1 1 1 0 1 1   +1

1 | 0 1 0 0 0 1 1 0   0 0 0 0 1 1 1 1

1 1 1 1 1 0 1 1   +1

1 | 0 1 0 0 0 0 0 1   0 0 0 1 0 0 0 0

1 1 1 1 1 0 1 1   +1

1 | 0 0 1 1 1 1 0 0   0 0 0 1 0 0 0 1

1 1 1 1 1 0 1 1   +1

1 | 0 0 1 1 0 1 1 1   0 0 0 1 0 0 1 0

1 1 1 1 1 0 1 1   +1

0 0 1 1 0 0 1 0   0 0 0 1 0 0 1 1

1 1 1 1 1 0 1 1   +1

0 0 1 0 1 1 0 1   0 0 0 1 0 1 0 0

1 1 1 1 1 0 1 1   +1

1 | 0 0 1 0 1 0 0 0   0 0 0 1 0 1 0 1

Q#3 -b 20P-0153

1 | 0 0 1 0 1 0 0 0   000010101
1 1 1 1 1 0 1 1   +1
1 | 0 0 1 0 0 0 1 1   00010110
1 1 1 1 1 0 1 1   +1
1 | 0 0 0 1 1 1 1 0   00010111
1 1 1 1 1 0 1 1   +1
1 | 0 0 0 1 1 0 0 1   00011000
     +1
1 1 1 1 1 0 1 1   00011001
1 | 0 0 0 1 0 1 0 0   +1
1 1 1 1 1 0 1 1   00011010
1 | 0 0 0 0 1 1 1 1   +1
1 1 1 1 1 0 1 1   00011011
1 | 0 0 0 0 1 0 1 0   +1
1 1 1 1 1 0 1 1   00011100
1 | 0 0 0 0 0 1 0 1   +1
1 1 1 1 1 0 1 1   00011101
1 | 0 0 0 0 0 0 0 0

$\Longleftrightarrow$ $(00011101)_2$.

taking 2's comp of $(00011101)_2$

verification.

$(11100011)_2 \Rightarrow (11100011)_2$

$-29 = -128 + 64 + 32 + 0 + 0 + 0 + 2 + 1$

-29
$5 \overline{)-145}$
-145
0

$= \boxed{-29}$

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Q# ~~4~~ a) $ABC_{16} + 1A3_{16}$

$(ABC)_{16} + (1A3)_{16}$

H		D		B
A	=	10	=	1010
B	=	11	=	1011
C	=	12	=	1100
F	=	15	=	1111

for $(ABC)_{16}$

10 11 12

$(1010\ 1011\ 1100)_2$

for $(1A3)_{16}$

~~001~~ 10 3

$(0001\ 1010\ 0011)_2$

Now

$(ABC)_{16} + (1A3)_{16}$

$$
\begin{array}{r}
1010\ 1011\ 1100_2 \\
+\ 0001\ 1010\ 0011_2 \\
\hline
1100\ 0101\ 1111
\end{array}
$$

12 5 15

C 5 F

$(C5F)_{16}$

or

$(C5F)_{16} = 12\times16^2 + 5\times16^1 + 15\times16^0$

$(3167)_{10} = 3072 + 80 + 15$

Verification:-

$(ABC)_{16} = 10\times16^2 + 11\times16^1 + 12\times16^0$

$= 2560 + 176 + 12$

$= (2748)_{10}$

Q#4 a) 20P-0153

$(1A3)_{16} = 1 \times 16^2 + 10 \times 16^1 + 3 \times 16^0$

$= 256 + 160 + 3$

$= (419)_{10}$

$(ABC)_{16} + (1A3)_{16} = 2748_{10} + 419_{10}$

$= (3167)_{10}$

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Q#4 (b) $(F1)_{16} - (A6)_{16}$

Solution:-

$$(F1)_{16} - (A6)_{16}$$

in Hexa $A = 10$, $F = 15$

$A = 10 = 1010$, $F = 15 = 1111$

$(F1)_{16} = (1111\,0001)_2$

$(A6)_{16} = (10100110)_2$

lets take 2's complement of $(A6)_{16}$.

$(10100110)_2 = (01011010)_2$ ← 2's complement

$$\begin{array}{lcr} (F1)_{16} & \rightarrow & 1\ 1\ 1\ 1\ 0\ 0\ 0\ 1 \\ -(A6)_{16} & \rightarrow & -0\ 1\ 0\ 1\ 1\ 0\ 1\ 0 \\ \hline & & \cancel{1}\ 0\ 1\ 0\ 0\ 1\ 0\ 1\ 1 \end{array}$$

verification:- $(01001011)_2 \rightarrow (4B)_{16}$

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

$75 = 64 + 0 + 0 + 8 + 0 + 2 + 1$

$\underbrace{0100}_{4}\ \underbrace{1011}_{B}$

$(4B)_{16}$

$(F1)_{16} = 241$

$(A6)_{16} = 166$

$$\begin{array}{r} 241 \\ -166 \\ \hline 75 \end{array}$$

$75_{10} = 4B_{16}$

verificated upword. in

Q#~~3~~: (Fam) 20D-0153

C) $(110)_{10} - (84)_{10} = (P)_2$

2	110
2	55 – 0
2	27 – 1
2	13 – 1
2	6 – 1
2	3 – 0
	1 – 1

2	84
2	42 – 0
2	21 – 0
2	10 – 1
2	5 – 0
2	2 – 1
	1 – 0

$(1101110)_2$ $(1010100)_2$

take (1010100)'s 2's complement

1010100 = 0101100 //2's comp.

$$\left.\begin{array}{r} 1\ 1\ 0\ 1\ 1\ 1\ 0 \\ 0\ 1\ 0\ 1\ 1\ 0\ 0 \end{array}\right\} \text{we will do addition process.}$$

discard carry $\cancel{1}$ | 0 0 1 1 0 1 0

$(0011010)_2 = 0 + 0 + 16 + 8 + 0 + 2 + 0$

$= 26$

$(0011010)_2$

Verification:-

$$\begin{array}{r} 110 \\ -\ 84 \\ \hline 26 \end{array}$$

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Q#5

Answer:-

The Gray code make only one bit change. When we move to next digit it make one-bit change. And also if we previous number it make 1-bit change.

for example 0000 → 0001 → 0011

→ Gray code for $(1111)_2$ = 1000

→ Gray code for $(0000)_2$ = 0000

Gray code is prooved by shaft shiffter example discussed previous lectures.