23GET275 & VQAR – 1

Unit-1 QUANTITAVE ABILITY – I

Topic 1: Number theory- Shortcuts, Divisibilityrule

1. Decimal Number System (Base 10)

Definition: The decimal number system is the standard system for denoting integer and non-integer numbers. It is based on 10 symbols (0-9).

Example:

- **Number:** 345
  - **Place values:** 3 × 10^2 + 4 × 10^1 + 5 × 10^0
  - **Calculation:** 3 × 100 + 4 × 10 + 5 × 1 = 300 + 40 + 5 = 345

2. Binary Number System (Base 2)

Definition: The binary number system uses only two symbols, 0 and 1.

Conversion from Binary to Decimal:

- **Number:** 1011
  - **Place values:** 1 × 2^3 + 0 × 2^2 + 1 × 2^1 + 1 × 2^0
  - **Calculation:** 1 × 8 + 0 × 4 + 1 × 2 + 1 × 1 = 8 + 0 + 2 + 1 = 11

Conversion from Decimal to Binary:

- **Number:** 13
  - **Divide by 2 and record remainders:**
    - 13 ÷ 2 = 6 (remainder 1)
    - 6 ÷ 2 = 3 (remainder 0)
    - 3 ÷ 2 = 1 (remainder 1)
    - 1 ÷ 2 = 0 (remainder 1)
  - **Binary Number:** 1101

3. Octal Number System (Base 8)

Definition: The octal number system uses eight symbols (0-7).

Conversion from Octal to Decimal:

- **Number:** 254

- **Place values:** 2 × 8^2 + 5 × 8^1 + 4 × 8^0
- **Calculation:** 2 × 64 + 5 × 8 + 4 × 1 = 128 + 40 + 4 = 172

Conversion from Decimal to Octal:

- **Number:** 100
- **Divide by 8 and record remainders:**
  - 100 ÷ 8 = 12 (remainder 4)
  - 12 ÷ 8 = 1 (remainder 4)
  - 1 ÷ 8 = 0 (remainder 1)
- **Octal Number:** 144

4. Hexadecimal Number System (Base 16)

Definition: The hexadecimal number system uses sixteen symbols (0-9, A-F).

Conversion from Hexadecimal to Decimal:

- **Number:** 1A3
- **Place values:** 1 × 16^2 + A × 16^1 + 3 × 16^0
- **Calculation:** 1 × 256 + 10 × 16 + 3 × 1 = 256 + 160 + 3 = 419

Conversion from Decimal to Hexadecimal:

- **Number:** 255
- **Divide by 16 and record remainders:**
  - 255 ÷ 16 = 15 (remainder 15 or F)
  - 15 ÷ 16 = 0 (remainder 15 or F)
- **Hexadecimal Number:** FF

5. Arithmetic Operations in Different Bases

Addition in Binary:

- **Example:** 1011 + 1101
- **Carry and sum:**
  - 1011
  - 1101

11000 (Binary)

Subtraction in Binary:

- **Example:** 1011 - 0110
- **Borrow and difference:**
  - 1011
  - 0110

0101 (Binary)

Multiplication in Binary:

- **Example:** 101 × 11
  - **Multiply:**
    - 101 × 011

101

  - 1010

1111 (Binary)

Division in Binary:

- **Example:** 1100 ÷ 11
  - **Divide:**
    - 1100 ÷ 11 = 100 (Binary)

6. Conversions between Bases

Decimal to Binary, Octal, Hexadecimal:

- **Decimal to Binary:** Use successive division by 2.
- **Decimal to Octal:** Use successive division by 8.
- **Decimal to Hexadecimal:** Use successive division by 16.

Binary to Decimal:

- Sum each bit multiplied by 2 raised to its position power.

Hexadecimal to Decimal:

- Sum each digit multiplied by 16 raised to its position power.

7. Practice Problems

1. **Convert 101101 (Binary) to Decimal:**
   - **Solution:** 1 × 2^5 + 0 × 2^4 + 1 × 2^3 + 1 × 2^2 + 0 × 2^1 + 1 × 2^0 = 32 + 8 + 4 + 1 = 45
2. **Convert 35 (Decimal) to Binary:**
   - **Solution:** 35 ÷ 2 = 17 (remainder 1), 17 ÷ 2 = 8 (remainder 1), 8 ÷ 2 = 4 (remainder 0), 4 ÷ 2 = 2 (remainder 0), 2 ÷ 2 = 1 (remainder 0), 1 ÷ 2 = 0 (remainder 1)
   - **Binary Number:** 100011
3. **Add 1010 and 1101 (Binary):**
   - **Solution:** 1010 + 1101 = 10111
4. **Convert A3 (Hexadecimal) to Decimal:**
   - **Solution:** A × 16^1 + 3 × 16^0 = 10 × 16 + 3 = 160 + 3 = 16