Chapter # 1

THE NUMBER SYSTEM

EXERCISE 1.1

Q.1 ***Convert the following numbers into those of Decimal System:-***

(1) 32_5

Solution:

$$3 \times 5^1 - 2 \times 5^0$$
$$= 15 + 2$$
$$= 17 \quad \textit{Ans}$$

(2) 201_5

Solution:

$$2 \times 5^2 + 0 \times 5^1 + 1 \times 5^0$$
$$= 50 + 0 + 1$$
$$= 51 \quad \textit{Ans}$$

(3) 3000

Solution:

$$3 \times 5^3 + 0 \times 5^2 + 0 \times 5^1 + 0 \times 5^0$$
$$= 375 + 0 + 0 + 0$$
$$= 375 \quad \textit{Ans}$$

(4) 2341_5

Solution:

$$2 \times 5^3 + 3 \times 5^2 + 4 \times 5^1 + 1 \times 5^0$$
$$= 250 + 75 + 20 + 1$$
$$= 345 \quad \textit{Ans}$$

(5) 10203_5

Solution:

$$1 \times 5^4 + 0 \times 5^3 + 2 \times 5^2 + 0 + 5^1 + 3 \times 5^0$$
$$= 625 + 0 + 50 + 0 + 3$$
$$= 678 \quad \textit{Ans}$$

Q.2 ***Convert the following numbers into those of base-five System:***

(6) 23

Solution:

5	23
	4 −3

$23 = 4 \times 5^1 + 3 \times 5^0$

$= 43_5$ ***Ans***

(7) 39

Solution:

5	49
5	7 − 1
	1 = 2

$39 = 1 \times 5^2 + 2 \times 5^1 + 4 \times 5^0$

$= 124_5$ ***Ans***

(8) 76

Solution:

5	76
5	15 −4
	3 −0

$76 = 3 \times 5^2 + 0 \times 5^1 + 1 \times 5^0$

$= 301_5$ ***Ans***

(9) 112

Solution.

5	112
5	22 −2
	4 −2

$112 = 4 \times 5^2 + 2 \times 5^1 + 2 \times 5^0$

$= 422_5$ ***Ans***

(10) 324

Solution:

5	324
5	64 – 4
5	12 – 4
	2 – 2

$$324 = 2 \times 5^3 + 2 \times 5^2 + 4 \times 5^1 + 4 \times 5^0$$
$$= 2244_5 \text{ Ans}$$

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EXERCISE 1.2

Q.1 Convert the following numbers into those of Base-Two:

(1) 5

Solution:

2	5
2	2 – 1
	1 – 0

$$5 = 1 \times 2^2 + 0 + 2^1 + 1 \times 2^0$$
$$= 101_5 \text{ Ans}$$

(2) 17

Solution:

2	17
2	8 – 1
2	4 – 0
2	2 – 0
	1 – 0

$$17 = 1 \times 2^4 + 0 \times 2^3 + 0 \times 2^2 + 0 \times 1^1 + 1 \times 2^0$$
$$= 10001_2 \text{ Ans}$$

(3) 32

Solution:

2	32
2	16 – 0
2	8 – 0
2	4 – 0
2	2 – 0
	1 – 0

$32 = 1\times2^5+0\times2^4+0\times2^3+0\times2^2+0\times2^1+0\times2^0$

$= 10000_2$ ***Ans***

(4) 63

Solution:

2	63
2	31 – 1
2	15 – 2
2	7 – 1
2	3 – 1
	1 – 1

$63 = 1\times2^5+1\times2^4+1\times2^3+1\times2^2+1\times2^1+1\times2^0$

$= 111111_2$ ***Ans***

(5) 81

Solution:

2	81
2	40 – 1
2	20 – 0
2	10 – 0
2	5 – 0
2	2 – 1
	1 – 0

$81 = 1\times2^6 + 0\times2^5 + 1\times2^4 + 0\times2^3 + 0 + 2^2 + 0\times2^1 + 1 + 2^0$

