1. Tick (✓) the correct answer.

a. What does a Computer System consist of?

(i) Hardware (ii) Software (iii) Both (i) and (ii) ✓ (iv) None of these

b. Which of the following is the appropriate definition of Base of a Number System?

(i) It is used to represent the number of digits in that Number System.

(ii) ✓ It is used to represent the number of digits that can be used in that number system.

(iii) It is used to represent the digits that are present in that number system.

(iv) It represents the number of digits that is required and that cannot be used to represent a number in that number system.

c. Which among the following is a valid Binary Number?

(i) ✓ 101101_2 (ii) 1101101_8 (iii) 10101024_8 (iv) $110A1_{16}$

d. Which is not a valid octal number?

(i) 2341_8 (ii) ✓ 7286_8 (iii) 4426_8 (iv) 27565_8

e. Which of the following is not a digit of the Hexadecimal Number System?

(i) A (ii) F (iii) 9 (iv) ✓ G

2. State whether the following statements are true (T) or false (F).

a. The number of digits that can be used in a Number System is called its Base. **T**

b. The Octal Number System has its base as 16. **F**

c. Decimal Number System is a native way of representing numbers in a computer. **F**

d. The last digit that can be used in hexadecimal number is 'Z'. **F**

e. $CAFE_{16}$ is a valid hexadecimal number. **T**

3. Fill in the blanks with the given words.

| 2 | octal | 16 | hexadecimal | Number | 7 |

a. The way of representing numbers to identify quantity is called ..**Number**.. System.

b. The largest digit present in octal number system is ..**7**.. .

c. The radix of Hexadecimal Number System is ..**16**.. .

d. 36_{16} is a **hexadecimal** number whereas 36_8 is a ..**octal**.. number.

e. To convert decimal number to binary, you need to divide it successively by ..**2**.. .

4. Observe the conversion process and ill in the blanks.

a. Convert 79_{10} to Binary.

```
2 | 79
2 | 39 ———→ 1
2 | 19 ———→ 1
2 | 9  ———→ 1
2 | 4  ———→ 1
2 | 2  ———→ 0
    1  ———→ 0
```
Ans. $\boxed{1001111}$

b. Convert 103_{10} to Binary.

```
2 | 103
2 | 51 ———→ 1
2 | 25 ———→ 1
2 | 12 ———→ 1
2 | 6  ———→ 0
2 | 3  ———→ 0
    1  ———→ 1
```
Ans. $\boxed{1100111}$

c. Convert 101101_2 to Decimal.

```
5  4  3  2  1  0
1  0  1  1  0  1
```
$1 \times 2^0 = 1$
$0 \times 2^1 = 0$
$1 \times 2^2 = 4$
$1 \times \boxed{2^3} = \boxed{8}$
$0 \times 2^4 = 0$
$\boxed{1 \times 2^5} = 32$

Ans. $\boxed{45}$

d. Convert 110110_2 to Decimal.

$1 \times 2 = 2$ $2 + 1 = 3$

$3 \times 2 = 6$ $6 + 0 = 6$

$6 \times 2 = 12$ $12 + 1 = 13$

$\boxed{13 \times 2 = 26}$ $26 + 1 = 27$

$27 \times 2 = 54$ $\boxed{54 + 0 = 54}$

Ans. $\boxed{54}$

1. COMPUTER SYSTEM

1. Convert the following numbers to binary

(a) 46_{10}

```
2 | 46
2 | 23 -> 0
2 | 11 -> 1
2 | 5 -> 1
2 | 2 -> 1
    1 -> 0
```

$46_{10} = 101110_2$

(b) 73_{10}

```
2 | 73
2 | 36 -> 1
2 | 18 -> 0
2 | 9 -> 0
2 | 4 -> 1
2 | 2 -> 0
    1 -> 0
```

$73_{10} = 1001001_2$

(c) 97_{10}

```
2 | 97
2 | 48 -> 1
2 | 24 -> 0
2 | 12 -> 0
2 | 6 -> 10
2 | 3 -> 0
    1 -> 1
```

$97_{10} = 1100001_2$

(d) 65_{10}

```
2 | 65
2 | 32 -> 1
2 | 16 -> 0
2 | 8 -> 0
2 | 4 -> 0
2 | 2 -> 0
    1 -> 0
```

$65_{10} = 1000001_2$

(e) 71_{10}

(F) 109_{10}

```
2 | 71
2 | 35 → 1
2 | 17 → 1
2 | 8 → 1
2 | 4 → 0
2 | 2 → 0
    1 → 0
```

$71_{10} = 1000111_2$

```
2 | 109
2 | 54 → 1
2 | 27 → 0
2 | 13 → 1
2 | 6 → 1
2 | 3 → 0
    1 → 1
```

