1 | Knowing Our Numbers

IN THIS CHAPTER, YOU WILL LEARN:

- Natural numbers
- Place value and face value of a digit in a number
- Indian system of numeration
- International system of numeration
- Use of commas in reading and writing large numbers
- Comparison of numbers
- Formation of numbers
- Conversion of units of length, mass and capacity
- Word problems on large numbers
- Estimation of numbers to a certain degree of accuracy
- Roman numerals.

NATURAL NUMBERS

In earlier classes, we have been dealing with counting numbers 1, 2, 3, 4, ... etc. These counting numbers are called **natural numbers**. The **smallest** natural number is 1.

Natural numbers are used in many different contexts and in many ways. Natural numbers help us in counting concrete objects. We can count objects in large numbers. For example, the number of students of your school, the number of people of your city (town or village). As the process of counting is endless, there is no **largest** natural number.

Digits or Figures

Any number (howsoever large) can be written with the use of ten symbols 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9. Each of these symbols is called a **digit** or a **figure**.

A number system involves counting in **tens**. When we speak of counting in tens, it simply means that we are thinking of collections by tens. Ten is called the **base** of the system.

In our number system:

Ten 'units or ones' make one ten   *i.e.* $10 \times 1 = 10$

Ten 'tens' make one hundred   *i.e.* $10 \times 10 = 100$

Ten 'hundreds' make one thousand   *i.e.* $10 \times 100 = 1000$ and so on.

Place Value and Face Value of a Digit in a Number

Let us consider the number 7302.

As the digit 7 occupies thousand's place, the *place (or local) value* of the digit $7 = 7 \times 1000$ = 7000.

Similarly, the place value of the digit $3 = 3 \times 100 = 300$,
the place value of the digit $0 = 0 \times 10 = 0$ and
the place value of the digit $2 = 2 \times 1 = 2$.

*Thus, the **place** (or **local**) **value** of a (non-zero) digit in a number depends upon the place it occupies in the given number; and the place value of the digit 0 is always 0 regardless of the place it occupies in the given number.*

Let us consider the number 5354.

The place value of the digit 5 at ten's place $= 5 \times 10 = 50$ and the place value of the digit 5 at thousand's place $= 5 \times 1000 = 5000$ but the face (true or intrinsic) value of both the fives is 5.

*Thus, the **face** (**true** or **intrinsic**) **value** of a digit in a number is the digit itself, regardless of the place it occupies in the number.*

Remark

To find the place value of a digit in a number, multiply the digit by the value of the place it occupies.

Numerals and Numeration

A number can be written in digits as well as in words.

A single digit or a group of digits representing a number is called a **numeral**. For example: 6, 28, 304 and 7659 are numerals.

Thus, a numeral is a symbolic **representation** of a number. Hereafter, we shall use the words number and numeral in the same sense.

Writing a number in words is called **numeration**.

To read and write numbers, the systems of numeration in common use are:
  (*i*) Indian system
 (*ii*) International system.

INDIAN SYSTEM OF NUMERATION

In the Indian system:

   100×1000 *i.e.* 100000 is called **lakh**,

   100×100000 *i.e.* 10000000 is called **crore** and so on.

In the Indian place value chart:
• The places ones (or units), tens and hundreds together are called **ones** (or **units**) **period**.
• The places thousands and ten thousands together are called **thousands period**.
• The places lakhs and ten lakhs together are called **lakhs period**.
• The places crores and ten crores together are called **crores period** and so on.

The Indian place value chart is shown below:

Periods	...	Crores		Lakhs		Thousands		Ones		
Places		Ten crores	Crores	Ten lakhs	Lakhs	Ten thousands	Thousands	Hundreds	Tens	Ones
		TC	C	TL	L	TTh	Th	H	T	O
Numbers		100000000	10000000	1000000	100000	10000	1000	100	10	1

Writing Numbers

To write numbers (numerals) for number names, consider the following examples:

(*i*) In a number, if a place is vacant then put 0 at that place. The number 'seven thousand thirty two' consists of a collection of 7 thousands, 3 tens and 2 units *i.e.* it consists of 7 thousands, 0 hundreds, 3 tens and 2 units.

This number is represented by writing 7 at thousand's place, 0 at hundred's place, 3 at ten's place and 2 at one's place.

Thus, the number is written as '7032'.

The **expanded form** of the number is

$$7032 = 7 \times 1000 + 0 \times 100 + 3 \times 10 + 2$$
$$= 7000 + 0 + 30 + 2$$
$$= 7000 + 30 + 2$$

(*ii*) The number 'eighty three crore seventy lakh twenty five thousand two' consists of 83 crores, 70 lakhs, 25 thousands and 2 ones *i.e.* it consists of 8 ten crores, 3 crores, 7 ten lakhs, 0 lakhs, 2 ten thousands, 5 thousands, 0 hundreds, 0 tens and 2 ones.

This number is represented by writing 8 at ten crore's place, 3 at crore's place, 7 at ten lakh's place, 0 at lakh's place, 2 at ten thousand's place, 5 at thousand's place, 0 at hundred's place, 0 at ten's place and 2 at one's place.

