Digital logic PYQ

1 The 2's Complement representation of the decimal value −15 is

sign bit 01111 → +ve 15

gate 2002

10001 −15 Ans

2 Sign extension is a step in

A) floation point multiplication

b) Signed 16 bit integer addition

c) arithmetic left shift

d) Converting a signed integer from one size to another ✓

gate 2002

3 Assuming all number are in 2's Complement which of the following number is divisible by 11111011? ⇒ −00101 = −5

A 11100111 → −011001 = −25 ✓ Ans

b 11100100 → −011100 = −28

c 11010111 → 00101001 = −41

d 11011011 → 00100101 = −37

gate 2003

gate 2003 / 4 The following is a scheme for the floating point ~~m~~ number representation using 16 bits

15	14 9	8 ---- 0
S	E	M
sign	Exponent	mantissa

Let s, e. and m be the numbers represented in binary in the sign, exponent and mantissa fields ~~repes~~ respectively. Then the floating point number represented is

$$\left[(-1)^{s} \left(1 + m * 2^{-9}\right) 2^{e-31} \right.$$, if the expone
otherwise

what is the maximum difference between two successive real number representable in this system

A) 2^{-40}
B) 2^{-9}
C) 2^{22}
D) 2^{31}

gate 2004 / 5 If 73x (in base x system) is equal to 54y (in base y-number system) the possible value of x and y are

A) 8, 16
B) 10, 12
C) 9, 13
D) 8, 11

$$(73)_x = (54)_y$$

$$7x + \overset{3}{\cancel{1}} = 5y + 4$$

$$7x - 5y = 4 - 3$$

$$7x - 5y = 1$$

Now put all bases given in option as x ~~any~~ and y = 1

$$7 \times 8 - 5 \times 11 = 1$$

$$56 - 55 = 1$$

Ans

gate 2004 / 6
What is the result of evaluating the following two expressions using three-digit floating point arithmetic with rounding

(113. + -111.) + 7.51
113. + (-111. + 7.51)

a) 9.51 and 10.0 respectively ✓
B) 10.0 and 9.51 " ✗
C) 9.51 and 9.51 " ✗
D) 10.0 and 10.0 " ✗

- $(113. + -111.) + 7.51$

$2 + 7.51 = 2.00 + 7.51 = 9.51$ Ans

$113. + (-111. + 7.51)$

$-1.11 \times 10^2 + 7.51 \times 10^0$

$-1.11 \times 10^2 + .0751 \times 10^2$

$-1.11 \times 10^2 + .08 \times 10^2$

1.03×10^2

$1.13 \times 10^2 - 1.03 \times 10^2$

$0.10 \times 10^2 = 10$ Ans

gate 2004/7 Let A = 11111010 and B 0000 1010 be two 8-bit 2's complement numbers Their product in 2's complement is

A) 11000100 ✓ Ans
B) 10011100
C) 10100101
D) 11010101

A) 11111010
$-00110 = -6$

B) $00001010 = 10$

$-6 \times 10 = -60$

$00111100 = +60$

$11000100 = -60$ Ans

gate 2004 The number $(123456)_8$ is quivalent to

A $(A72E)_{16}$ and $(22130232)_4$ ✓ Ans
B $(A72E)_{16}$ and $(22131122)_4$
C $(A73E)_{16}$ and $(22130232)_4$
D $(A62E)_{16}$ and $(22120232)_4$

$(123456)_8 = \underbrace{0010}_{A}\underbrace{1001}_{7}\underbrace{1100}_{2}\underbrace{1011}_{E}$ ... 001 010 011 100 101 110

A 7 2 E

gate 2005

The range of integers that can be represented by an n bit 2's complement number system is:

A -2^{n-1} to $(2^{n-1}-1)$ ✓ Ans
B $-(2^{n-1}-1)$ to $(2^{n-1}-1$
C -2^{n-1} to 2^{n-1}
D $-(2^{n-1}+1)$ to $(2^{n-1}-1)$

sign bit signbit

SMR, 1's $\Rightarrow -2^{n-1}-1$ to $2^{n-1}-1$

for -ve 0 for +ve 0

2's $\rightarrow -2^{n-1}$ to $2^{n-1}-1$

only one representation of "0"

Gate 2005 The hexadecimal representation of $(657)_8$ is:

$(657)_8$

$(110101111)_2$

A 1AF ✓

B D78

C D71

D 32F

1AF Ans

Gate 2005 $(34.4)_8 \times (23.4)_8$ evaluates to

A $(1053.6)_8$ ✓ Ans

B $(1053.2)_8$

C $(10242)_8$

D None of these

```
    344
    234
  -----
   1620
  1254X
 710XX
 ------
 1053.60
```

Gate 2005 Consider the following floating-point format

15	14 … 8	7 … 0
S	E	M

E → Excess 64

Mantissa is a pure ~~form~~ fraction in sign-magn form

The decimal number 0.239×2^{13} has the following hexadecimal representation (without normalization and rounding off):

A 0D24

B 0D 4D

C 4D 0D

D 4D 3D ✓

$(0.239)_{10}$ —

$$\begin{array}{r} 0.239 \\ \times 2 \\ \hline .478 \end{array} \qquad \begin{array}{r} .478 \\ \times 2 \\ \hline .956 \end{array} \qquad \begin{array}{r} 956 \\ \times 2 \\ \hline 1.912 \end{array}$$

$$\begin{array}{r} .912 \\ \times 2 \\ \hline 1.824 \end{array} \qquad \begin{array}{r} 824 \\ \times 2 \\ \hline 1.648 \end{array} \qquad \begin{array}{r} 648 \\ \times 2 \\ \hline 1.296 \end{array} \qquad \begin{array}{r} 296 \\ \times 2 \\ \hline .592 \end{array}$$

$$\begin{array}{r} 592 \\ \times 2 \\ \hline 1.184 \end{array}$$

$(0.239)_{10} \rightarrow (00111101)_2$

Ex – 64 + 13 → $\underbrace{100}_{4}\,\underbrace{1101}_{D}\,\underbrace{0011}_{3}\,\underbrace{1101}_{D}$

4D3D Ans

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gate 2005

15	14 ... 8	7 ... 0
S	E	M

Excess 64

The normalized representation for the above format is specified as follow. The mantisa has an implicit 1 preceding the binary (radix) point. Assume that only 0's are padded in while ~~shiftin~~ shifting a field.

The normalized representation of the above number (0.239×2^{13}) is:

A. 0A 20
B. 11 34
C. 49 D0
D. 4A E8 ✓

$0.239 \times 2 = 0.478$
$0.478 \times 2 = 0.956$
$0.956 \times 2 = 1.912$
$0.912 \times 2 = 1.824$
$0.824 \times 2 = 1.648$
$0.648 \times 2 = 1.296$
$0.296 \times 2 = 0.592$
$0.592 \times 2 = 1.184$

8 digit because mentisa of 8 bit
0011 1101

$0.0011\,1101 \times 2^{13}$

in normalized form $= 1.11101000 \times 2^{10}$
Exponent $= 10$
Excess $= 64$
$64 + 10 = 74$

$$\underbrace{1001010}_{}\,\underbrace{1110}_{}\,\underbrace{1000}_{} \quad \text{4 A E 8} = (4AE8)_{16}$$

Ans

gate 2006 : The addition of 4 bit two's Complement binary numbers 1101 and 0100 result in:

A 0001 and an overflow
B 1001 " no "
C 0001 " no " ✓
D 1001 " an "

$$\begin{array}{r} 0100 \\ 1101 \\ \hline 0001 \end{array}$$ Ans

gate 2007 $(C012.25)_H - (10111001110.101)_B$

A $(135103.412)_O$ ✓ Ans
B $(564611.412)_O$
C $(564411.205)_O$
D $(135103.205)_O$

$(C012.25)_H \rightarrow$ 1100 0000 0001 0010 . 0010 0101
10111001 1110 . 10100000
1 01 1 1 0 1 001000 011 . 1 00001010
3 . 4 1 2

gate 2008 The following bit pattern represent a floating point number in IEEE 754 Single precision format

1 10000011 10100000000 0000----

S E M

$-1.101 \times 2^4 = -11010 = -26$

Ans

Date:
Page No.

gate 2008 In the IEEE floating point representation the hexadecimal value 0x 0000 0000 corresponds to

A The normalized value 2^{-127}

B " " " 2^{-126}

C " " " $+0$

D The special value $+0$ ✓

gate 2008 Let r denote number radix. The only value of r that satisfy the equation $\sqrt{121_r} = 11_r$ is:

A decimal 10

B " " 11

C " 10 and 11

D any value > 2

$$\sqrt{r^2+2r+1}$$

$$\sqrt{(r+1)^2}$$

$$r+1 = (11)_r$$