Binary 0, 1 base 2

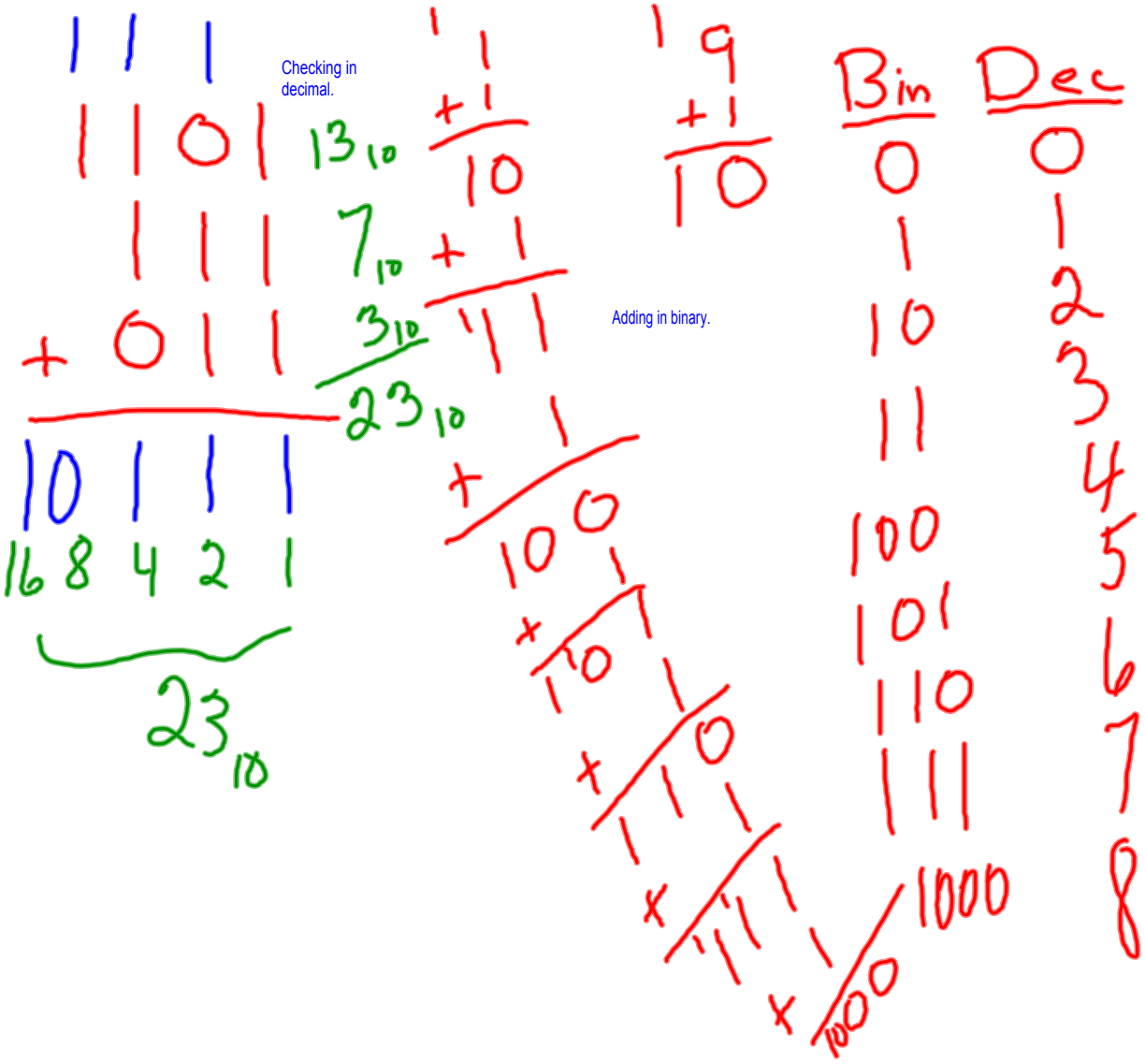
Review of binary conversions.

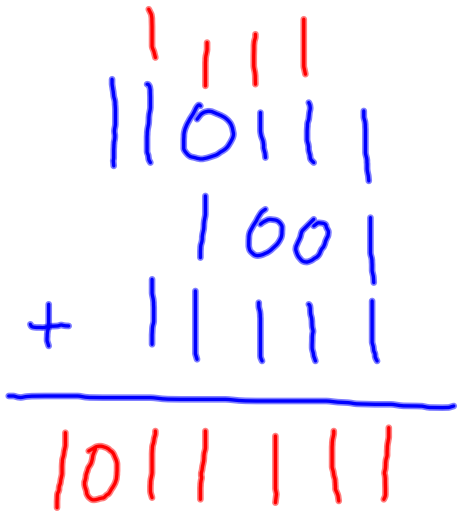
1	0	1	1	0	face
1	0	1	1	0	place value
2^5	2^4	2^3	2^2	2^1	2^0	positional value
32	16	8	4	2	1	

$1 \times 16 = 16$
$0 \times 8 = 0$
$1 \times 4 = 4$
$1 \times 2 = 2$
$0 \times 1 = 0$

