As per NEP 2020

Evershine

Cobot

Self Learning Series on Computer

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PREFACE

Digital transformation involves using digital technologies to transform the curriculum to become more efficient or effective. The idea is to use technology to transform and improve education process while playing a vital role in the progress of the country. **COBOT**, a comprehensive and exhaustive computer series for class **1** to **8** is an endeavour to equip students with necessary repertoire of technical skills and contribute effectively in shaping the digital world.

To make students ready to face the uncertain challenges and to stay tuned with the unprecedented journey of technology, **National Education Policy 2020** has suggested certain skills that should be taught to them. These skills will help them in becoming successful, innovative, adaptable, and productive human beings in the various fields such as Digital Literacy, Coding, Computational Thinking and Artificial Intelligence in the rapidly changing tech-savvy world. This series is based on **Windows 10** and **MS Office 2016** version with a glimpse of **Windows 11** which helps the students to learn the basics of the subject while simultaneously giving them opportunities for exploration and self-learning.

This book incorporates the following features to facilitate the learning process by accomplishing these objectives :

- Proper explanation of concepts is given in each chapter followed with interactive fun-based coding for all levels which empowers them not only to use technology but also to create it.
- **PLUGIN** gives the idea of the chapter at a glance.
- **FACT FOLDER** provide extra information about the concerned topics as well as will help the students to know about the historical development of computers with the flavour of pictorial data regarding inventors and discoverers. It also provides keyboard shortcuts to consolidate the learning process.
- **Fetching Time** includes the different kinds of activities to develop the observation power of the students.
- **THROWBACK** summarizes the whole chapter.
- **Bookmarks** covers the important terms covered in the chapter.
- **Exercise** at the back of the chapter are designed in accordance with an objective and subjective pattern to evolve the conceptual understanding of students.
- **Fun Venture** of every lesson provides an integrated approach to learning and adds value to the long-term growth of a child. It also includes discussion-based questions which helps the students to develop communication and analytical skills. A perfect blend of Sustainable Development Goals (SDGs) which encompass economic, social and environment dimensions.
- **HOTS** put advanced cognitive demand on the students which encourage them to think beyond literal questions.
- **Lab Tech** are given along with the guidelines to enhance the creativity of students.
- **HyperLink** provides online links to breakthrough technologies that are incorporated to access more information on the given topics.
- **Projects** have been added to encourage students to try out for themselves, and to instil in them the confidence before they embark on making their projects using a software.
- **National Cyber Olympiad (NCO)** questionnaire is included to promote awareness about the national level competition.

The amazing world of apps gives a new dimension to this journey of learning. An insight into the captivating branches of augmented and virtual reality, artificial intelligence, big data analytics and machine learning is included. We welcome constructive suggestions and valuable feedback to make this series more relevant, updated and useful for both the teachers and learners.

–Publishers

Objective of NEP 2020

NEP 2020 aims at reforming school education with equal emphasis on all subjects and soft skills while integrating them with new era technology-based learning to prepare the students for the leading role in future. This series has specially been designed to achieve the goal set by NEP 2020, CBA, NIPUN BHARAT and SAFAL 2021.

Spatial Intelligence

An ability to perceive and derive insight from visual data. This is an approach to judge space and visualize its different angles, shapes and fine details, along with recognizing and remembering complete visual scenes. This cognitive process creates an aptitude for understanding visual information in the real and abstract world.

Vocational Skills

It is a non-academic education which provides information on practical activities. These activities are thereby related to a specific trade, occupation or vocation. It prepares students for future job possibilities.

Life Skills

- It is all about working together to improve the overall results and enhancing psychosocial capabilities to deal with the situations and the people in an acceptable manner.

Environment & Health

Students should be aware of the need of a healthy environment and the importance of their own physical and mental health. A healthy environment helps in generating interest and increasing learning capabilities.

Experiential Learning

Experiential learning is the purposeful engagement with students in direct experience and focused reflection in order to increase knowledge, develop skills and clarify values.

Multidisciplinary Learning

A multidisciplinary curriculum is one in which the same topic is studied from the viewpoint of more than one discipline.

