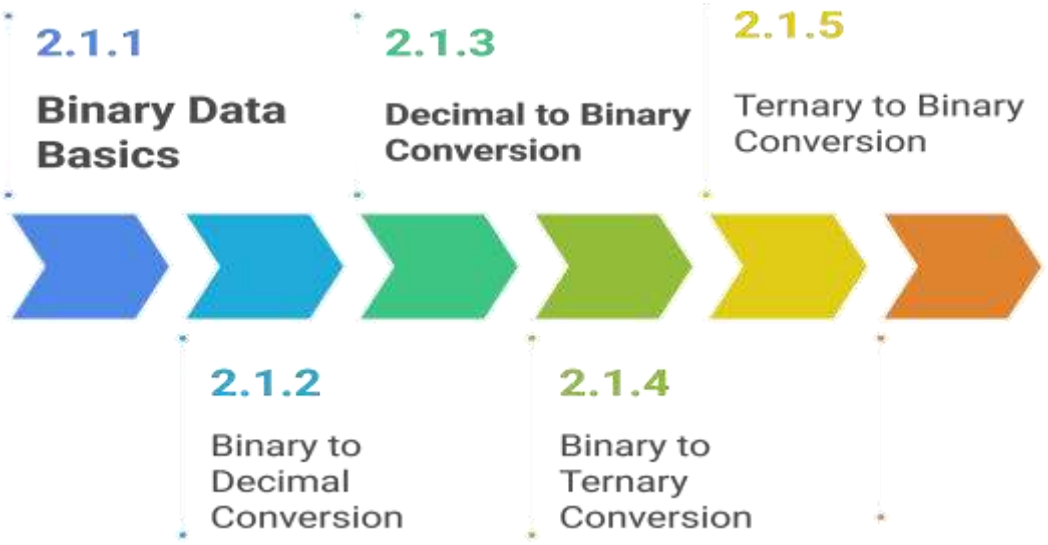
UNIT 2: DATA

2.1: BINARY DATA CONVERSION

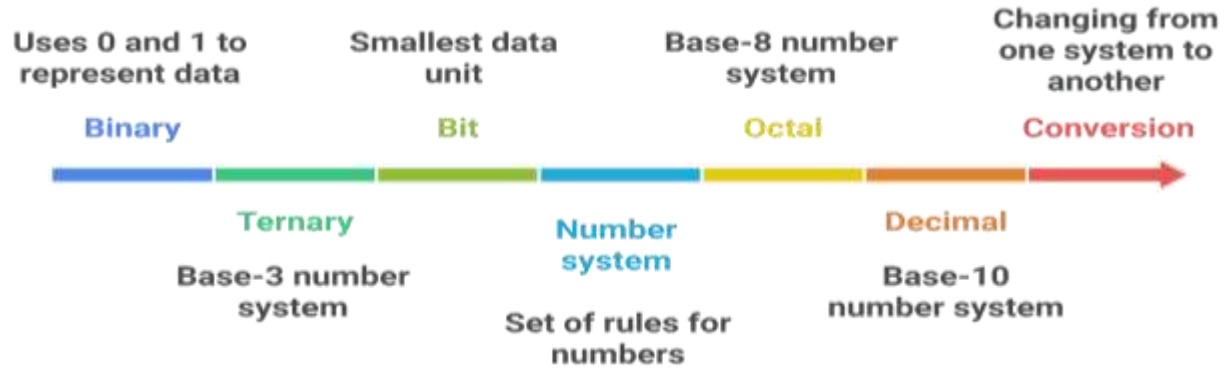
Number systems are ways to represent and express numbers using different bases. They are essential in computing for storing, processing, and communicating data. Decimal number system (Base 10): Uses digits 0–9 and is commonly used by humans for everyday calculations, e.g., 245_{10}. Binary number system (Base 2): Uses only 0 and 1 and is used by computers to process data, e.g., 1011_2. Octal number system (Base 8): Uses digits 0–7 and is sometimes used as a compact form of binary, e.g., 157_8.Hexadecimal number system (Base 16): Uses digits 0–9 and letters A–F and is widely used in computing, e.g., $2F_{16}$



2.1.1: Binary Data Basics

The Binary Number System is a base-2 number system that uses only the digits 0 and 1. It is the fundamental language of computers, as all data and instructions are represented in binary form. Each binary digit (bit) represents an on or off state in electronic circuits.

