Exploring Computer Technology TEJ0 G9
The Dragon Academy
Course Review

June 11, 2018

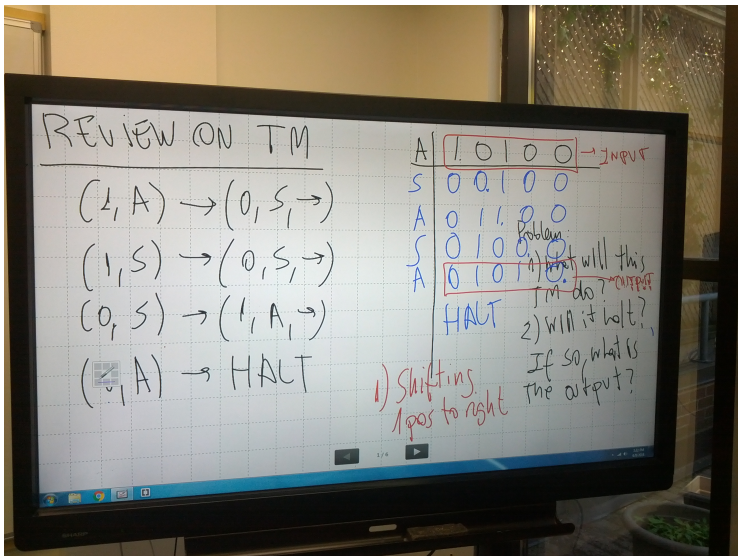
1 Index of topics

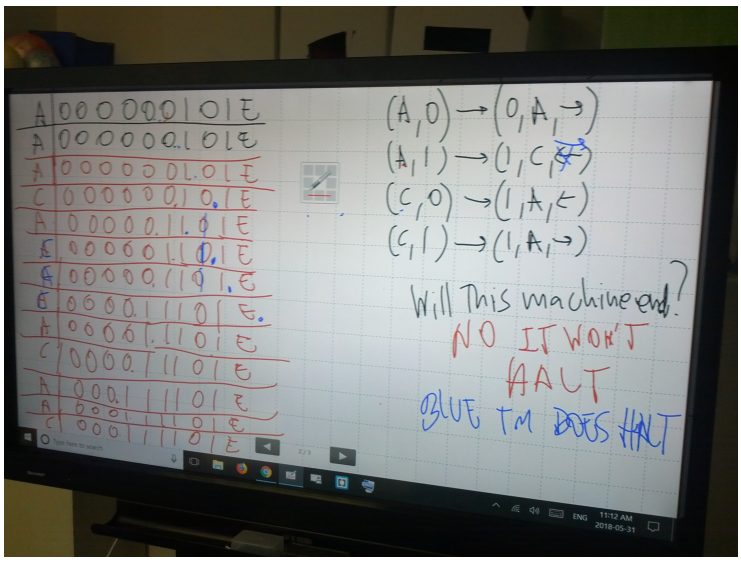
1. Turing Machines:
   - 1.1. Given the rules of a TM, an input string of 0s and 1s and an initial state, determine if the TM will halt or not and what will be on the tape in the end.
2. Logic Gates and Logic Circuits
   - 2.1. Truth values
   - 2.2. Logic gates as words: AND, OR, NOT.
   - 2.3. Identify and sketch the diagram of each of the three basic logic gates. Label all inputs and outputs.
   - 2.4. Write the truth table of each basic logic gate
   - 2.5. Analyze and write the truth table of logic circuits
3. Binary Numbers
   - 3.1. Given a binary number of 8 bits, determine its decimal representation
   - 3.2. Given an integer in the decimal number system between 0 and 1024, write its binary representation.
4. Web pages: HTML and CSS

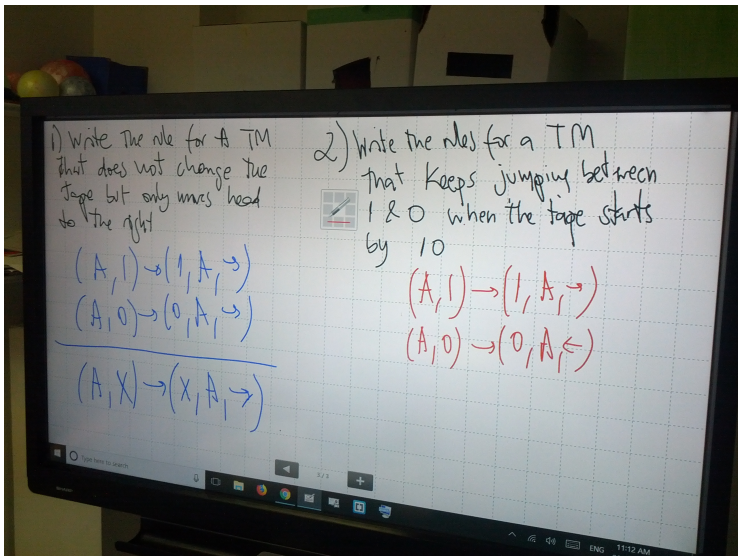
   4.1 HTML
   - 4.1.1 The template of a web page: the *doctype, html, head, title* and *meta* body tags
   - 4.1.2 Headings: h1, h2, and h3
   - 4.1.3 Paragraphs: p
   - 4.1.4 Boldface and emphasize: strong and em.