Conceptual Learning

This is to make sure that students are engaged in quality learning around key concepts and central ideas rather than using the traditional method of focusing on topics.

Creativity

Creativity is an ability to make things happen using skills and imaginations. It is the way of self-expression which can reflect and nurture children's emotional health. There is nothing more satisfying and fulfilling for children than to be able to express themselves openly and without judgment.

Art Integration

A teaching-learning model which is based on learning 'through the arts' and 'with the arts'. It is an approach to engage in a creative process which connects an art form and another subject and to meet evolving objectives in both.

LEADERSHIP SKILLS

Students must be trained to be visionaries and are goal oriented. They should be able to see beyond the task at hand. They involve people and set the steps to achieve it for themselves and for the team.

Communication is the act of giving, receiving and sharing information. Communication skills are needed to speak appropriately with a wide variety of people whilst maintaining good eye contact, demonstrate a varied vocabulary and respect different opinions.

Communication Skills

Critical Thinking

Critical thinking is at the forefront of learning, as it aids a student reflect and understand their points of views to reason better. It helps them base conclusions on facts rather than emotions and ability to go deep into details and examine the different aspects of an issue.

Computational Thinking

It is a problem solving process followed with an interrelated set of skills and practices for solving complex problems. It is a way to learn topics in many discipline by fully participating in a computational world with an approach that integrates across activities.

Scientific Temper

It is a way of life which uses the scientific method followed with an attitude of logical reasoning observing physical reality, questioning, testing, hypothesizing, analysing and communicating.

Problem Solving

Students learn to look at challenges from a fresh perspective. Therefore, they take more calculated risks by examining the questions to find the key ideas, doing the calculations, choosing an appropriate strategy and finding the answers.

Democratic and Human Values

India is a democratic country. Everyone should be treated equally and fairly regardless of their background. Students should learn to have respect and empathy for all human beings.

CONTENTS

THE NUMBER SYSTEM

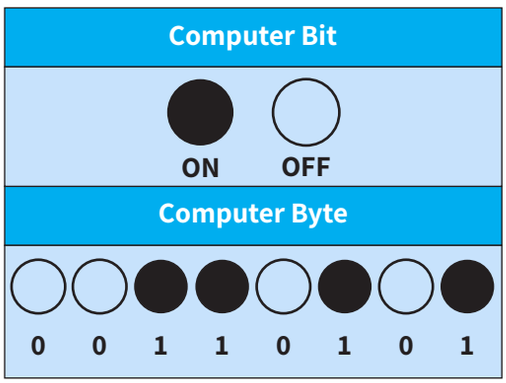
PLUGIN

- Number System
- Conversion of Number Systems
- Types of Number Systems
- Computer Arithmetic

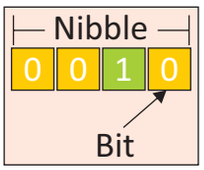
A computer is a man-made electronic machine which can do calculations very fast. It does not understand the language people use to communicate with each other.

Computers recognize only two discrete states : **ON** and **OFF**. This is because computers are electronic devices powered by electricity, which also has only two states. The two digits, **zero** and **one**, can easily represent these two states. The digit, zero (0) represents the electronic state OFF (absence of an electronic charge). The digit one (1) represents the electronic state ON (presence of an electronic charge).

BINARY DIGIT (BIT)	ELECTRONIC CHARGE	ELECTRONIC STATE
1		**ON**
0		**OFF**



The decimal number system is generally used for counting. A computer uses a binary system as it understands only two states. The binary system is a number system that has just two unique digits, 0 and 1, called bits. A bit is the smallest unit of data that a computer represents. When eight bits are grouped together as a unit, they form a byte. Half a byte is called a nibble. A nibble is a collection of bits on a 4-bit boundary. In this chapter, we will learn how a computer calculates.



FACT FOLDER

Byte is a group of 8 bits. Evidently, many such groups can be made in the binary system. 2^8 or 256 bytes are possible and they can represent 256 characters. Clearly, these 256 bytes are enough to represent 26 letters of the alphabet (both in capital and small forms), numbers from 0 to 9, punctuation marks, currency signs, and some special symbols. These 256 bytes are represented by different binary numerals starting from 00000000 and ending with 11111111.