Keywords

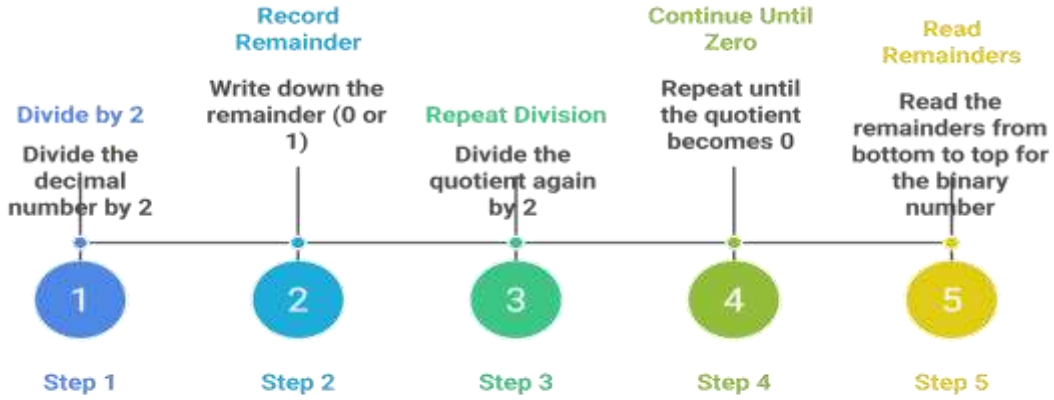


UNIT 2: DATA

2.1: BINARY DATA CONVERSION

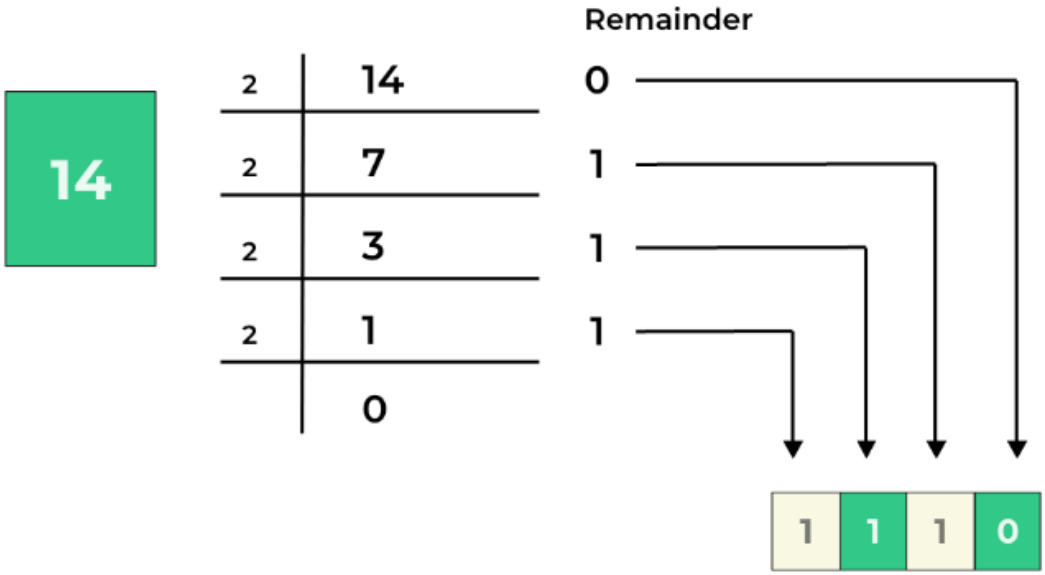
2.1.2: Decimal to Binary Conversion

Binary data stores information using just two values: 0 and 1. These values are called bits, which form the basic building blocks of digital data. Computers use combinations of bits to represent numbers, text, images, and other information. Gaining knowledge of binary data helps learners understand the internal working of computer systems. Every digital device, such as smartphones, tablets, and laptops, depends on binary data to function.