2 Examples

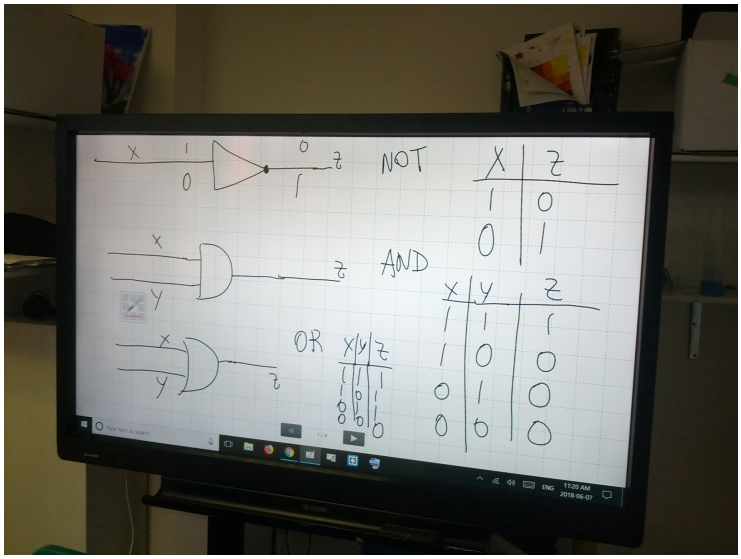
2.1 1. Turing Machine

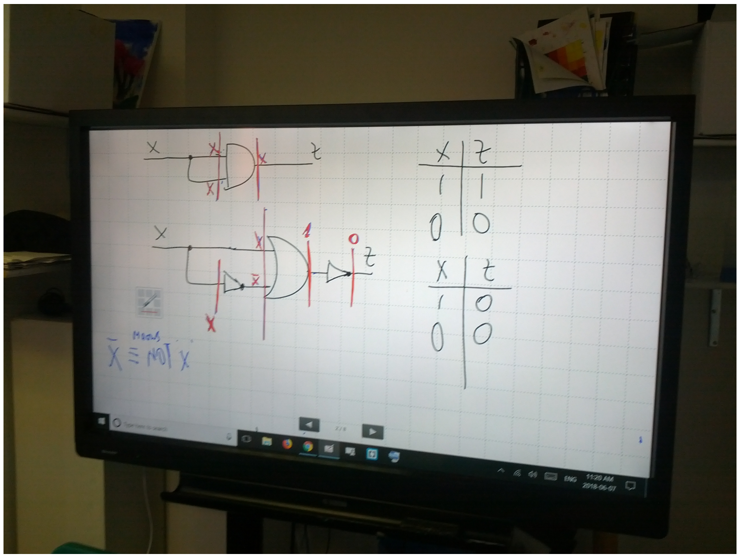


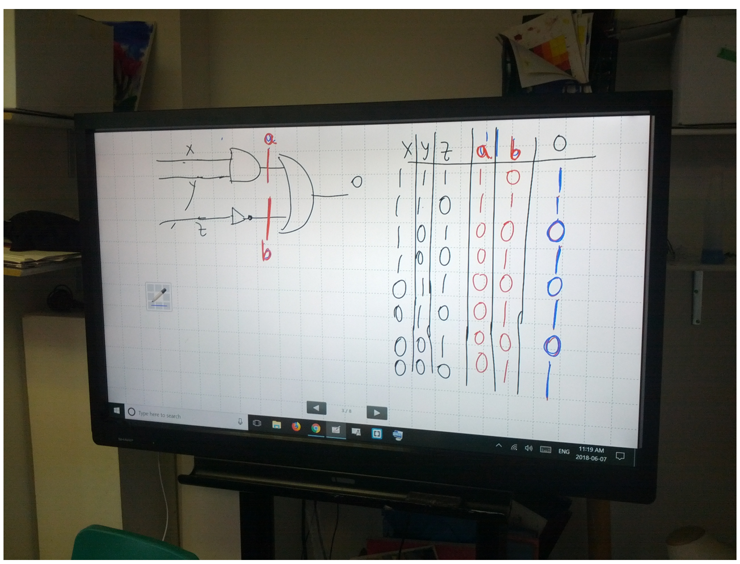


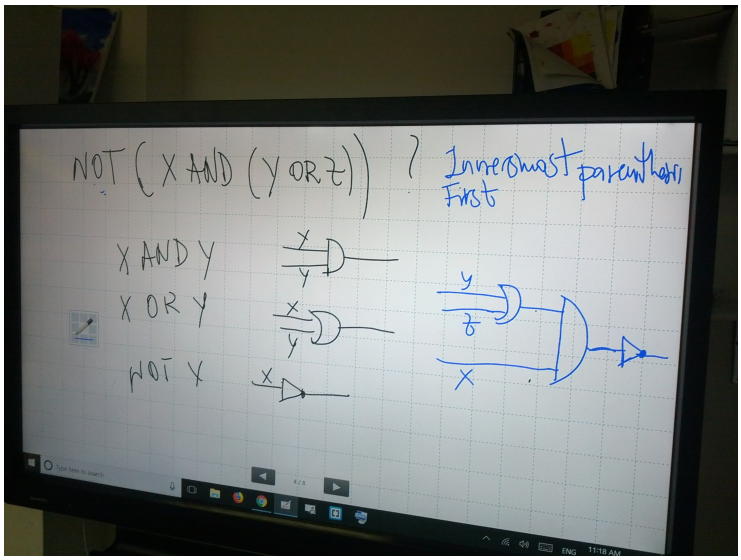


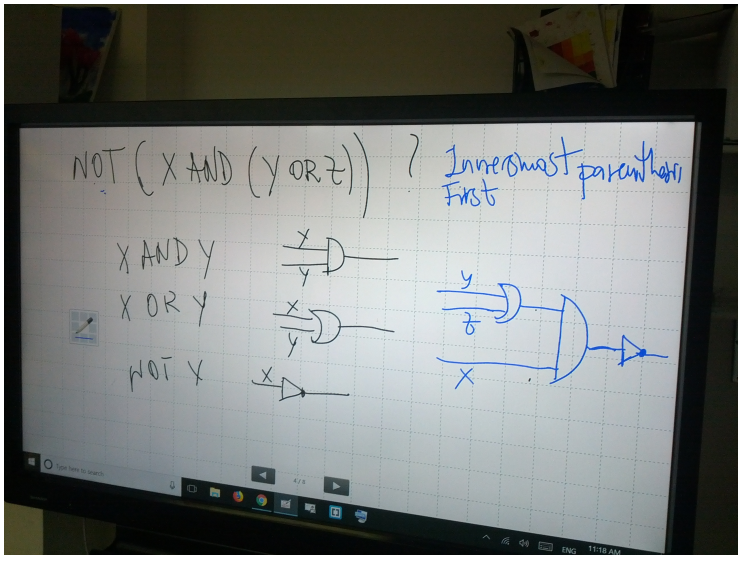
2.2 2. Logic Gates and Circuits

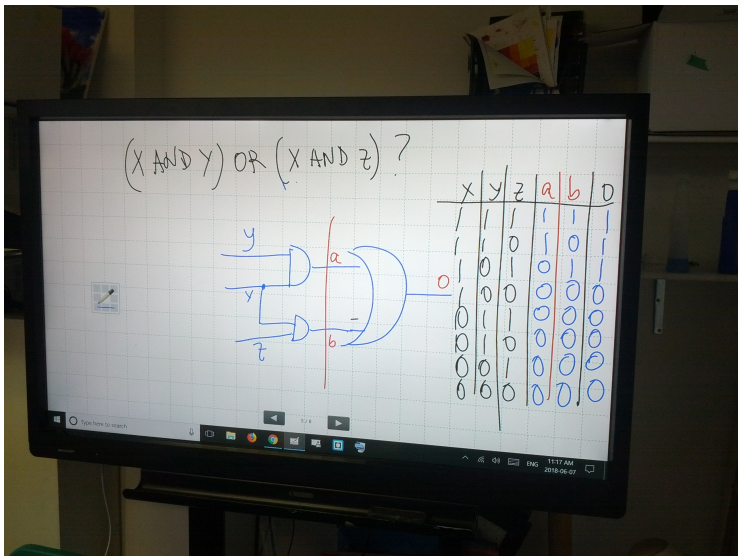