NUMBER SYSTEM

Computer stores data in coded form or machine readable form. Therefore, characters have to be represented in the form of electronic pulses. Two pulses that are used to represent basic numbers are **0** and **1**. Absence of pulse represents '0', and presence of pulse represents '1'.

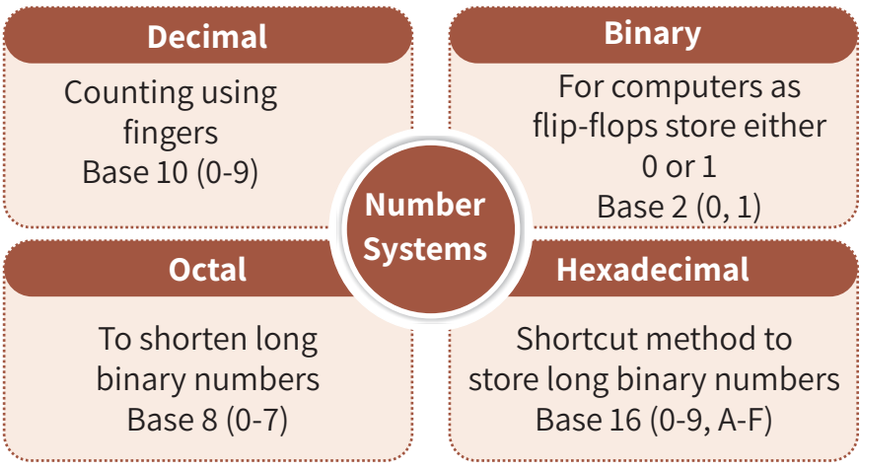
Number system is a way to represent numbers in a computer system. Every value that we are giving to/getting from computer memory has a defined number system.

When we type some letters or words, the computer translates them into numbers as computers can understand only numbers. A computer can understand positional number system where there are only a few symbols called digits and these symbols represent different values depending on the position they occupy in the number.

A value of each digit in a number can be determined using :

- the digit
- the position of the digit in the number
- the base of the number system (where base is defined as the total number of digits available in the number system).

TYPES OF NUMBER SYSTEMS



Decimal Number System

The number system that we use in our day-to-day life is the decimal number system. Decimal number system has **base 10** as it uses 10 digits from 0 to 9. In decimal number system, the successive positions to the left of the decimal point represent units, tens, hundreds, thousands and so on.

Each position represents a specific power of the base (10). For example, the decimal number 1234 consists of the digits—4 in the units position, 3 in the tens position, 2 in the hundreds position and 1 in the thousands position and its value can be written as :

$= (1 \times 1000) + (2 \times 100) + (3 \times 10) + (4 \times 1)$

$= (1 \times 10^3) + (2 \times 10^2) + (3 \times 10^1) + (4 \times 10^0)$

$= 1000 + 200 + 30 + 4$

$= 1234$

Binary Number System

The binary number system, also called the **base 2** number system, is a method of representing numbers, that counts by combinations of only two numerals : zero (0) and one (1). Computers use the binary number system to manipulate and store all of their data including numbers, words, graphics and music.

Binary number system is also positional value system, where each digit has a value expressed in powers of 2, as displayed here.

2^4 2^3 2^2 2^1 2^0

In any binary number, the right-most digit is called least significant bit (LSB) and left-most digit is called most significant bit (MSB).

1	1	0	1	0
MSB				LSB

And decimal equivalent of this number is sum of product of each digit with its positional value.