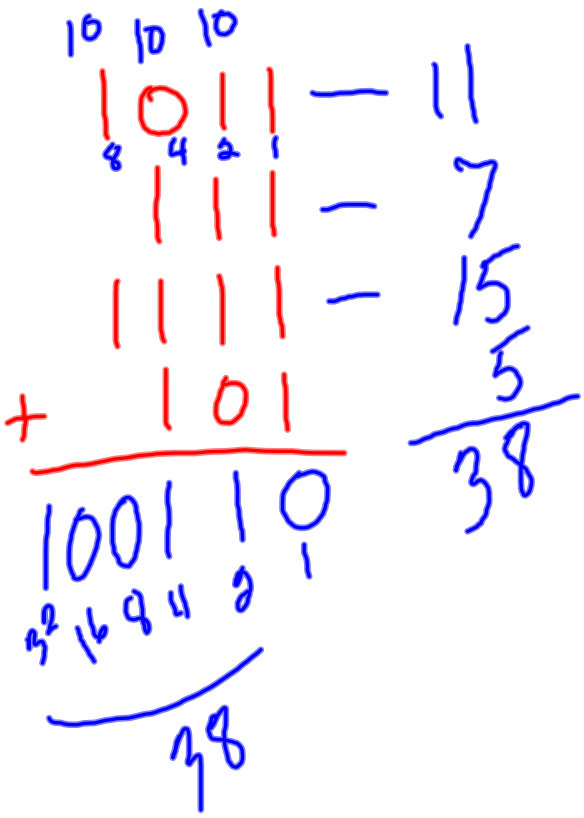
22_{10}

22_{10}
-16
6
-4
2
-2
0

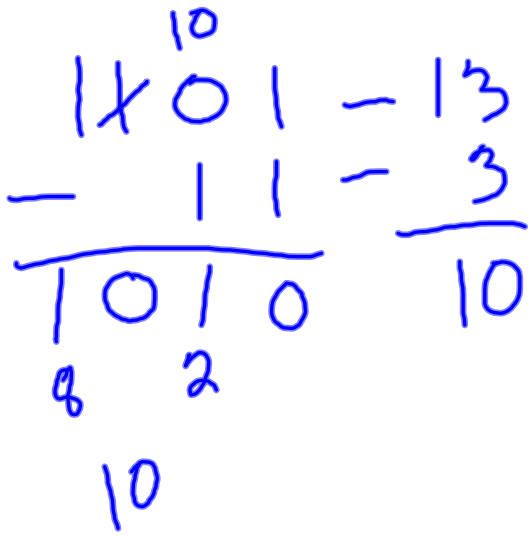

Checking in decimal.
Adding in binary.
Bin
Dec



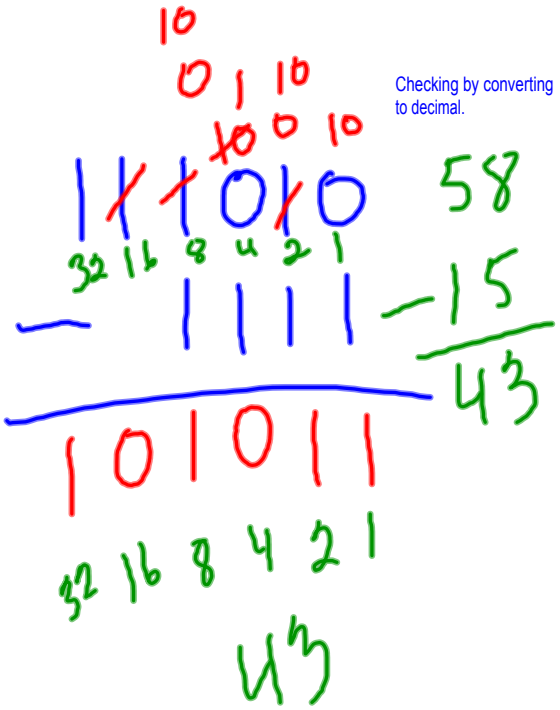
Checking by converting to decimal.

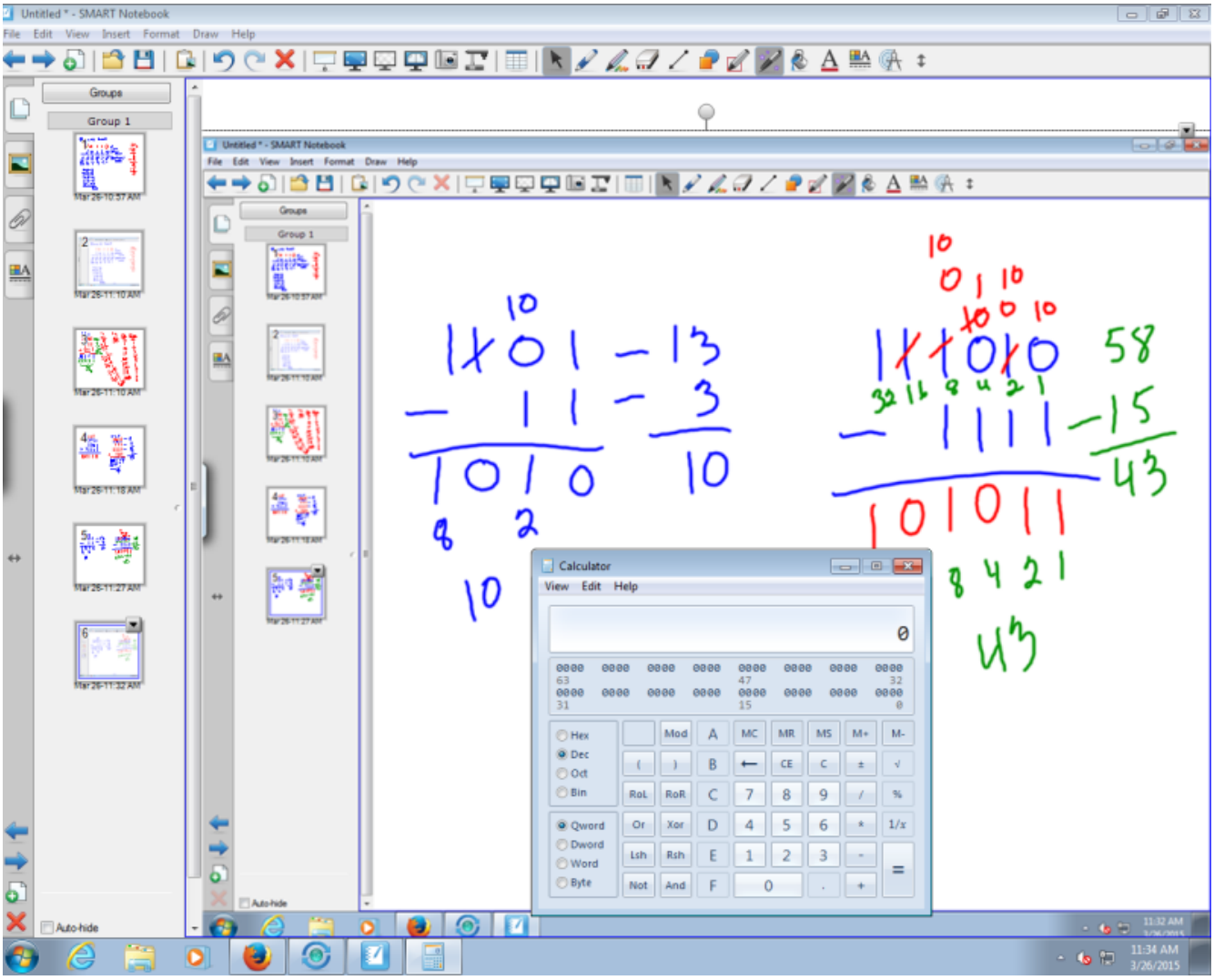


Subtract in binary.



Checking by converting to decimal.