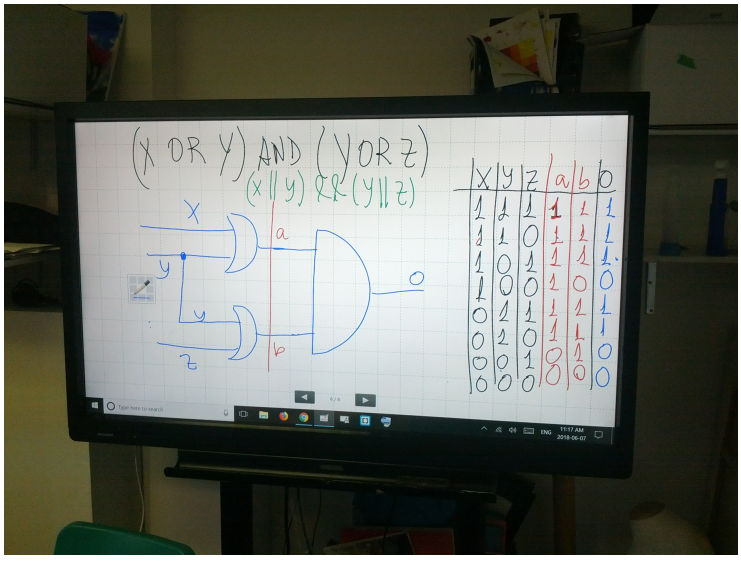


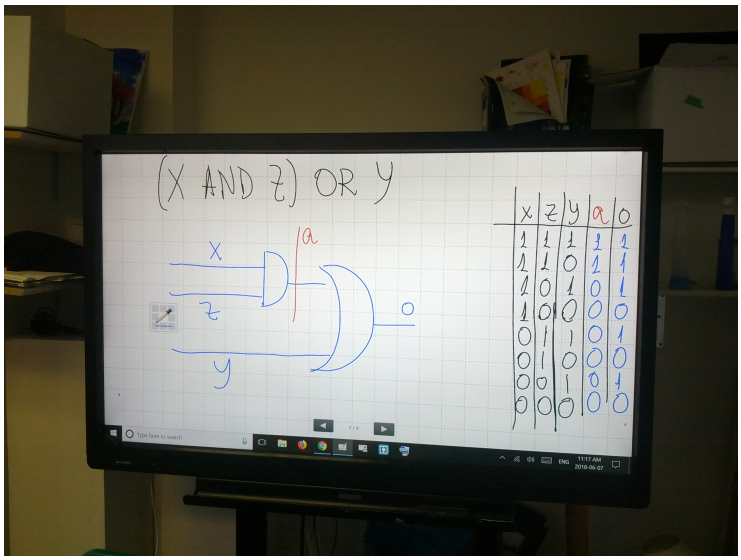



NOT (X AND (Y OR Z)) ?
Innermost parenthesis First
X AND Y
X OR Y
NOT X
X
Y
Y
Z
X


NOT (X AND (Y OR Z)) ?
Innermost parenthesis First
X AND Y
X OR Y
NOT X
X
Y
Y
Z
X


(X AND Y) OR (X AND Z) ?
X Y Z a b O
y
a
y
z
b
O


(X OR Y) AND (Y OR Z)