Thus, the number is written as '837025002'.

The above numbers are written in the place value chart as under:

Periods	...	Crores		Lakhs		Thousands		Ones		
Places		TC	C	TL	L	TTh	Th	H	T	O
Numbers							7	0	3	2
		8	3	7	0	2	5	0	0	2

Remarks

☞ If a place is vacant in a number, put 0 at that place.

☞ Never write 0 at the higher place of a number *i.e.* do not put 0 as the extreme left digit of a number. For example, the number seven hundred thirty five is written as 735 and not as 0735.

Reading Numbers

To read large numbers, we insert commas after each period starting from ones period. In the Indian system, the various periods from the right are: ones, thousands, lakhs, crores and so on.

For example, the number 29307546 in the Indian system can be written as

2, 93, 07, 546.

It is read as "two crore ninety three lakh seven thousand five hundred forty six".

INTERNATIONAL SYSTEM OF NUMERATION

In the International system:

1000×1000 *i.e.* 1000000 is called **million**,

1000×1000000 *i.e.* 1000000000 is called **billion** and so on.

In the International place value chart:

- The places ones (or units), tens and hundreds together are called **ones period.**
- The places thousands, ten thousands and hundred thousands together are called **thousands period**.
- The place millions, ten millions and hundred millions together are called **millions period** and so on.

The International place value chart is shown below:

Periods	...	Millions			Thousands			Ones		
Places		Hundred millions	Ten millions	Millions	Hundred thousands	Ten thousands	Thousands	Hundreds	Tens	Ones
		HM	TM	M	HTh	TTh	Th	H	T	O
Numbers		100000000	10000000	1000000	100000	10000	1000	100	10	1

Reading and Writing Numbers

To read large numbers, we insert commas after each period starting from the ones period.

In the International system, the various periods from the right are:

ones, thousands, millions, billions and so on.

For example, the number 3 0 44 705 693 in the International system can be written as

<p style="text-align:center">3, 044, 705, 693.</p>

It is read as "three billion forty four million seven hundred five thousand six hundred ninety three".

To write numbers for number names, consider the following example:

The number 'twenty three million seven hundred thirty thousand five hundred eight' consists of a collection of 2 ten millions, 3 millions, 7 hundred thousands, 3 ten thousands, 5 hundreds and eight ones *i.e.* it consists of 2 ten millions, 3 millions, 7 hundred thousands, 3 ten thousands, 0 thousands, 5 hundreds, 0 tens and 8 ones.

This number can be represented by writing 2 at ten million's place, 3 at million's place, 7 at hundred thousand's place, 3 at ten thousand's place, 0 at thousand's place, 5 at hundred's place, 0 at ten's place and 8 at one's place.

Thus, the number is written as 23, 730, 508.

This number in the International place value chart is written as under:

Periods	...	Millions			Thousands			Ones		
Places		HM	TM	M	HTh	TTh	Th	H	T	O
23, 730, 508			2	3	7	3	0	5	0	8

Uses of Commas

- Use of commas is very helpful in reading and writing large numbers.
- Commas are used in separating periods.

- In the Indian system of numeration, the first comma comes after 3 digits from the right and the next comma comes after every 2 digits.
- In the International system of numeration, the commas come after every 3 digits from the right.
- While writing number names, we do not use commas.

Remark

By comparing the Indian and the International place value charts, we find that:

1 million = 10 lakhs,   10 millions = 1 crore,

100 millions = 10 crores and   1 billion = 100 crores

Example 1. What is the place value of the digit 3 in the number 2370186?

Solution. The given number (in Indian system) can be written as 23,70,186.

As the digit 3 occupies lakh's place, so its place value

$$= 3 \times 100000 = 300000.$$

Example 2. Write the face value and the place value of each of the underlined digit in the numeral

$$\underline{6}\ \underline{0}\ 3\ \underline{8}\ \underline{1}\ 2\ \underline{4}$$

Solution. Using Indian system and inserting comma after each period, the given numeral can be written as

$$\underline{6}\ \underline{0},\ 3\underline{8},\ \underline{1}2\underline{4}.$$

The underlined digits in the given numeral are 6, 0, 8, 1 and 4.

Digit	Face value	Place value
6	6	$6 \times 1000000 = 6000000$
0	0	$0 \times 100000 = 0$
8	8	$8 \times 1000 = 8000$
1	1	$1 \times 100 = 100$
4	4	$4 \times 1 = 4$

Example 3. Using International system of numbers, find the difference of the place values of two 5's in 6857021530.

Solution. The given number in International system can be written as

6, 857, 021, 530.

The place value of 5 at hundred's place $= 5 \times 100 = 500$.

The place value of 5 at ten million's place

$$= 5 \times 10,000,000 = 50,000,000.$$

∴ The required difference $= 50,000,000 - 500$

$$= 49,\ 999,\ 500.$$

Exercise 1.1

1. Write the smallest natural number. Can you write the largest natural number?
2. Fill in the blanks:
    (*i*) 1 lakh = ... ten thousand   (*ii*) 1 million = ... hundred thousand
    (*iii*) 1 crore = ... ten lakh   (*iv*) 1 billion = ... hundred million.

