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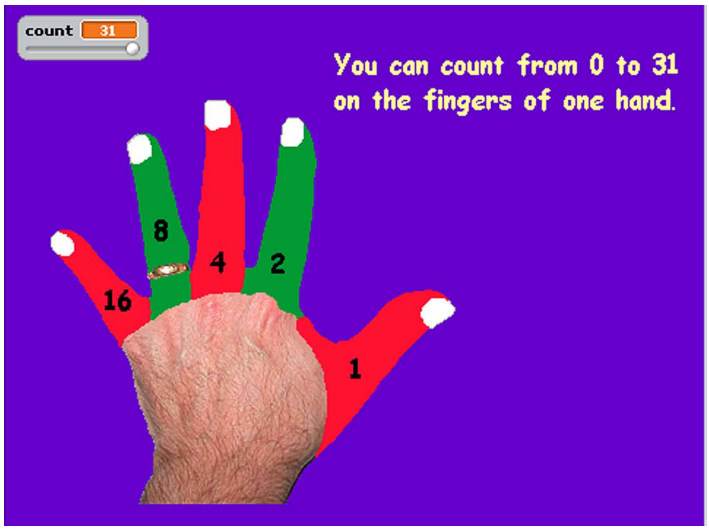
Tech News

Counting in Binary on Your Fingers

With five fingers, you are not limited to counting just to five. With a little practice, you can count from zero to 31 on one hand. With more practice you can count four or five items per second. Each finger is one binary digit (a bit) like the bits used to represent numbers in a computer. You can extend the finger to represent a one bit and curl it to represent a zero bit.

Each finger has a different value. The thumb has the value 1 and is extended whenever the number is odd. The pointing finger has the value 2, the middle finger 4, and the values keep doubling for each successive finger. The number represented by a hand position is the sum of the values of the extended fingers.



A closed fist represents zero, just the thumb extended is one, just the pointer finger is two, the thumb and forefinger both extended is three, and so on. All fingers extended is the highest count:: 31. If you use both hands (10 fingers) you can count from zero all the way to $2^{10}-1=1023$.

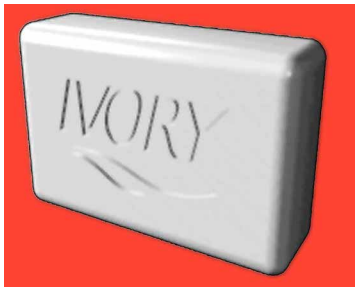
I have written a scratch program to demonstrate binary counting and put it on the web page

http://www.soe.ucsc.edu/~karplus/scratch_programs

where you can also find back issues of *Tech News*.

Soap in the microwave

We'll do another fun physics experiment today. What happens when you put a bar of ivory soap in the microwave and heat it up for a couple of minutes? Does Ivory soap behave differently from other brands of soap?



To figure out why the soap behaves the way it does, it helps to know that Ivory soap floats. The reason the soap floats is that it has extra air whipped into it as it cools. Originally (in 1879) the extra whipping was a mistake, but people liked having a soap that floated, so it became a part of the sales campaign for Ivory.

What is soap anyway, and how does it help clean things? What is the difference between soap and detergent? Will the soap still work after being microwaved?

A detergent is any of a large variety of chemicals or mixtures of chemicals (including soap) intended for cleaning. The most important ingredient of a detergent is the "surfactant" that helps dissolve fats and oils.

Both soap and detergents work in the same way—they consist of molecules with two ends, one of which dissolves well in water (the "polar" or "hydrophilic" end) and one that dissolves in fats and oils (the "nonpolar" or "hydrophobic" end). Normally nonpolar substances like fat and oil do not mix with water, but the soap or detergent molecules coat small globules of fat with the nonpolar ends sticking into the globule and the polar ends sticking out into the water. This globule is then soluble in water and the fat can be rinsed off of hands or out of clothes.

Soap is a salt of a fatty acid made by treating fat with lye (sodium stearate, sodium oleate, …). The fatty acid tail is the nonpolar end, and the polar end is formed when the sodium separates from the fatty acid, leaving an extra electron behind. Other detergents often have a sulphate group on the polar end, and may modify the tail to be less irritating to skin or otherwise change the properties of the detergent.