$109_{10} = 1101101_2$

(g) 83_{10}

(h) 58_{10}

```
2 | 83
2 | 41 → 1
2 | 20 → 1
2 | 10 → 0
2 | 5 → 0
2 | 2 → 1
    1 → 0
```

$83_{10} = 1010011_2$

```
2 | 58
2 | 29 → 0
2 | 14 → 1
2 | 7 → 0
2 | 3 → 1
    1 → 1
```

$58_{10} = 111010_2$

(i) 136_{10}

(j) 215_{10}

```
2 | 136
2 | 68 -> 0
2 | 34 -> 0
2 | 17 -> 0
2 | 8 -> 1
2 | 4 -> 0
2 | 2 -> 0
  | 1 -> 0
```

```
2 | 215
2 | 107 -> 1
2 | 53 -> 1
2 | 26 -> 1
2 | 13 -> 0
2 | 6 -> 1
2 | 3 -> 0
  | 1 -> 1
```

$136_{10} = 10001000_2$

$215_{10} = 11010111_2$

(K) 178_{10}

(l) 297_{10}

```
2 | 178
2 | 89 -> 0
2 | 44 -> 1
2 | 22 -> 0
2 | 11 -> 0
2 | 5 -> 1
2 | 2 -> 1
  | 1 -> 0
```

```
2 | 297
2 | 148 -> 1
2 | 74 -> 0
2 | 37 -> 0
2 | 18 -> 1
2 | 9 -> 0
2 | 4 -> 1
2 | 2 -> 0
  | 1 -> 0
```

$178_{10} = 10110010_2$

$297_{10} = 100101001_2$

2. Convert the following numbers to decimal

(a) 1011_2

$3\ 2\ 1\ 0$
$1\ 0\ 1\ 1$

$\rightarrow 1 \times 2^0 = 1$
$\rightarrow 1 \times 2^1 = 2$
$\rightarrow 0 \times 2^2 = 0$
$\rightarrow 1 \times 2^3 = 8$

$1011_2 = 11_{10}$

(b) 1101_2

$3\ 2\ 1\ 0$
$1\ 1\ 0\ 1$

$\rightarrow 1 \times 2^0 = 1$
$\rightarrow 0 \times 2^1 = 0$
$\rightarrow 1 \times 2^2 = 4$
$\rightarrow 1 \times 2^3 = 8$
$\overline{13}$

$1101_2 = 13_{10}$

(c) 1110_2

$3\ 2\ 1\ 0$
$1\ 1\ 1\ 0$

$\rightarrow 0 \times 2^0 = 0$
$\rightarrow 1 \times 2^1 = 2$
$\rightarrow 1 \times 2^2 = 4$
$\rightarrow 1 \times 2^3 = 8$
$\overline{14}$

