Week 8

Trinity Web Site Design

Today we will learn about the technology of numbering systems.

Would you believe me if I told you -
I can prove that 10 + 10 = 100
<without a shadow of a doubt>.

You can baffle your friends with what
You will learn today!

To think that 7 + 1 = 10
Is a true statement!
(sounds a little strange, doesn't it)…

Let me break it down…

Ok Class here we are in:
Good Old Tampa Florida.

Where every smart student
Knows how to count:
1,2,3,4,5,6,7,8,9,…

Notice that we have 9
Symbols - ten total when we
Include zero.

OK so lets think of a mile gage on you parents car.
When the car is brand new - starts at zero:
[0][0][0][0][0][0]

[ ][ ][ ][ ][ ][ ]

After we travel the first mile:
[0][0][0][0][0][1]

After the 2nd mile
[0][0][0][0][0][2]

After the 3rd mile
[0][0][0][0][0][3]

Stay with me, I know this seems over easy!
…
After the 9th mile
[0][0][0][0][0][9]

What Happens next?
**** the 6th position gets reset to zero
[][][][][][0]
**** and the 5th position advances to one
[0][0][0][0][1][0]
--> you could say that all the numbers
(0-9) were used up and the counter needed to
Advance…

OK

To easy Coach - now tell us something we don't know…

We need to verify you understand a system for counting:

Symbol	**Value**
0	Zero
1	One
2	two
3	three
4	four
5	five
6	six
7	seven
8	eight
9	nine

Values go to infinity(very large)
In the decimal numbering system
There are ten symbols zero - nine.
And these symbols can represent
Every number negative and positive.

Next - Lets take a trip

Imagine we take a trip to a new place, you
Have never been before

Have never been before…

The land of Octal…

Octal is a place with nice people, However you are taught
Something a little strange about this place. They only have
Eight symbols for counting…

What about symbols eight(8) & nine(9)…
Too bad so sad - they don't exist. There was a long fairy tail
Explanation… So we need to learn to count while we are
In the land of Octal !!!

Symbol	**Value**
0	Zero
1	One
2	two
3	three
4	four
5	five
6	six
7	seven

Now lets think about our mile gage Here in this land of Octal:

OK so lets think of a mile gage on you parents car.
When the car is brand new - starts at zero:
[0][0][0][0][0][0]

After we travel the first mile:
[0][0][0][0][0][1]

After the second mile
[0][0][0][0][0][2]

After the third mile
[0][0][0][0][0][3]

...

After the seventh mile
[0][0][0][0][0][7]

Wait they don't have a
Symbol for eight... What
Comes Next ???

After the mile eight
[0][0][0][0][1][0]

Hold on a minute: is that <u>legal</u>

(All of the people in Octal all know that 10 = eight… It always has)

After the mile nine
[0][0][0][0][1][1]

After the mile ten
[0][0][0][0][1][2]

After the mile eleven
[0][0][0][0][1][3]
…

After the mile fifteen
[0][0][0][0][1][7] $8^0 * 7 + 8^1 * 1$

After the mile sixteen
[0][0][0][0][2][0]

After the mile seventeen
[0][0][0][0][2][1]

The people of Octal know
21 = seventeen which is:
$2 *_{(base)} 8 + 1$
Or
Sixteen plue one.

Students - check this out.

$7 + 1 = 10_{octal}$

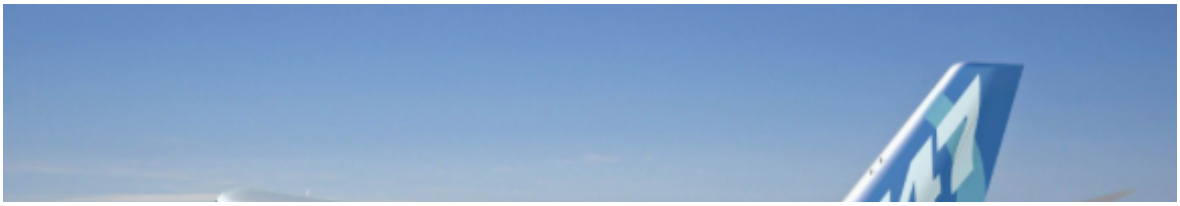
What is:

$10 + 11 =$____$_{octal}$

$10 + 11 =$ Seventeen or 21_{octal}

In Octal and all numbering system - **math operations** Work the same: counting, addition, subtraction, Multiplication, division, …

OK - Lets take another trip…



Our next stop is to a very large country,
Next we go to the land of Hexadecimal.
(People are friendly, and there is lots
see and do)

In the Land of Hexadecimal they have a different
Way of counting. Octal only had 8 symbols.
Here in Hexadecimal they have 16 different symbols.

Symbol	Value
0	Zero
1	One
2	two
3	three
4	four
5	five
6	six
7	seven
8	eight
9	nine
A	ten
B	eleven
C	twelve
D	thirteen
E	fourteen
F	fifteen

Now lets think about our mile gage

Here in this land of Hexadecimal:

OK so lets think of a mile gage on you parents car.

When the car is brand new, starts at zero:

When the car is brand new - starts at zero:
[0][0][0][0][0][0]

After we travel the first mile:
[0][0][0][0][0][1]
…
After the mile nine:
[0][0][0][0][0][9]

After the mile ten:
[0][0][0][0][0][A]

After the mile eleven:
[0][0][0][0][0][B]

After the mile twelve:
[0][0][0][0][0][C]

After the mile thirteen:
[0][0][0][0][0][D]

After the mile fourteen:
[0][0][0][0][0][E]

After the mile fifteen:
[0][0][0][0][0][F]

After the mile sixteen:
[0][0][0][0][1][0]

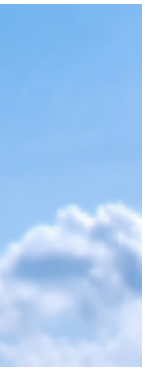
I know this is sometime hard to understand

I know this is sometime hard to understand…

Still, I think you are learning…

Ok so 23 in Hexadecimal equals
2 * sixteen + 3 = (thirty two + 3 = thirty six)

OK Get ready for our last Stop.



The (very) small land of Binary.
People here are also very friendly,
and usually travel around in pairs…

In this small land of

Binary… You can guess:
They only have two Symbols for there numbers
zero and one.

Symbol	Value
0	Zero
1	One

Now lets think about our mile gage

Here in this land of binary:

OK so lets think of a mile gage on you parents car.

When the car is brand new - starts at zero:

[0][0][0][0][0][0]

After we travel the first mile:

After we travel the first mile:
[0][0][0][0][0][1]

After we travel mile two:
[0][0][0][0][1][0]

After we travel mile three:
[0][0][0][0][1][1]

After we travel mile four:
[0][0][0][1][0][0]

After we travel mile five:
[0][0][0][1][0][1]

$(2^2 * 1) + (2^1 * 0) + (2^0 * 1)$
4 + 0 + 1
After we travel mile six:
[0][0][0][1][1][0]

After we travel mile seven:
[0][0][0][1][1][1]

After we travel mile eight:
[0][0][1][0][0][0]

After we travel mile nine:
[0][0][1][0][0][1]

OK, so 1001_{Binary} equals nine,
Which is –

Which is –

$2^3 * 1 + 2^2 * 0 + 2^1 * 0 + 2^0 * 1$

(anything to the zero power = 1)

$2^3 * 1 = 2 * 2 * 2$ = eight

$2^2 * 0 = 2 * 2 * 0$ = zero

$2^1 * 0 = 2 * 0$ = zero

$2^0 * 1 = 1 * 1 = 1$ one

Let's break this down by math(using exponents)

$111_{binary} = 2^2 * 1 + 2^1 * 1 + 2^0 * 1$

$2^2 * 1 = 2 * 2 * 1$ = four

$2^1 * 1 = 2 * 1$ = two

$2^0 * 1 = 1 * 1$ = one

Four + two + one = seven

Then the statement:

$10_{Binary} + 10_{Binary} = 100_{Binary}$

Is the same as:

Two + two = four