$1001_2 = 1 \times 2^3 + 0 \times 2^2 + 0 \times 2^1 + 1 \times 2^0$

$= 8 + 0 + 0 + 1$

$= 9_{10}$

The table below represents the binary equivalent of some decimal numbers :

Decimal	Binary
0	0000
1	0001
2	0010
3	0011
4	0100
5	0101

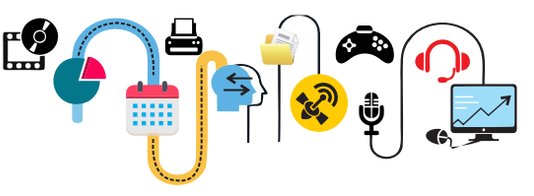
Decimal	Binary
6	0110
7	0111
8	1000
9	1001
10	1010
11	1011

Decimal	Binary
12	1100
13	1101
14	1110
15	1111
100	1100100
512	1000000000

FACT FOLDER

Computer memory is measured in terms of how many bits it can store. Here is a chart for memory capacity conversation :

1 Byte (B)	=	8 Bits
1 Kilobyte (KB)	=	1024 Bytes
1 Megabyte (MB)	=	1024 KB
1 Gigabyte (GB)	=	1024 MB
1 Terabyte (TB)	=	1024 GB
1 Petabyte (PB)	=	1024 TB
1 Exabyte (EB)	=	1024 PB
1 Zettabyte (ZB)	=	1024 EB
1 Yottabyte (YB)	=	1024 ZB



Octal Number System

The octal number system is the number system with **base 8**. The base 8 means the system uses eight digits from 0 to 7. All the eight digits from 0 to 7 have same physical meaning as that of decimal numbers. The next digit in octal number is represented by 10, 11, 12, 13, 14, 15, 16, 17 which represents the decimal digits 8, 9, 10, 11, 12, 13, 14, 15 respectively. In this manner, the octal number 20 represents the decimal number 16 and subsequently 21, 22, 23... octal numbers will show the decimal digits 17, 18, 19... etc., and so on.

For example : The binary representation for decimal $(74)_{10}$ is $(1001010)_2$ and the octal representation is $(112)_8$.

$(1001010)^2 = 1 \times 2^6 + 0 \times 2^5 + 0 \times 2^4 + 1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 0 \times 2^0$

$= 64 + 0 + 0 + 8 + 0 + 2 + 0$

$= 74_{10}$

$(112)^8 = 1 \times 8^2 + 1 \times 8^1 + 2 \times 8^0$

$= (1 \times 64) + (1 \times 8) + (2 \times 1)$

$= 64 + 8 + 2$

$= 74_{10}$

Octal	Binary
0	000
1	001
2	010
3	011
4	100
5	101
6	110
7	111

Now, since there are only 8 digits (0 to 7) in the octal number system, 3 bits are sufficient to represent an octal number in a Binary system.

The table given alongside displays that in an octal format, each digit represents three binary digits.

With this table, it is easy to translate between Octal and Binary.

For example :

$(37)_8 = (011\ 111)_2$ $\qquad$ $(51)_8 = (101\ 001)_2$

Hexadecimal Number System

The hexadecimal number system uses 16 values to represent numbers. These values are :

0 1 2 3 4 5 6 7 8 9 A B C D E F

0 has the least value and **F** has the greatest value. Columns are used in the same way as in the decimal system, that is the left-most column is used to represent the greatest value. As we have seen in the decimal system, the values in the set (0 and 1) repeat, in both the vertical and horizontal directions.

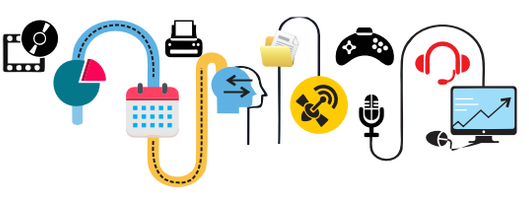
For example : $(1FF)_{10} = 1 \times 16^2 + F \times 16^1 + F \times 16^0$

$= 1 \times 256 + 15 \times 16 + 15 \times 1$

$= 256 + 240 + 15$

$= 511$

Thus, the decimal equivalent of hexadecimal number $(1FF)_{16}$ is $(511)_{10}$. Since, there are only 16 digits in the hexadecimal number system, 4 bits are sufficient to represent any hexadecimal number in binary.



