Answer to the question no-1.

Binary Number System, a method of representing numbers that has 2 as its base and uses only the digits 0 and 1. Each successive digit represents a power of 2. In mathematics and digital electronics all the operations expressed in the base-2 ~~numeria~~ numeral system or binary numeral system. This is a positional notation with a radix of 2. Each digit is referred to as a bit. Mostly, computing devices use binary numbering to represent electronic circuit voltage state, (i.e. on/off switch), which considers 0 voltage input as off and 1 input as on. Micro controllers only use binary logic in computing. Digital Design is concerned with the design of electronic circuits. Logic design, digital logic, switching circuits and digital system works or maintain their operation with boolean operation which is also a base-2 numerical system. Characteristic of a digital system is its manipulation of discrete elements of information. Discrete elements of information are represented in a digital system by physical quantities. The signals in electronic digital systems have only two discrete values and ~~are~~ said to be bainary. So, in order to oparate a digital computer or system it is must to know the discrete quantities of information ~~thus~~ from which the idea of ~~di~~ binary number system has born. So, the study of binary number system is very obvious.

Answer to the question no - 2

We know, A range of a ~~k bit~~ k bits binary numbers is 2^k because every bit has two possibillities to be 0 or 1.

So with 64 bits (unsigned) integer the range of binary number will be; minimum being 0.

maximum being $2^{64}-1$

$\therefore$ For unsigned, Range $= 0$ to $(2^{64}-1)$

Ans

If the number is signed,

$\therefore$ For signed integer Range $= -(2)^{64}$ to $(2)^{64} - 1$.

Ans

Answer to the question no - 3

$(10100)_2$

$= 2^4 + (2^3 \times 0) + 2^2 + 0 + 0$

$= (20)_{10} \quad = (20)_{10} \times 2^0$

By attaching a zero at the right end,

$(101000)_2$

$= 2^5 + 0 + 2^3 + 0 + 0 + 0$

$= (40)_{10} \quad = (20)_{10} \times 2^1$

By attaching 2 zeros at the right end.

$(1010000)_2$

$= 2^6 + 0 + 2^4 + 0 + 0 + 0 + 0$

$= (80)_{10} \quad = (20)_{10} \times 2^2$

So, By attaching n zeron at the right end.

The decimal value will be $= (20)_{10} \times 2^n$.

So, we will get new decimal number for ~~adding~~ attaching every single zeros, and the ~~valu~~ Decimal value will ~~a~~ rise into 2 multiplies with the previous one.

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The fraction $\left(\frac{11}{16}\right)_{10} = (0.6875)_{10}$

Now,

	2	0.6875×2
MSB →	1	$.375 \times 2$
	0	$.75 \times 2$
	1	$.5 \times 2$
LSB →	1	$.00$

∴ The binary expansion of the fraction is $(0.1011)_2$ Ans

5

$(543)_6$, first convert this into Decimal number.

$(3\times6^0) + (4\times6^1) + (5\times6^2)$

$= (207)_{10}$.

So, $(543)_6 = (207)_{10} = (317)_k$ —①

Now, $(317)_k$ convert this into Decimal number.

$(3\times k^2) + (1\times k) + (7\times k^0)$

$= (3k^2 + k + 7)_{10}$.

So, eqn ①, $3k^2 + k + 7 = 207$.

$\Rightarrow 3k^2 + k - 200 = 0$.

$\Rightarrow k = 8$ or $\frac{-25}{3}$ (which is not possible)

So the base x is equal to 8. which represents the number as a octal number. (Ans)

-6

$(110100)_x$ converting this number into Decimal,

$= k^5 + k^4 + 0 + k^2 + 0 + 0.$

$= (k^2(k^3 + k^2 + 1))_{10}.$

So, $(19257)_{10} = (k^2(k^3 + k^2 + 1))_{10}.$

So, $19257 = k^5 + k^4 + k^2$

$\Rightarrow k^5 + k^4 + k^2 - 19257 = 0.$

now, $f(k) = 0.$

$f(7) = 7^5 + 7^4 + 7^2 - 19257 = 0.$

So, $k-7$ is a derivative for $f(k)$.

