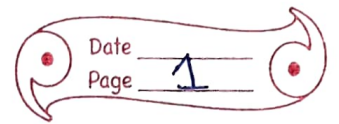


CW
16/4/22

Ch-1

Number System



Number system → It is a set of values used to represent different quantities.

The different types of Number system are -:

- (i) Decimal Number System
- (ii) Binary number System
- (iii) Octal number System
- (iv) Hexadecimal number system.

Decimal Number System

Decimal number system consist of 10 digits (0-9)

The base or radix of the decimal number system is 10.

For ex- (84^{10})

$$8 \times 10^1 + 4 \times 10^0$$

$$= 8 \times 10 + 4 \times 1$$

$$= 80 + 4 = 84$$

Binary Number System

Binary number System consists of two digits. (0 and 1)

It base or radize is 2.

Conversion of decimal to Binary

For ex - $(123)_{10} = (1111011)_2$

2	123	1
2	61	1
2	30	0
2	15	1
2	7	1
2	3	1
2	1	1
	0	

(ii) $(223)_{10} = (11011111)_2$

2	223	1
2	111	1
2	55	1
2	27	1
2	13	1
2	6	0
2	3	1
2	1	1
	0	

Binary to decimal

$$(i) \quad \begin{matrix} 7 & 6 & 5 & 4 & 3 & 2 & 1 & 0 \\ (11011111)_2 & = & (223)_{10} \\ = 128 + 64 + 0 + 16 + 8 + 4 + 2 + 1 \\ = 223 \end{matrix}$$

$$(ii) \quad \begin{matrix} 6 & 5 & 4 & 3 & 2 & 1 & 0 \\ (111011)_2 & = & (59)_{10} \\ = 1 \times 2^5 + 1 \times 2^4 + 1 \times 2^3 + 0 \times 2^2 + \\ & 1 \times 2^1 + 1 \times 2^0 \\ = ~~64~~ 32 + 16 + 8 + 0 + 2 + 1 \\ = 59 \end{matrix}$$

Octal Number System

Octal number system consist of 8 digits. (0 to 7)

It base or radix is 8.

$$(i) \quad (143)_{10} = (217)_8$$

8	143	7	↑
8	17	1	
8	2	2	
	0		

$$(ii) \quad (217)_8 = (143)_{10}$$

$$\begin{aligned}
 & 2 \times 8^2 + 1 \times 8^1 + 7 \times 8^0 \\
 &= 128 + 8 + 7 \\
 &= 143
 \end{aligned}$$