Decimal to Binary Conversion Steps

Convert 14_{10} Into A Binary Number.



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2.1: BINARY DATA CONVERSION

Convert 18_{10} Into A Binary Number.

number = 18

Step 1 : Divide the number repeatedly by 2 until we get our quotient as 0.

		remainder
2 |	18	
2 |	9	0
2 |	4	1
2 |	2	0
2 |	1	0
	0	1

Step 2 : Write the remainders in reverse order **10010**

$18_{10} = (10010)_2$

Examples

Represent the number 13 in binary.

Step 1: Divide 13 by 2 → quotient 6, remainder 1
Step 2: Divide 6 by 2 → quotient 3, remainder 0
Step 3: Divide 3 by 2 → quotient 1, remainder 1
Step 4: Divide 1 by 2 → quotient 0, remainder 1
Step 5: Write remainders bottom to top → 1101

Represent the number 25 in binary.

Step 1: Divide 25 by 2 → quotient 12, remainder 1
Step 2: Divide 12 by 2 → quotient 6, remainder 0
Step 3: Divide 6 by 2 → quotient 3, remainder 0
Step 4: Divide 3 by 2 → quotient 1, remainder 1
Step 5: Divide 1 by 2 → quotient 0, remainder 1

Lab-WK-1-L1: Practice Examples

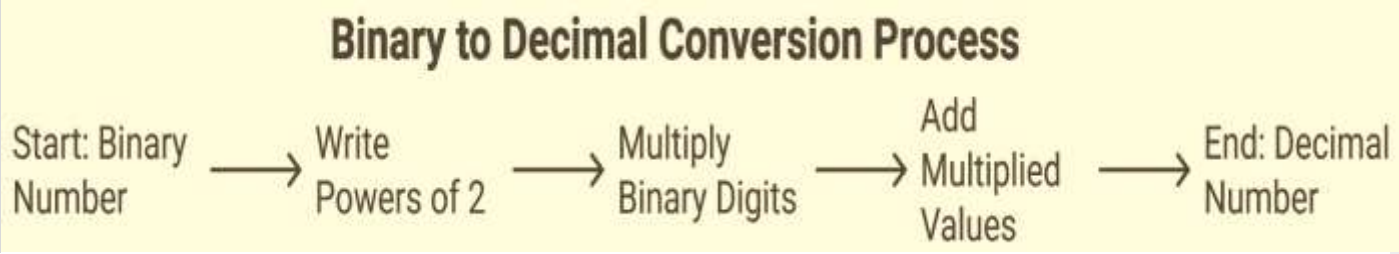
1. Convert the decimal number 45 into binary using the standard decimal-to-binary conversion process and show the final binary result.
2. Convert the decimal number 72 into binary by systematically dividing the number by 2 and arranging the remainders from last to first.
3. Convert the decimal number 24 into binary by systematically dividing the number by 2 and arranging the remainders from last to first.

UNIT 2: DATA

2.1: BINARY DATA CONVERSION

2.1.3: Binary To Decimal Conversion

Binary data stores information using just two values: 0 and 1. These values are called bits, which form the basic building blocks of digital data. Computers use combinations of bits to represent numbers, text, images, and other information. Gaining knowledge of binary data helps learners understand the internal working of computer systems. Every digital device, such as smartphones, tablets, and laptops, depends on binary data to function.



Examples

Convert the binary number 1101 to decimal.

