# Long Questions

**Q.1 What are the main types of data used in different computer applications? Explain the uses of each of the data types and the operations performed on it.**

**DATA**

The collection of raw facts and figures is called data. The list of students' name and their marks is an example of data

**TYPES OF DATA**

All computer programs use three basic types of data.

1. Numeric Data
2. Alphabetic Data
3. Alphanumeric Data

**Numeric Data**

Numeric data is used to represent different quantities on which arithmetic is to be performed e.g. marks of different students, sales record of goods at a shop etc. mostly this data is represented as integers or real numbers e.g. 45, 929,-85.09 etc. there are two types of numeric data.

1. Integer
2. Real number

**ALPHABETIC DATA**

Alphabet data only contains of a fixed set of alphabetic characters e.g. data consisting of English alphabets A, B, C… Z as well as a, b, c… z. we can use these English alphabets to represent names of student in a class. This data is represented as a sequence of characters and no arithmetic operations can be carried out on it.

**ALPHANUMERIC DATA**

Alphanumeric data contains alphabets, numbers and other special characters i.e. $ # % etc. example of such data can be telephone number and addresses such as, (042)-6779142 and house # 633 Faisal town etc.

**Q.2 Explain the 1's complement method of representing signed numbers. How can you perform subtraction using this method**

**1's COMPLEMENT**

1's complement of an 8-bit binary number is obtained by subtracting the number from (11111111). For example 1's complement of the binary number 10111101 is taken as

```
  11111111
- 10111101
  --------
  01000010
```

Hence 1's complement of 10011001 is 01100110

It means that 1's complement of a binary number can be directly obtained changing all 1's with 0's and all 0's with 1's

**Example:** We Take 1's complement of the binary number 01011110.

| | |
|---|---|
| Original number: | 01011110 |
| 1's complement | 10100001 |

**Representations of Negative Numbers Using 1's Complement**

The following steps are performed to represent a negative number in complement form.

- The number of bits to represent number is determined first
- The number is converted into binary form
- 0 is placed in the MSB (Most Significant Bit) and binary of the number is placed in the remaining bits with 0's in the empty places between binary and the MSB (if required)
- 1's complement of the result is taken

**Example:** Represent $(-55)_{10}$ in 1's complement form using 8-bit

Number of bits=8

Binary of $(55)_{10} = (110111)_2$

$(55)_{10}$ in 8 bits = $(00110111)_2$

$(55)_{10}$ in 1's complement form = $(11001000)_2$

We should also know that 1's complement representation of negative integer is same as the usual binary number representation and will always have a "0" in MSB

**Q.3 Explain the 2's complement method of representing signed numbers. How can you perform subtraction using this method?**

**2's COMPLEMENT**

The 2's complement method is very useful for representing signed number. Most computers represent integers using this method; similarly many digital calculators also used this method for representing integers

2's complement of a binary number can be obtained by first taking 1's complement and then adding 1 in the result. For example, to obtain the 2's complement of the binary number (01100110), following steps are performed:

1- Taking 1's complement of the given binary number $(01110110)_2$ such as:

```
  11111111
- 01110110
  10001001
```

2- Adding 1 to the result (i.e. 1's complement of 01100110) to obtain the 2's complement

```
  1000100 1
+        1
  10001010
```

Hence 2's complement of $(01110110)_2$ is $(10001010)_2$

**Representation of Negative Numbers Using 2's Complement**

We can obtain 2's complement of a binary number directly without taking 1's complement. The following steps are performed to obtain the 2's complement directly.

- The number of bits to represent number is determined first
- The number is converted into binary form
- 0 is placed in the MSB (Most Significant Bit) and binary of the number is placed in the remaining bits with 0's in the empty places between binary and the MSB (if required)
- Taking 2's complement of the result by coping the same bits up to first 1 from the right side and replacing 1's with 0's and 0's with 1's for the remaining bits

**Example:** Represent $(-54)_{10}$ in 2's complement form using 8-bit

Number of bits = 8

Binary of $(54)_{10}$ = $(110110)_2$

$(54)_{10}$ in 8 bits = $(00110110)_2$

$(-54)_{10}$ in 2's complement form = $(11001010)_2$

**Q.4 Define number system? Also describe different types of number systems.**

**Ans: Number System**

A number system defines a set of values used to represent different quantities. For example we can represent the number of students in our class or number of viewers watching a certain TV programs etc.

**Types of number systems**

**(i)** Decimal number system

**(ii)** Binary number system

**(iii)**Octal number system

**(iv)**Hexadecimal number system

**Decimal number system**

The decimal number system consists of 10 digits i.e. 0,1,2,3,4,5,6,7,8,9. The base of this number system is 10. It is a positional number system as value of every digit in a number of this system depends upon the position of that digit in that number.

**Binary number system**

This number system uses only two digits 0 and 1 to represent any quantity. These are called binary digits or BIT. The base of this number system is 2. Numbers in this system are represented as 1011(2), 1101.11(2)

**Hexadecimal number system**

The Hexadecimal number system consists of 16 digits i.e. 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F. The decimal values A,B,C,D,E,F are 10,11,12,13,14,15 respectively. The base of this number system is 16. Numbers in this system are represented as 1B9 (16), 1A09.1D (16)

**Octal number system**

The octal number system consists of 8 digits from 0 to 7 i.e. 0, 1, 2, 3, 4, 5, 6, 7. The base of this number system is 8. Numbers in this system are represented as $176_{(8)}$, $1046.15_{(8)}$

**Q.5 Define data and also describe different types of data.**

**Ans: Data**

Data is defined as the collection of facts and figure.

**Types of data**

All programs use one or more of the following types of data

**(i)** Numeric data

**(ii)** Alphabet data

**(iii)**Alphanumeric data

**Numeric data**

Numeric data is used to represent different quantities on which arithmetic is can be performed e.g marks of different students, sales records of goods at a shop etc. mostly this data is represented as integers or real numbers e.g. 40, 323,–46.07 etc.

**Types of numeric data**

There are two types of numeric data

**(i)** Integer

**(ii)** Real number

**Alphabetic data**

Alphabet data only consists of a fixed set of alphabetic characters e.g. data consisting of English alphabets A, B, C…… Z as well as a, b, c,…….z. we can use these English alphabets to represent names of students in a class. This data is represented as a sequence is character and no arithmetic operation can be carried out on it.

**Alphanumeric data**

Alphanumeric data contains alphabets, number and other special characters i.e.$, #, %etc.