You need to do each of the following worksheets in a word document. Each worksheet has a single problem on it to solve. You can work them out on paper in your notebook if you want, but answer them on the word document. When you have finished, you will need to save the word document, upload it to google docs, and share it with me for grading.

When you save the file, save it as:

Binworkfirstlast.doc

For example, my file would be:

Binworkdarrenholt.doc

Worksheet Activity: Counting higher than 31

Look at the binary cards again. If you were going to make the next card in the sequence, how many dots would it have? What about the next card after that? What is the rule that you are following to make your new cards? As you can see, only a few cards are needed to count up to very big numbers.

If you look at the sequence carefully, you can find a very interesting relationship:

1, 2, 4, 8, 16…

Try adding: $1 + 2 + 4 = ?$ What does it come to?

Now try $1 + 2 + 4 + 8 = ?$

What happens if you add all the numbers up from the beginning?

Have you ever heard of "let your fingers do the walking"? Well now you can let your fingers do the counting, but you can get much higher than ten—no, you don't have to be an alien! If you use the binary system and let each finger on one hand represent one of the cards with dots you can count from 0–31. That's 32 numbers. (Don't forget that zero is a number too!)

Try counting in order using your fingers. If a finger is up it is a one, and if it is down it is a zero.

You can actually get from 0–1023 if you use both hands! That's 1024 numbers!

If you had really bendy toes (now you would have to be an alien) you could get even higher. If one hand can be used to count 32 numbers, and two hands can count to $32 \times 32 = 1024$ numbers, what is the biggest number Miss Flexi-Toes can reach?

AH, BUT CAN YOU COUNT UP TO 741,014?
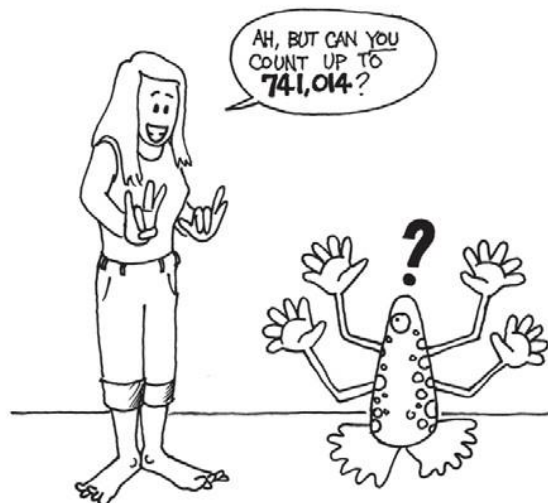
Worksheet Activity: More on Binary Numbers

1. Another interesting property of binary numbers is what happens when a zero is put on the right hand side of the number. If we are working in base 10 (decimal), when you put a zero on the right hand side of the number, it is multiplied by 10. For example, 9 becomes 90, 30 becomes 300.

   But what happens when you put a 0 on the right of a binary number? Try this:

   $$1001 \quad - \quad 10010$$
   <div align="center">(9)   (?)</div>

   Make up some others to test your hypothesis. What is the rule? Why do you think this happens?

2. Each of the cards we have used so far represents a 'bit' on the computer ('bit' is short for '**b**inary dig**it**'). So our alphabet code we have used so far can be represented using just five cards, or 'bits'. However a computer has to know whether letters are capitals or not, and also recognise digits, punctuation and special symbols such as **$** or **~**.

   Go and look at a keyboard and work out how many characters a computer has to represent. So how many bits does a computer need to store all the characters?

   Most computers today use a representation called ASCII (**A**merican **S**tandard **C**ode for **I**nformation **I**nterchange), which is based on using this number of bits per character, but some non-English speaking countries have to use longer codes.

Worksheet Activity: Writing Coded Messages

Go to http://www.eso.org/~ndelmott/ascii.html and write me a message in ASCII binary.

Each character has a binary code associated with it. Write out the combinations of codes to write a message.

For example, if I wanted to say "Hi dude", it would work like this.

H	01101000
I	01101001
(space)	00100000
d	01100100
u	01110101
d	01100100
e	01100101

You can put the codes in order to write the words.

01101000 01101001 00100000 01100100 01110101 01100100 01100101

You can also remove the spaces.

01101000011010010010000001100100011101010110010001100101

Go to http://www.roubaixinteractive.com/PlayGround/Binary_Conversion/Binary_To_Text.asp and type in your message. See if your message says what you wanted it to...

After you have completed all FOUR parts, save the file, upload it, and share it with me.