Step 1: Write place values → 8 4 2 1
Step 2: Match binary digits → 1 1 0 1
Step 3: Multiply and add → (1×8) + (1×4) + (0×2) + (1×1)
Step 4: Add values → 8 + 4 + 0 + 1 = 13

Convert the binary number 11001 to decimal.

Step 1: Write place values → 16 8 4 2 1
Step 2: Match binary digits → 1 1 0 0 1
Step 3: Multiply and add → (1×16) + (1×8) + (0×4) + (0×2) + (1×1)
Step 4: Add values → 16 + 8 + 0 + 0 + 1 = 25

Lab-WK-1-L1: Practice Examples

1. Convert the binary number 10010 into decimal.
2. Convert the binary number 101101 into decimal.
3. Convert the binary number 11001 into decimal.
4. Convert the binary number 100111 into decimal.

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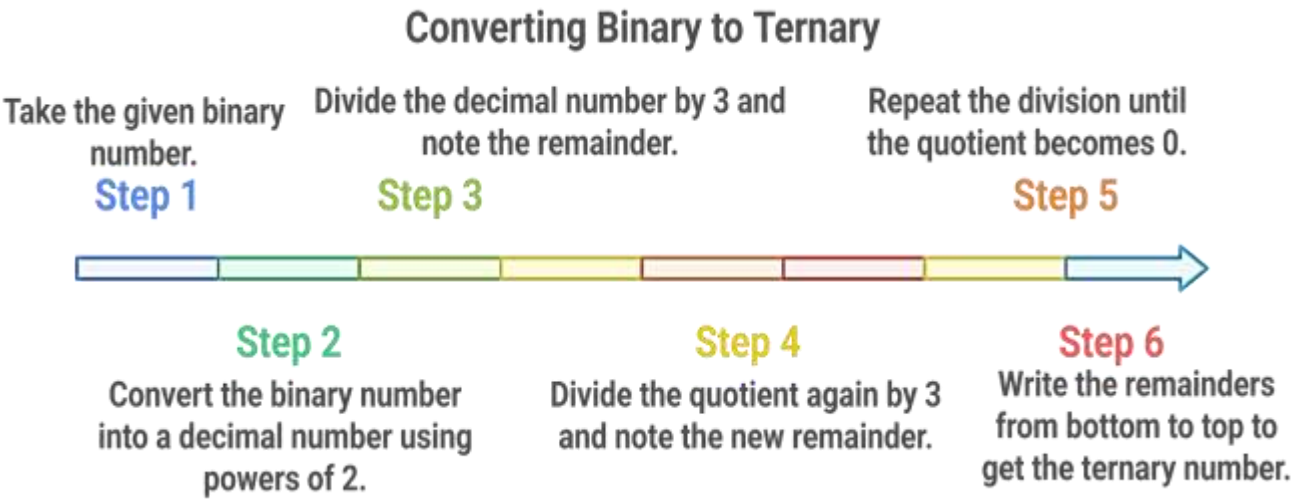
2.1: BINARY DATA CONVERSION

2.1.4: Binary To Ternary Conversion

Binary to ternary conversion involves transforming a number from base-2 into base-3 form. The binary system works with only 0 and 1, whereas the ternary system uses 0, 1, and 2 as its digits. In this method, the binary value is first changed into a decimal number, which is then converted into ternary form. This conversion process helps students understand how different number systems are connected and applied in computing concepts.



Examples

Convert the binary number 1011 to ternary.

Step 1: Convert binary to decimal → (1×8) + (0×4) + (1×2) + (1×1) = 11
Step 2: Divide 11 by 3 → quotient 3, remainder 2
Step 3: Divide 3 by 3 → quotient 1, remainder 0
Step 4: Divide 1 by 3 → quotient 0, remainder 1
Step 5: Write remainders bottom to top → 102

Convert the binary number 11010 to ternary.