Untitled * - SMART Notebook
File Edit View Insert Format Draw Help
Groups
Group 1
Calculator
View Edit Help
Hex
Dec
Oct
Bin
Qword
Dword
Word
Byte
Auto-hide

Hex base 16

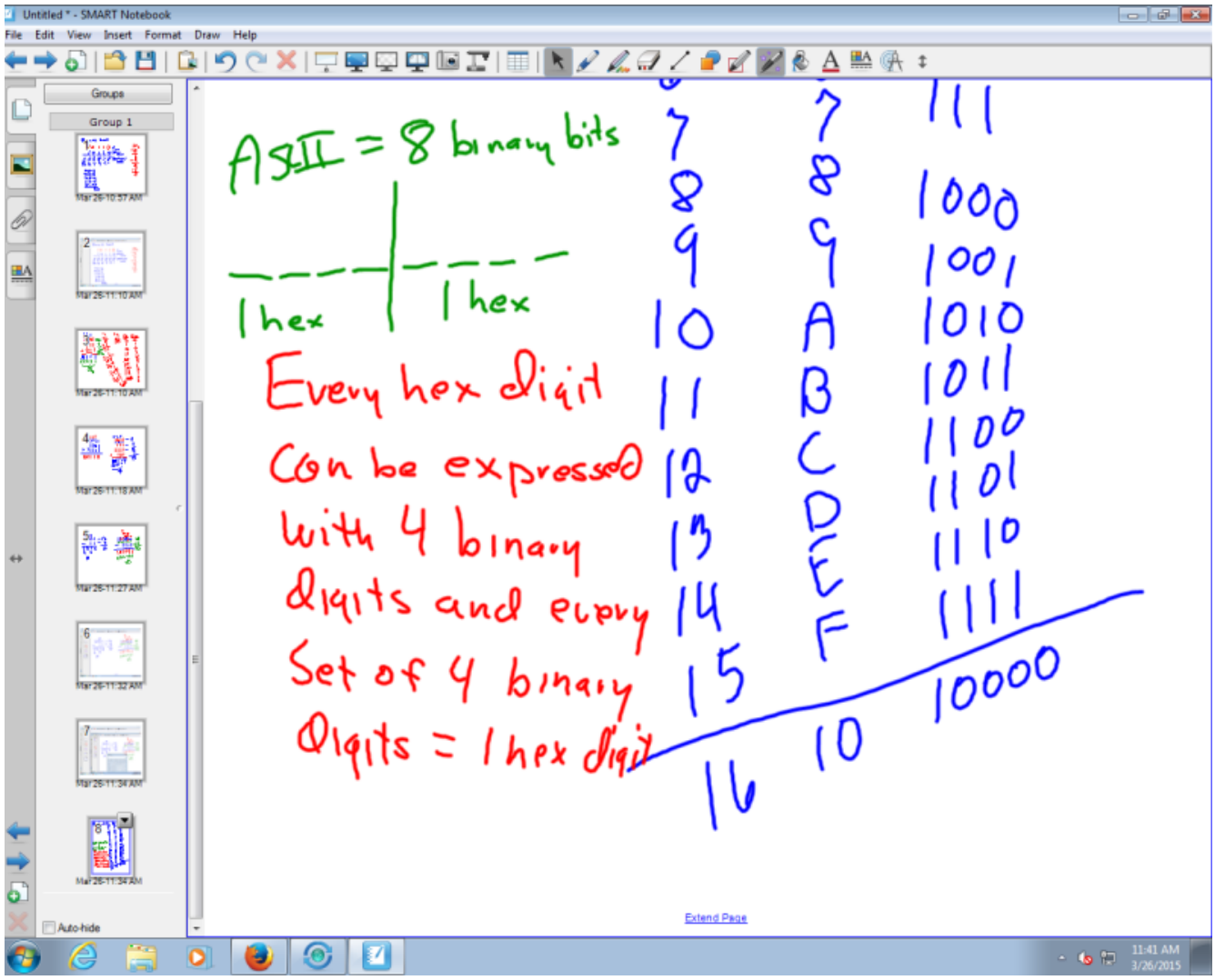
Introducing hexadecimal with characters from 0 to F.

Dec	Hex	Binary
0	0	0
1	1	1
2	2	10
3	3	11
4	4	100
5	5	101
6	6	110
7	7	111
8	8	1000
9	9	1001
10	A	1010
11	B	1011
12	C	1100
13	D	1101
14	E	1110
15	F	1111
16	10	10000

ASII = 8 binary bits

1 hex | 1 hex

Every hex digit can be expressed with 4 binary digits and every set of 4 binary digits = 1 hex digit


Untitled * - SMART Notebook
File Edit View Insert Format Draw Help
Groups
Group 1
ASII = 8 binary bits
1 hex
1 hex
Every hex digit
Can be expressed
with 4 binary
digits and every
Set of 4 binary
Digits = 1 hex digit
7 7 111
8 8 1000
9 9 1001
10 A 1010
11 B 1011
12 C 1100
13 D 1101
14 E 1110
15 F 1111
16 10 10000
Extend Page
Auto-hide
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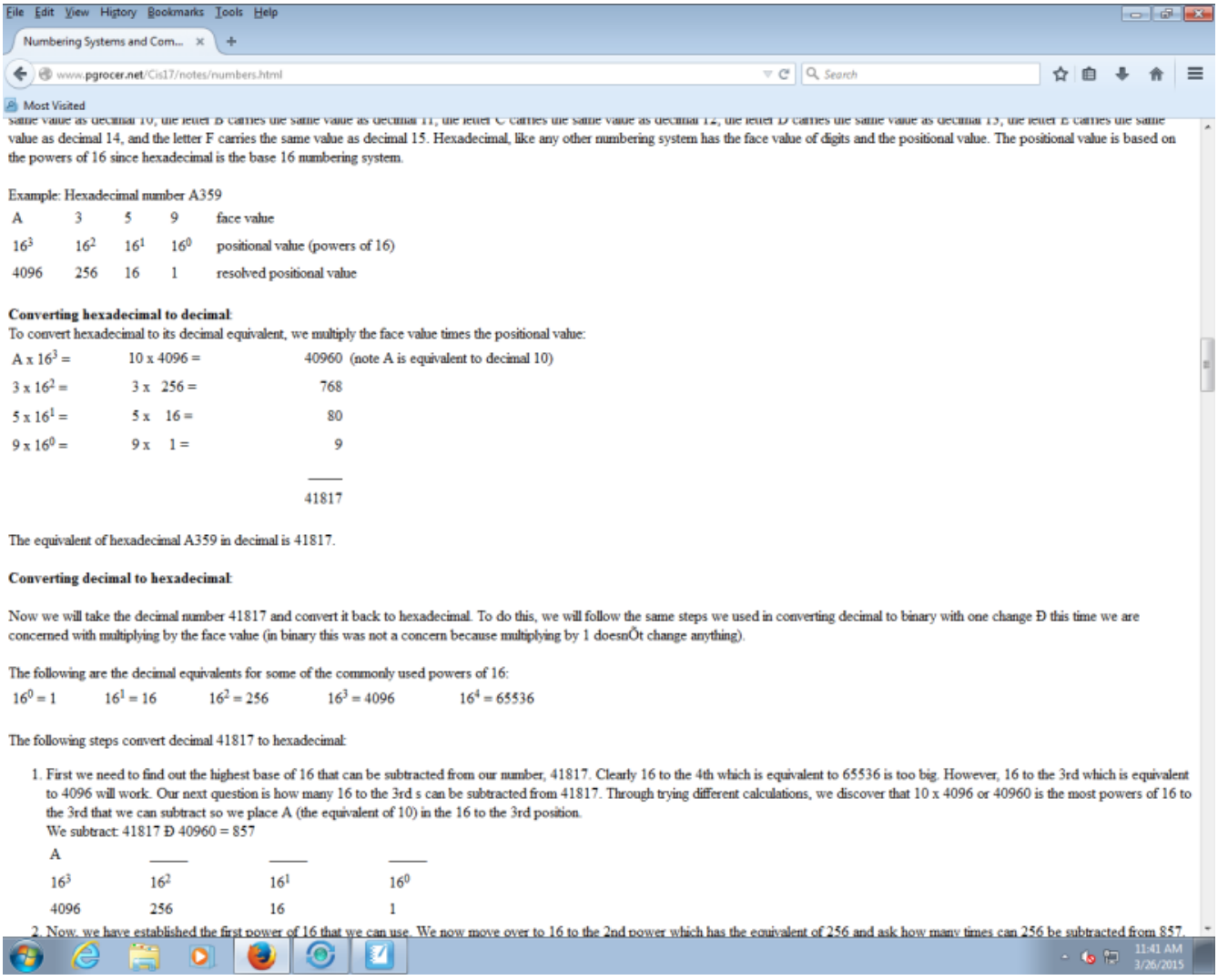
3/26/2015



