1.

a)

45.2310

45 / 16 = 2 Remainder : 13

2 / 16 = 0 2

45 = 2D

0.23 \* 16 = 3 .68

0.68 \* 16 = 10 .88

0.88 \* 16 = 14 .08

0.08 \* 16 = 1 .28

0.28 \* 16 = 4 .48

.48 \* 16 = 7 .68

0.68 \* 16 = 10 0.88

0.88 \* 16 = 14 0.08000004

0.08000004 \* 16 = 1 0.28

0.28 \* 16 = 4 0.48

0.48 \* 16 = 7 0.68

0.68 \* 16 = 10 0.8828

0.8828 \* 16 = 14 0.125

0.125 \* 16 = 2 0

**45.2310 = 2D.3AE147AE147AE216**

45.2310

45 / 2 = 22 1

22 / 2 = 11 0

11 / 2 = 5 1

5 / 2 = 2 1

2 / 2 = 1 0

1 / 2 = 0 1

4510 = 1011012

0.2310

0.23 \* 2 = 0 .46

0.46 \* 2 = 0 .92

0.92 \* 2 = 1 .84

0.84 \* 2 = 1 .68

0.68 \* 2 = 1 .36

0.36 \* 2 = 0 .72

0.72 \* 2 = 1 .44

0.44 \* 2 = 0 .88

0.88 \* 2 = 1 .76

0.76 \* 2 = 1 .52

**45.23= 101101.00111010112**

b)

206.510

|  |  |  |
| --- | --- | --- |
| Number: |  | Remainder |
| 206 / 16 = | 12 | 14 |
| 12 / 16 = | 0 | 12 |

|  |  |  |  |
| --- | --- | --- | --- |
| Decimal Number | | Times | Remainder |
| 0.5 | \* 16 = | 8 | 0 |

**20610 = CE.816**

206.510

|  |  |  |
| --- | --- | --- |
| Number: |  | Remainder |
| 206 / 2 = | 103 | 0 |
| 103 / 2 = | 51 | 1 |
| 51 / 2 = | 25 | 1 |
| 25 / 2 = | 12 | 1 |
| 12 / 2 = | 6 | 0 |
| 6 / 2 = | 3 | 0 |
| 3 / 2 = | 1 | 1 |
| 1 / 2 = | 0 | 1 |

20610 = 110011102

|  |  |  |  |
| --- | --- | --- | --- |
| Decimal Number | |  | Remainder |
| 0.5 | \* 2 = | 1 | 0 |

**206.510 = 11001110.12**

2.

Convert to Base 6: 2B4.3514

2 \* 14^2 = 392

11 \* 14 = 154

4 \* 1 = 4

3 \* (1/14) = 0.21428

5 \* (1/14^2) = 0.02551

2B4.3514 = 550.2397910

422.2397910

|  |  |  |  |
| --- | --- | --- | --- |
| Number: | |  | Remainder |
| 550 / 6 = | | 91 | 4 |
| 91 / 6 = | | 15 | 1 |
| 15 / 6 = | | 2 | 3 |
| 2 / 6 = | | 0 | 2 |
| Decimal Number | | Times | Remainder |
| 0.23979 |  | 1 | 0.43874 |
| 0.43874 |  | 2 | 0.63244 |
| 0.63244 |  | 3 | 0.79464 |
| 0.79464 |  | 4 | 0.76784 |
| 0.76784 |  | 4 | 0.60704 |
| 0.60704 |  | 3 | 0.64224 |
| 0.64224 |  | 3 | 0.85344 |
| 0.85344 |  | 5 | 0.12064 |
| 0.12064 |  | 0 | 0.72384 |

**422.2397910 = 2314.123443356**

3.

a)

11

1111 1111 1111

+ 1110 - 1110 \* 1110

-------------- ---------- ----------------------

**11101** **0001** 0000

11110

111100

+ 1111000

--------------------

**11010010**

b)

11 1

111001 111001 111001

+ 1001 - 1001 \* 1001

-------------- ---------- ----------------------

**1000010** **110000** 111001

+ 111001000

--------------------

**1000000001**

c)

11 11 1111

111001 111001 111001

+ 1011 - 1011 \* 1011

-------------- ---------- ----------------------

**1000100 101100**  111001

1110010

**+** 111001000

--------------------

**1001110011**

4.

Convert to Octal. Convert to Hexadecimal. Then convert both to decimal to verify they’re the same.

a)

111011001.112

Binary decimals would mean the first digit is ½ and the second is ¼

So our fraction is ¾. Thus, we only need to figure out what is ¾ of both 16 and 8.

3 / 4 = 6 / 8 = 12 / 16

8 = 2 ^ 3

111 011 001 11 = **731.68**

16 = 2^4

1 1101 1001 11 = **1D9.C16**

(7\*8^2) + (3\*8) + 3 + (6/8)= 448 + 24 + 1 = 473.7510

(1 \* 16^2) + (13\*16) + 9 + (12/16) = 256 + 208 + 9 = 473.7510

Therefore, my answers must be correct.

b)

11000011001.012

Our fraction here is ¼.