HW
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Home Assignment



$$(i) (423)_{10} = (11010011)_{2}$$

$$(ii) (327)_{8} = (215)_{10}$$

$$(iii) (1011111)_{2} = (95)_{10}$$

$$(iv) (272)_{10} = (420)_{8}$$

$$(v) (129)_{10} = (201)_{8}$$

Answers

$$(i) (423)_{10} = (11010011)_{2}$$

2	423	1
2	211	1
2	105	1
2	52	0
2	26	0
2	13	1
2	6	0
2	3	1
2	1	1
	0	

$$(ii) \quad (327)_8 = (215)_{10}$$

$$= (327)_8$$

$$= 3 \times 8^2 + 2 \times 8^1 + 7 \times 8^0$$

$$= 192 + 16 + 7$$

$$= 215$$

$$(iii) \quad (101111)_2 = (95)_{10}$$

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

$$= 64 + 0 + 16 + 8 + 4 + 2 + 1$$

$$= 95$$

$$(iv) \quad (272)_{10} = (420)_8$$

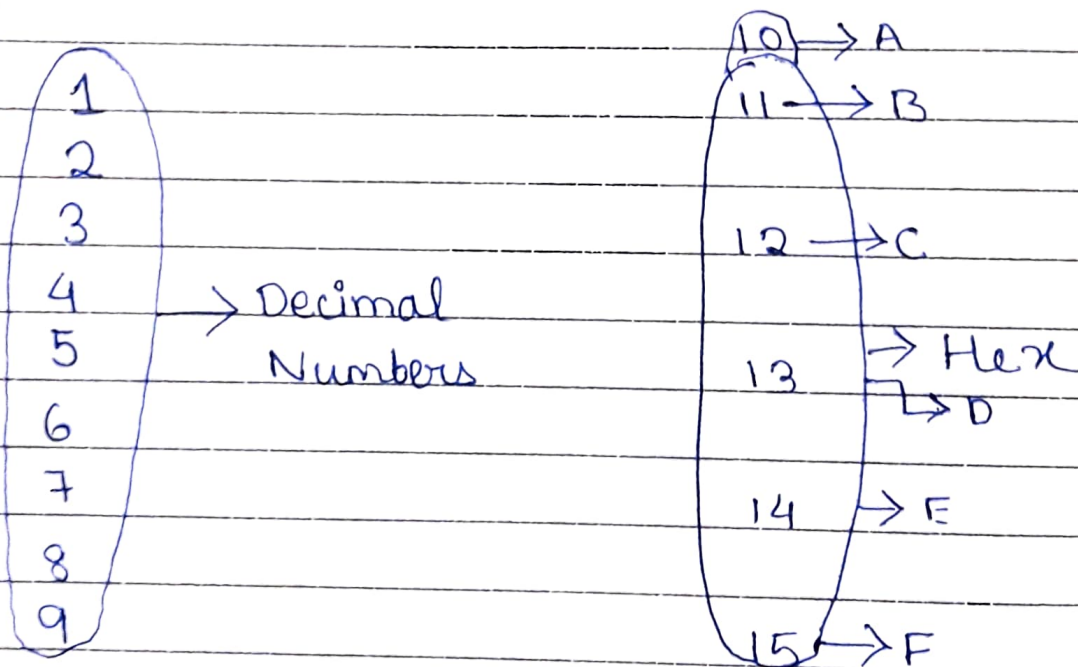
8	272	0
8	34	2
8	4	4
	0	

$$(v) \quad (129)_8 = (201)_{10}$$

8		129	_____	1
8		16	_____	0
8		2	_____	2
		0		

Hexadecimal Number System

- Hexadecimal Number System consists of 16 digits. (0 to 15)
- Its base is 16.



$$(1) \quad (222)_{10} = (DE)_{16}$$

$$= \begin{array}{r|l} 16 & 222 \\ \hline & 14 \quad E \\ 16 & 12 \\ & 13 \quad D \\ & 0 \end{array}$$

Hexadecimal to Decimal

$$(1) \quad (96)_{16} = (156)_{10}$$

$$= 9 \times 16^1 + 12 \times 16^0$$

$$= 144 + 12$$

$$= 156$$

$$(2) \quad (3DF)_{16} = (991)_{10}$$

$$= 3 \times 16^2 + 13 \times 16^1 + 15 \times 16^0$$

$$= 768 + 208 + 15$$

$$= 991$$

Binary Arithmetic

Addition

$$(1) \quad (10111)_{2} + (1011)_{2}$$

$$= \begin{array}{r} 10111 \\ + 001011 \\ \hline 1001010 \end{array}$$

$$= (1001010)_{2}$$

$$1001010$$

Substraction

$$\begin{array}{r}
 (1) \quad 1010 \times 10 \\
 - 001111 \\
 \hline
 011011
 \end{array}
 = (11011)$$

$$\begin{array}{r}
 (2) \quad 110 \times 10 \\
 - 11 \\
 \hline
 1001
 \end{array}$$

Multiplication

$1 \times 1 = 1$
$1 \times 0 = 0$
$0 \times 0 = 0$
$0 \times 1 = 0$

$$\begin{array}{r}
 (1) - \quad 1011 \\
 \quad \quad 111 \\
 \hline
 11011 \\
 11010 \\
 \hline
 101100 \\
 1001101
 \end{array}$$

HW
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Activity

(A) Convert the following Decimal numbers into Binary numbers.

(a) $(68)_{10} = (1000100)_2$

2	68	0	
2	34	0	
2	17	1	
2	8	0	=
2	4	0	(1000100) ₂
2	2	0	
2	1	1	
	0		

(b) $(987)_{10} = (1111011011)_2$

2	987	1	
2	493	1	
2	246	0	
2	123	1	
2	61	1	=
2	30	0	(1111011011) ₂
2	15	1	
2	7	1	
2	3	1	
2	1	1	
	0		

c. $(657)_{10} = (101001001)_2$

2	657	1	
2	<u>328</u>	0	
2	<u>164</u>	0	
2	<u>82</u>	0	
2	<u>40</u>	1	=
2	<u>20</u>	0	
2	<u>10</u>	0	=
2	<u>5</u>	1	
2	<u>2</u>	0	=
2	<u>1</u>	1	
	0		

$(101001001)_2$

(B) → Convert the following Binary numbers into Decimal numbers.

