Binary Numbers – Part 3
Lesson Plan: Class 04 / P / 12

Overall goal of the lesson	Children will learn more about Binary Numbers.
Prior knowledge required	Lessons learned from the previous Binary Numbers periods. Knowledge of basic mathematics: addition, multiplication, division.

MODULE 1: **Module time:** 35 minutes

Goal:	To learn how to use binary numbers to make messages.
Description:	Children will learn about binary numbers with the help of an activity.
Material required:	**Physical:** 1. One copy of the worksheet Binary Numbers Part 3 per child. 2. Writing material to solve the worksheet: pencil and eraser. **Electronic:** PPT Presentation for Binary Numbers Part 3.
Procedure Details:	1. Begin with a quick recap of the previous lesson. The students learned that the digits in the Binary Number System have place values in multiples of two. Right most digit has the units place with a value of 1. As we move leftwards, the digits have values in multiples of two. They learned how to convert binary to decimal. They also learned about the divide by 2 method of conversion between decimal and binary. 2. The students learned about ASCII values. ASCII standard is used to assign numeric values for alphabets, numbers and symbols that are typically found on keyboards. These numeric values are converted to binary so that they can be understood by all computers all over the world. 3. Invite the students to play a "spy" game. The game involves sending and receiving coded or secret messages. What are coded messages? Messages that look like gibberish and mean nothing at first glance … but if we apply a secret key to the gibberish message it suddenly starts to make sense. 4. Encode means to create the coded message. Decode means to solve the code and get the message. 5. So the first thing we need is the code that the sender and receiver can both understand. Ask the students to have a look at the first page of their worksheets. This page is the secret key needed to understand the message. The page contains the ASCII representation of the alphabet. For simplicity sake we are using all capital letters. 6. Before beginning the game, let us first understand how to use the secret key. The first row of the chart shows the numbers 128, 64, 32, 16, 8, 4, 2, and 1. These numbers are the place values of an 8-bit binary number. 7. The left most column of the chart shows capital letters A to Z. The column next to the letters shows numbers from 65 to 90. These numbers are the ASCII values of capital A to Z. Remind the students that ASCII is the standard method that all computers use to recognize alphabets seen on keyboards. 8. The subsequent columns are showing the binary representation of the letters. Our chart is showing the ON (=1) values as dark rectangles and the OFF (=0) values as blank rectangles.

9. For example: the ASCII value of ‘A’ is 65. So the column with place value 64 is ON and the column with place value 1 is ON. When we add the ON values we get 65.
10. Let’s look at more values… e.g.: ‘O’ has the value 79. The break-up of 79 using the binary place values is 64 + 8 + 4 + 2 + 1 = 79. Now look at the dark values for ‘O’ … do they match?
11. Let’s try to encode a simple word first, example: ‘BAT’. This word has the letter B (value = 66), letter A (value = 65) and letter T (value = 84). To send this word using the binary code, the message will look like this:

	ASCII	128	64	32	16	8	4	2	1
B	66		■					■	
A	65		■						■
T	84		■		■		■		

12. Encoding the word ‘HELLO’ will look like:

	ASCII	128	64	32	16	8	4	2	1
H	72		■			■			
E	69		■				■		■
L	76		■			■	■		
L	76		■			■	■		
O	79		■			■	■	■	■

13. So how do we decode messages when we receive them? Let’s take the example shown below. If we add the place values of all the dark rectangles in a row, we will get the total value. When we look up this value in the chart we will get the corresponding alphabet.

128	64	32	16	8	4	2	1	ASCII	
	■					■		66	B
	■						■	65	A
	■		■		■			84	T

14. Ask the students to solve the secret messages in the worksheet.