same value as decimal 10, the letter B carries the same value as decimal 11, the letter C carries the same value as decimal 12, the letter D carries the same value as decimal 13, the letter E carries the same value as decimal 14, and the letter F carries the same value as decimal 15. Hexadecimal, like any other numbering system has the face value of digits and the positional value. The positional value is based on the powers of 16 since hexadecimal is the base 16 numbering system.

Example: Hexadecimal number A359

A	3	5	9	face value
16^3	16^2	16^1	16^0	positional value (powers of 16)
4096	256	16	1	resolved positional value

Converting hexadecimal to decimal:
To convert hexadecimal to its decimal equivalent, we multiply the face value times the positional value:

A x 16^3 =	10 x 4096 =	40960 (note A is equivalent to decimal 10)
3 x 16^2 =	3 x 256 =	768
5 x 16^1 =	5 x 16 =	80
9 x 16^0 =	9 x 1 =	9
		41817

The equivalent of hexadecimal A359 in decimal is 41817.

Converting decimal to hexadecimal:

Now we will take the decimal number 41817 and convert it back to hexadecimal. To do this, we will follow the same steps we used in converting decimal to binary with one change Ð this time we are concerned with multiplying by the face value (in binary this was not a concern because multiplying by 1 doesnÕt change anything).

The following are the decimal equivalents for some of the commonly used powers of 16:

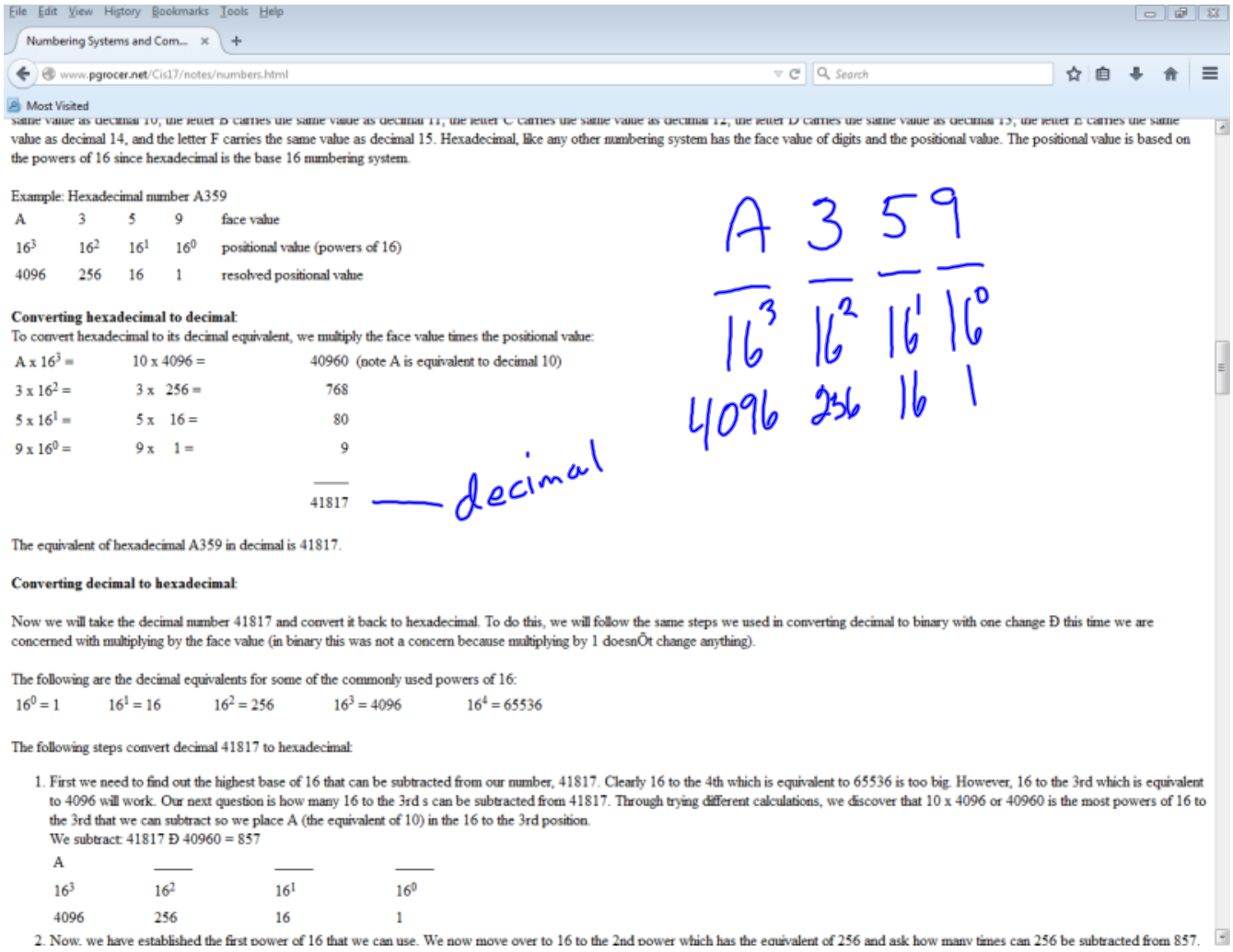
$16^0 = 1$ $16^1 = 16$ $16^2 = 256$ $16^3 = 4096$ $16^4 = 65536$