1 / 4 = 2 / 8 = 4 / 16

Thus the extra decimal will be

11 000 011 001 = **3031.28**

110 0001 1001 = **619.416**

(3\*8^3) + (3\*8) + 1 + (2/8)= 1536 + 24 + 1 = 1561.2510

(6 \* 16^2) + (1 \* 16) + 9 + (4/16) = 1536 + 16 + 9 = 1561.2510

Therefore, my answers should be right.

5. Devise a scheme for converting base 3 numbers to base 9. Use your method to convert to base 9.

Well, since 9 = 3^2, you can group the base 3 bits into two’s, and convert each digit to it’s respective base 9 digit.

11022.22013

1 10 22 = 1389

Our fraction in base 3 is (2/3) + (2/9) + (1/81) = 54 / 81 + 18/81 + 1/81 = 73 / 81 = 8.1111 / 9

**11022.22013 = 138.811119**

6. 111

1111 1111 1111

+ 1101 - 1101 \* 1101

-------------- ---------------------- ------------------------

**11100** **0010** 1111

111100

+ 1111000

--------------------------

**11000011**

111 1111

1101101 1101101 1101101  
 + 11110 - 11110 \* 11110

-------------- ------------------- ----------------

**10001011** **1001111**  11011010

110110100

1101101000

+ 11011010000

-------------------------

**110011000110**

111 1

111110 111110 111110

+ 1101 - 1101 \* 1101

---------------- -------------- ------------------

**1001011 110001** 111110

11111000

+ 111110000

-------------------- **1100100110**

7.

Convert to hexadecimal, then give the ASCII code for resulting hexadecimal (including code for decimal point)

1. 212.210

|  |  |  |
| --- | --- | --- |
| Number: |  | Remainder |
| 212 | 13 | 4 |
| 13 | 0 | 13 |

|  |  |  |  |
| --- | --- | --- | --- |
| Decimal Number | | Times | Remainder |
| 0.2 |  | 3 | 0.2 |
| 0.2 |  | 3 | 0.2 |
| 0.2 |  | 3 | 0.2 |
| 0.2 |  | 3 | 0.2 |

Thus, 212.210 = D4.3333333

1. 181.1810

|  |  |  |
| --- | --- | --- |
| Number: |  | Remainder |
| 181 | 11 | 5 |
| 11 | 0 | 11 |

|  |  |  |  |
| --- | --- | --- | --- |
| Decimal Number | | Times | Remainder |
| 0.18 |  | 2 | 0.88 |
| 0.88 |  | 14 | 0.08 |
| 0.08 |  | 1 | 0.28 |
| 0.28 |  | 4 | 0.48 |
| 0.48 |  | 7 | 0.68 |
| 0.68 |  | 10 | 0.88 |
| 0.88 |  | 14 | 0.079999998 |
| 0.079999998 |  | 1 | 0.279999971 |
| 0.279999971 |  | 4 | 0.479999542 |
| 0.479999542 |  | 7 | 0.679992676 |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

**Thus, 181.1810 = B5.2E147AE**

8.

a)

11010 - 11100 = ?

The one’s complement of 11100 is 00011. The two’s complement of 11100 is 00100.

One’s: Two’s:

11010 11010

+ 00011 + 00100

-------------- -----------

11101 11110

There is no overflow because there is no carry-over and thus the answer can in fact fit in a five bit number.

b) 01011 – 11100 = ?

The one’s complement of 11100 is 00011. The two’s complement is 00100.

One’s: Two’s:

01011 01011

+ 00011 + 00100

-------------- -----------

01110 01111

There is no overflow because there is no carry-over and thus the answer can in fact fit in a five bit number.

1. 10101 – 01010 = ?

The one’s complement of 01010 is 10101. The two’s complement of 01010 is 10110.

One’s: Two’s:

1 1 1

10101 10101

+ 10101 + 10110

-------------- -----------

01011 01011

Overflow has occurred in both one’s and two’s complement because -15 cannot be represented in a five bit signed number.

1. 10111 – 11010 = ??

The one’s complement of 11010 is 00101. The two’s complement is 00110.

One’s: Two’s:

111 11

10111 10111

+ 00101 + 00110

-------------- -----------

11100 11101

Overflow has not occurred because there is no carry-over thus the answer fits in a five bit number.

9.

Construct a table for 4-3-2-1 weighted code and write 8147 using this code

|  |  |
| --- | --- |
| 1 | 0001 |
| 2 | 0010 |
| 3 | 0100 |
| 4 | 1000 |
| 5 | 1001 |
| 6 | 1010 |
| 7 | 1100 |
| 8 | 1101 |

So 8147 would be **1101 0001 1000 11000.**