

# Mathematics in Information Security

## UNIT 1



# Number Theory



Number theory is one of the elementary branches of mathematics that deals with the study of numbers (natural numbers) and properties of numbers, classification of numbers based on certain arithmetic operations.

Problems:

1. Find the LCM of 8, 27 and 72 using the prime factorisation method.
2. What is the value of  $(612 - 392) \div (512 - 492)$ .
3. What are the common factors of 48 and 54.
4. Find the sum of the divisors of 12.
5. What is the divisibility rule of 11? Give one example.

# Divisibility



A divisibility rule enables us to know whether a particular number is divisible by a divisor simply looking at its digits instead of going through the complete division operation. It allows us to determine multiples and factors of numbers without undergoing the long division operation. By using divisibility rules, a person can determine whether an integer is divisible by another integer.

Problems :

1. How many three-digit numbers are divisible by 5?
2. Check whether the number 2024 is divisible by 4.
3. Check whether 1440 is divisible by 15.
4. Is 2848 divisible by 11?
5. Check whether the number 2112 is divisible by 6?

# Factors



Problems :

1. Find the factors of 8.
2. Find the factors of 15.
3. Find the factors of 20.
4. Find the factors of 30.

# Prime Numbers



Prime numbers are natural numbers greater than 1 that have no positive divisors other than 1 and themselves. In other words, a prime number can only be divided evenly by 1 and the number itself.

Few prime numbers are:

2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, and so on.

# Properties of Divisibility



- Divisibility by 2:  
A number is divisible by 2 if its last digit is even (0, 2, 4, 6, or 8).
- Divisibility by 3:  
A number is divisible by 3 if the sum of its digits is divisible by 3.
- Divisibility by 4:  
A number is divisible by 4 if the number formed by its last two digits is divisible by 4.
- Divisibility by 5:  
A number is divisible by 5 if its last digit is 0 or 5.
- Divisibility by 6:  
A number is divisible by 6 if it is divisible by both 2 and 3.

# Properties of Divisibility



- Divisibility by 8:  
A number is divisible by 8 if the number formed by its last three digits is divisible by 8.
- Divisibility by 9:  
A number is divisible by 9 if the sum of its digits is divisible by 9.
- Divisibility by 10:  
A number is divisible by 10 if its last digit is 0.
- Divisibility by 11:  
A number is divisible by 11 if the difference between the sum of its digits in odd positions and the sum of its digits in even positions is divisible by 11.
- Divisibility by 12:  
A number is divisible by 12 if it is divisible by both 3 and 4.

# Representation of integers in different bases



Integers can be represented in various bases, each using a different set of digits.

The Binary system has 2 symbols 0,1.

The Octal system has 8 symbols 0,1,2,3,4,5,6,7.

Our decimal system is the base 10 system. There are ten symbols 0-9.

The Hexadecimal system is base sixteen. It uses sixteen symbols:  
0,1,2,3,4,5,6,7,8,9,A,B,C,E,F



# Conversion of Decimal to Binary



Problems :

1. Convert  $278_{10}$  into a binary number.
2. Convert  $180_{10}$  into a binary number.
3. Convert  $56_{10}$  into a binary number.
4. Convert  $1073_{10}$  into a binary number.
5. Convert  $403_{10}$  into a binary number.

# Conversion of Decimal to Octal



Problems :

1. Convert  $127_{10}$  to Octal.
2. Convert  $525_{10}$  to Octal.
3. Convert  $100_{10}$  to Octal.
4. Convert  $212_{10}$  to Octal
5. Convert  $456_{10}$  to Octal

# Conversion of Decimal to HexaDecimal



Problems :

1. Convert decimal number 49 into hexadecimal.
2. Convert  $1228_{10}$  into hex.
3. Convert  $600_{10}$  into a hexadecimal number.
4. Convert the decimal number  $1542_{10}$  to the hexadecimal number.
5. What is the hexadecimal equivalent of the decimal number  $(175)_{10}$

# Greatest Common Divisor



Problems :

1. Find the GCD of 12 and 18.
2. Find the GCD of 24 and 36.
3. Find the GCD of 48 and 64.
4. Find the GCD of 15 and 25.
5. Find the GCD of 252 and 1050.

# Least Common Multiple



Problems :

1. Find the LCM using Prime Factorization Method for 12,18,27.
2. Find the LCM of 20 and 12 by prime factorization method.
3. Find the LCM of 24 and 15 by the division method.
4. Find the LCM 4,6 and 12 by Listing method.

# Integer



An integer is a whole number (not a fractional number) that can be positive, negative, or zero.

Examples of integers are: -5, 1, 5, 8, 97, and 3,043.

Examples of numbers that are not integers are: -1.43,  $1 \frac{3}{4}$ , 3.14, .09, and 5,643.1

The set of integers, denoted  $Z$ , is formally defined as follows:

$$Z = \{..., -3, -2, -1, 0, 1, 2, 3, ...\}$$

# Integer



Problems :

1.  $22 - (-87)$
2.  $198 + (-12)$
3.  $-16.87 - 30$
4.  $-19 + 34 - 34$
5. Verify  $a + (b + c) = (a + b) + c$  for the following:
  - i.  $a = 2, b = 0, c = -9$
  - ii.  $a = 34, b = 90, c = -1$

Completion  
of Unit-3





*Your  
Questions*



THANKS

