Teacher's Guide: Counting Systems
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Thank you for considering Counting Systems for your class. I hope you and your students enjoy the experience. This teacher's guide is written as a supplement to the video Teacher's Guide included at the end of the video segments. So, if you have not yet viewed that, it would be best to view it now, and then return here! Thanks!

The Concept: This video aims to explain counting systems (Decimal, Binary, Hexadecimal). Students will get to know how to convert numbers between these systems. Also students will learn how to do some byte and bit level operations. They will use a Visual Basic (VB) application that changes colors through logical operation on numbers.

Prerequisites: For this lesson, a student needs only to know how to use basic operations in mathematics (+, - , * , / , Power)

Materials: You will need a scientific calculator or a calculator program, which is a Windows Accessory. Also, you could add letters & numbers of children games to add some fun to the lesson. Finally, there is a Mixer which is a simple VB application that I wrote for changing colors through logical operation on numbers. You can find it with lesson files on BLOSSOMS website under "For Teachers".


Activities: In the first segment activity: Students try to find relation between numbers used in memories of computers, and why. In second activity, they try to convert 11011 from binary to decimal. In third activity, students count from 1 to 100 but in hexadecimal system. In forth activity, they use Calculator to convert between systems. Here I suggest that the teacher write on the board the following numbers: 5,8,12 and convert them to binary 101,1000,1100 and hexadecimal 5,8,C. Then use + and – with each of the three systems and convert each result to the other two systems. That activity is to show students that binary and hexadecimal systems are like the decimal system, except in + an – operations. Maybe you try to do 5-8, which gives -3 in decimal, and gives incorrect result in binary and hexadecimal because of underflow. (Note: In decimal we use (-) to mention negative numbers, and this (-) does not belong to the ten characters (digits), so if we used (-) with binary and hexadecimal, then no underflow will happen)

Fifth activity is a little bit hard. You can ignore it, or give it to the excellent students only. Anyway, if you are going to use it, please clarify to your students that &H& are used to tell VB that this number is in hexadecimal for example &HF0&

Also tell your students that division on 16 in hexadecimal is similar to division on 10 in decimal, i.e.: We shift the digits to the right by one digit (16 is 2^4). The purpose of this line is to merge two high 4-bits from two bytes, in one new byte, and that is the most important line

in source code of The Magic Picture application. (In VB: 10/3=3.333 and 10\3=3, and in our example no difference between / and \)

$$Byte3 = (Byte1 \text{ And } \&HF0\&) \text{ Or } ((Byte2 \text{ And } \&HF0\&) \setminus 16)$$
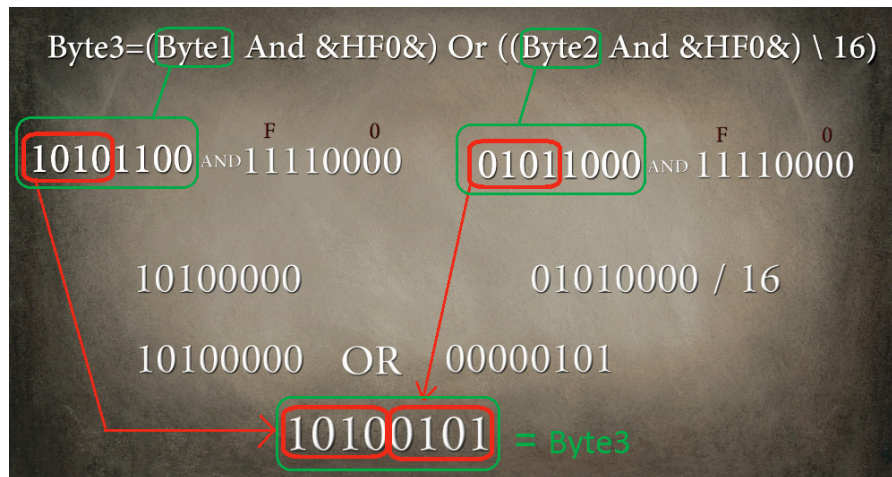
Colors: You may use Paint in Windows to show your students how colors are made by mixing 3 amounts of red, green and blue.
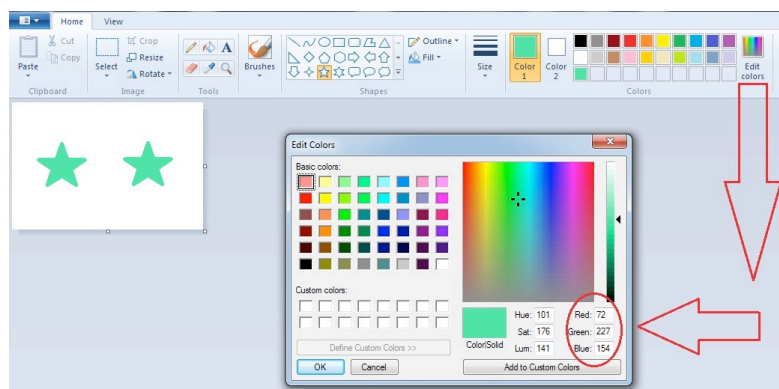
Usually, colors system is RGB which is Red, Green and Blue. But in BMP format and in VB, colors are arranged like this BGR, and I used BGR in this lesson.

Joke: I wanted to mention a joke at the end of the video lesson, but that did not happen. Anyway, you can say it to your students. The joke is:

There are 10 kinds of people, one kind that is able to understand binary system, and the other that is unable to understand it.

Explanation: The 10 is a binary number which is equal to 2 in decimal, i.e.: There are two kinds of people, one….

Time: The lesson is prepared in such a way that you can do it in your 45-50 min class. But if you want to speak in depth about its issues, especially which are mentioned in the end of the lesson, then you may need more time.

Contact me: Finally, Please don't hesitate in sending any questions, suggestions or comments you have, to my email: abdullah@salaamsoft.com