(x || y) && (y || z)
X Y Z a b O
X
a
y
y
z
b
O



2.3 3. Binary Numbers

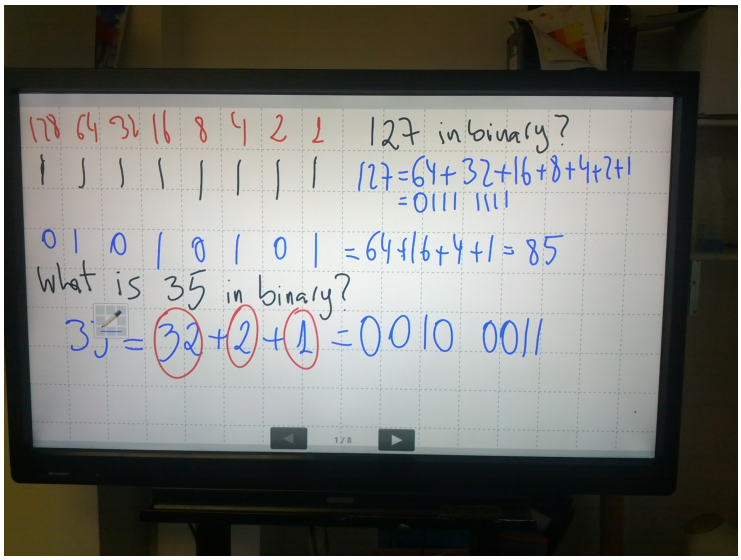
In a group of 8 bits, the position of each of them represents a different value. For instance, if we set all to 0 (switched off) except the right-most bit, which we set to 1 (switched on), the value represented is 1.

If instead the only bit we switch on is the second right-most one, then the value we have is 2. And so on and so forth.

$$
\begin{aligned}
0000\,0001 &= 1 \\
0000\,0010 &= 2 \\
0000\,0100 &= 4 \\
0000\,1000 &= 8 \\
0001\,0000 &= 16 \\
0010\,0000 &= 32 \\
0100\,0000 &= 64 \\
1000\,0000 &= 128
\end{aligned}
$$

When we have several bits switched on, we just "collect" the values represented by each of them and add them up

$$
\begin{aligned}
0101\,0101 &= 64 + 16 + 4 + 1 = 85 \\
1000\,1010 &= 128 + 8 + 2 = 138
\end{aligned}
$$



We can also do the other way around: given a decimal number like 35 write its binary representation.

Solution: First try to write 35 in terms of the previous powers of 2. $35 = 32 + 3 = 32 + 2 + 1$. Hence, 35 in binary is 0010 0011.

What is 127 in binary?

Solution: $127 = 64 + 32 + 16 + 8 + 4 + 2 + 1$, hence in binary 0111 1111.

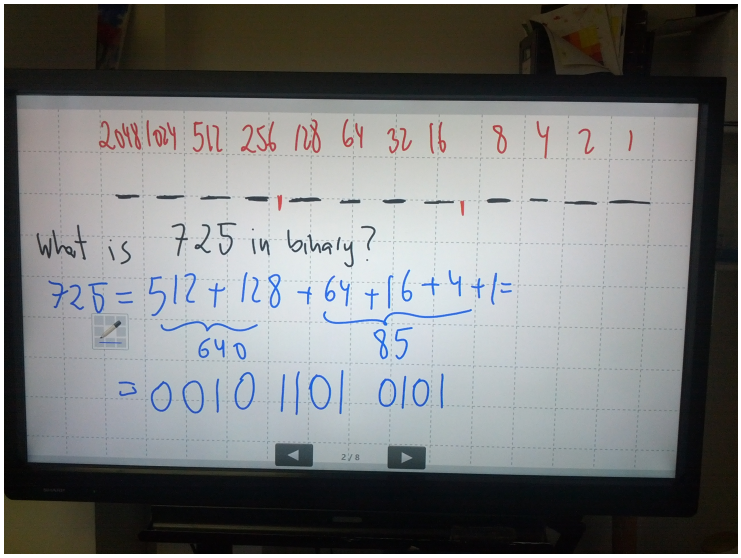
What is 255 in binary? Check that the solution is all 8 bits set: 1111 1111

What numbers are the following?

$$\begin{aligned} 0000\,0011 &= \\ 0000\,0111 &= \\ 0000\,1111 &= \\ 0001\,1111 &= \\ 0011\,1111 &= \\ 0111\,1111 &= \end{aligned}$$

