Q. No	Question (s)	Marks	BL	CO
	UNIT – III			
1	**a.** Classify the data types in digital computers	**1M**		
	b. What are the different number systems	**1M**		
	c. Represent +6132.789 as a floating-point number	**1M**		
	d. Why should the sign of the remainder after a division is same as the sign of the dividend.	**1M**		
	e. What are the different ways of representing a negative number?	**1M**		
2	**a.** Explain (r-1) complement in decimal and binary number systems	**3M**		
	b. Explain how a 2's complement subtraction is performed.	**3M**		
	a. Find the 1's and 2's complement of the following eight-digit binary number a. 10101110 b. 10000001	**3M**		
	b. What is the purpose of Decimal Arithmetic Unit?	**3M**		
	c. State the addition algorithm.	**3M**		
3	**a.** Explain the representation of Floating-point numbers	**5M**		
	b. Explain the register organization for floating point operations.	**5M**		
	c. Discuss how decimal numbers are represented using fixed point representation.	**5M**		
	d. Discuss the different types of representation of signed numbers.	**5M**		
	e. Explain BCD Adder.	**5M**		
4	**a.** Using 2's complement method solve the following i. -75 +26 ii. 46 - 14 iii. – 6 – 13	**10M**		
	b. Explains Booths Multiplication Algorithm with a numerical example	**10M**		
	c. Draw and explain the hardware for signed – magnitude addition and subtraction.	**10M**		

ANSWERS:

1a). Classify the data types in digital computers

Ans:

The data types in registers of digital computers may be classified as

i. numbers used in arithmetic computations,

ii. letters of the alphabet used in data processing, and

iii. other discrete symbols used for specific purposes

1b). What are the different number systems

Ans:

The different number systems are

i. Decimal Number system

ii. Binary Number System

iii. Octal Number System

iv. Hexadecimal Number System

1c) . Represent +6132.789 as a floating-point number

Ans:

Consider number: **+6132.789**,

Here the number is a decimal number with r = 10, the decimal point is at the fourth position from right e = +4 and the mantissa +0.6132789

Thus, the floating-point representation is $+0.6132789 \times 10^{+4}$

1d). Why should the sign of the remainder after a division is same as the sign of the dividend.

Ans:

1e). What are the different ways of representing a negative number?

Ans:

The different types of representing negative numbers are 1's complement form and 2's complement form.

2a). Explain (r-1) complement in decimal and binary number systems

Ans:

The decimal number system with radix =10 has 9's complement and 10's complement. For 9's complement, we subtract each digit from 9 and for 10's complement we add 1 to the 9's complement of the number.

The binary number system with radix=2 has 1'complemenet and 2's complement. For 1's complement, we subtract each bit from 1 and for 2's complement, 1 is added to 1's complement of the number

2b). Explain how a 2's complement subtraction is performed.

Ans:

To perform A-B using 2's complement method, the following steps are used :

i. The length of Minuend A and Subtrahend B has to be same.

ii. Add the 2's complement of the subtrahend to the minuend.

iii. If a carry is generated from the last bits, ignore it.

iv. Check the MSB,

   a. If **MSB = 0**, the number is **Positive** and the remaining bits are in true binary form and define the Magnitude of the number

   b. If **MSB=1**, the number is **Negative** and the remaining bits are in 2'complement form. To get the magnitude, take the 2's complement of the remaining bits.

2c). **Find the 1's and 2's complement of the following eight-digit binary number**

i. 10101110 ii. 10000001

Ans:

1's complement is obtained by subtracting each bit of the number from 1.

2's complement is obtained by adding 1 to 1's complement of the number.

i.

A = 1 0 1 0 1 1 1 0

1's(A) = 0 1 0 1 0 0 0 1

2's(A) = 1's(A) + 1 = 0 1 0 1 0 0 1 0

ii. **A** = 1 0 0 0 0 0 0 1

1's(A) = 0 1 1 1 1 1 1 0

2's(A) = 1's(A) + 1 = 0 1 1 1 1 1 1 1

2d). What is the purpose of Decimal Arithmetic Unit?
Ans:

2e). State the addition algorithm.
Ans:

3a). Explain the representation of Floating-point numbers
Ans:

The floating-point representation of a number consists of two parts.