(a) $(1011)_2 = (11)_{10}$

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

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

$$= 11$$

(b) $(100110)_2 = (38)_{10}$

$$\begin{aligned}
 &= 1 \times 2^5 + 0 \times 2^4 + 0 \times 2^3 + 1 \times 2^2 + \\
 &\quad 1 \times 2^1 + 0 \times 2^0 \\
 &= 32 + 0 + 0 + 4 + 2 + 0 \\
 &= 38
 \end{aligned}$$

(c) $(\overset{4}{1}\overset{3}{0}\overset{2}{1}\overset{1}{0}\overset{0}{1})_2 = (21)_{10}$

$$\begin{aligned}
 &= 1 \times 2^4 + 0 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + \\
 &\quad 1 \times 2^0 \\
 &= 16 + 0 + 4 + 0 + 1 \\
 &= 21
 \end{aligned}$$

(C) → Perform Binary addition on the following.

(a) - $10101 + 00111$

$$\begin{array}{r}
 \overset{1}{1} \overset{1}{1} \\
 10101 \\
 + 00111 \\
 \hline
 11100
 \end{array} = (11100)_2$$

(b) $1001101 + 1000101101$

$$\begin{array}{r}
 \overset{1}{1} \overset{1}{1} \overset{1}{1} \\
 0001001101 \\
 + 1000101101 \\
 \hline
 1001111010
 \end{array} = (100111010)_2$$

(c) $1101 + 1001$

$$\begin{array}{r} 1101 \\ + 1001 \\ \hline 10110 \end{array} = (10110)_2$$

(D) → Find the difference between the following Binary numbers.

(a) $10011 - 01010$

$$\begin{array}{r} 10011 \\ - 01010 \\ \hline 01001 \end{array} = (1001)$$

(b) $11001001 - 01100110$

$$\begin{array}{r} 11001001 \\ - 01100110 \\ \hline 01100011 \end{array} = (1100011)$$

(c) $111 - 001$

$$\begin{array}{r} 111 \\ - 001 \\ \hline 110 \end{array} = (110)$$

(E) → Multiply the following Binary numbers

(a) 101×011

$$\begin{array}{r}
 101 \\
 \times 011 \\
 \hline
 101 \\
 000 \\
 + 0000 \\
 \hline
 01111
 \end{array}
 = (1111)$$

(b) 1011×101

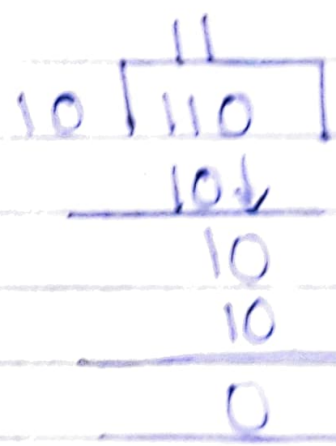
$$\begin{array}{r}
 1011 \\
 \times 101 \\
 \hline
 1011 \\
 0000 \\
 + 101100 \\
 \hline
 110111
 \end{array}
 = (110111)$$

(c) 101010×1011

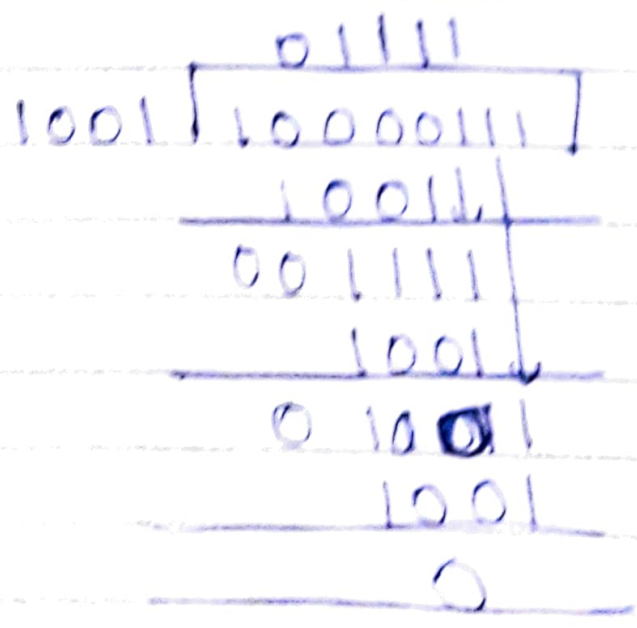
$$\begin{array}{r}
 101010 \\
 \times 1011 \\
 \hline
 101010 \\
 1010100 \\
 0000000 \\
 + 10101000 \\
 \hline
 11100110
 \end{array}
 = (11100110)$$