The following steps convert decimal 41817 to hexadecimal:

1. First we need to find out the highest base of 16 that can be subtracted from our number, 41817. Clearly 16 to the 4th which is equivalent to 65536 is too big. However, 16 to the 3rd which is equivalent to 4096 will work. Our next question is how many 16 to the 3rd s can be subtracted from 41817. Through trying different calculations, we discover that 10 x 4096 or 40960 is the most powers of 16 to the 3rd that we can subtract so we place A (the equivalent of 10) in the 16 to the 3rd position.
   We subtract: 41817 Ð 40960 = 857

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

2. Now, we have established the first power of 16 that we can use. We now move over to 16 to the 2nd power which has the equivalent of 256 and ask how many times can 256 be subtracted from 857.



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A	3	5	9	face value
16^3	16^2	16^1	16^0	positional value (powers of 16)
4096	256	16	1	resolved positional value

A 3 5 9
16^3 16^2 16^1 16^0
4096 256 16 1

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   We subtract: 41817 Ð 40960 = 857

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

2. Now, we have established the first power of 16 that we can use. We now move over to 16 to the 2nd power which has the equivalent of 256 and ask how many times can 256 be subtracted from 857.

$B7F_{16} = \underline{\quad 2943 \quad}_{10}$

B	7	F
16^2	16^1	16^0
256	16	1

$11 \times 256 = 2816$

$7 \times 16 = 112$

$15 \times 1 = 15$

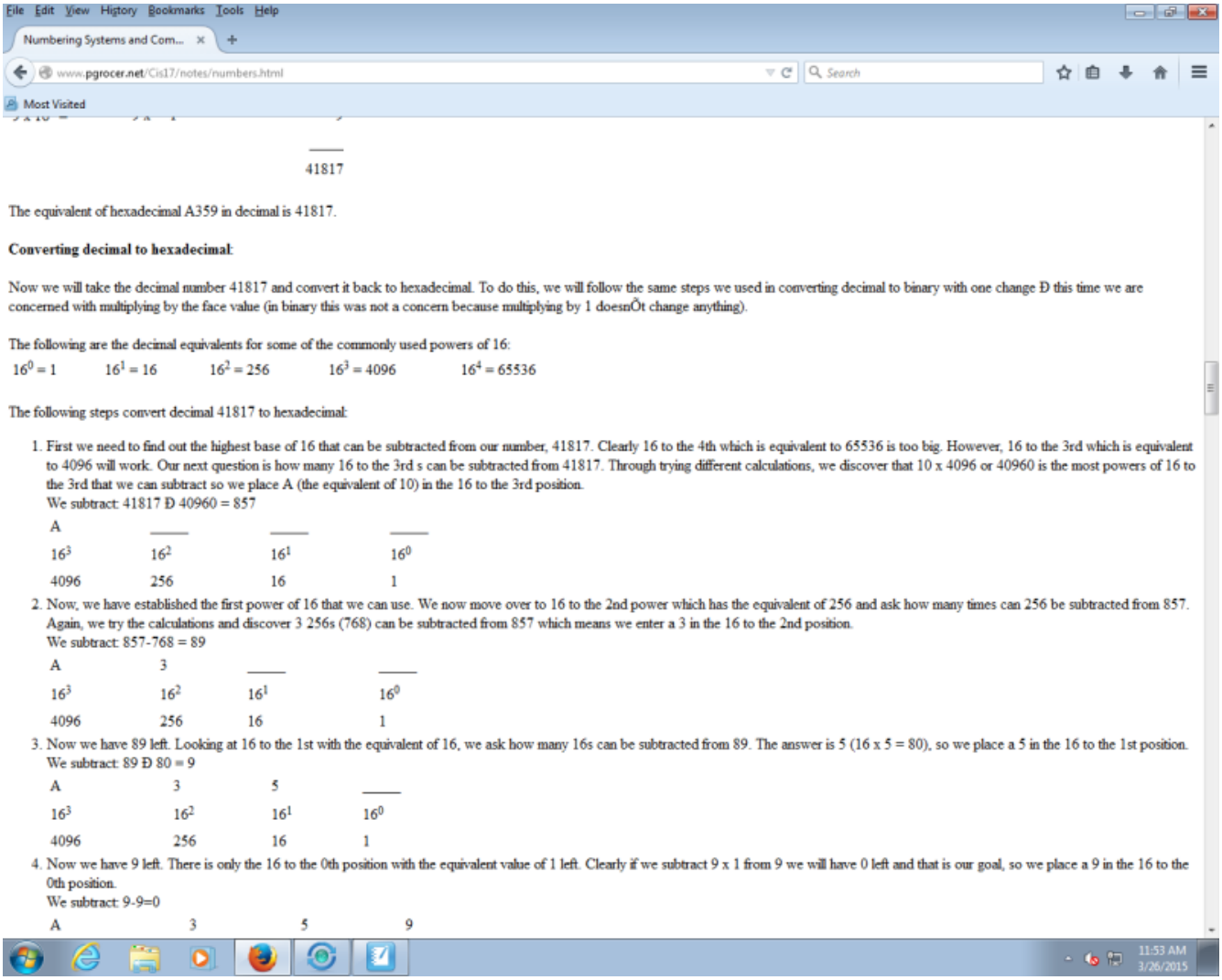
2943

$2ED5_{16} = \underline{\quad 11989 \quad}_{10}$

14 13
2 E D 5
16^3 16^2 16^1 16^0
4096 256 16 1

$2 \times 4096 = 8192$
$14 \times 256 = 3584$
$13 \times 16 = 208$
$5 \times 1 = 5$

11989



41817

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   We subtract: 41817 Ð 40960 = 857

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

2. Now, we have established the first power of 16 that we can use. We now move over to 16 to the 2nd power which has the equivalent of 256 and ask how many times can 256 be subtracted from 857. Again, we try the calculations and discover 3 256s (768) can be subtracted from 857 which means we enter a 3 in the 16 to the 2nd position.
   We subtract: 857-768 = 89