So, $k - 7 = 0.$

$\therefore k = 7.$ (Ans)

(6)

)

-1)

If $k = 8$ then

$= \frac{75}{-3}$ (which is not possible)

So the base k is equal to 8. Ans

7

$(71)_8$

$= (7 \times 8) + (1 \times 8^0)$

$= 56 + 1$

$= (57)_{10}$

$(71)_{16}$

$= (7 \times 16) + 1$

$= (113)_{10}$

$(11011)_8$

$= (1 \times 8^4) + (1 \times 8^3) + 0 + 8 + 1$

$= (4617)_{10}$

$(DE0)_{16}$

$= (13 \times 16^2) + (14 \times 16) + 0$

$= (3552)_{10}$

$(ABC)_{16}$

$= (10 \times 16^2) + (11 \times 16) + (12 \times 16^0)$

$= 2748$

$(1001)_{16}$

$= (1 \times 16^3) + 0 + 0 + (1 \times 16^0)$

$= 4097$

$(70.7)_8$

$= (8 \times 7) + 0 + (7 \times 8^{-1})$

$= (56.875)_{10}$

$(A1.F)_{16}$

$= (10 \times 16) + (1 \times 1) + (15 \times 16^{-1})$

$= (161.9375)_{10}$

$(110011 \cdot 1101)_2$

$= \cancel{2^{\cdot 5}} = (1\times 2^5) + (1\times 2^4) + 0 + 0 + (1\times 2) + (1\times 1) + (1\times 2^{-1})$

$+ (1\times 2^{-2}) + 0 + (1\times 2^{-4})$

$\cancel{= (51)_{10}} = (51 \cdot 8125)_{10}$

$(1100111101)_2$

$= (1\times 2^9) + (1\times 2^8) + 0 + 0 + (1\times 2^5) + (1\times 2^4) + (1\times 2^3) + (1\times 2^2)$

$+ 0 + 1$

$= (829)_{10}$

$(110111 \cdot 11101)_2$

$= (2^5\times 1) + (1\times 2^4) + 0 + (1\times 2^2) + (1\times 2^1) + 1 + (1\times 2^{-1}) + (1\times 2^{-2})$

$+ (1\times 2^{-3}) + 0 + (1\times 2^{-5})$

$= (55 \cdot 90625)_{10}$

$(110111)_2$

$= (2^5\times 1) + (1\times 2^4) + 0 + (1\times 2^2) + (1\times 2) + (1\times 2^0)$

$= (55)_{10}$

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$(123 \cdot 23)_8$

$= (1\times8^2) + (2\times8) + (3\times1) + (2\times8^{-1}) + (3\times8^{-2})$

$= (83 \cdot 4375)_{10}$

$(23456 \cdot 236)_8$

$= (2\times8^4) + (3\times8^3) + (4\times8^2) + (5\times8) + (6\times1) + (2\times8^{-1}) + (3\times8^{-2})$
$+ (6\times8^{-3})$

$= (10030 \cdot 30859)_{10}$

$(756734)_8$

$= (7\times8^5) + (5\times8^4) + (6\times8^3) + (7\times8^2) + (3\times8) + (4\times1)$

$= (253404)_{10}$

$(34243.753)_8$

$= (3\times8^4) + (4\times8^3) + (2\times8^2) + (4\times8) + (3\times1) + (7\times8^{-1})$
$+ (5\times8^{-2}) + (3\times8^{-3})$

$= (14499 \cdot 95898)_{10}$

-10

$(12121)_3$

$= (1\times3^4) + (2\times3^3) + (1\times3^2) + (2\times3^1) + (1\times3^0)$

$= 151$

$(12343)_5$
$= (1\times5^4)+(2\times5^3)+(3\times5^2)+(4\times5)+(3\times1)$
$= (973)_{10}$

$(15435)_6$
$= (1\times6^4)+(5\times6^3)+(4\times6^2)+(3\times6)+(5\times1)$
$= (2543)_{10}$

$(198)_{12}$
$= (1\times12^2)+(9\times12)+(8\times12^0)$
$= (260)_{10}$

$(345678)_9$
$= (3\times9^5)+(4\times9^4)+(5\times9^3)+(6\times9^2)+(7\times9)+8$
$= (207593)_{10}$

$(123)_4$
$= (1\times4^2)+(2\times4^1)+(3\times4^0)$
$= (27)_{10}$

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1 $(7684.245)_{10}$

The Decimal part, 7684. First convert it into octal.

