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①

Q3.1) What is 5ED4-07A4 when these values represent unsigned 16-bit hexadecimal numbers? The result should be written in hexadecimal. Show your work.

Ans

First lets convert the hexadecimal Numbers to the binary number.

$(5ED4)_{16} = (0101\ 1110\ 1101\ 0100)_2$

$(07A4)_{16} = (0000\ 0111\ 1010\ 0100)_2$

Taking 2's compliment of $(07A4)_{16}$, we get

0000 0111 1010 0100

1111 1000 0101 1011

+ 1

$(1111\ 1000\ 0101\ 1100)_2$

Adding the Numbers we get

0101 1110 1101 0100

1111 1000 0101 1100

$\boxed{1}(0101\ 0111\ 0011\ 0000)_2$

Hence, After converting to Hex, we get $\boxed{5730_{16}}$

Q3.2 What is 5ED4 - 07A4 when these values represent signed 16-bit hexadecimal numbers stored in sign-magnitude format? The result should be written in Hexadecimal. Show your work.

ANS Let us convert the Hexadecimal to Binary.

5ED4 = 0101 1110 1101 0100

07A4 = 0000 0111 1010 0100.

Neither one have a sign bit set, so the math is same as unsigned math.

The subtraction will as follows:-

$$
\begin{array}{lr}
5ED4 & 0101\ 1110\ 1101\ 0100 \\
-\,07A4 & 0000\ 0111\ 1010\ 0100 \\
\hline
 & \underbrace{0101}_{5}\ \underbrace{0111}_{7}\ \underbrace{0011}_{3}\ \underbrace{0000}_{0}
\end{array}
$$

After converting into Hex, we get $(5730)_{16}$

2

Q3.3 Convert 5ED4 into a binary number. What makes base 16 (Hex) an attractive numbering system for representing Values in computers?

Ans Converting the 5ED4 in Binary we get,

$$(5ED4)_{16} = (0101\ 1110\ 1101\ 0100)_2$$

Base 16 is an attractive numbering system for representing Values in computer because

① 16 = 2^4, so each digit in a hexadecimal number displays 4 bits. Due to this, a byte (8 bits) can be specified by exactly 2 hex digits. This makes the representation easy & accurate

② It allows large numbers to be displayed in less digits, for example, In binary the decimal No 1000 is written as 1111101000 which is 10 digits and the same number in Hex is written as 3E8 which is just 3 digits

Q3.8> Assume 185 and 122 are signed 8-bit decimal integers stored in sign magnitude format. calculate 185 ~~and~~ + 122. Is there overflow, underflow, or neither.

Ans

Let us convert the decimal in Binary,

$$
\begin{array}{rcr}
(185)_{10} & = & 10111001 \\
-\ (122)_{10} & = & 01111010 \\
\hline
 & & (00111111)_2
\end{array}
$$

$$(00111111)_2 = (63)_{10}$$

As, We are subtracting the operands of the same sign, we end up by adding operands of different sign. Hence overflow does Not occur in this case.

Q3.9 Assume 151 and 214 are signed 8 bit decimal integers stored in two's complement format. Calculate 151 + 214 using saturating arithmetic. The result should be written in decimal. Show your work.

Ans Convert the decimal in binary.

$151 = (10010111)_2$

$214 = (11010110)_2$

Now, taking two's complements of each, we get

	151	214
	10010111	11010110
1's complement =	01101000	00101001
Add 1	1	+ 1
2's complement =	01101001	00101010

Now adding 151 + 214

$$
\begin{array}{r}
01101001 \\
00101010 \\
\hline
10010011
\end{array}
$$

Since, the sign bit set it means the result is negative. In A+B, when A≥0 and B≥0 and the result is negative means there is overflow so the result cannot be determined correctly in decimal.

Q3.10 Assume 151 and 214 are signed 8-bit integers ~~Calculate~~ ~~151~~ stored in 2's complement format. Calculate 151 - 214 using saturating arithmetic. The result should be written in decimal. Show your work?.

Ans. Converting decimal into binary we get,

$(151)_{10} = 10010111$

$(214)_{10} = 11010110$

Now taking 2's complement of each,

$(151)_{10} = 10010111$

1st complement = 01101000

Add 1 + 1

2's complement 01101001

$(214)_{10} = 11010110$

00101001

+1

00101010

Now performing subtraction we get,

151	01101001
-214	00101010
	00111111

The sign bit is Not set. Hence it is a positive No. The decimal No is $(63)_{10}$

Q3.11 Assume 151 and 214 are unsigned 8 bit integers. Calculate 151 + 214 using saturating arithmetic. The result should be written in decimal. Show your work?

Converting Decimal to binary we get,

$(151)_{10} = (10010111)_2$

$(214)_{10} = (11010110)_2$.

Performing the Addition we get.

$$
\begin{array}{lcr}
(151)_{10} & = & 10010111 \\
(214)_{10} & = & 11010110 \\
\hline
 & & \boxed{1}\,01101101
\end{array}
$$

As it is the unsigned bit, the overflow are ignored.

Hence the result is $(109)_{10}$

Q3·20

What decimal Number does the bit Pattern represent 0X0C000000, if it is ~~an~~ a 2's compliment integer? An unsigned integer?

Ans First We need to convert the No. in binary.

0x0C000000 = 00001100 0000 0000 0000 0000 0000 0000

(a) Taking 2's complement we get.

0x0C000000 = 0000 1100 0000 0000 0000 0000 0000 0000

1st complement = 1111 0011 1111 1111 1111 1111 1111 1111

Add 1 = + 1

1111 0100 0000 0000 0000 0000 0000 0000

As the sign bit is set it is a -ve No.

The decimal equivalent is = $\boxed{-(4093640704)_{10}}$

(b) If it is an unsigned Integer, we get

0x0C000000 = 0000 1100 0000 0000 0000 0000 0000 0000

$\boxed{=(201326592)_{10}}$

(5)

Q3.21 If the bit Patter 0x0C000000 is Placed into the Instruction Register, What MIPS instruction will be executed?

ANS To Place 0x0C0000 into the instruction Register, the MIPS instruction is

$$\boxed{\text{add \$t1, \$t1, 0x0C000000}}$$

Q3.22 What decimal No. does the bit pattern 0x0C0000 represent if it is a floating Point number? Use IEEE 754 Standard.

Ans> Convert 0x0C000000 into binary we get 0000 0000 0000

= 0000 1100 0000 0000 0000 0000

Sign(1)	Exponent (8)	fraction(23)
0	000 1100 = 24	00000000000000000000000 = 0

By using IEEE 754 standard-

$= (-1^{sign}) * (1+fraction) * 2^{Exponent-127}$

$= (-1)^0 * (1+0) * 2^{24-127}$

$= (-1)^0 * (1) * 2^{-103}$

$\boxed{\text{Decimal value} = 9.8607613e-32}$