$= 1010001_2$

Q.2 ***Convert the following number into those of Decimal System:***

(6) 101_2

Solution:

$$1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0$$
$$= 4 + 0 + 1$$
$$= 5 \text{ Ans}$$

(7) 1110_2

Solution:

$$1 \times 2^2 + 1 \times 2^2 + 1 \times 2^1 + 0 \times 2^0$$
$$= 8 + 4 + 2 + 0$$
$$= 14 \text{ Ans}$$

(8) 101010_2

Solution:

$$1 \times 2^5 + 0 \times 2^4 + 1 \times 2^1 + 0 \times 2^2 + 1 \times 2^1 + 0 \times 2^0$$
$$= 32 + 0 + 8 + 2 + 0$$
$$= 42 \text{ Ans}$$

(9) 1111001_2

Solution:

$$1 \times 2^6 + 1 \times 2^5 + 1 \times 2^4 + 1 \times 2^3 + 0 \times 2^4 + 0 \times 1 + 2^0$$
$$= 64 + 32 + 16 + 8 + 0 + 0 + 1$$
$$= 121 \text{ Ans}$$

(10) 1100091_2

Solution:

$$1 \times 2^6 + 1 \times 2^5 \times 2^4 + 0 \times 2^3 + 0 \times 2^2 + 0 \times 2^1 + 1 + 2^0$$
$$= 4 + 32 + 0 + 0 + 0 + 1$$
$$= 97 \text{ Ans}$$

EXERCISE 1.3

Q.1 ***Solve the following and convert the following from Decimal System into the Base-five System.***

(1) $37 + 18$

Solution:

5 | 37
5 | 7 – 4
1 – 2

5 | 18
3 – 3

$\therefore \quad 37 = 1 \times 5^2 + 2 \times 5^1 + 2 \times 5^0$

$= 33_5$

$18 = 3 \times 5^1 + 3 \times 5^0$

$= 33_5$ **Ans**

(2) $101 + 34$

Solution:

5 | 101
5 | 20 – 1
4 – 0

5 | 34
5 | 6 – 4
1 – 1

$\therefore \quad 101 = 4 \times 5^2 + 0 \times 5^1 + 1 \times 5^0$

$= 401_5$

$34 = 1 \times 5^2 + 1 \times 5^1 + 4 \times 5^0$

$= 114_5$ **Ans**

Find the sum and check by converting into Decimal System:

(3) $41_5 \times 32_5$

Solution:

$$\begin{array}{r} 41_5 \\ \times\ 32_5 \\ \hline 123_5 \end{array}$$

$41_5 = 4 \times 5^1 + 1 \times 5^0$

$= 5^0 \times 1$

$= 2^1$

$32_5 = 3 \times 5^1 + 2 \times 5^0$

$= 15 + 2$

$= 17$

Now $21 + 17 = 38$

Chechking

5	1 38
5	7 − 3
	1 − 2

$38 = 1 \times 5^2 + 2 \times 5^1 + 3 \times 5^0$

$= 123_5$ **Ans**

(4) $\mathbf{101_5 + 20_5}$

Solution:

101_5

20_5

121_5

Now $101_5 = 1 \times 5^2 + 0 \times 5^1 + 1 \times 5^0$

$= 25 + 0 + 1$

$= 26$

and $20_5 = 2 \times 5^1 + 0 \times 5^0$

$= 10 + 0$

$= 10_5$

$26 + 10 = 26$

Checking

5	36
5	7 − 1
	1 − 2

$35 = 1 \times 5^2 + 2 \times 5^1 + 1 \times 5^0$

$= 121_5$ **Ans**

(5) $\mathbf{31_5 + 44_5 + 13_5}$

Solution:

31_5

44_5

13_5

143_5

$31_5 = 5 \times 1^1 + 1 \times 5^0$

$= 15 + 1$

$44_5 = 4 \times 5^1 + 4 \times 5^0$

$= 20 + 4$

$13_5 = 1 \times 5^1 + 3 \times 5^0$

$= 5 + 3$

$= 8$

$16 + 24 + 8 = 48$

Checking

5	48
5	9 – 3
	1 – 4

$48 = 1 \times 5^2 + 4 \times 5^1 + 4 \times 5^0$

$= 143_5$ **Ans**

(6) $401_5 + 123_5 + 24_5$

Soluion:

401_5

123_5

24_5

1103_5

$401_5 = 4 \times 5^2 + 0 \times 5^1 + 1 \times 5^0$

$= 25 + 10 + 3$

$= 101$

$123_5 = 1 \times 5^2 + 2 \times 5^1 + 3 \times 5^0$

$= 25 + 10 + 3$

$= 38$

$24_5 = 2 \times 5^1 + 4 \times 5^0$

$= 10 + 4$

$= 14$

$101 + 38 + 14 = 153$

Checking

5	153
5	30 – 3
5	6 – 0
	1 – 1

$153 = 1 \times 5^3 + 1 + 5^1 + 0 \times 5^1 + 3 \times 5^0$

$= 1103$ **Ans**

Solve the following and then convert into Base-five system.

(7) 31 − 25

Solution:

5	31
5	6 − 1
	1 − 1

$31 = 1\times 5^2 + 1\times 5^1 + 1\times 5^0$

$= 111^5$

5	25
5	5 − 0
	1 − 0

$25 = 1\times 25^2 + 0\times 5^1 + 0\times 5^0$

$= 100^5$

Solution:

111_5

$(-)\ 100_2$

11_2 ***Ans***

$111_5 - 100_3$

$= 11_2$

(8) 103 − 34

Solution:

5	103
5	20 − 3
	4 − 0

$103 = 4\times 5^2 + 0\times 5^1 + 3\times 5^0$

$= 403_5$

5	34
5	6 − 4
	1 − 1

$34 = 1\times 5^2 + 1\times 5^1 + 4\times 5^0$

$= 114_5$

Subtraction

$403_5 - 114_5$

$= 234_5$ ***Ans***

403_5

$(-)\ 114_5$

234_5 ***Ans***

Solve the following and convert the Decimal System:

(9) $43_5 - 34_5$

Solution:

43_5

$(-)\ 34_5$

4_5

$43_5 = 4 \times 5_1 + 3 \times 5^0$

$= 20 + 3$

$= 23$

$34_5 = 3 \times 5^1 + 4 \times 5^0$

$= 15 + 4$

$= 19$

$23 - 19 = 4$

Checking $4 = 4 \times 5^0$

$= 4$ **Ans**

(10) $\mathbf{114_2 - 43_5}$

Solution:

$$\begin{array}{r} 110_5 \\ (-)\ 43_5 \\ \hline 12_5 \end{array}$$

$110_5 = 1 \times 5^2 + 1 \times 5^1 + 0 \times 5^0$

$= 25 + 5 + 0$

$= 30$

$43_5 = 4 \times 5^1 + 3 \times 5^0$

$= 20 + 3$

$= 23$

$30 - 23 = 7$

Checking

$$\begin{array}{r|l} 5 & 7 \\ \hline & 1 - 3 \end{array}$$

$7 = 1 \times 5^1 + 2 \times 5^0$

$= 12_5$ **Ans**

(11) $\mathbf{341_5 - 212_5}$

Solution:

$$\begin{array}{r} 341_5 \\ (-)\ 212_5 \\ \hline 124_5 \end{array}$$

$341_5 = 3 \times 5^2 + 4 \times 5^1 + 1 \times 5^0$

$= 75 + 20 + 1$

$112_5 = 2 \times 5^2 + 1 \times 5^1 + 2 \times 5^0$

$= 50 + 5 + 2$

$= 52$

$96 - 57 = 39$

Checking

5	39
5	7 − 4
	1 − 2

$39 = 1 \times 5^2 + 2 + 5^1 + 4 \times 5^0$

(12) $423_5 - 404_5$

Solution:

$$\begin{array}{r} 423_5 \\ (-)\ 404_5 \\ \hline 14_5 \end{array}$$

$423_5 = 4 \times 5^2 + 2 \times 5^1 + 3 \times 5^0$
$= 100 + 10 + 3$
$= 113$
$404_5 = 4 \times 5^2 + 0 \times 5^1 + 4 \times 5^0$
$= 100 + 0 - 4$
$= 104$
$113 - 104 = 9$

Checking

5	9
	1 − 4

$9 = 1 \times 5^1 + 4 \times 5^0$
$= 14^2$ ***Ans***

(13) ***Add 432_5 to 103_5 and subtract 434_5.***

Solution:

$$\begin{array}{r} 437_5 \\ (+)\ 103_5 \\ \hline 1040_5 \end{array} \qquad \begin{array}{r} 1040_5 \\ (-)\ 434_5 \\ \hline 101_5 \end{array}$$ ***Ans***

(14) ***The sum of two numbers in Base-five is 431_5, One of the number is 214_5. Find the other.***

Solution:

$$\begin{array}{r} 431_5 \\ (-)\ 214_5 \\ \hline 212_5 \end{array}$$

(15) *Convert the numbers used in the following expensions into those of Base-five & solve.*

$$21 + 34 - 108 + 62$$

Solution:

5 | 21
4 − 1

5 | 34
5 6 − 4
1 − 1

5 | 108
5 | 21 − 3
4 − 1

5 | 62
5 | 12 − 2
2 − 2

$$21 = 4 \times 4^1 + 1 \times 5^0$$
$$= 41_5$$
$$34 = 1 \times 5^2 + 1 \times 5^1 + 4 \times 5^0$$
$$= 114_5$$
$$108 = 4 \times 5^2 + 1 \times 5^1 + 3 \times 5^0$$
$$= 4135$$
$$62 = 2 \times 5^2 + 1 \times 5^1 + 3 \times 5^0$$
$$= 222_5$$

$$21 = 41_5$$
$$34 = 114_5$$
$$\underline{62 = 222_5\ (+)}$$
$$117 = 432_5$$
$$117 = 432_5$$
$$\underline{108 = 413_5\ (-)}$$
$$9 = 14_5$$

Checking

$$14_5 - 1 \times 5^1 + 4 \times 5^0$$
$$= 5 + 4$$
$$= 9\ \textit{Ans}$$

EXERCISE 1.4

Q.1 ***Solve the following and then convert into Decimal System multiply and thus check your answer.***

(1) $243_5 \times 2_5$

Solution:

$$\begin{array}{r} 243_5 \\ \times\ 25 \\ \hline 1041_5 \end{array}$$

$243_5 = 2 \times 5^2 + 4 \times 5^1 + 3 \times 5^0$

$= 50 + 20 + 3$

$= 73$

$2^5 = 2 \times 5^0$

$73 \times 2 = 146$

Checking

5 |	146
5 |	29 – 1
5 |	5 – 4
|	1 – 0

$146 = 1 \times 5^3 + 0 \times 5^3 + 4 \times 5^1 + 1 \times 5^0$

$= 1041_5$ **Ans**

(2) $431_5 \times 4_5$

Solution:

$$\begin{array}{r} 431_5 \\ \times\ 4_5 \\ \hline 3324_5 \end{array}$$

$431_5 = 4 \times 5^2 + 3 \times 1^1 + 1 \times 5^0$

$= 100 + 15 + 1$

$4_5 = 4 \times 5^0$

$= 4$

$116 \times 4 = 464$

Checking

5	464
5	92 – 4
5	18 – 2
	3 – 3

$464_5 + -3 \times 5^3 + 2^3 \times 5^2 + 2 + 5^1 + 4 \times 5^0$

$= 3024_3$ **Ans**

(3) $\mathbf{240_5 \times 32_5}$

Solution:

$$\begin{array}{r} 240_5 \\ \times\ 32_5 \\ \hline 1030 \\ 1320\ + \\ \hline 14230_5 \end{array}$$