The hexadecimal number 4B3A translates to the following binary number :

4	B	3	A
↓	↓	↓	↓
0100	1011	0011	1010

The table given below displays the binary and decimal equivalents of some hexadecimal numbers :

Hexadecimal	Binary	Decimal
0	0000	0
1	0001	1
2	0010	2
3	0011	3
4	0100	4
5	0101	5
6	0110	6
7	0111	7

Hexadecimal	Binary	Decimal
8	1000	8
9	1001	9
A	1010	10
B	1011	11
C	1100	12
D	1101	13
E	1110	14
F	1111	15

FACT FOLDER

The major disadvantage of the octal number system is that the computer doesn't understand the octal number system. So, the additional circuit is required for the digital systems which converts the octal number to binary number. The octal number system is used in minicomputers.

CONVERSION OF NUMBER SYSTEMS

Decimal to Binary Conversion

To convert the decimal number to its binary equivalent, follow these steps :

Step 1 : Divide the decimal number by the value of the new base.

Step 2 : Record the remainder from Step 1 as the right-most digit (least significant bit) of the new base number.

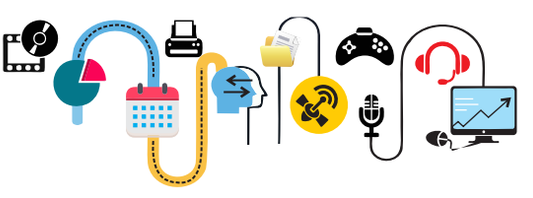
Step 3 : Divide the quotient of the previous division by the new base.

Step 4 : Record the remainder from Step 3 as the next digit (to the left) of the new base number.

		Remainder	
2	43		LSB
2	21	1	
2	10	1	
2	5	0	
2	2	1	
2	1	0	
	0	1	MSB

Repeat **Steps 3** and **4**, recording remainders from right to left, until the quotient becomes zero.

For example : Convert $(43)_{10}$ to binary equivalent, we get $(101011)_2$.



Binary to Decimal Conversion

To convert from binary to decimal equivalent, follow the given steps :

Step 1 : Start the decimal result at 0.

Step 2 : Remove the most significant binary digit (left-most) and add it to the result.

Step 3 : If all binary digits have been removed, it is done.

Step 4 : Otherwise, multiply the result by 2.

Step 5 : Go to Step 2.

For example : Convert $(1001110)_2$ to its decimal equivalent.

$1001110 = 1 \times 2^6 + 0 \times 2^5 + 0 \times 2^4 + 1 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 0 \times 2^0$

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

$= 78_{10}$ (Therefore, the decimal number value is 78.)

Decimal to Octal Conversion

Decimal numbers can be converted to octal by repeated division of the number by 8 while recording the remainder.

For example : Convert $(473)_{10}$ to octal number system, we get $(731)_8$.

		Remainder	
8	473		LSD
8	59	1	↑
8	7	3	↑
	0	7	MSD

Decimal to Hexadecimal Conversion

Decimal numbers can be converted to octal by repeated division of the number by 16 while recording the remainder.

For example : Convert $(423)_{10}$ to hexadecimal number system, we get $(1A7)_{16}$.

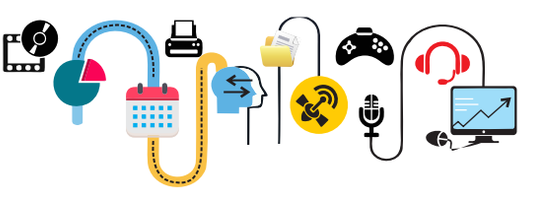
		Remainder
16	423	
16	26	7
16	1	A ↑
	0	1

Number System	Base	Used Digits	Example
Binary	2	0, 1	$(11110000)_2$
Octal	8	0, 1, 2, 3, 4, 5, 6, 7	$(360)_8$
Decimal	10	0, 1, 2, 3, 4, 5, 6, 7, 8, 9	$(249)_{10}$
Hexadecimal	16	0, 1, 2, 3, 4, 5, 6, 7, 8, 9 A, B, C, D, E, F	$(1D9)_{16}$

Fetching Time

Do as directed : [Conceptual Learning]

1. Convert the decimal number 81 into binary.
2. Convert the binary number 1101 into decimal.



COMPUTER ARITHMETIC

Binary Addition

It is a key for binary subtraction, multiplication and division. There are four rules of binary addition.