P.T.O.

Divisor	Number	remains	
8	7684		
8	960	4	← LSB
8	120	0	
8	15	0	
8	1	7	
	0	1	← MSB

and, The after points part, 0·245 . Convert it into octal.

Now,

		0·245
		×8
MSB →	1	·96
		×8
	7	·68
		×8
	5	·44
		×8
	3	·52
		×8
LSB →	4	·16

So, $(7684 \cdot 245)_{10} = (17004 \cdot 17534\ldots)_8$ Ans

#② $(45682 \cdot 783)_{10}$.

Divisor	Number	remains	
16	45682		
16	2855	2	← LSB
16	178	7	
16	11	2	
	0	11 (B)	← MSB

P.T.O.

	0.783
	×16
MSB → 12 (C)	.528
	×16
8	.448
	×16
7	.168
	×16
LSB → 2	.688

so, $(95682.783)_{10} = (B272.C872\ldots)_{16}$ (Ans)

#5 $(2345.126)_{10}$

integer part

2	2345	
2	1172	1 ← LSB
2	586	0
2	293	0
2	146	1
2	73	0
2	36	1
2	18	0
2	9	0
2	4	1
2	2	0
2	1	0
	0	1 ← MSB.

fractional part

	0.126
	×2
MSB → 0	.252
	×2
0	.504
	×2
LSB → 1	.008

So, $(2345.126)_{10} = (100100101001.00100\ldots)_2$ Ans

a) $\begin{array}{r} 101 \\ +\ 11 \\ \hline 1000 \end{array}$

b) $\begin{array}{r} 111 \\ +\ 111 \\ \hline 1110 \end{array}$

c) $\begin{array}{r} 1010 \\ +1010 \\ \hline 10100 \end{array}$

d) $\begin{array}{r} 11101 \\ +1010 \\ \hline 100111 \end{array}$

e) $\begin{array}{r} 11111 \\ +\ 11111 \\ \hline 111110 \end{array}$

f) $\begin{array}{r} 10 \\ -10 \\ \hline 00 \end{array}$

g) $\begin{array}{r} 101 \\ -\ 11 \\ \hline 010 \end{array}$

h) $\begin{array}{r} 1001 \\ -\ 11 \\ \hline 0110 \end{array}$

i) $\begin{array}{r} 1101 \\ -\ 11 \\ \hline 1010 \end{array}$

j) $\begin{array}{r} 10001 \\ -\ 100 \\ \hline 01101 \end{array}$

k) $\begin{array}{r} 10 \\ \times\ 10 \\ \hline 00 \\ +\ 100 \\ \hline 100 \end{array}$

l) $\begin{array}{r} 100 \\ \times 11 \\ \hline 100 \\ 1000 \\ \hline 1100 \end{array}$

m) $\begin{array}{r} 101 \\ \times\ 10 \\ \hline 000 \\ 1010 \\ \hline 1010 \end{array}$

n) $\begin{array}{r} 1011 \\ \times\ 11 \\ \hline 1011 \\ 10110 \\ \hline 100001 \end{array}$

o) $\begin{array}{r} 11011 \\ \times\ 101 \\ \hline 11011 \\ 000000 \\ 1101100 \\ \hline 10000111 \end{array}$

i) $\begin{array}{r} 110.110 \\ +\ 10.011 \\ \hline 1001.001 \end{array}$

ii) $\begin{array}{r} 1010.01 \\ +\ 1101.11 \\ \hline 11000.00 \end{array}$

iii) $\begin{array}{r} 1111.110 \\ -\ 1010.001 \\ \hline 0101.101 \end{array}$

iv) $\begin{array}{r} 1101.11 \\ -\ 101.01 \\ \hline 1000.10 \end{array}$

v)
$$\begin{array}{r} 1011.00 \\ -\ 10.01 \\ \hline 1000.11 \end{array}$$

vi)
$$\begin{array}{r} 100.0 \\ -\ 11.1 \\ \hline 0.1 \end{array}$$

vii)
$$\begin{array}{r} 11.11 \\ -\ 10.10 \\ \hline 1.01 \end{array}$$

viii)
$$\begin{array}{r} 0.1101 \\ -\ 0.1001 \\ \hline 0.0100 \end{array}$$

$\Rightarrow 0.01$

p) 10) 100 (10
$$\begin{array}{r} 100 \\ \hline 0 \end{array}$$

So, 100 / 10 = 10

q) 11) 111 (10
$$\begin{array}{r} 110 \\ \hline 1 \end{array}$$

So, 111 / 11 = 10,
reminder 1.

