QUESTION # 1 Complete the table.

Decimal	BCD	Hexa	Octal
98	10011000	62	142
98	10011000	62	142
1467	0001010001100111	5BB	2673
43981	0100001110011000001	ABCD	125715

NAME : JAWAD AHMED

ROLL NO : 20P-0165

SECTION : 2A

ASSIGNMENT : 02

Question No 2

(a) 01101010 by 11110001

Solution:

Second Number is negative Taking 2's complement

$(11110001)_2 = (00001111)_2$

Now Multiplying

```
        0 1 1 0 1 0 1 0
        0 0 0 0 1 1 1 1
    -----------------------
        0 1 1 0 1 0 1 0
      0 1 1 0 1 0 1 0 X
    -----------------------
      1 0 0 1 1 1 1 1 0
    0 1 1 0 1 0 1 0 X X
    -----------------------
    1 0 1 1 1 0 0 1 1 0
  0 1 1 0 1 0 1 0 X X X
    -----------------------
  1 1 0 0 0 1 1 0 1 1 0
```

Next All are zero so we add Number of zeroes that are have to multiplied.

= 0000 11000 110110

Taking 2's complement Again Because the Number is negative.

So,

$= \overset{1}{\underset{0}{1}}111001110010\overset{1}{1}0$

$\boxed{= (1111001110010 10)_2}$

Ans

Question #2

(b) 219 by 15

Solution:

2	219
2	109 - 1
2	54 - 1
2	27 - 0
2	13 - 1
2	6 - 1
2	3 - 0
	1 - 1

2	15
2	7 - 1
2	3 - 1
	1 - 1

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

$(15)_{10} = (1111)_2$

$(219)_{10} = (00000000\ 11011011)_2$

$(15)_{10} = (000000000000\ 1111)_2$

```
  0000000011011011
  0000000000001111
  ----------------
  0000000011011011
 0000000011011011X
  ----------------
  0000000101001001
 00000000110110 1XX
  ----------------
  00000000101111101
 00000000110110 11XXX
  ----------------
  0000000110011010101
```

Again Next are all zeros so no need to multiply

B = 0000110011010101

$\boxed{= 0000110011010101}$

Ans

Question #3 Divide in the 2's complement form.

Solution:

(1) 10001000 by 00100010

00100010 = 34

Solution:

Taking 2's complement of Divident

10001000 = -128 + 8 ⇒ -120

10001000 = 01111000 => 64+32+16+8

01111000 = +120

Taking 2's complement of Divisor

00100010 = 11011110

11011110 = -34

Subtracting Divident from 2's complement Divisor.

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

~~1~~) 0 1 0 1 0 1 1 0
1 1 0 1 1 1 1 0

~~1~~) 0 0 1 1 0 1 0 0
1 1 0 1 1 1 1 0

~~1~~) 0 0 0 1 0 0 1 0 => 18 < 34
So we stop.

Taking 2's complement
$\boxed{\frac{-}{+} = -}$ $(11101110)_2$

Verifying

2 + 4 + 16 + 64 = 86 ✓
4 + 16 + 32 = 52 ✓
2 + 16 = 18 ✓

$$34 \overline{)\,-120\,}\ \ -3$$
102
-18 -> remainder

120
-34
86 ✓

86
-34
52 ✓

52
-34
18 ✓

Quotient = 0000 0000
+ 1
0000 0001
+ 1
0000 0010
+ 1
3 = 0000 0011

Quotient = 3
Remainder = -18
(11101110) = -18

Question 3

Part (b)

Divide −145 by +5

$145 = \overset{2^7}{128} + \overset{2^4}{16} + \overset{2^1}{1}$

$= 010010001$

2's complement

$-145 = 101101111 \Rightarrow$ Dividend

$+5 = \overset{2^2}{4} + \overset{2^0}{1}$

$= 00000101$ ↓ Divisor

Divident	Quotient
101101111	00000000
+ 000000101	+ 1
101110100	00000001
+ 000000101	+ 1
101111001	00000010
+ 000000101	+ 1
101111110	00000011
+ 000000101	+ 1
110000011	00000100
+ 000000101	+ 1
110001000	00000101
+ 000000101	+ 1
110001101	00000110
+ 000000101	+ 1
110010010	00000111
+ 000000101	+ 1
110010111	00001000
+ 000000101	+ 1
110011100	00001001
+ 000000101	+ 1
110100001	00001010