$1110_2 = 14_{10}$

(d) 11011_2

$4\ 3\ 2\ 1\ 0$
$1\ 1\ 0\ 1\ 1$

$\rightarrow 1 \times 2^0 = 1$
$\rightarrow 1 \times 2^1 = 2$
$\rightarrow 0 \times 2^2 = 0$
$\rightarrow 1 \times 2^3 = 8$
$\rightarrow 1 \times 2^4 = 16$
$\overline{27}$
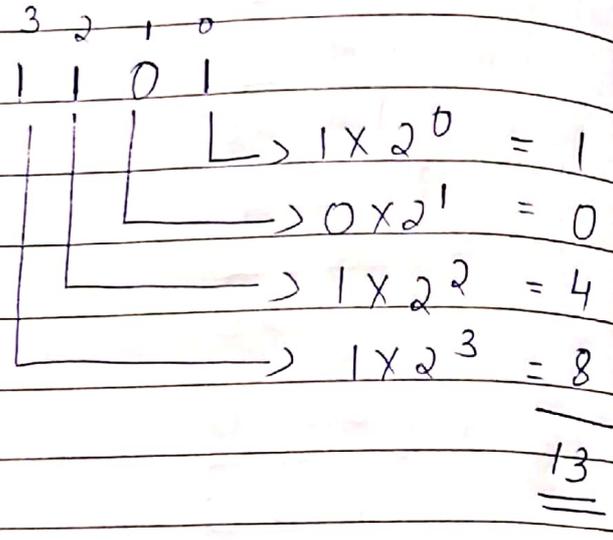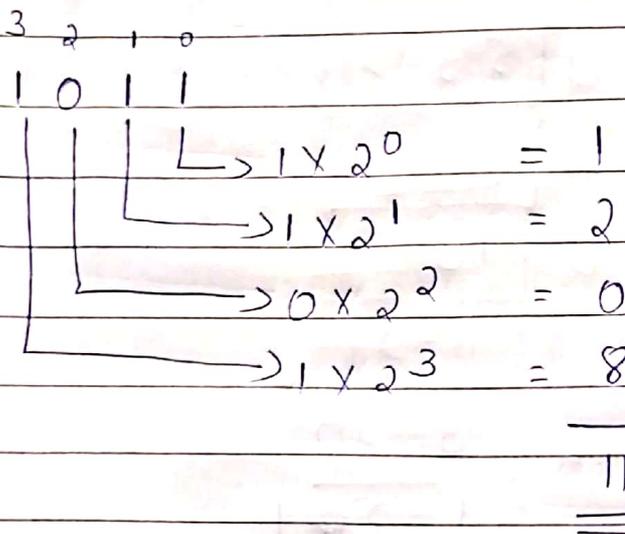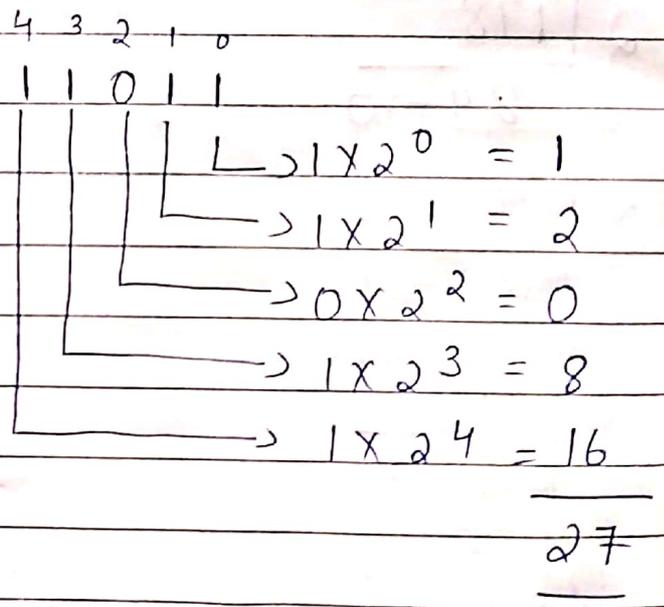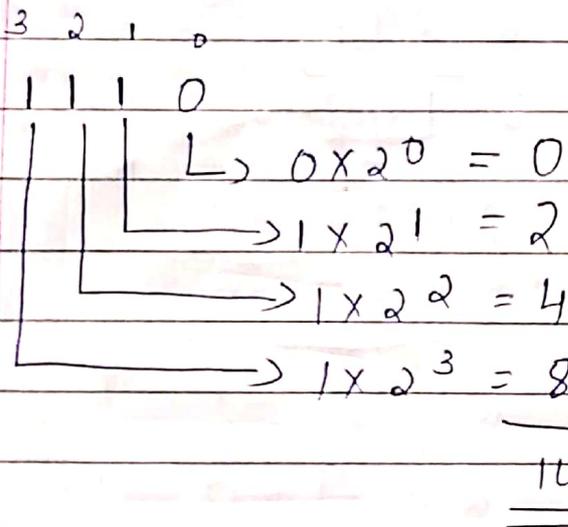
$11011_2 = 27_{10}$

(e) 10111_2 (F) 10110_2
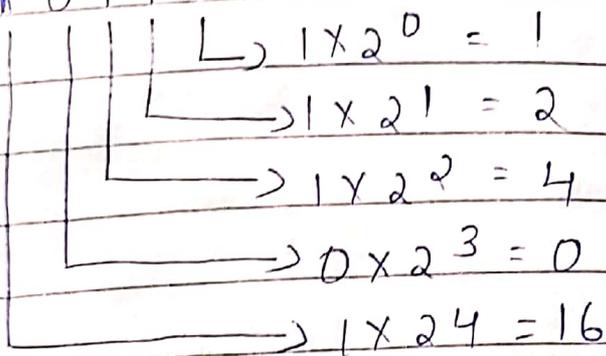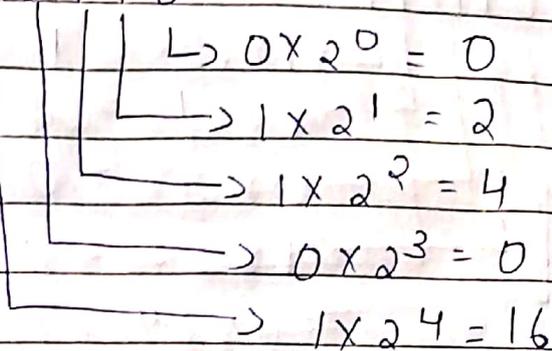
$$
\begin{array}{ccccc}
4 & 3 & 2 & 1 & 0 \\
1 & 0 & 1 & 1 & 1
\end{array}
$$

