Converting positive denary whole numbers

Teacher's Notes

Lesson Plan

Length	60 mins	Specification Link	2.1.4/c
Learning objective	Candidates should be able to: (a) convert positive denary whole numbers (0-255) into 8-bit binary numbers and vice versa		

Time (min)	Activity	Further Notes
10	Ask the students: • The number of and names of the digits used for counting in denary. • The digits used for counting in binary. Using a projector, display the **Interactive Starter Activity**. This can be paused to highlight the place values of digits in both systems and how they are similar, as columns are added to the left when the highest permissible value is reached, in both systems.	10 digits. 0 to 9. 2 digits. 0 and 1.
10	Watch the set of videos pausing to discuss the content.	
5	Discuss the videos. • Ask the students the place values of a 4-bit binary number. • What is written to use (or not use) a place value. • What is the largest denary number that can be represented by an 8-bit binary number.	8, 4, 2, 1. 1 and 0. 255.
10	Pupils to complete **Worksheet 1** either on paper or on a computer. Ask individual students for their responses and discuss with the class so that all students will have the correct answers.	Answers provided. Ask students with the correct responses to explain to the class how they arrived at their answers.
15	The students use the **Interactive Activity.** Ask the students to test the two conversion routines, denary to binary and vice versa, using numbers of their own. Ask the students to view the code and move their mouse pointers over the lines to view the explanations. Explain that this is written in Javascript but the principles are the same for any language. **Challenge** Ask the students to write similar routines using the programming language they are learning.	
	Extension Challenge/Homework Students to complete and submit **Worksheet 2** for homework and complete the programming challenge from the previous activity.	

Time (min)	Activity	Further Notes
5	**Plenary** **Peer questioning** Ask the students to work in pairs. Each asks their partner to convert a denary number to binary and a binary one to denary.	

WORKSHEET 1 ANSWERS

1 Complete the following table which shows the place values of an 8-bit binary number.

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
128	64	32	16	8	4	2	1

2 Convert the following denary numbers into 8-bit binary ones.

(a) 13
00001101

(b) 69
01000101

(c) 131
10000011

(d) 199
11000111

(e) 245
11110101

3 **Convert the following 8-bit binary numbers to denary ones.**

(a) 11001101
205

(b) 01000100
68

(c) 10101010
170

(d) 11110000
240

(e) 10111100
188

WORKSHEET 2 ANSWERS

1 **(a) Calculate the denary value of the 8-bit binary number 11011001. (2)**

You must show your working.

Answer line 1
128 + 64 + 16 + 8 + 1

Answer line 2
217

(b) Calculate the binary value of the denary number 139. (2)

You must show your working.

Answer line 1

128	64	32	16	8	4	2	1

Answer line 2

1	0	0	0	1	0	1	1

Answer line3
Remainder 11 remainder 3

Answer line 4
10001011