Step 1: Convert binary to decimal → (1×16) + (1×8) + (0×4) + (1×2) + (0×1) = **26**
Step 2: Divide 26 by 3 → quotient 8, remainder 2
Step 3: Divide 8 by 3 → quotient 2, remainder 2
Step 4: Divide 2 by 3 → quotient 0, remainder 2
Step 5: Write remainders bottom to top → **222**

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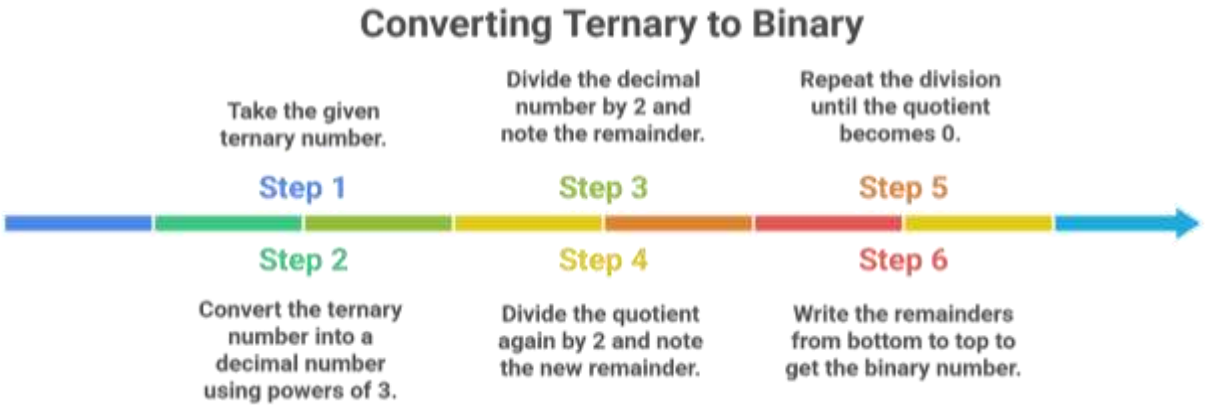
2.1: BINARY DATA CONVERSION

2.1.5: Ternary To Binary Conversion

Ternary to binary conversion refers to changing a number from base-3 into base-2 form. The ternary system uses the digits 0, 1, and 2, whereas the binary system works with only 0 and 1. In this approach, the ternary value is first changed into a decimal number, which is then converted into binary format. This process helps students develop confidence in working with multiple number systems.



Example

Convert the ternary number 102 to binary.

Step 1: Convert ternary to decimal → (1×9) + (0×3) + (2×1) = **11**
Step 2: Divide 11 by 2 → quotient 5, remainder 1
Step 3: Divide 5 by 2 → quotient 2, remainder 1
Step 4: Divide 2 by 2 → quotient 1, remainder 0
Step 5: Divide 1 by 2 → quotient 0, remainder 1

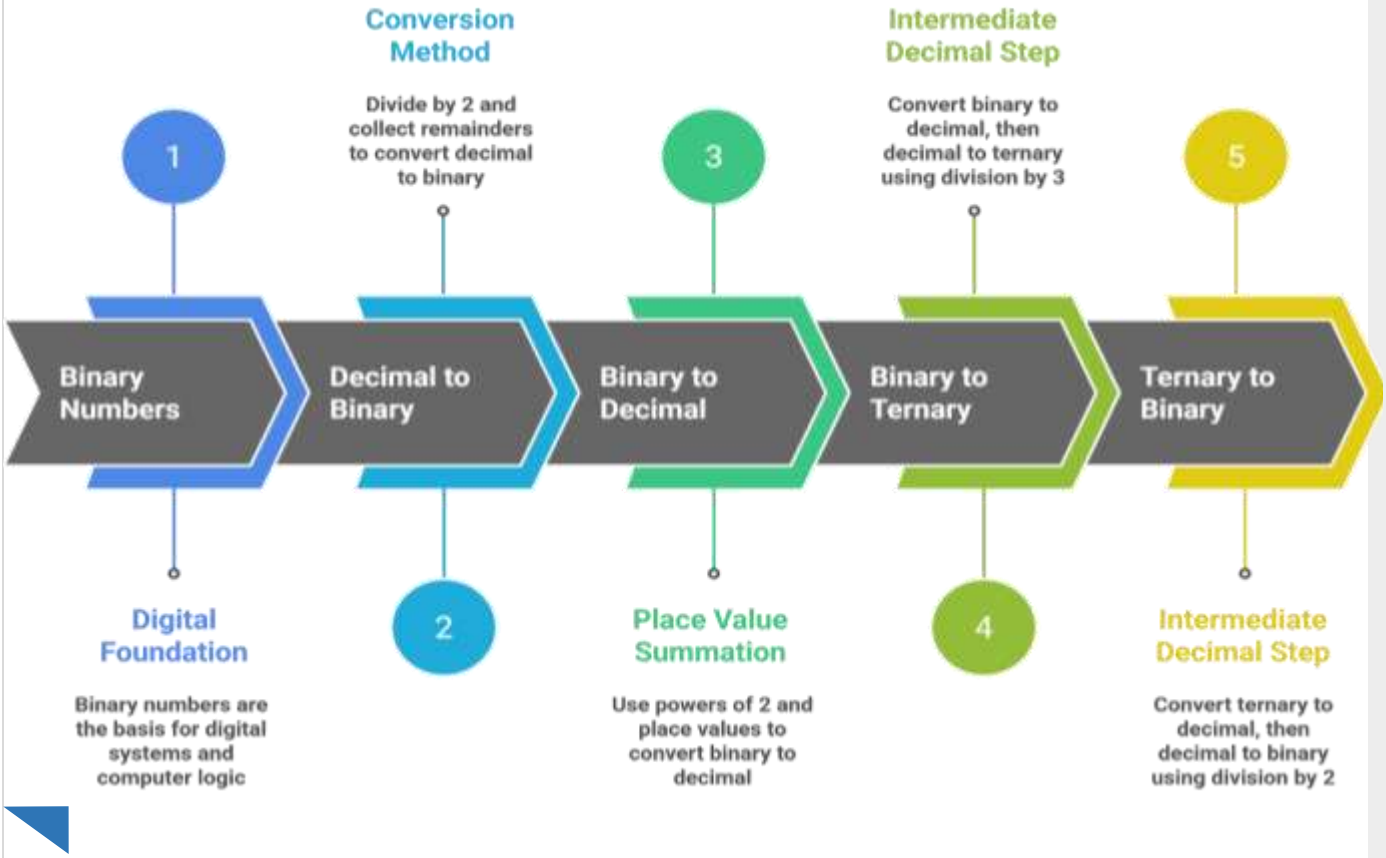
Lab-WK-1-L2: Practice Examples

1. Convert the binary number 1001 into ternary
2. Convert the binary number 11100 into ternary. Convert to decimal first, then to ternary.
3. Convert the binary number 101010 into ternary.
4. Convert the ternary number 101 into binary. Show all conversion steps clearly.
5. Convert the ternary number 212 into binary. Convert to decimal first, then to binary.

UNIT 2: DATA

2.1: BINARY DATA CONVERSION

Lesson Summary



☑	**Computers use binary numbers (0s and 1s) as the foundation of all digital systems.**
☑	A **bit** is the smallest unit of data, and multiple bits encode numbers, text, and images.
☑	**Decimal to binary conversion** is done by dividing the decimal number by 2 repeatedly and writing remainders bottom to top.
☑	**Binary to decimal conversion** is done by multiplying each bit by its corresponding power of 2 and summing the results.
☑	**Binary to ternary conversion** is done via decimal as an intermediate step, using repeated division by 3.
☑	**Ternary to binary conversion** is done via decimal as an intermediate step, using repeated division by 2.

END OF LESSON 2.1