$$\rightarrow 1 \times 2^0 = 1$$
$$\rightarrow 1 \times 2^1 = 2$$
$$\rightarrow 1 \times 2^2 = 4$$
$$\rightarrow 0 \times 2^3 = 0$$
$$\rightarrow 1 \times 2^4 = 16$$
$$\overline{23}$$

$$
\begin{array}{ccccc}
4 & 3 & 2 & 1 & 0 \\
1 & 0 & 1 & 1 & 0
\end{array}
$$

$$\rightarrow 0 \times 2^0 = 0$$
$$\rightarrow 1 \times 2^1 = 2$$
$$\rightarrow 1 \times 2^2 = 4$$
$$\rightarrow 0 \times 2^3 = 0$$
$$\rightarrow 1 \times 2^4 = 16$$
$$\overline{22}$$

$$10111_2 = 23_{10}$$

$$10110_2 = 22_{10}$$

(g) 110110_2

$$
\begin{array}{cccccc}
5 & 4 & 3 & 2 & 1 & 0 \\
1 & 1 & 0 & 1 & 1 & 0
\end{array}
$$

$$\rightarrow 0 \times 2^0 = 0$$
$$\rightarrow 1 \times 2^1 = 2$$
$$\rightarrow 1 \times 2^2 = 4$$
$$\rightarrow 0 \times 2^3 = 0$$
$$\rightarrow 1 \times 2^4 = 16$$
$$\rightarrow 1 \times 2^5 = 32$$
$$\overline{54}$$

$$110110_2 = 54_{10}$$

(h) 101011_2

$$
\begin{array}{cccccc}
5 & 4 & 3 & 2 & 1 & 0 \\
1 & 0 & 1 & 0 & 1 & 1
\end{array}
$$

$1 \times 2^0 = 1$

$1 \times 2^1 = 2$

$0 \times 2^2 = 0$

$1 \times 2^3 = 8$

$0 \times 2^4 = 0$

$1 \times 2^5 = 32$

$$\overline{43}$$

$101011_2 = 43_{10}$

(i) 101100_2

$$
\begin{array}{cccccc}
5 & 4 & 3 & 2 & 1 & 0 \\
1 & 0 & 1 & 1 & 0 & 0
\end{array}
$$

$0 \times 2^0 = 0$

$0 \times 2^1 = 0$

$1 \times 2^2 = 4$

$1 \times 2^3 = 8$
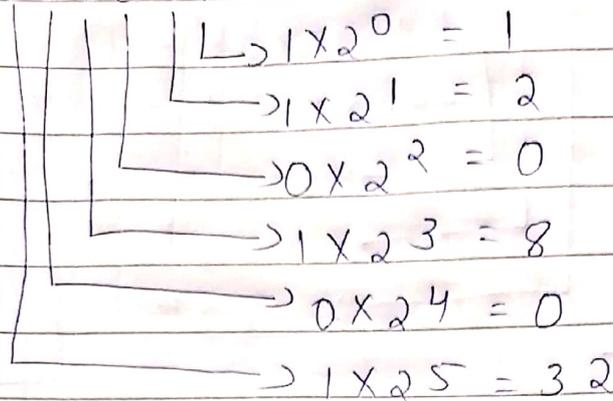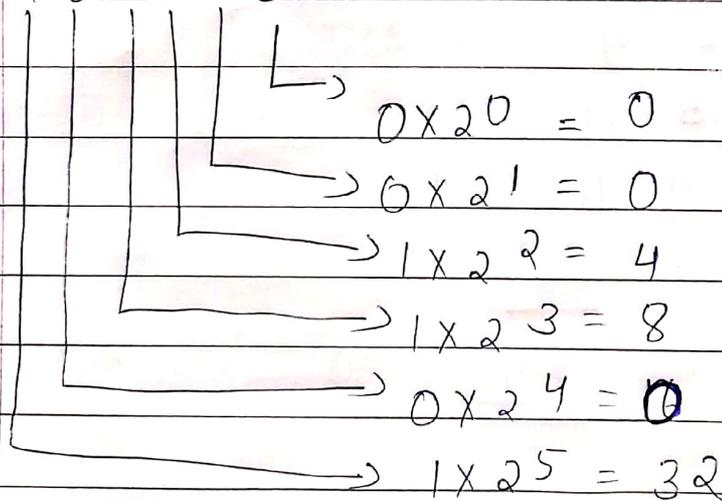
$0 \times 2^4 = 0$