Case	A + B	Sum	Carry
1	0 + 0	0	0
2	0 + 1	1	0
3	1 + 0	1	0
4	1 + 1	0	1

In fourth case, a binary addition is creating a sum of (1 + 1 = 10) ,i.e., 0 is written in the given column and a carry of 1 goes to the next column.

For example : Compute $(1000)_2 + (111)_2$

$$\begin{array}{r} 1000 \\ +\,0111 \\ \hline 1111 \\ \hline \end{array}$$

Binary Subtraction

Subtraction and borrow, these two words will be used very frequently for the binary subtraction. There are four rules of binary subtraction.

Case	A – B	Difference	Borrow
1	0 – 0	0	0
2	1 – 0	1	0
3	1 – 1	0	0
4	0 – 1	1	1

For example : Compute $(1100)_2 - (11)_2$

Borrowed 1 Again borrowed 1

		Balance 0	10 Balance 1	Number is now
	1	1	0	0 ($\begin{array}{r} 10 \\ -\,1 \\ \hline 1 \\ \hline \end{array}$)
–	0	0	1	1
	1	0	0	1

FACT FOLDER

Borrow is taken only when 1 is subtracted from 0.

Binary Multiplication

Binary multiplication is similar to decimal multiplication. It is simpler than decimal multiplication because only 0s and 1s are involved. There are four rules of binary multiplication.

Case	A × B	Multiplication
1	0 × 0	0
2	0 × 1	0
3	1 × 0	0
4	1 × 1	1

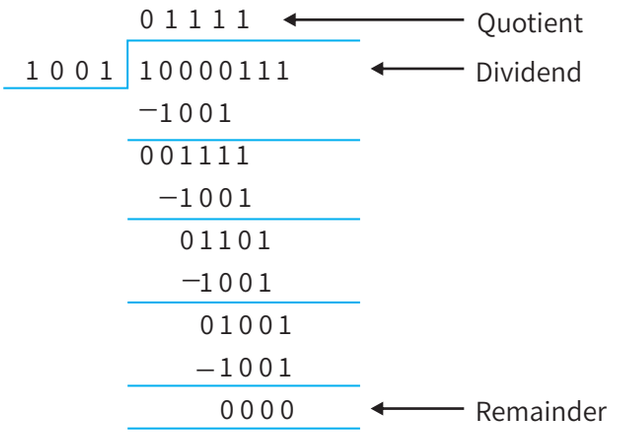
For example : Compute $(1111)_2 \times (101)_2$

$$\begin{array}{rccccccc} & & & & 1 & 1 & 1 & 1 \\ \times & & & & & 1 & 0 & 1 \\ \hline & & & & 1 & 1 & 1 & 1 \\ & & & 0 & 0 & 0 & 0 & \times \\ + & & 1 & 1 & 1 & 1 & \times & \times \\ \hline & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\ \hline \end{array}$$

Binary Division

Binary division is similar to decimal division. It is called as the long division procedure.

For example : Compute $(10000111)_2 \div (1001)_2$



THROWBACK

- Computer recognize only two discrete states : ON and OFF.
- Computer memory is measured in terms of how many bits it can store.
- Decimal number system has base 10 as it uses 10 digits from 0 to 9.
- Binary number system is a method of representing numbers, that counts by combinations of only two numerals : zero (0) and one (1).
- The base 8 in octal number system means the system uses eight digits from 0 to 7.
- The hexadecimal number system uses 16 digits including 6 letters of alphabet, i.e., it includes symbols 0 to 9 and A to F.
- Binary addition is a key for binary subtraction, multiplication and division.

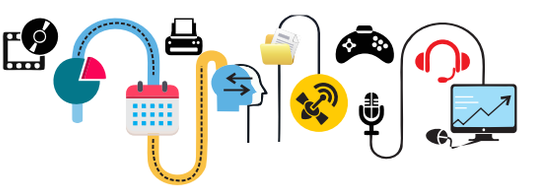
Bookmarks

Bit : Smallest unit of data that a computer represents.
Nibble : Group of 4 bits.
Byte : Group of 8 bits.
Number System : A way to represent numbers in a computer system.
Decimal Number System : A number expressed in the base 10 numeral system.
Binary Number System : A number expressed in the base 2 numeral system.
Octal Number System : A number expressed in the base 8 numeral system.
Hexadecimal Number System : A number expressed in the base 16 numeral system.

