Place Value, Face Value, Expanded Form, and Ordering Large Numbers

i. Place Value and Face Value

Face Value: The face value of a digit in a number is simply the value of the digit itself, regardless of its position.

- It's the intrinsic value of the digit.

Example: In the number 8,145**,** the face value of the digit '4' is just **4**. The face value of '8' is 8**.**

Place Value: The place value of a digit in a number is its face value multiplied by the value of the place it occupies in the number.

- It tells us the true value of a digit based on its position (ones, tens, hundreds, thousands, etc.).
- Formula: Place Value = Face Value × Value of the Place

Example: In the number 8,145:

- The place value of '4' is 4 × 10 = 40 (since it is in the tens place).
- The place value of '8' is 8 × 1,000 = 8,000 (since it is in the thousands place).

Key Points

- The face value of a digit never changes.
- The place value of a digit changes depending on its position in the number.
- The place value of the digit '0' is always 0, but it acts as a crucial placeholder.

Detailed Example: -

Consider the number **7,654,321**.

Digit	Face Value	Place	Value of the Place	Place Value (Face Value × Value of Place)
7	7	Millions	1,000,000	7,000,000
6	6	Hundred Thousand	100,000	600,000
5	5	Ten Thousands	10,000	50,000

Digit	Face Value	Place	Value of the Place	Place Value (Face Value × Value of Place)
4	4	Thousands	1,000	4,000
3	3	Hundreds	100	300
2	2	Tens	10	20
1	1	Ones	1	1

ii. Expanded Form

Expanded form breaks down a number into the sum of the place values of its digits.

A. Definition and Explanation

Writing a number in expanded form means expressing it as an addition of the place values of each digit.

Example 1: Write 347,812 in expanded form.

Method 1: Using Place Values

- 3 is in the hundred thousands place = 300,000
- 4 is in the ten thousands place = 40,000
- 7 is in the thousands place = 7,000
- 8 is in the hundreds place = 800
- 1 is in the tens place = 10
- 2 is in the ones place = 2
- Expanded Form: 300,000 + 40,000 + 7,000 + 800 + 10 + 2

Method 2: Using Multiplication

- This method shows the face value multiplied by the value of the place.
- Expanded Form: (3 × 100,000) + (4 × 10,000) + (7 × 1,000) + (8 × 100) + (1 × 10) + (2 × 1)

Example 2 (with a zero): Write 5,092,604 in expanded form.

- We can skip the zero digits as their place value is 0.
- Expanded Form: 5,000,000 + 90,000 + 2,000 + 600 + 4

- OR (5 × 1,000,000) + (9 × 10,000) + (2 × 1,000) + (6 × 100) + (4 × 1)

iii. Ordering Large Numbers

Ordering means arranging numbers from smallest to largest (ascending order) or largest to smallest (descending order).

A. Key Rules for Comparing Numbers

Rule 1: Count the Digits

- The number with more digits is always greater.
- Example: 12,345,678 (8 digits) is greater than 9,876,543 (7 digits).

Rule 2: Compare from the Left

- If the numbers have the same number of digits, start comparing the digits from the leftmost place.
- Move from left to right, one place at a time, until you find two digits that are different.
- The number with the larger digit at that place is the greater number.

B. Detailed Example

Problem: Arrange the following numbers in ascending order (smallest to largest): 45,678,901; 5,678,901; 45,712,345; 45,679,001

Step-by-Step Solution:

1. Count the digits:
   - 45,678,901 → 8 digits
   - 5,678,901 → 7 digits
   - 45,712,345 → 8 digits
   - 45,679,001 → 8 digits
   - The number with the fewest digits is the smallest. So, 5,678,901 is the smallest number.
2. Compare the remaining 8-digit numbers: 45,678,901; 45,712,345; 45,679,001.
   - Start from the leftmost digit (Ten Millions place). All have '4'.
   - Move to the next digit (Millions place). All have '5'.

- Move to the next digit (Hundred Thousands place). 45,**6**78,901 ; 45,**7**12,345 ; 45,**6**79,001.
- We find a difference! The digit '7' in 45,712,345 is greater than '6'. Therefore, 45,712,345 is the largest of these three.

3. Compare the last two numbers: 45,678,901 and 45,679,001.
   - We already know the first four digits (45,67) are the same.
   - Move to the next digit (Thousands place): 45,67**8**,901 vs 45,67**9**,001.
   - We find a difference! 8 is less than 9.
   - Therefore, 45,678,901 is smaller than 45,679,001.
4. Final Ascending Order:
   1. 5,678,901
   2. 45,678,901
   3. 45,679,001
   4. 45,712,345

iv. Summary of Main Concepts

- **Face Value:** The digit itself (e.g., in 123, face value of 2 is 2).
- **Place Value:** The value of a digit based on its position (e.g., in 123, place value of 2 is 20).
- **Expanded Form:** Writing a number as the sum of its place values (e.g., 123 = 100 + 20 + 3).
- **Number Systems:** The Indian System uses Lakhs and Crores (commas at 3, 2, 2...). The International System uses Millions and Billions (commas at 3, 3, 3...).
- **Ordering Rule 1:** The number with more digits is greater.
- **Ordering Rule 2:** If digits are equal, compare from the leftmost place until you find a difference.