$1 \times 2^5 = 32$

$$\overline{44}$$

$101100_2 = 44_{10}$

(j) 1011011_2

$$\overset{6\ 5\ 4\ 3\ 2\ 1\ 0}{1\ 0\ 1\ 1\ 0\ 1\ 1}$$

$1 \times 2^0 = 1$

$1 \times 2^1 = 2$

$0 \times 2^2 = 0$

$1 \times 2^3 = 8$

$1 \times 2^4 = 16$

$0 \times 2^5 = 0$

$1 \times 2^6 = 64$
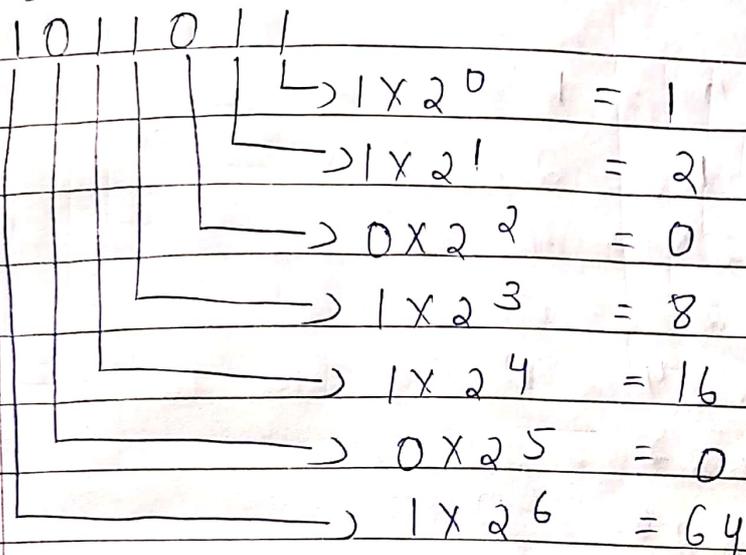
$\overline{91}$

$$1011011_2 = 91_{10}$$

(k) 1111101_2

$$\overset{6\ 5\ 4\ 3\ 2\ 1\ 0}{1\ 1\ 1\ 1\ 1\ 0\ 1}$$

$1 \times 2^0 = 1$

$0 \times 2^1 = 0$

$1 \times 2^2 = 4$

$1 \times 2^3 = 8$

$1 \times 2^4 = 16$

$1 \times 2^5 = 32$

$1 \times 2^6 = 64$
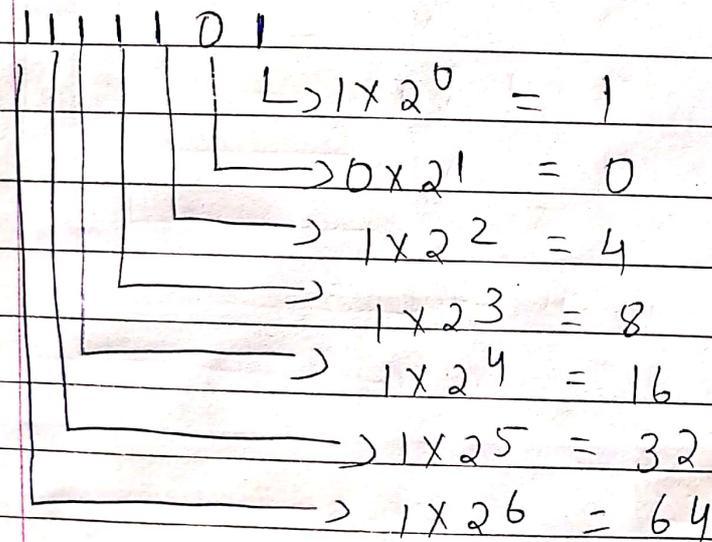
$\overline{125}$

$$1111101_2 = 125_{10}$$

(1) 10100111_2

$7\ 6\ 5\ 4\ 3\ 2\ 1\ 0$

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

$\rightarrow 1 \times 2^0 = 1$

$\rightarrow 1 \times 2^1 = 2$

$\rightarrow 1 \times 2^2 = 4$

$\rightarrow 0 \times 2^3 = 0$

$\rightarrow 0 \times 2^4 = 0$

$\rightarrow 1 \times 2^5 = 32$

$\rightarrow 0 \times 2^6 = 0$

$\rightarrow 1 \times 2^7 = 128$

$\overline{}$

167

$10100111_2 = 167_{10}$