3. Insert commas suitably and write each of the following numbers in words in the Indian system and the International system of numeration:
    (*i*) 506723   (*ii*) 180018018

4. Write the following numbers in expanded form:
    (*i*) 750687   (*ii*) 5032109

5. Write the following numbers in figures:
      (*i*) Seven lakh three thousand four hundred twenty
    (*ii*) Eighty crore twenty three thousand ninety three
    Also write the above numbers in the place value chart.

6. Write each of the following numbers in numeral form and place commas correctly:
      (*i*) Seventy three lakh seventy thousand four hundred seven.
    (*ii*) Nine crore five lakh forty one.
   (*iii*) Fifty eight million four hundred twenty three thousand two hundred two.

7. Write the face value and place value of the digit 6 in the number 756032.

8. Write the face value and the place value of each of the underlined digit in the numeral 3̲ 2 5̲ 7̲ 4 0̲ 1̲.

9. Find the difference between the place value and the face value of the digit 9 in the number 229301.

10. Determine the difference of the place value of two 7's in 37014472 and write it in words in International system.

11. Determine the product of place value and the face value of the digit 4 in the number 5437.

12. Find the difference between the number 895 and that obtained on reversing its digits.

COMPARISON OF NUMBERS

To compare two natural numbers, we adopt the following procedure:

Step 1. If the number of digits in the given numbers is unequal, then the number having more digits is greater.

Step 2. If the number of digits in the given numbers is equal, then compare the digits at the highest place, the number having greater digit (at the highest place) is greater. If the digits at the highest place are equal, then compare the digits at the next highest place, the number having greater digit (at the next highest place) will be greater, and so on.

For example:
  (*i*) Consider the numbers 53757 and 400381.
     The number of digits in 53757 = 5,
     the number of digits in 400381 = 6.
     ∴ 400381 > 53757.
 (*ii*) Consider the numbers 46301 and 49012.
     The number of digits in 46301 = 5,
     the number of digits in 49012 = 5.
     ∴ Both the numbers have equal digits.
     The digit in the highest place in 46301 = 4,
     the digit in the highest place in 49012 = 4.
     ∴ Both numbers have same digit at the highest place.

$$\begin{matrix} 4 & 6 & 3 & 0 & 1 \\ 4 & 9 & 0 & 1 & 2 \end{matrix}$$

The digit in the second highest place in 46301 = 6,

the digit in the second highest place in 49012 = 9.

As 9 > 6, therefore, 49012 > 46301.

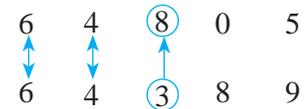■ **Example 1.** Arrange the following numbers in ascending order:
4378, 64805, 64389.

Solution. The number of digits in 4378 = 4,

the number of digits in 64805 = 5 and

the number of digits in 64389 = 5.

To compare the numbers 64805 and 64389; write these numbers as shown:

Since 8 > 3, 64805 > 64389

∴ The given numbers in ascending order are 4378, 64389, 64805.

> Ascending means smaller to greater

| 6 | 4 | ⑧ | 0 | 5 |
| 6 | 4 | ③ | 8 | 9 |

■ **Example 2.** Arrange the following numbers in descending order:
25047, 374504, 374318, 25407, 3700911

Solution. The number of digits in 25047 = 5,

the number of digits in 374504 = 6,

the number of digits in 374318 = 6,

the number of digits in 25407 = 5 and

the number of digits in 3700911 = 7.

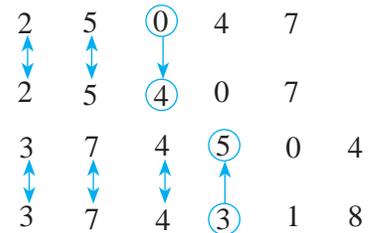To compare 25047 and 25407, write the numbers as shown:

Since 4 > 0, 25407 > 25047.

To compare 374504 and 374318, write the numbers as shown:

Since 5 > 3, 374504 > 374318.

> Descending means greater to smaller

2	5	⓪	4	7	
2	5	④	0	7	
3	7	4	⑤	0	4
3	7	4	③	1	8

Thus, the given numbers in descending order are:

3700911, 374504, 374318, 25407, 25047.

FORMATION OF NUMBERS ───────●

We can form numbers from the given digits with or without repetition of digits.

■ **Example 3.** Write all possible 2-digit numbers that can be formed by using the digits 2, 7 and 9 when repetition of digits is not allowed.

Solution. We are required to write 2-digit numbers. The given digits are 2, 7, 9 and the repetition of digits is not allowed.

Out of the given digits, the possible ways of choosing two digits are

2, 7; 2, 9; 7, 9

Using the digits 2 and 7, the numbers are 27 and 72.

Similarly, *using the digits 2 and 9*, the numbers are 29 and 92.

Using the digits 7 and 9, the numbers are 79 and 97.

Hence, all possible 2-digit numbers are

27, 72, 29, 92, 79, 97.

Tens	Ones
2	7
7	2
2	9
9	2
7	9
9	7