The first part is called as mantissa which consist of **sign** followed by the **fixed-point** number and the second part called as exponent defines the **position** of the decimal/binary point

Floating point numbers take the form $\mathbf{m \times r^e}$. Where, m is mantissa, r is radix of the number and e is the actual position of the decimal/binary point.

Consider the example of a number: **+6132.789**,
Here the number is a decimal number with r=10, the decimal point is after the fourth digit e=+4 and the mantissa is +0.6132789

Thus, the floating-point representation is $+0.6132789 \times 10^{+4}$

Consider an example of signed number given by **1001.11**.
Here, the number is a binary number with r=2, the decimal point is after 4^{th} bit, the number is positive hence the MSB of mantissa is 0 with mantissa = 0100111 and e = 4 =100.

If the mantissa is represented as 8-bits and exponent as 6-bits. Then the above number is represented as 01001110 x $2^{+4.}$

3b). Explain the register organization for floating point operations.
Ans:

3c). Discuss how decimal numbers are represented using fixed point representation
Ans:

In addition to the sign, a number may have a binary (or decimal) point. The position of the binary point is needed to represent fractions, integers, or mixed integer-fraction numbers. The representation of the binary point in a register is complicated by the fact that it is characterized by a position in the register. The fixed-point method assumes that the binary point is always fixed in one position. The two positions most widely used are (1) a binary point in the extreme left of the register to make the' stored number a fraction, and (2) a binary point in the extreme right of the register to make the stored number an integer. In either case, the binary point is not actually present, but its presence is assumed from the fact that the number stored in the register is treated as a fraction or as an integer. The floating-point representation uses a second register to store (l. number that designates the position of the decimal point in the first register

3d). Discuss the different types of representation of signed numbers.
Ans: different types of representing singed numbers are

i. Sign magnitude form
ii. Sign 2's complement form
iii. Sign 1's complement form

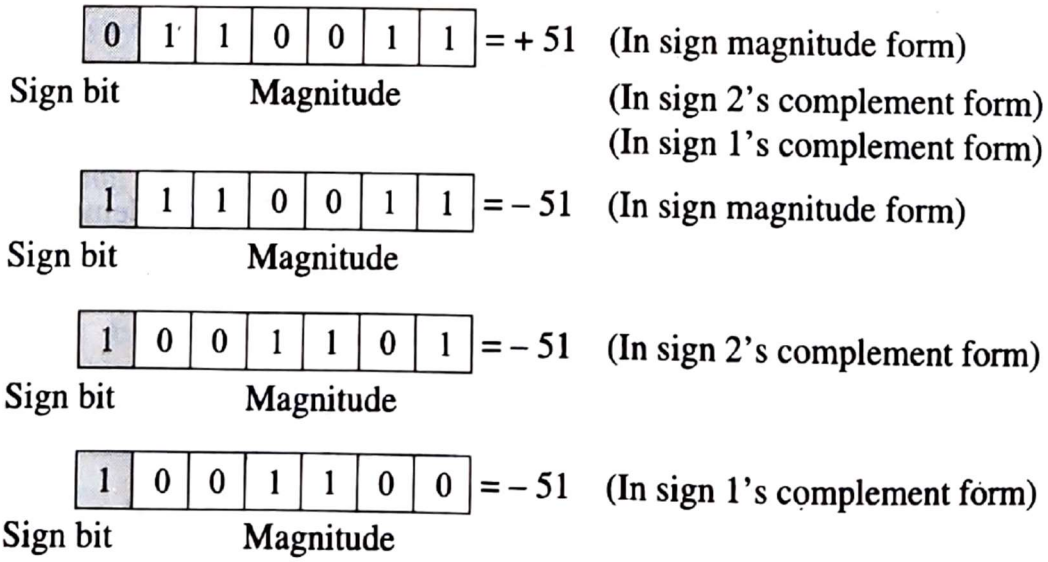
A positive number is represented with same value in all the above 3 forms
A negative number is represented as follows

Sign magnitude form: the MSB =1 and remaining bits form the magnitude and are in true binary

Sign 2's complement form: MSB=1, remaining bits form the 2's complement of magnitude

Sign 1's complement form: MSB=1, remaining bit form the 1's complement of magnitude

Example:



3e). Explain BCD Adder.
Ans:

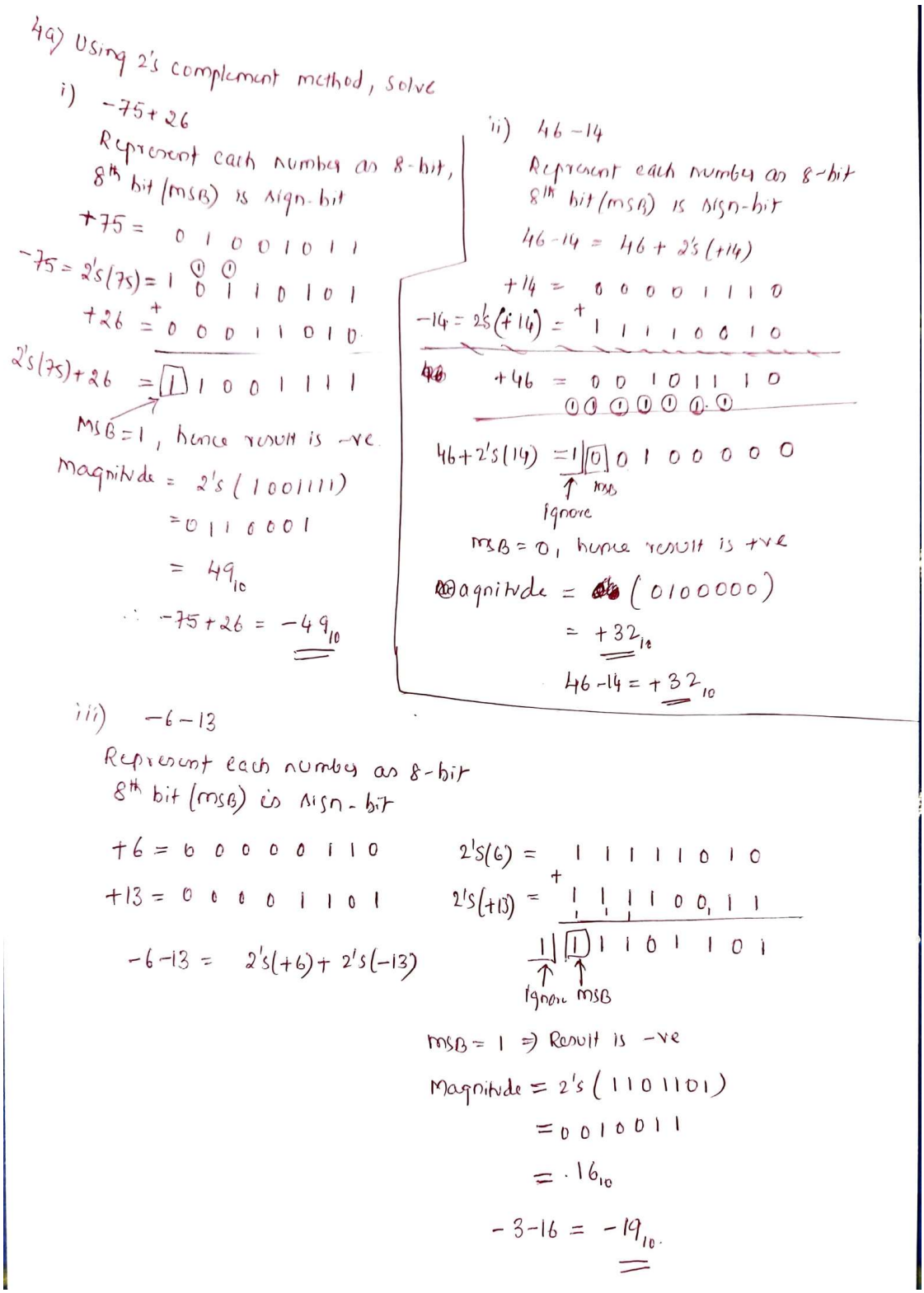
4a). Using 2's complement method solve

i. **-75 +26**

ii. **46 – 14**

iii. **– 6 – 13**

Ans:



4b). Explains Booths Multiplication Algorithm with a numerical example
Ans:

4c). Draw and explain the hardware for signed – magnitude addition and subtraction
Ans: