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CISP - 440

Assignment 0.1

9/6/2018

Part 0 - Common Bases.

Description:

The goal for this section of the assignment was to perform mathematical conversions on several different numbers from many different systems. This included hexadecimal, decimal, octal, and binary.

Problem 1:

Convert 1234 decimal to binary.

Look at binary chart:

32768	16384	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2	1
2^15	2^14	2^13	2^12	2^11	2^10	2^9	2^8	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0

By examining this chart and figuring out the corresponding sizes that the number fits into we can determine what the binary digit would be.

1024 + 128 + 64 + 16 + 2 = 1234

Thus the binary number would be:

0100 1101 0010

Problem 2:

Convert ABBA base 16 to decimal.

Look at hex chart:

4096	256	16	1
16^3	16^2	16^1	16^0

Recognize that A = 10 & B = 11 in decimal.

The answer can be found by multiplying the decimal value in the corresponding spot with the corresponding decimal equivalent.

(10 * 4096) + (11 * 256) + (11 * 16) + (10 * 1) = 43962

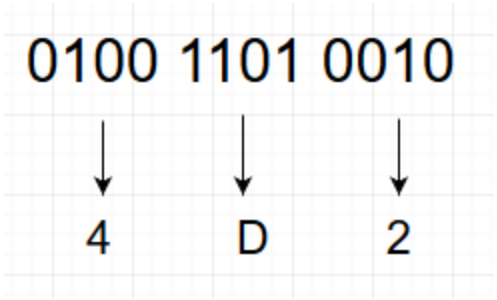
Thus the decimal number would be:

43,962

Problem 3:

Convert 1234 base ten to hexadecimal.

In a previous problem we converted 1234 to binary. If we use that binary number we can easily find the hexadecimal equivalent.



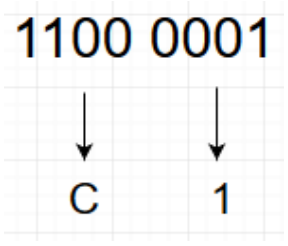
Thus the answer would be:

4D2

Problem 4:

Convert 1100 0001 binary to hexadecimal.

Using the same process in the above problem we can solve for the hexadecimal equivalent.



Thus the answer would be:

C1

Problem 5:

Convert 11,000,001 decimal to hexadecimal.

We can perform this conversion simply and painlessly by using the MOD DIV algorithm structure. To do this, we will divide the number by 16 to some power and capture the remainder until our division answer is zero.

MOD	DIV
11,000,001 % 16^5 = 514,241	11,000,001 / 16^5 = 10
514,241 % 16^4 = 55,489	514,241 / 16^4 = 7
55,489 % 16^3 = 2241	55,489 / 16^3 = 13
2241 % 16^2 = 193	2241 / 16^2 = 8
193 % 16^1 = 1	193 / 16 = 12
1 % 16^0 = 1	

By examining these calculations we can take the remainders and convert to hex giving us this answer:

A7 D8C1

Problem 6:

Convert 1234567 octal to decimal.

To convert this octal number to decimal we can just multiply each number by their decimal equivalents.

(1 * 8^6) + (2 * 8^5) + (3 * 8^4) + (4 * 8^3) + (5 * 8^2) + (6 * 8^1) + (7 * 8^0) = 342,391

Thus the decimal number would be:

342,391

Problem 7:

Convert 1234567 octal to hexadecimal.

In the previous problem we converted 1234567 octal to decimal. If we use the decimal number we can perform this conversion painlessly.

MOD	DIV
342,391 % 16^4 = 14,711	342,391 / 16^4 = 5
14,711 % 16^3 =2423	14,711 / 16^3 = 3
2423 % 16^2 = 119	2423 / 16^2 = 9
119 % 16^1 = 7	119 / 16^1 = 7
7 % 16^0 = 7	

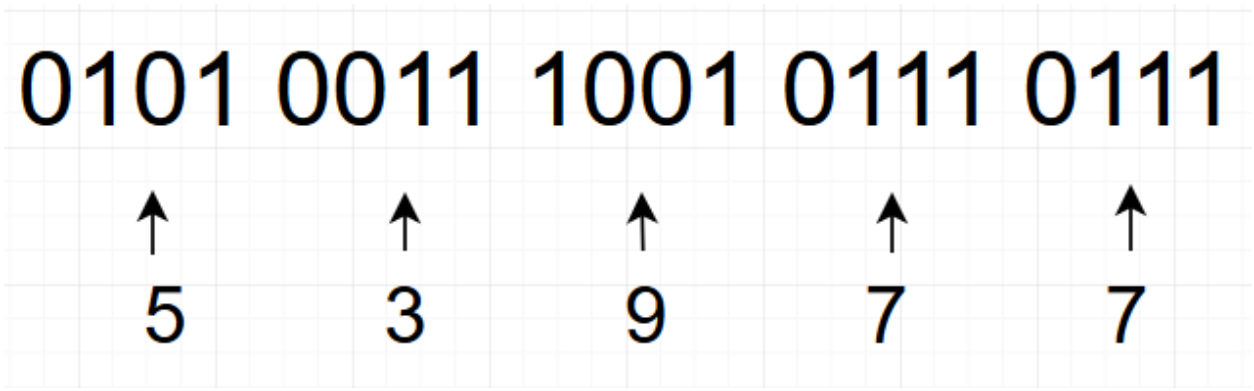
By examining these calculations we can take the remainders and convert to hex giving us this answer:

5 3977

Problem 8:

Convert 1234567 octal to binary.

In the previous problem, we converted 1234567 octal to hex. If we use the hex number we can perform this conversion painlessly.



Thus the binary answer would be:

0101 0011 1001 0111 0111

Part 1 - Other Bases.

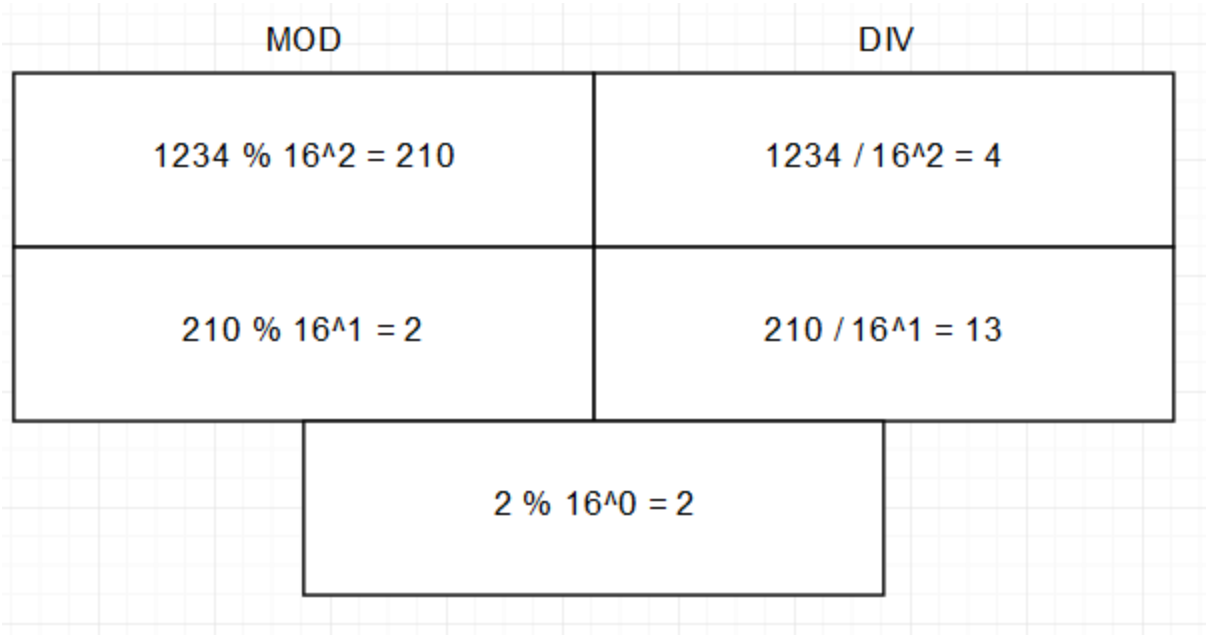
Description:

The goal for this section of the assignment was to perform mathematical conversions on several different numbers from many different systems. This included numbers from a various degree of systems. In addition we were told to use the following digit sequence for our bases.
123456789ABCDEFGHIJKLMNOPQRSTUVWXYZ

Problem 1:

Convert 1234 base 10 to base 16.

We can perform this conversion using the Mod Div process.



Thus the answer would be:

4D2

Problem 2:

Convert 1234 base 16 to base 10.

To convert this hex number to decimal we can just multiply each number by their decimal equivalents.

(1 * 16^3) + (2 * 16^2) + (3 * 16^1) + (4 * 16^0) = 4660

Thus the answer would be:

4660

Problem 3:

Convert 4567 base 10 to base 5.

Refer to base 5 chart:

78125	15625	3125	625	125	25	5	1
5^7	5^6	5^5	5^4	5^3	5^2	5^1	5^0

By examining this chart and figuring out the corresponding sizes that the number fits into we can determine what the binary digit would be.

4567 / 3125 = 1 with remainder 1442
1442 / 625 = 2 with remainder 192
192 / 125 = 1 with remainder 67
67 / 25 = 2 with remainder 17
17 / 5 = 3 with remainder 2
2 / 1 = 2 with remainder 0

Thus the answer would be:

121232

Problem 4:

Convert 1234 base 5 to base 10.

To convert this hex number to decimal we can just multiply each number by their decimal equivalents.

(1 * 5^3) + (2 * 5^2) + (3 * 5^1) + (4 * 5^0) = 194

Thus the answer would be:

194

Problem 5:

Convert 1234 base 7 to base 9.

First we will convert 1234 base 7 to base 10.

(1 * 7^3) + (2 * 7^2) + (3 * 7^1) + (4 * 7^0) = 466

Now we will take our base 10 number 466 and convert to base 9 using the following chart.

729	81	9	1
9^3	9^2	9^1	9^0

466 / 81 = 5 with remainder 61
61 / 9 = 6 with remainder 7
7/1 = 7 with remainder 0

Thus the answer would be:

567

Problem 6:

Convert 4567 base 10 to base 24.

To perform this conversion we will use the following chart.

576	24	1
24^2	24^1	24^0

4567 / 576 = 7 with remainder 535
535 / 24 = 22 with remainder 7
7 / 1 = 7 with remainder 0

Thus the answer would be:

7M7

Problem 7:

Convert 4567 base 24 to base 2.

First we will convert 4567 base 24 to base 10.

(4 * 24^3) + (5 * 24^2) + (6 * 24^1) + (7 * 24^0) = 58,327

Now we will examine the following chart and add up the necessary values to convert to base 2.

32768	16384	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2	1
2^15	2^14	2^13	2^12	2^11	2^10	2^9	2^8	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0

32,768 + 16,384 + 8192 + 512 + 256 + 128 + 64 + 16 + 4 + 2 + 1 = 58,327

Thus the answer would be:

1110 0011 1101 0111

Problem 8:

Convert FIVE base 36 to base 19 (FIVE != 5).

First we will convert FIVE base 36 to base 10.

(15 * 36^3) + (18 * 36^2) + (31 * 36^1) + (14 * 36^0) = 724,298

Now we will use the following chart to convert to base 19.

130,321	6859	361	19	1
19^4	19^3	19^2	19^1	19^0

724,298 / 130,321 = 5 with remainder 72,693
72,693 / 6859 = 10 with remainder 4103
4103 / 361 = 11 with remainder 132
132 / 19 = 6 with remainder 18
18 / 1 = 18 with remainder 0

Thus the answer would be:

5AB6I

Problem 9:

Convert THREE base 28 to base 10 (THREE != 3).

To convert we can simply multiply each section of the number by its base 10 equivalent.

(29 * 28^4) + (17 * 28^3) + (27 * 28^2) + (14 * 28^1) + (14 * 28^0) = 18,219,782

Thus the answer would be:

18,219,782

Problem 10:

Convert 1234 base 10 to base 36.

We can convert this number using the following chart.

1296	36	1
36^2	36^1	36^0

1234 / 36 = 34 with remainder 10
10 / 1 = 10 with remainder 0

Thus the answer would be:

YA

Part 2 - DNA.

Description:

The goal for this section of the assignment was to perform mathematical conversions on several different numbers from a certain system. This system is called DNA. The letters CTAG refer to the values 0123 thus making a base 4 system.

Problem 1:

Convert ACT to base 10.

To perform this conversion we can simply multiply each number with their corresponding value in decimal.

(2 * 4^2) + (0 * 4^1) + (1 * 4^0) = 33

Thus the answer would be:

33

Problem 2:

Convert ATTGC to base ten.

To perform this conversion we can simply multiply each number with their corresponding value in decimal.

(2 * 4^4) + (1 * 4^3) + (1 * 4^2) + (3 * 4^1) + (0 * 4^0) = 604

Thus the answer would be:

604

Problem 3:

Convert TTAA to base ten.

To perform this conversion we can simply multiply each number with their corresponding value in decimal.

(1 * 4^3) + (1 * 4^2) + (2 * 4^1) + (2 * 4^0) = 90

Thus the answer would be:

90

Problem 4:

Convert 1234 base ten to DNA format.

Using the following chart we can easily convert to DNA format.

1024	256	64	16	4	1
4^5	4^4	4^3	4^2	4^1	4^0

1234 / 1024 = 1 with remainder 210
210 / 64 = 3 with remainder 18
18 / 16 = 1 with remainder 2
2 / 4 = 0 with remainder 2
2 / 1 = 2 with remainder 0

Thus the answer would be:

TGTCA

Problem 5:

Convert 20 base ten to DNA format.

Using the chart from problem 4 we can easily convert to DNA format.

20 / 16 = 1 with remainder 4
4 / 4 = 1 with remainder 0

Thus the answer would be: (next page)

TTC

Problem 6:

Look up the 4 codons for the amino acid alanine and convert them to base ten.

After doing a quick Google search I figured out that the 4 codons for Alanine are as follows:

GCT, GCC, GCA, GCG

Converting the first to base ten.

(3 * 4^2) + (0 * 4^1) + (1 * 4^0) = 49

Converting the second to base ten.

(3 * 4^2) + (0 * 4^1) + (0 * 4^0) = 48

Converting the third to base ten.

(3 * 4^2) + (0 * 4^1) + (2 * 4^0) = 50

Converting the fourth to base ten.

(3 * 4^2) + (0 * 4^1) + (3 * 4^0) = 51

Thus the answers would be:

49 48 50 51

Problem 7:

Explain how to group a binary string so that it can be easily converted to DNA format. Give an example.

A binary string can be very easily converted to DNA format because binary as a base 2 system can easily represent the corresponding DNA letter with two digits of binary. Refer to the following example for further clarification.

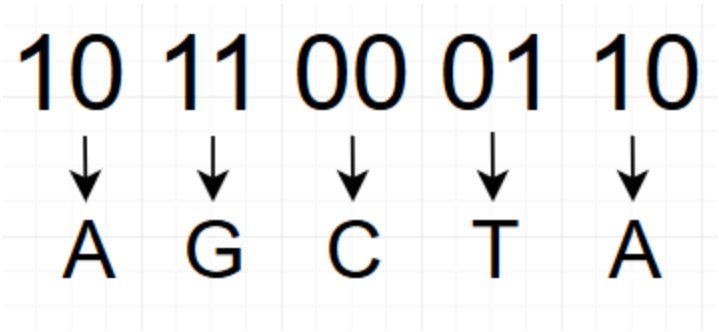
If we start with the following binary string:

1011000110

We can split this binary string into parts of two.

10 11 00 01 10

Then perform the conversion linking each binary part to its corresponding DNA representation.



Part 3 - Colors.

Description:

The goal for this section of the assignment was to perform mathematical conversions on several different numbers from a certain system. This system is called Color Code. The words RED, BlUE, GREEN refer to the values 012. Thus making a base 3 system.

Problem 1:

What is 1234 decimal in Color Code?

To perform this conversion we will refer to the following chart.

2187	729	243	81	27	9	3	1
3^7	3^6	3^5	3^4	3^3	3^2	3^1	3^0

1234 / 729 = 1 with remainder 505
505 / 243 = 2 with remainder 19
19 / 81 = 0 with remainder 19
19 / 27 = 0 with remainder 19
19 / 9 = 2 with remainder 1
1 / 3 = 0 with remainder 1
1 / 1 = 1 with remainder 0

Thus the answer would be:

BLUE GREEN RED RED GREEN RED BLUE

Problem 2:

Explain how yellow would be represented in this Color Code?

As Color Code currently exists YELLOW has no place. As a base 3 system with all values possible already named it would be illegal to add another value. The only way that Color Code could support YELLOW would be if we change Color Code into a base 4 system. In that case YELLOW would take the value of 4.

Problem 3:

What is your favorite color, in this Color Code?

Clearly the answer is BLUE since it represents the first number with any value in this system. Thus, without BLUE the system would fall apart and be useless. Though, that could be said about any number in the system.

Conclusion

This assignment proved to be tedious. I personally did not expect it to take this long to perform all of the requested operations (4hrs). However, I am happy that this task was assigned. By doing all of the requested mathematical conversions I was able to remind myself on how everything worked. Overall, a very valuable learning experience.