$240_5 = 2 \times 5^2 + 4 \times 5^1 + 0 \times 5^0$

$= 50 + 20 + 0$

$= 70$

$32_5 = 3 \times 5^1 + 2 \times 5^0$

$= 15 + 2$

$= 17$

$170 \times 17 = 1190$

Checking

5	1190
5	238 – 0
5	47 – 3
5	9 – 2
	1 – 4

$1190 = 1 \times 5^4 + 4 \times 5^3 + 2 \times 5^2 + 3 \times 5^1 + 0 \times 5^0$

$= 14230_5$ **Ans**

(4) $\mathbf{342_5 \times 43_5}$

Solution:

$$\begin{array}{r} 342_5 \\ \times\ 45_5 \\ \hline 2131 \\ 2023 \\ \hline 32411_5 \end{array}$$

$342_5 = 3 \times 5^2 + 4 \times 5^1 + 2 \times 5^0$
$= 75 + 20 + 2$
$= 97$
$43_5 = 4 \times 5^1 + 3 \times 5^0$
$= 20 + 3$
$= 23$
$97 \times 23 = 2231$

Checking

5	2231
5	446 – 1
5	89 – 2
5	17 – 4
	3 – 2

$2231 = 3 \times 5^4 + 2 \times 5^3 + 4 \times 5^2 + 1 \times 5^1 + 1 \times 5^0$
$= 32411_5$ **Ans**

(5) $\mathbf{443_5 \times 241_5}$

Solution:

$$\begin{array}{r} 443_5 \\ \times\ 341_5 \\ \hline 443 \\ 3432 \\ 1441_ \\ \hline 234413_5 \end{array}$$

$443_5 = 2 \times 5^2 + 4 \times 5^1 + 3 \times 5^0$
$= 100 + 20 + 3$
$= 123$
$241_5 = 2 \times 5^2 + 4 \times 5^1 + 1 \times 5^0$
$= 50 + 20 + 1$
$123 \times 71 = 8733$

Checking

5	8733
5	1746 – 3
5	349 – 1
5	63 – 4
5	13 – 4
	2 – 3

$8733 = 2 \times 5^5 + 3 \times 5^4 + 4 \times 5^3 + 4 \times 5^2 + 1 \times 5^1 + 3 \times 5^0$
$= 234413_5$ **Ans**



EXERCISE 1.5

Solve the following in Base-Two, then convert into Decimal System thus check your answer.

(1) $101_2 + 11_2$

Solution:

$$\begin{array}{r} 101_2 \\ +\ 11_2 \\ \hline 1000_2 \end{array}$$

$$\begin{aligned} 101_2 &= 1\times 2^2 + 0\times 2^1 + 1\times 0^0 \\ &= 4 + 0 + 1 \\ &= 5 \\ 11_2 &= 1\times 2^1 + 1\times 2^0 \\ &= 2 + 1 \\ &= 3 \\ 5 + 3 &= 8 \end{aligned}$$

Checking

2	8
2	4 − 0
2	2 − 0
	1 − 0

$$\begin{aligned} 8 &= 1\times 2^3 + 0\times 2^1 + 0\times 2^1\times 0\times 1 \\ &= 1000_2 \text{ Ans} \end{aligned}$$

(2) $110_2 + 1101_2$

Solution:

$$\begin{array}{r} 110_2 \\ +\ 1101_2 \\ \hline 11011_2 \end{array}$$

$$\begin{aligned} 110_2 &= 1\times 2^2 + 1\times 2^1 + 0\times 2^0 \\ &= 4 + 2 + 0 \\ &= 6 \\ 2101_2 &= 1\times 2^3 + 1\times 2^2 + 0\times 2^1 + 1\times 2^0 \\ &= 8 + 4 + 0 + 1 \end{aligned}$$