Divident

110100001
+000000101
110100110
+000000101
110101011
+000000101
110110000
+000000101
110110101
+000000101
110111010
+000000101
110111111
+000000101
111000100
+000000101
111001001
+000000101
111001110
+000000101
111010011
+000000101
111011000
+000000101
111011101
+000000101
111100010
+000000101
111100111

Quotient

00001010
+1
00001011
+1
00001100
+1
00001101
+1
00001110
+1
00001111
+1
00010000
+1
00010001
+1
00010010
+1
00010011
+1
00010100
+1
00010101
+1
00010110
+1
00010111
+1
00011000

Divident	Quotient
111100111	00011000
+ 000000101	+ 1
111101100	00011001
+ 000000101	+ 1
111110001	00011010
+ 000000101	+ 1
111110110	00011011
+ 000000101	+ 1
111111011	00011100
+ 000000101	+ 1
0000000000	00011101

Zero Remainder

So, final quotient is = 00011101

and final Remainder is = 00000000

quotient = 00011101 = 29

2's quotient = 11100011 = -29

Final Remainder = 0

Checking

$$\begin{array}{r|l} & -29 \\ \hline +5 & -145 \\ & \mp 145 \\ \hline & 0 \end{array}$$

-29 ⟶ Quotient

-145 ⟶ Dividend

0 ⟶ Final Remainder

QUESTION NO 4

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

Solution

$$\begin{array}{ccc} \overset{1}{A} & B & C \\ 1 & A & 3 \\ \hline C & 5 & F \end{array}$$

$(ABC)_{16} + (1A3)_{16} = (C5F)_{16}$

A = 10
B = 11
C = 12
D = 13
E = 14
F = 15

Verify

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

$= (10\ 11\ 12)_{16} + (1\ 10\ 3)_{16}$

$= (1010\ 1011\ 1100)_2 + (0001\ 1010\ 0011)_2$

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

$= \underline{1100}\ \overline{0101}\ \overline{1111}$

$= (C\ 5\ F)_{16}$

Hence Proved

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

Solution:

$$\begin{array}{cc} \overset{14}{\cancel{F}} & \overset{1+16=17}{\cancel{1}} \\ A & 6 \\ \hline 4 & B \\ \hline \end{array}$$

$14 = 1 - 15 = F$

$$(F1)_{16} - (A6)_{16} = (4B)_{16}$$

Verification

$(11110001)_2 - (10100110)$

Taking 2's complement of subtrahend.

$10100110 = 01011010$

$$\begin{array}{r} 11110001 \\ +\ 01011010 \\ \hline \cancel{1}\ 01001011 \\ \hline \end{array}$$

~~$01001011 = (4B)_{16}$~~ $(01001011)_2 = (4B)_{16}$

Hence Proved

Scanned with CamScanner

Q4(c) $(110)_{10} - (84)_{10} = (?)_2$

Solution:

$$
\begin{array}{ccc}
1 & \overset{0}{\cancel{1}} & \overset{10}{\cancel{0}} \\
 & 8 & 4 \\
\hline
(& 2 & 6)_{10}
\end{array}
$$

2	26
2	13 – 0
2	6 – 1
2	3 – 0
	1 – 1

$(110)_{10} - (84)_{10} = (11010)_2$

Verifying

$(110)_{10} = (01101110)_2$

$(84)_{10} = (01010100)_2$

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

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

Taking 2's complement of $(84)_{10}$

$(84)_{10} = (01010100)_2$

$= (10101100)_2$

& **Adding**

~~1 1 0 1 1 1 0~~

~~1 0 1 0 1~~

$$
\begin{array}{cccccccc}
1 & 1 & & 1 & 1 & & & \\
0 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \\
1 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \\
\hline
0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\
\hline
\end{array}
$$

$(00011010)_2 = 16 + 8 + 2$

$= (26)_{10}$

HENCE Proved

QUESTION No 5

Ans: The gray codeD makes 1 bit change at a time when going from one number in the sequence of Next Number.

In gray code there is a change of one one bit so change not occur eventualy. That is why grey code is better.

→ ~~Gray code for $(1111)_2$ =~~