Solution: $3, 7, 15, 31, 63, 127$

2.3.1 More than 8 bits

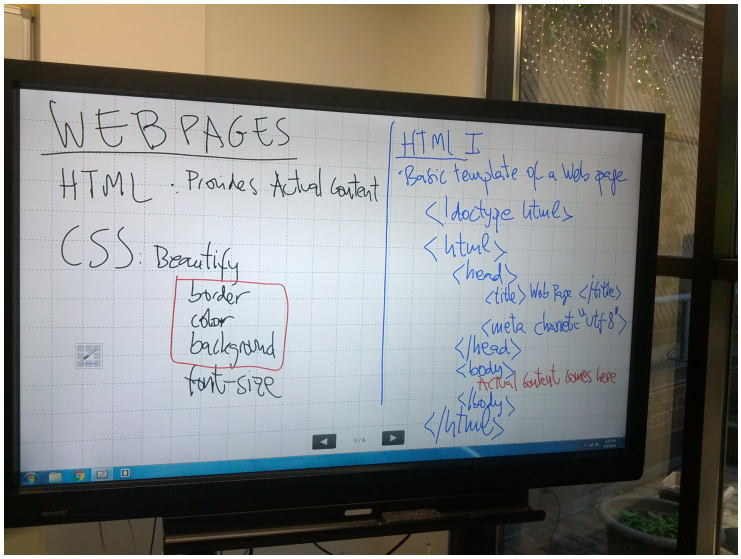


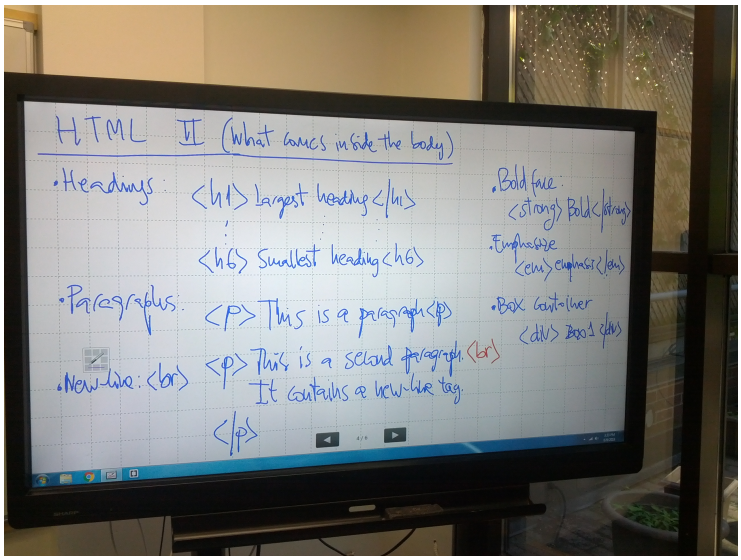
$$
\begin{aligned}
0001\,0000\,0000 &= 256 \\
0010\,0000\,0000 &= 512 \\
0100\,0000\,0000 &= 1024 \\
1000\,0000\,0000 &= 2048
\end{aligned}
$$

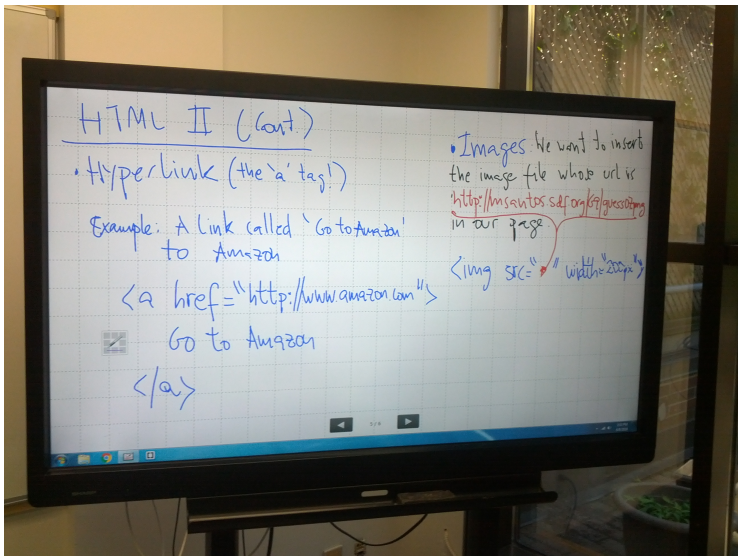
What is the binary expression of 725?

Solution: We proceed as before, expressing this number as a sum of powers of 2, namely, $725 = 512 + 128 + 64 + 16 + 4 + 1$, hence in binary it is $0010\,1101\,0101$.