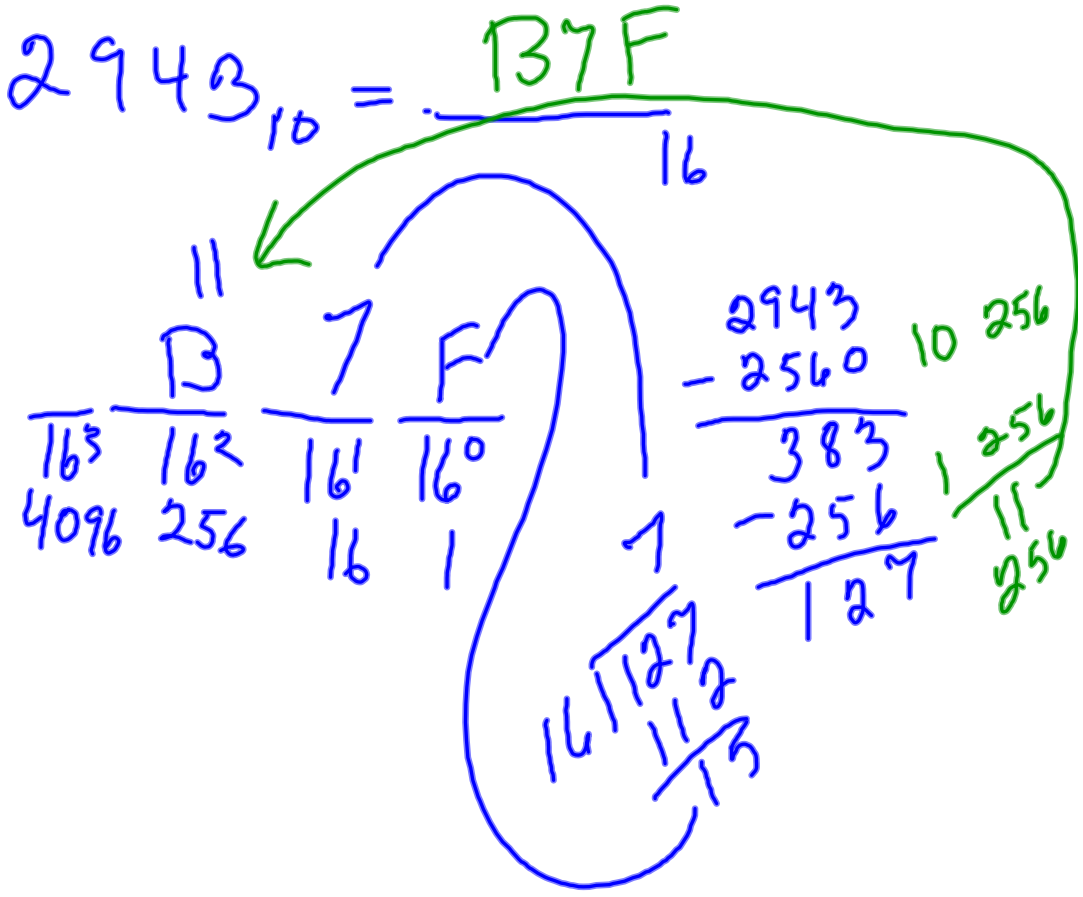
A	3		
16^3	16^2	16^1	16^0
4096	256	16	1

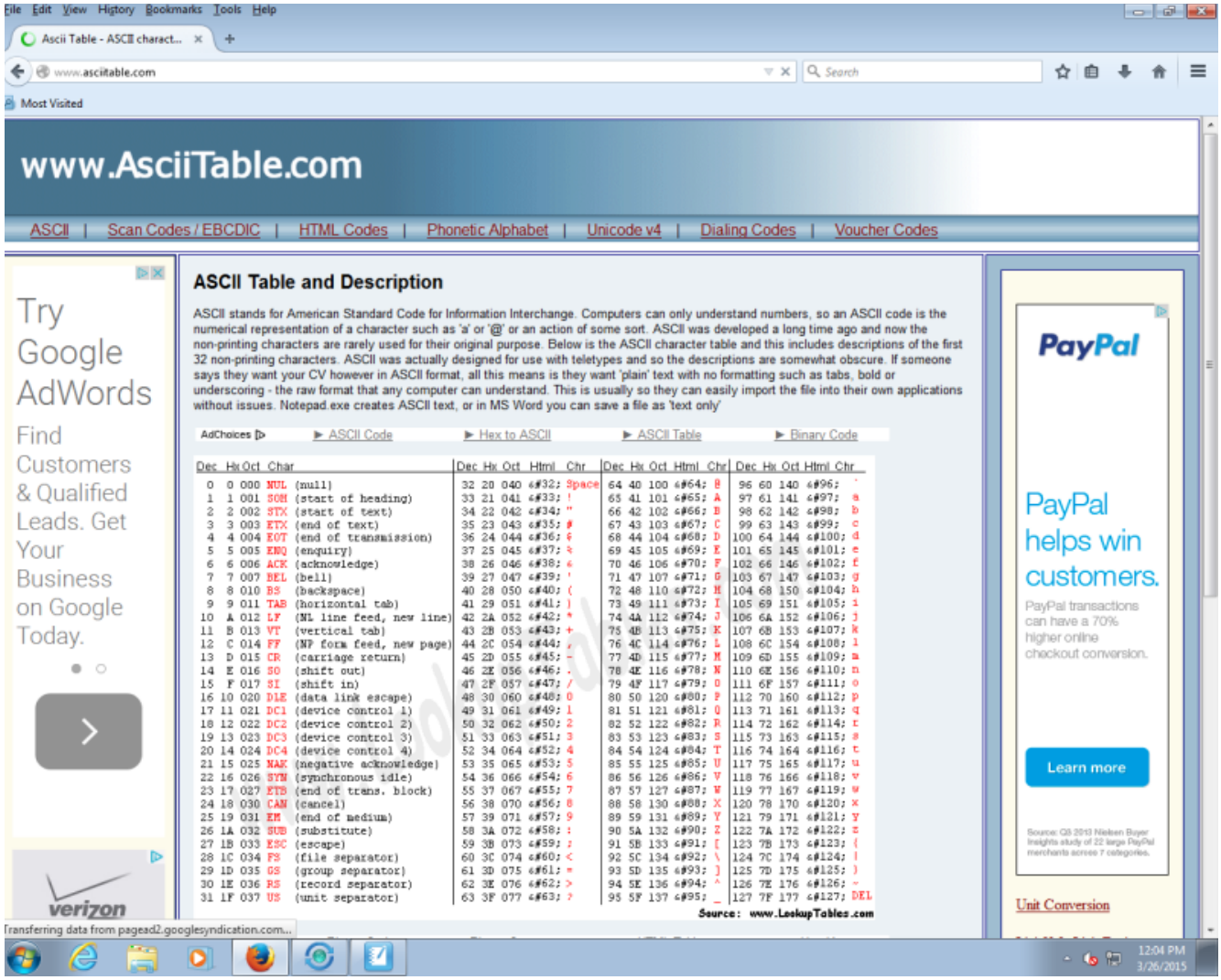
3. Now we have 89 left. Looking at 16 to the 1st with the equivalent of 16, we ask how many 16s can be subtracted from 89. The answer is 5 (16 x 5 = 80), so we place a 5 in the 16 to the 1st position.
   We subtract: 89 Ð 80 = 9