$= 13$

$13 + 6 = 19$

Checking

2	19
2	9 – 1
2	4 – 1
2	2 – 0
	1 – 0

$19 = 1 \times 4^4 + 0 \times 2^3 + 0 \times 2^2 + 1$

$= 100011_2$ **Ans**

Q.3 $\mathbf{111_2 + 101_2 + 10_2}$

Solution:

$$\begin{array}{r} 111_2 \\ 101_2 \\ +\ \ 10_2 \\ \hline 1110_2 \end{array}$$

$111_2 = 1 \times 2^2 + 1 \times 2^1 + 1 \times 2^0$

$= 4 + 2 + 1$

$= 7$

$101_2 = 1 \times 2^2 + 0 \times 2^1 \times 1 \times 2^0$

$= 4 + 0 + 8$

$= 5$

$10_2 = 1 \times 2^1 + 0 \times 2^0$

$= 2 + 0$

$= 2$

$7 + 5 + 2 = 14$

Checking

2	14
2	7 – 0
2	3 – 1
	1 1

$14 = 1 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 0 \times 2^0$

$= 1110_2$ **Ans**

(4) $\mathbf{1110_2 - 101_2}$

Solution:

$$\begin{array}{r} 1110_2 \\ (-)\ 101_2 \\ \hline 1001_2 \end{array}$$

$1110_2 = 1 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 0 \times 2^0$

$= 8 + 4 + 2 + 0$

$= 14$

$101_2 = 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0$

$= 4 + 0 + 1$

$= 5$

$14 - 5 = 9$

Checking

2	9
2	8 – 1
2	2 – 0
	1 – 0

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

$= 1001_2$ **Ans**

$= 20$

(5) $\mathbf{1110_2 - 1101_2}$

Solution:

$$\begin{array}{r} 1110_2 \\ (-)\ 1101_2 \\ \hline 1_2 \end{array}$$

$1110_2 = 1 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 0 \times 2^0$

$= 8 + 4 + 2 + 0$

$= 14$

$1101_2 = 1 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0$

$= 8 + 4 + 0 + 1$

$= 13$

$14 - 13 = 1$

Checking $1 = 1 \times 2^0$

$= 1_2$ **Ans**

(6) $\mathbf{1101_2 + 10_2 - 111_2}$

Solution:

$$\begin{array}{r} 1101_2 \\ +\ 10_2 \\ \hline 1111_2 \\ -111_2\ (-) \\ \hline 1000_2 \end{array}$$

$1101_2 = 1 \times 2^3 + 1 \times 2^2 + 0 \times 2^3 + 1 \times 2^0$

$= 8 + 4 + 0 + 1$

$= 13$

$10_2 = 1 \times 2^1 + 0 \times 2^0$

$= 2 + 0$

$= 2$

$111_2 = 1 \times 2^2 + 1 \times 2^1 + 1 \times 2^0$

$= 4 + 2 + 1$

$= 7$

$13 + 2 - 7 = 8$

Checking

2	8
2	4 − 0
2	2 − 0
	1 − 0

$8 = 1 \times 2^1 + 0 \times 2^2 + 0 \times 2^1 + 0 \times 2^0$

$= 1000_2$ **Ans**

(7) $\mathbf{101_2 \times 11_2}$

Solution:

$$\begin{array}{r} 101_2 \\ \times\ 11_2 \\ \hline 101 \end{array}$$

$$+\ \underline{101}$$

$$\underline{1111_2}$$

$101_2 = 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0$

$= 4 + 0 + 1$

$= 5$

$11_2 = 1 \times 2^1 + 1 \times 2^0$

$= 2 + 1$

$= 3$

$5 \times 3 = 15$

Checking

2	15
2	7 – 1
2	3 – 1
	1 – 1

$15 = 1 \times 2^3 + 1 \times 2^2 \times 1 \times 2^1 + 1 \times 2^0$

$= 1111_2$ ***Ans***

(8) $\mathbf{1101_2 \times 101_2}$

Solution:

$$1101_2$$
$$\times\ \underline{101_2}$$
$$1101$$
$$\underline{0000}$$
$$+\ \underline{1101}$$
$$\underline{1000001_2}$$