2.4 4. Web pages

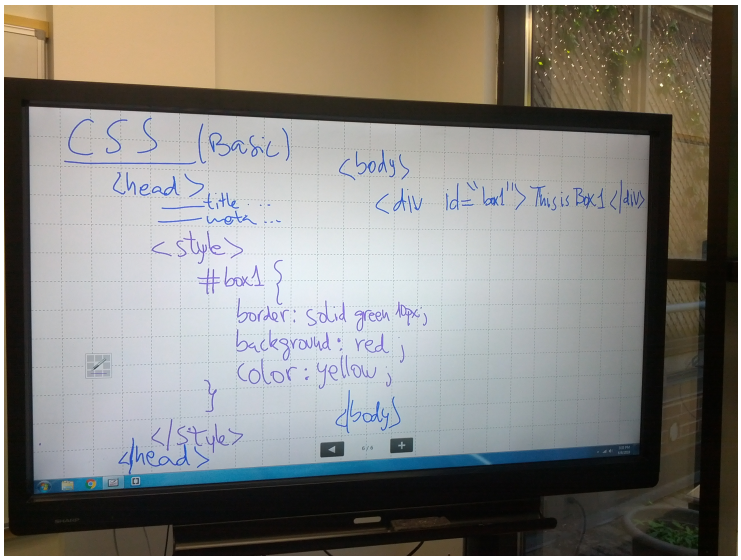




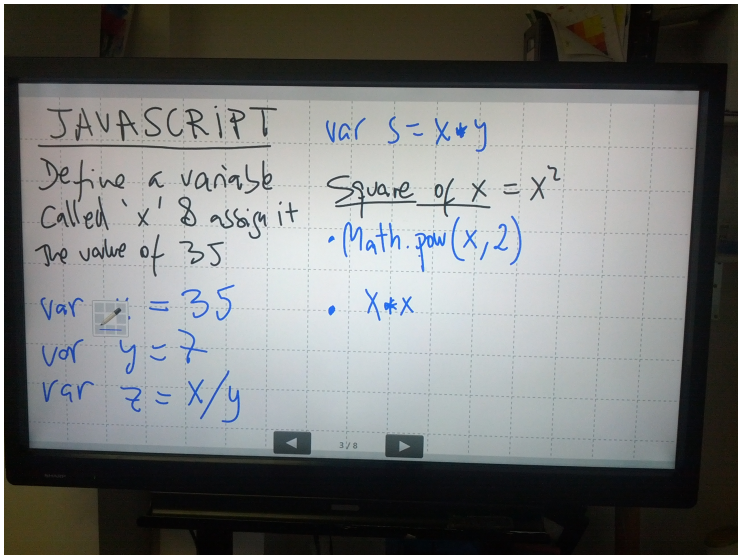

HTML II (cont.)
• Hyperlink (the 'a' tag!)
Example: A link called 'Go to Amazon' to Amazon

Go to Amazon

• Images We want to insert the image file whose url is
in our page
<img src="
width="


CSS (Basic)
<head>
title
meta ...
<style>
#box1 {
border: solid green 10px;
background: red;
color: yellow;
}
</style>
<head>
<body>
This is Box 1
</body>

2.5 5. Programing in Javascript



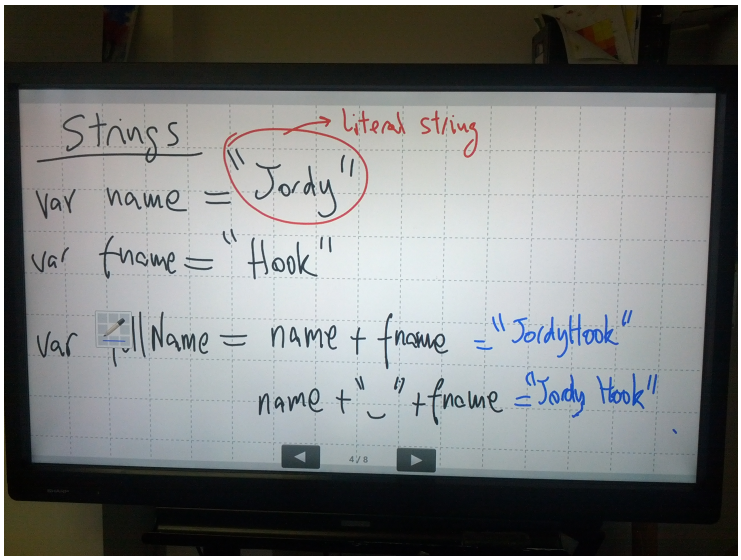

```
var x = 3.5
var y = 7
var z = x*y
var s = Math.pow(x,2)
alert( z )
```

The variable x gets assigned the value 3.5, y 7 and z the product of those two, namely 24.5.

We can calculate the square of the value contained in x by writing "Math.pow(x,2)". There is a second method though, namely simply writing the product of x by itself: "x*x".

"alert" is a way to output information to the user. It creates a new small pop-up window showing the content of whatever we put between the parentheses after alert. In this case it will show the value of z.