r) 100) 1010 (10
$$\begin{array}{r} 100 \\ \hline 010 \\ 000 \\ \hline 10 \end{array}$$

So, 1010 / 100 = 10, reminder, 10.

s) 11) 1101 (100
$$\begin{array}{r} 11 \\ \hline 00 \\ 00 \\ \hline 01 \\ 00 \\ \hline 1 \end{array}$$

So, 1101 / 11 = 100, reminder 1.

t) 10) 10111 (1011
$$\begin{array}{r} 10 \\ \hline 01 \\ 00 \\ \hline 11 \\ 10 \\ \hline 11 \\ 10 \\ \hline 1 \end{array}$$

So, 10111 / 10 = 1011, reminder 1.

$(BA3)_{16} + (5DE)_{16}$

$$\begin{array}{r} (BA3)_{16} \\ +(5DE)_{16} \\ \hline (1181)_{16} \end{array}$$

$(1A)_{16} + (2E)_{16}$

$$\begin{array}{r} (1A)_{16} \\ +(2E)_{16} \\ \hline (48)_{16} \end{array}$$

$(BEAD)_{16} + (4321)_{16}$

$$\begin{array}{r} (BEAD)_{16} \\ +(4321)_{16} \\ \hline (101CE)_{16} \end{array}$$

Ans

~~$(10000)_{16}$~~

$(BEAD)_{16} - (4321)_{16}$

$$\begin{array}{r} (BEAD)_{16} \\ -(4321)_{16} \\ \hline (7B8C)_{16} \end{array}$$

$(10000)_{16} - (1)_{16}$

$$\begin{array}{r} (10000)_{16} \\ -(1)_{16} \\ \hline (FFFF)_{16} \end{array}$$

a) 11001

$$\begin{array}{rl} 1\text{'s} \rightarrow 00110 & (1\text{'s complement}) \text{ Ans} \\ +\ 1 & \\ \hline 2\text{'s} \rightarrow 00111 & (2\text{'s complement}) \end{array}$$

Ans

b) 0·1100111

Here, $n=0$, ~~$n=0$~~ $m=7$

So, 1's complement $= (2^{0} - 2^{-7})_{10} - (0{\cdot}1100111)_2$

$= (0{\cdot}9921875)_{10} - (0{\cdot}1100111)_2$

$= (0{\cdot}0011000)_2$ [1's complement] Ans

$$\begin{array}{r} +1 \\ \hline 0{\cdot}0100 \end{array}$$ [2's complement]

Ans

c) 0011001

or, 11001

Here, $n=5$, $m=0$.

1's Complement $= (2^5 - 2^0)_{10} - (11001)_2$.

$= (11111)_2 - (11001)_2$

$= (110)_2$ [1's comple

$$\begin{array}{r} +1 \\ \hline (111)_2 \end{array}$$ [2's complem

d) 10100.11001

Here, $n=5$, $m=5$, $r=2$

$\therefore$ 1's complement $= (2^5 - 2^{-5})_{10} - (10100.11001)_2$

$= (31.96875)_{10} - (10100.11001)_2$

$= (01011.00110)_2$

2's complement $= (2^5)_{10} - (10100.11001)_2$

$= (100000)_2 - (10100.11001)_2$

$= (1011.00111)_2$.

a) 45 → Decimal

0100 0101

So, $(45)_{10}$ = 01000101 in BCD.

(Ans)

b) 273.98

0010 0111 0011 1001 1000

So, $(273.98)_{10}$ = 0010 0111 0011 . 1001 1000 in BCD

(Ans)

c) 62.905

0110 0010 1001 0000 0101

So, $(62.905)_{10}$ = (01100010.100100000101) in BCD.