A	3	5	
16^3	16^2	16^1	16^0
4096	256	16	1

4. Now we have 9 left. There is only the 16 to the 0th position with the equivalent value of 1 left. Clearly if we subtract 9 x 1 from 9 we will have 0 left and that is our goal, so we place a 9 in the 16 to the 0th position.
   We subtract: 9-9=0

A	3	5	9


2943₁₀ = B7F
16
11
B 7 F
16³ 16² 16¹ 16⁰
4096 256 16 1
2943
-2560 10 256
383
-256 1 256
127 11
1 127
16 112
13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ASCII stands for American Standard Code for Information Interchange. Computers can only understand numbers, so an ASCII code is the numerical representation of a character such as 'a' or '@' or an action of some sort. ASCII was developed a long time ago and now the non-printing characters are rarely used for their original purpose. Below is the ASCII character table and this includes descriptions of the first 32 non-printing characters. ASCII was actually designed for use with teletypes and so the descriptions are somewhat obscure. If someone says they want your CV however in ASCII format, all this means is they want 'plain' text with no formatting such as tabs, bold or underscoring - the raw format that any computer can understand. This is usually so they can easily import the file into their own applications without issues. Notepad.exe creates ASCII text, or in MS Word you can save a file as 'text only'
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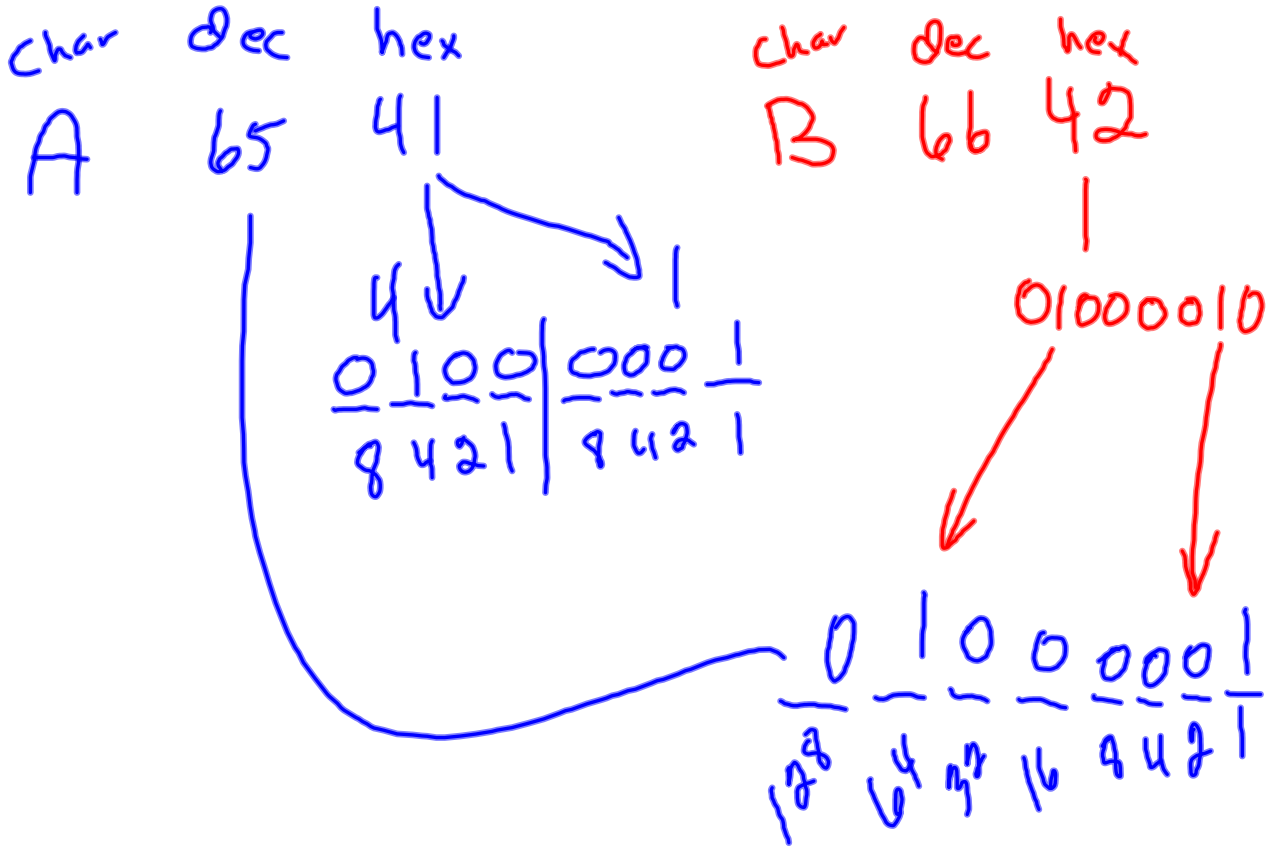
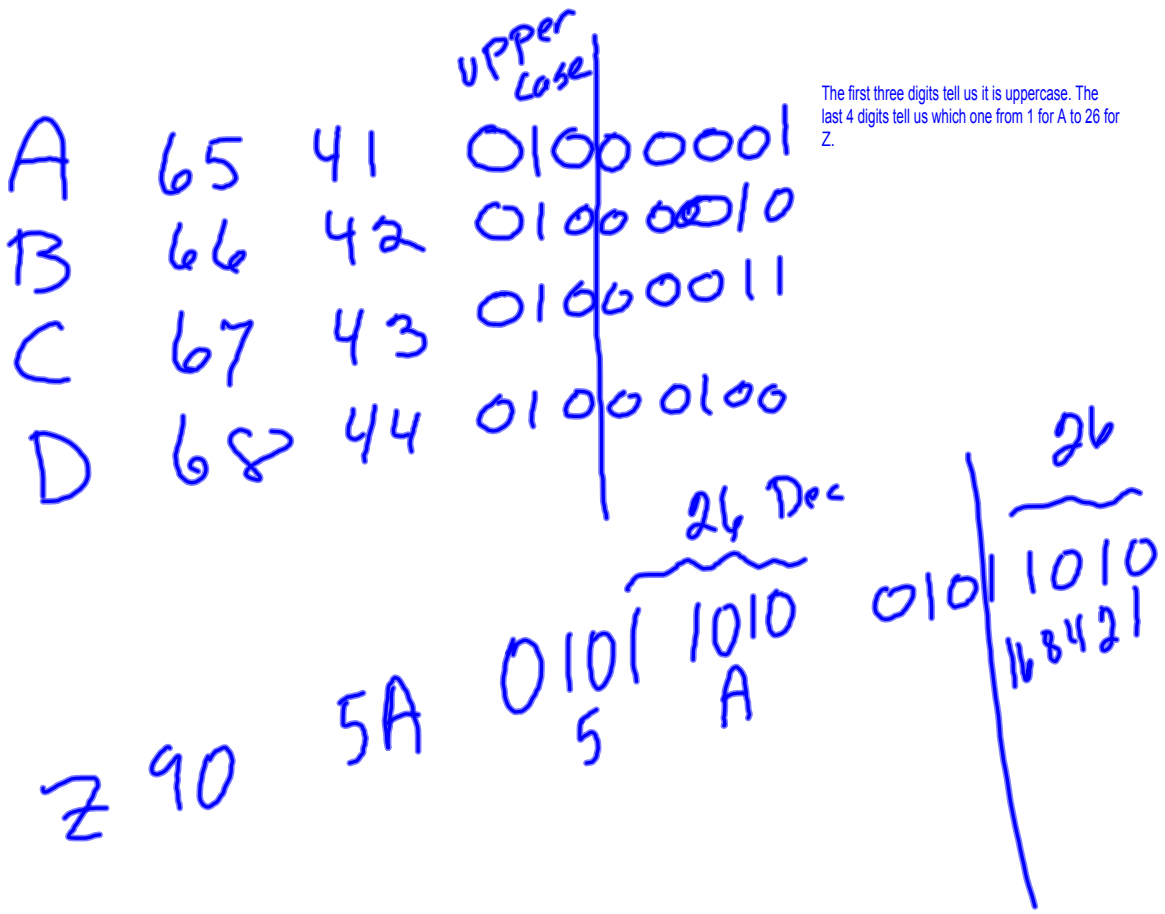
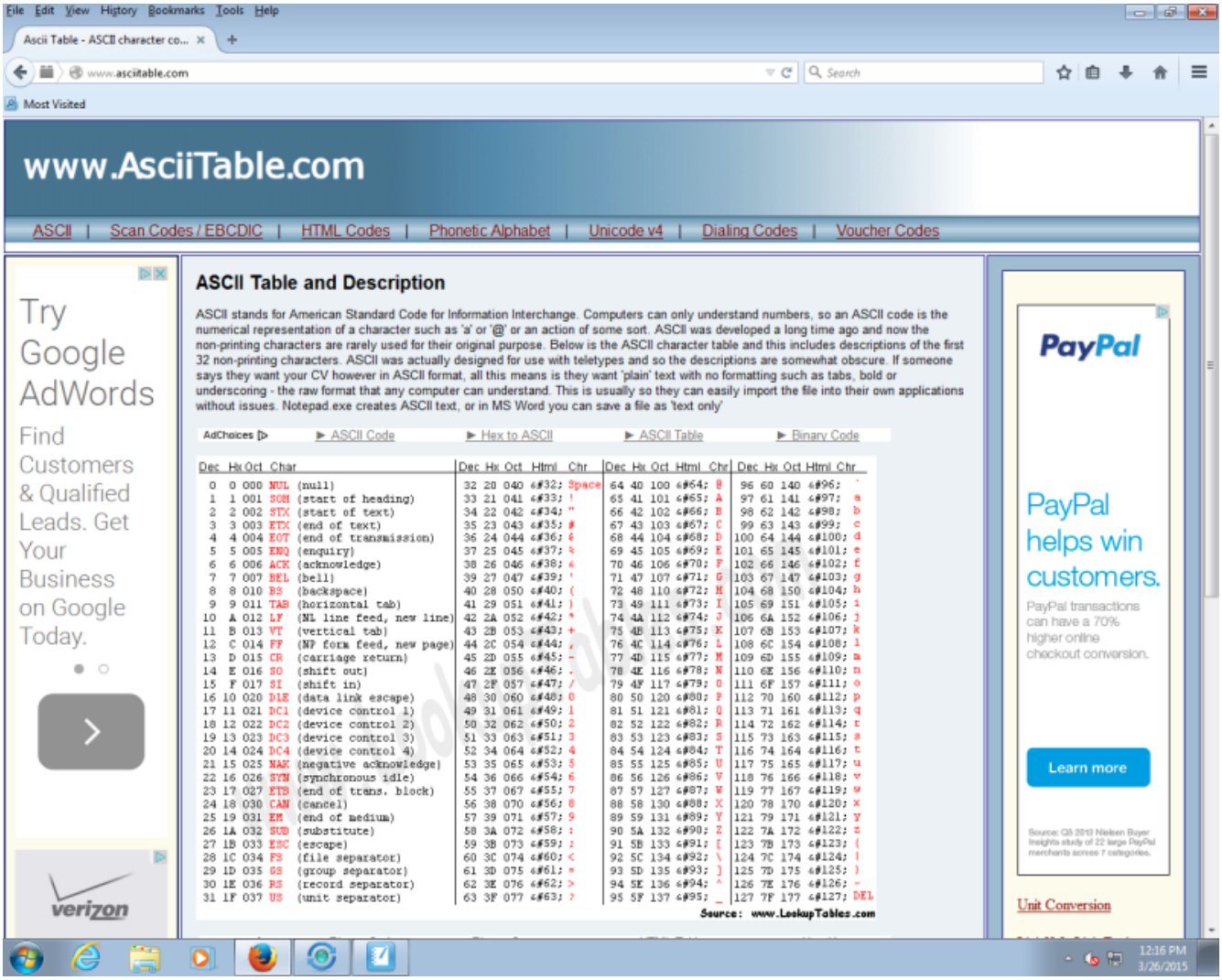

char dec hex
A 65 41
4 1
0100 0001
8421 8421
char dec hex
B 66 42
1
01000010
0 1 0 0 0 0 1 0
128 64 32 16 8 4 2 1



The first three digits tell us it is uppercase. The last 4 digits tell us which one from 1 for A to 26 for Z.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