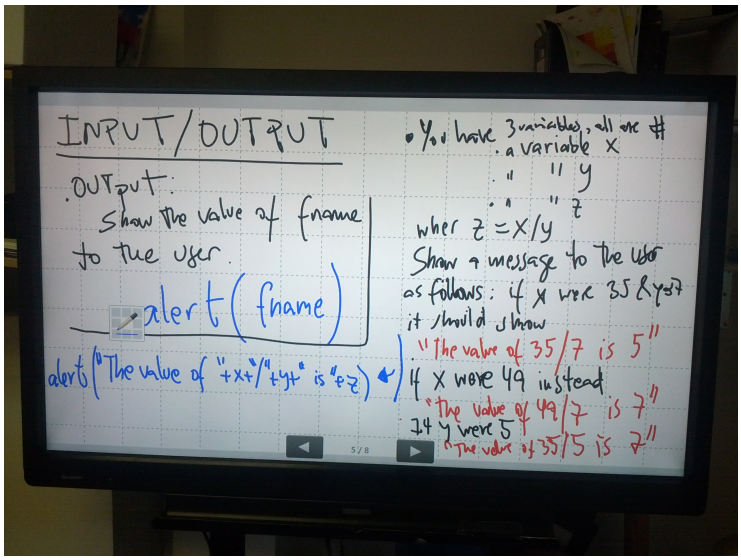
We can

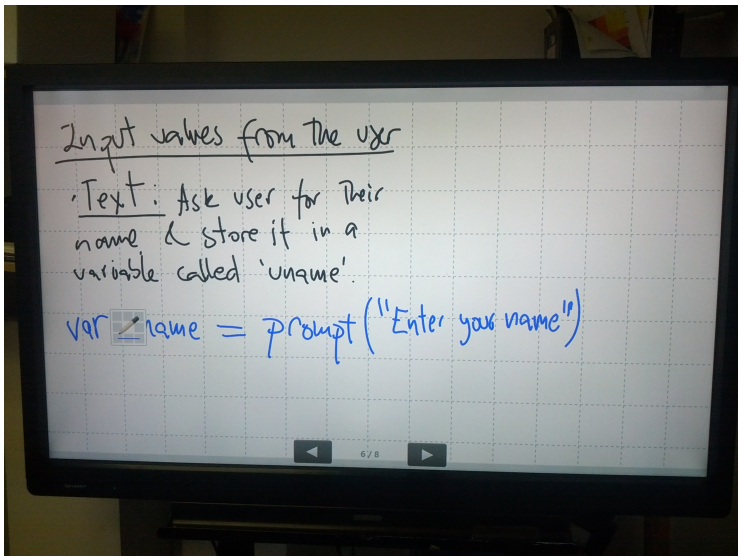


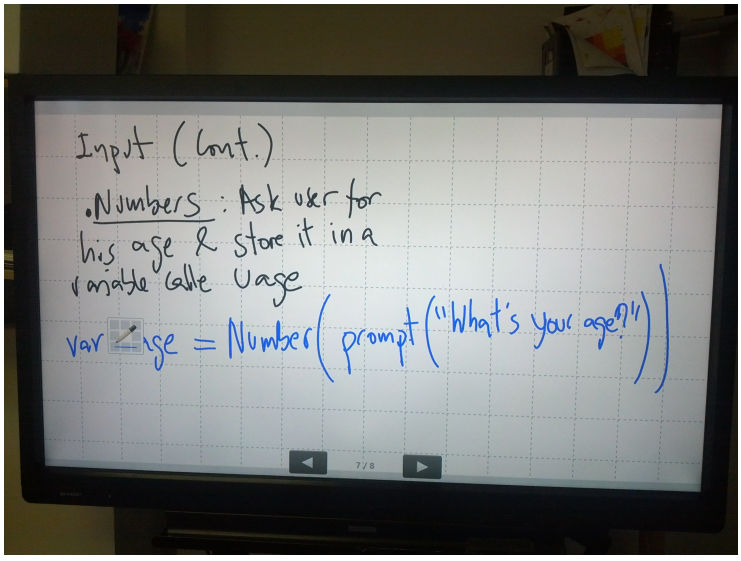
In a similar way we can deal with "strings":

```
var name = "George"
var familyName = "Lucas"
var fullName = name + " " + familyName
alert("This person's name is "+ fullName)
```

We can compose strings out of smaller strings by using the plus + sign.





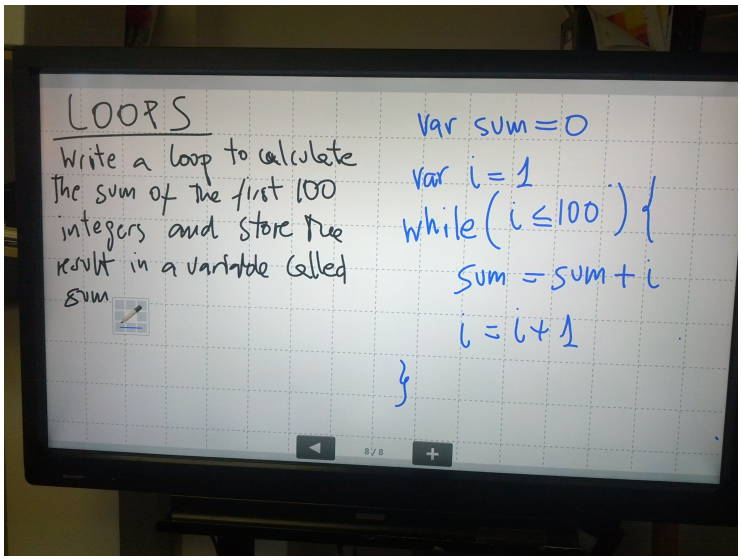


We can ask the user for input through the command "prompt". If we expect a number, we need to wrap the prompt with the function "Number"

```
var user_name = prompt("Enter your name:")

var user_number = Number( prompt("Enter a number:")  )

alert( "The user "+ user_name + " entered the value "+ user_number )
```



Loops allow repetition of statements without actually having to write them several times. Loops allow use to calculate tedius mathematical expressions.

Write the sum of the first 100 numbers. Store the result into a variable called "sum" and show it to the user.

```
var sum = 0
var i = 1
while( i <= 100 ){
    sum = sum + i
    i = i + 1
}
alert( "The sum of the first 100 integers is "+ sum )
```

2.6 6. Algorithms