(Ans)

a) 100101001

= 0001 0010 1001

↓ ↓ ↓

1 2 9

so, 100101001 in BCD represents $(129)_{10}$

b) 100010010011

= 1000 1001 0011

↓ ↓ ↓

8 9 3

so, 100010010011 represennts $(893)_{10}$.

c) 0111000 1001 · 10010010

= 0011 1000 1001 . 1001 0010

↓ ↓ ↓ ↓ ↓

3 8 9 · 9 2

so, 01110001001·10010010 represensts $(389.92)_{10}$

a) 38

↓ ↓

0110 1011

so, $(38)_{10}$ can be represented in 01101011 in excess-3 code.

b) 471·78

0111 1010 0100 · 1010 1011

So, $(471 \cdot 78)_{10}$ can be represented as (01111010 0100 · 10101011) in excess-3 code.

c) 23·105

0101 0110 0100 0011 1000

So, $(23 \cdot 105)_{10}$ can be represented as (01010110·0100 00111000) in excess-3 code.

a) 0101 1011 1100 0111

2 8 9 4

So, The (0101 1011 1100 0111) excess-3 code represents $(2894)_{10}$

b) 0011 1000 1010 0100

0 5 7 1.

So, The given excess-3 code represents $(0571)_{10}$.

(Ans)

c) 0101 1001 0011

2 6 0

So, The given excess-3 code represents $(260)_{10}$

a) $(61)_{10}$

By representing $(61)_{10}$ in Binary :

2	61	
2	30	1
2	15	0
2	7	1
2	3	1
2	1	1
	0	1

So, $(61)_{10} = (111101)_2$

Now,

$$\begin{array}{r} 111101 \\ 0111101 \\ \hline 0100011 \end{array}$$

So, $(61)_{10}$ can be represented as (100011) in gray code

b) $(83)_{10}$.

By representing $(83)_{10}$ in Binary = 1010011

Now,

$$\begin{array}{r} 1010011 \\ 01010011 \\ \hline 01111010 \end{array}$$

leading zero

So, $(83)_{10}$ can be represented as (1111010) in gray code.

c) 324.

By representing $(324)_{10}$ in Binary $= (101000100)_2$

Now,

$$
\begin{array}{r}
10100100 \\
0\,1010010\,0 \\
\hline
11110110
\end{array}
$$

eliminate this

So, $(324)_{10}$ can be represented as (11110110) in ~~BCD~~ Gray code.

(Ans)

d) 456

By representing $(456)_{10}$ in Binary $= (111001000)_2$

Now,

$$
\begin{array}{r}
111001000 \\
0\,11100100\,0 \\
\hline
100101100
\end{array}
$$

eliminate last bit.

So, $(456)_{10}$ can be represented as (100101100) in ~~BCD~~ Gray code.

(Ans)

a) $(10110)_2$.

$$
\begin{array}{r}
10110 \\
0\,1011\,0 \\
\hline
11101
\end{array}
$$

eliminate last bit.

So $(10110)_2$ can be expressed (11101) in Gray code.

(Ans)

b) $(011011)_2$

$$
\begin{array}{r}
011011 \\
0\,01101\,1 \\
\hline
010110
\end{array}
$$

eliminate

So, $(011011)_2$ can be expressed as (10110) in Gray code.

(Ans)

c) $(101010011)_2$.

$$\begin{array}{r} 101010011 \\ 0101010011 \\ \hline 111111010 \end{array}$$

So, $(101010011)_2$ can be expressed as (111111010) in Gray code.

Ans

d) $(101011100)_2$

$$\begin{array}{r} 101011100 \\ 0101011100 \\ \hline 111110010 \end{array}$$

So, $(101011100)_2$ can be expressed as (111110010) in Gray code.

Ans

e) $(110110001)_2$

$$\begin{array}{r} 110110001 \\ 0110110001 \\ \hline 101101001 \end{array}$$

So, $(110110001)_2$ can be expressed as (101101001) in Gray code.

Ans.

f) $(10001110110)_2$

$$\begin{array}{r} 10001110110 \\ 010001110110 \\ \hline 11001001101 \end{array}$$

So, $(10001110110)_2$ can be expressed as (11001001101) in Gray code.

Ans

———— x ————