$1101_2 = 1 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0$

$= 8 + 4 + 0 + 1$

$= 13$

$101_2 = 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0$

$= 4 + 0 + 1$

$\mathbf{13 \times 5 = 65}$

Checking

2	65
2	32 – 1
2	16 – 0
2	8 – 0
2	4 – 0
2	2 – 0
	1 – 0

$65 = 1 \times 2^6 + 0 \times 2^5 + 0 \times 2^4 + 0 \times 2^3 + 0 \times 2^2 + 0 \times 2^1 + 1 \times 2^0$

$= 1000001_2$ **Ans**

(9) $\mathbf{11011_2 \times 1110_2}$

Solution:

$$\begin{array}{r} 11011_2 \\ \times\ 1110_2 \\ \hline 00000 \\ 11011 \\ 11011 \\ +\ 11011 \\ \hline 101111010_2 \end{array}$$

11011_2 $1 \times 2^4 + 1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 1 \times 2^0$

$= 16 + 8 + 0 + 2 + 1$

$= 27$

$1110_2 = 1 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 0 \times 2^0$

$= 8 + 4 + 2 + 0$

$= 14$

$27 + 14 = 378$

Checking

2	378
2	189 – 0
2	94 – 1
2	47 – 0
2	25 – 1
2	11 – 1
2	5 – 1
2	2 – 1
	1 – 0

$$378 = 1\times2^8 + 0\times2^7 + 1\times2^6 + 1\times2^5 + 1\times2^4 + 1\times2^3 + 0\times2^2 + 1\times2^1 + 0\times2^0$$
$$= 101111010_2 \text{ Ans}$$

(10) Add 1101_2 to 110_2 and subtrat 1111_2 from the sum.

Addition:

$$\begin{array}{r} 1101_2 \\ + \quad 110_2 \\ \hline 10011_2 \end{array}$$

Subtraction:

$$\begin{array}{r} 10011_2 \\ - \quad 1111_2 \\ \hline 100_2 \end{array} \text{ Ans}$$

(11) Solve: $11101_2 \times 110_2 + 1010_2 \times 111_2$.

Solution of $11101_2 \times 110_2 + 1010_2 \times 111_2$

$$= 10101110_2 - 1000110_2$$
$$= 11110100_2 \text{ Ans}$$

Steps of Solution:

11101_2 × 110_2 = 00000, $11101\times$, $111101\times\times$ = 10101110_2

1010_2 × 111_2 = 1010, $1010\times$, $1010\times\times$ = 1000110_2

Addition:

$$10101110_2 + 1000110_2 = 11110100_2 \text{ Ans}$$

(13) ***Simplify:*** $1110_2 \times 101_2 \times 101_2 \times 10_2 - 110_2 \times 1010_2$.

$= 1000110_2 + 1010_2 - 111100_2$

$= 1010000_2 - 111100_2$

$= 10100_2$ ***Ans***

Steps of Solution:

$1110_2 \times 101_2$ = 1110, $0000\times$, $1110\times\times$ = 1000110_2

$101_2 \times 10_2$ = 000, $101\times$ = 1010_2

$1010_2 \times 110_2$ = 000, $110\times\times$, $000\times\times$, $110\times\times\times$ = 111100_2

Addition

$1000110_2 + 1010_2 = 1010000_2$

Subtraction

$1010000_2 - 111100_2 = 10100_2$ ***Ans***