Chapter 2:

Data Representation

Note by Fatinah

2.1:
Binary Number System

Introduction of Binary Number System

- Important in computer systems because **computers read & store data in binary number systems**.
- Known as the base system 2. This system uses only 2 digits, namely **0 and 1**.
- The data in a computer is represented as an electrical signal in the off and on state. **Digit 1 represents on and digit 0 represents off**.
- Each digit in a binary number has a specific place value. The place values for binary numbers are 1,2,4,8,16 and so on.

Introduction of Decimal Number System

- Always used in daily life.
- Known as the **base 10 system** because it has ten digit choices **from 0 to 9**.

Conversion of Binary Numbers to Decimal Numbers

- A binary number can be converted to a decimal number by multiplying the binary number by the place value of its digits and the binary number.

For example,table 1 show the conversion of the binary number **110011** to a decimal number.

Binary Numbers	1	1	0	0	1	1
Place Value	32	16	8	4	2	1
Digit Value	32	16	0	0	2	1
Decimal Number	32 + 16 + 0 + 0 + 2 + 1 =51					

Table 1

Thus, the binary number 110011 is equal to 51 in decimal numbers.

Decimal Number Conversion

- Two methods are used to convert decimal numbers to binary numbers:

    a. The method divides by 2 and uses the remainder.

    b. Method of taking from the balance.

Divide Method By 2 & Use the Remainder

Steps of the method:

1. Divide a decimal number by 2.
2. Record the division result and the remainder.
3. The result of the first division is divided by 2 again. The division result is recorded.
4. The result of the division will be divided by 2 so that it cannot be further divided.
5. The value of a binary number is taken based on the remainder inversely.

Example of converting a decimal number 25 to a binary number using the method of dividing by 2 and using the remainder:

25	÷	2	=	12	Remainder	1
12	÷	2	=	6	Remainder	0
6	÷	2	=	3	Remainder	0
3	÷	2	=	1	Remainder	1
1	÷	2	=	0	Remainder	1

The balance written from bottom to top yields the binary number 11001.

Addition of Two Duplicate Numbers

- Five procedures are followed during the addition operation for two binary numbers.

Addition Operation	Addition Results
0 + 0	0
0 + 1	1
1 + 0	1
1 + 1	10
10 + 0	11

Addition of Two Duplicate Numbers

- Example of sum calculator for two duplicate numbers 101 and 111.

- The sum of the two binary numbers 101 and 111 is 1100.

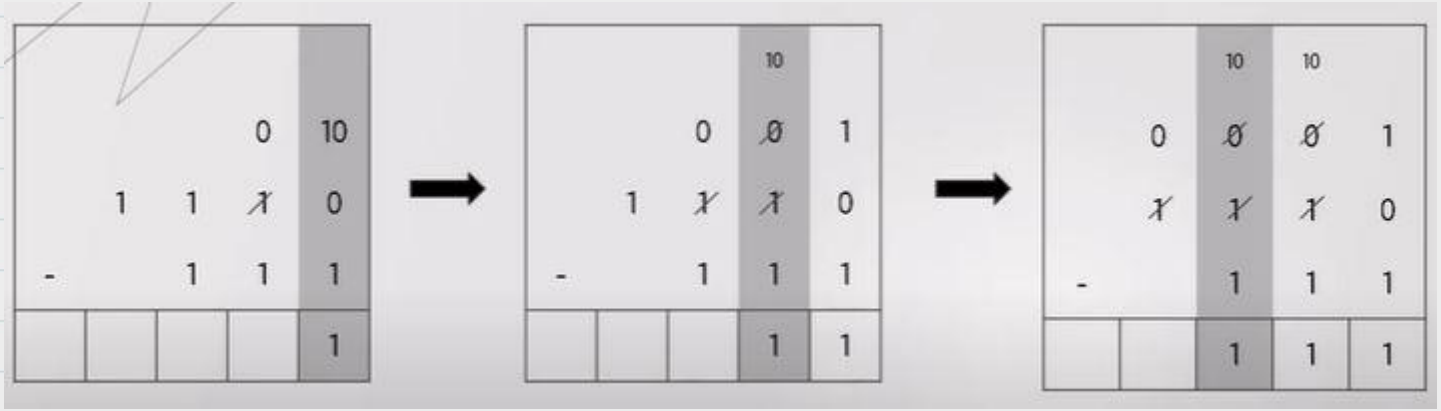
Subtraction of Two Binary Numbers

- Five known procedures during a subtraction operation for two duplicate numbers.

Subtraction Operation	Subtraction Result
0 - 0	0
1 - 0	1
1 - 1	0
10 - 1	1
11 - 1	10

Subtraction of Two Binary Numbers

- Example of calculating the minus result for two binary numbers 1110 and 111.



- The result of the subtraction of the two binary numbers 1110 and 111 is 111.