Exercise

A. Tick (✓) the correct option :

1. Computers recognize only two discrete states, i.e., _____.
   a) Yes and No ☐ b) Right and Wrong ☐ c) On and Off ☐
2. The smallest unit in computer processing is called a _____.
   a) byte ☐ b) bit ☐ c) nibble ☐



3. What is the binary number system ?
   a) A number system based on two numbers, 0 and 1.
   b) A number system based on eight numbers, 0 to 7.
   c) A number system based on ten numbers, 0 to 9.
4. Which among the following has a base of 16 ?
   a) Decimal number system b) Octal number system
   c) Hexadecimal number system
5. Which among the following is used as a base to convert decimal number to octal number ?
   a) 2 b) 10 c) 8

B. Match the following :

1. Decimal number system	a) Has base 16
2. Binary number system	b) Uses 10 digits
3. Octal number system	c) Uses 2 digits
4. Hexadecimal number system	d) Uses 8 digits

C. Write T for true and F for false statements :

1. A nibble is a collection of 5 bits.
2. Binary number system has base 2.
3. The decimal number system consists of 10 digits, i.e., 0 to 9.
4. The method of binary addition is same as decimal addition.
5. Arithmetic operations cannot be performed on binary numbers.

D. Answer the following questions :

1. Which kind of symbols can be represented by a computer ?
2. What do you mean by number system ? Mention its types.
3. What are the steps to convert binary to decimal number system ?
4. Differentiate between the following :
   a) Binary number system and Decimal number system.
   b) Octal number system and Hexadecimal number system.

Fun Venture

A. Convert the following : [Computational Thinking]

1. Decimal to Binary
   i) 345
   ii) 117

2. Binary to Decimal

i) 111

ii) 1101

3. Decimal to Octal

i) 55

ii) 90

4. Decimal to Hexadecimal

i) 32

ii) 230

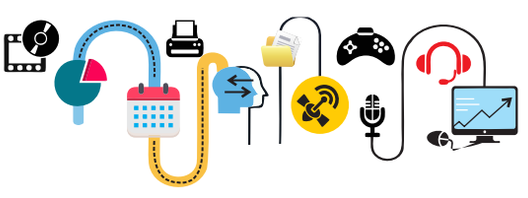
B. Compare the different number systems. The format of comparative table is given below : [Critical Thinking]

Name of Number System	Digits Used	Base Digit	Example

C. Perform the following binary operations : [Computational Thinking]

1. Addition : 101001 + 11101

   1100 + 1111



2. Multiplication : 110×011
1101×110

3. Subtraction : $10011 - 11001$
$1111 - 1110$

LabTech

Make a presentation on "Number System". The presentation should consist of five slides which will include introduction, decimal number system, binary number system, octal number system and hexadecimal number system. Apply different slide transition and animation effects on the slides. Save the presentation as 'Number System'. [Creativity]

- Binary Number System
- Octal Number System
- Decimal Number System
- Hexadecimal Number System

HyperLink

The combinations of 0s and 1s that represent uppercase and lowercase letters, numbers, and special symbols are defined by patterns called **coding scheme**. **ASCII**, which stands for **American Standard Code for Information Interchange**, is the most widely used coding scheme to represent the letters, numbers, symbols and some of the commands used by a computer. The ASCII code gives a binary code of eight numbers to each character or command. The binary code controls the switches that send a signal to the computer. For example, the uppercase letter D sends the binary code 01000100. [Multidisciplinary Learning]

Surf the net and know how these letters are converted into Binary form and vice versa :

A 01000001	B 01000010	C 01000011	D 01000100	E 01000101	F 01000110	G 01000111	H 01001000	I 01001001
J 01001010	K 01001011	L 01001100	M 01001101	N 01001110	O 01001111	P 01010000	Q 01010001	R 01010010
S 01010011	T 01010100	U 01010101	V 01010110	W 01010111	X 01011000	Y 01011001	Z 01011010	