Binary Division

(i) $(110)_2 \div (10)_2 = (11)_2$



(ii)



Activity

F- Divide these binary numbers.

a. $1111 \div 11 = 101$

$$\begin{array}{r}
 101 \\
 11 \overline{) 1111} \\
 \underline{11} \\
 01 \\
 \underline{0} \\
 11 \\
 \underline{11} \\
 0
 \end{array}$$

b- $111001 \div 101$

$$\begin{array}{r}
 1011 \rightarrow \text{quotient} \\
 101 \overline{) 111001} \\
 \underline{101} \\
 0100 \\
 \underline{000} \\
 1000 \\
 \underline{101} \\
 0111 \\
 \underline{101} \\
 010 \rightarrow \text{Remainder}
 \end{array}$$

Question answers

2

Section-A

2

Fill in the blanks.

The base of binary number system

4

is 2

The base of decimal number

5

system is 10.

Octal number consists of 8

6

digits.

In binary addition, $1 + 1$ equals

10

Binary number system is
used by the computer
system.

Hexadecimal uses 16 symbols
numbers.

In binary subtraction, $1 - 1$

is false.

Binary is an arithmetic
system.

[E]

2. The decimal number system consists of 10 digits i.e., 0 to 9. [T]
3. The method to perform binary division is not same as that of decimal numbers. [F]
4. 1 multiplied by 0 equal to 0. [T]
5. Charles Babbage introduced the concept of 0. [F]
6. The numbers used in octal number system are 1 to 7. [F]

Section-B

A- MCQs

1. Aryabhat introduced to the concept of zero.
(a) Ada Lovelace
(b) Aryabhat
(c) Bill gates
2. A digital computer converts decimal format in its binary

equivalent.

- (a) Digital Computers
- (b) Cell phone
- (c) Abacus.

3- A Computer understand only Binary code.

- (a) English
- (b) French
- (c) Binary

4- In binary multiplication, $|x|$ equals to 1

- (a) 0
- (b) 1
- (c) 2

5- To convert decimal to Binary we have to divide with 2

- (a) 2
- (b) 8
- (c) 10

B- Answer the questions

1- what is number system? Name the different types of number system.

A- Number system is a set of values that represent a particular quantity. The different types of number system are :-

- (i) Decimal number system.
- (ii) Binary number system.
- (iii) Octal number system.
- (iv) Hexadecimal number system.

2- what are the rules to convert a decimal number to a Binary number?

Ans- The rules are :-

- (i) First we have to divide the number with 2.
- (ii) we have to repeat it till the remainder or the last digit become zero.
- (iii) We have to write the remainders downward to upward.

3- Write the rules to multiply two binary numbers.

A- The multiplication is same as the decimal numbers -

Rules

a	b	$a \times b = c$
0	0	$0 \times 0 = 0$
0	1	$0 \times 1 = 0$
1	0	$1 \times 0 = 0$
1	1	$1 \times 1 = 1$

4- Briefly explain the Octal System.

A- The octal number system consists of eight digits. (i.e. - 0 to 7). Its base or radix is 8.

5- What do you understand by hexadecimal number system?

A- Hexadecimal number system consist of 16 digits. where 0-9 are decimal numbers and 10-15 are called Hex. 10 to 15 are denote by

(i) 10 = A
(ii) 11 = B
(iii) 12 = C

(iv) 13 = d
(v) 14 = E
(vi) 15 = F

hw
30/4/22

Activity

F- Divide

(iii)

		10111	→	quotient
	1011		11111111	
		101	↓	
		1001	↓	
		0000	↓	
		10011	↓	
		1011	↓	
		010001		
		1011	↓	
		1101	↓	
		1011	↓	
		0101	→	Remainder