Assignment -3
(Computer Consideration)

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Ques-1 If one byte is available to store an integer with the first bit used for the sign, how would the number -33 be stored?

Ans-1 One byte (8 bits) is available to store an integer

33 stored as a binary integer (8 bits)

To convert (33) to binary

	32	16	8	4	2	1
Value	1	0	0	0	0	1
Remainder	1	1	1	1	1	0

The number 33 in binary (8-bits) is 00100001
Since it is negative, the sign bit will be 1

Therefore, the representation of -33 would be 10100001

Ans:- $-33_{10} = 10100001_2$

Ques2: How would the number -99 be stored in a single byte using two's complement representation?

99	64	32	16	8	4	2	1
Value	1	1	0	0	0	1	1
Remainder	35	3	3	3	3	1	0

$99_{10} = 01100011$

$-99_{10} = 99$ (Swap 0s and 1s) $+1$

$= 01100011$ (Swap 0s and 1s) $+1$

$= 10011100 + 1$

$= 10011101_2$

Ans:- $-99_{10} = 10011101_2$

Ques3 Perform the arithmetic operation 144-103 using one byte to store each integer and 2's complement representation. Kindly list all the steps and answer in both binary And Decimal.

144	128	64	32	16	8	4	2	1
Value:	1	0	0	1	0	0	0	0
Remainder:	16	16	16	0	0	0	0	0

103	64	32	16	8	4	2	1
Value:	1	1	0	0	1	1	1
Remainder:	39	7	7	7	3	1	0

$144 + (-103)$

Convert to binary and add

$144_{10} = 10010000_2$

$103_{10} = 01100111_2$

$-103 = 103$ (Swap 0s and 1s) $+1$
$= (01100111)$ (Swap 0s and 1s) $+1$
$= 10011000 + 1$
$= 10011001_2$

Now add the binary numbers

$144 + (-103) = 10010000 + 10011001$
$= 100101001_2$

Since there are 8-bits used for storage of an integer, the leading (9th) bit 1 is dropped.

00101001_2 (In binary)

Remaining leftmost digit (0) indicates a positive value.

$+41_{10}$ (in decimal)

Ans:- $144 - 103 = 00101001$ (in binary)
$= +41$ (in decimal)

Ques: What real number is represented by
01000001100110000000000000000000
according to the IEEE standard? Please provide your final answer in decimal.

Ans:- • The first bit will represent the sign of the number. (0 for +ve, 1 for -ve)

• The next 8-bits will represent the exponent and

the remaining 23 bits will be used to store the number.

- The no. will be stored in normalized notation in binary form.

01000001100110000000000000000000

Rewrite:

0 10000011 00110000000000000000000

First bit is 0 +

Exponent in binary form 10000011_2

Exponent in decimal form 131

Unbaised exponent 131 − 127 = 4

Number in normalized notation 00110000000000000000000

Unnormalized binary number 1.0011_2

The number in decimal 1.1875_{10}

The original decimal number = 1.1875×2^4

= 1.1875×16

= 19

Ans:- Final answer in decimal

01000001100110000000000000000000 = 19_{10}

Ques5:- What is the value −3.109 truncated to three significant digit?

Ans5 Truncating −3.109 to three significant digits means we keep only the first three non-zeros digits and discard the rest without rounding

So, -3.109 truncated to three significant digit is -3.10. We keep the digits -3, 1, 0

-3.10 is the value.

Ans -3.109 truncated to 3 S.D = -3.10

Ques6:- What is the value 14.006 accurate to four significant rounded using conventional software development rules?

Ans6 → Look at the fifth significant digit

→ If the fifth digit is 5 or greater, round up the fourth digit. If it is less than 5, keep the fourth digit unchanged.

In this case, the fifth significant digit is 6, so we need to round up the fourth digit

Therefore 14.006 rounded to four significant digits is 14.01

Ans:- 14.01

Ques7 Represent the number 22.2 using the IEEE standard and convert the result back to decimal. Indicate if there is a conversion error.

22.2

In binary form 10110.$\overline{0011}$

In normalized binary form $1.0110\overline{0011} \times 2^4$

The sign of the number 0

The stored exponent $4 + 127 = (131)_{10}$

The exponent in binary form 10000011

The final representation is

0 10000011 0110 0011 0011 0011 0011 001

22.2 represented as 0 10000011 0110 0011 0011 0011 0011 001 in IEEE-754 form.

Now, convert the result into decimal

Re write

0 10000011 0110 0011 0011 0011 0011 001

First bit is 0	+
Exponent in binary form	10000011_2
Exponent in decimal form	131_{10}
Unbiased exponent	131 - 127 = 4
Number in normalized notation	0110 0011 0011 0011 0011 001
Unnormalized binary number	$1.0110\,\overline{0011}_2$
The number in decimal	1.387499928474426269 53
The original decimal number	$1.387499928474426269 53 \times 24$
	22.199998856

The IEEE representation corresponds to the decimal value 22.199998856, which is slightly different from the original value of 22.2

Therefore, when converting 22.2 to the IEEE standard and back to decimal, there is small conversion error (~ 0.1) resulting in a slight different decimal value due to limitations of representing real numbers in binary format.