Spook numbers & MYCA Challenge

The following Spook numbers problem requires a very good understanding of place value.

This problem is suitable for upper primary and junior secondary students.

MYCA CHALLENGE school-based problem-solving program

+ Designed to help teachers motivate, stimulate, encourage and develop mathematically interested students in years 3–10

+ It can be undertaken by an individual or group, solo or preferably with some time support at school where teacher can monitor progress (e.g. 1 hour per week in class).

+ Materials provided by AMT include question booklets, teacher guide (questions, solutions, marking schemes, extension work), certificates and stats reports.

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Spook numbers

Look at the number **8161**

It is made up of four digits: **8, 1, 6** and **1**. It does not contain the digit **0**. The first digit from the left is **8**. We will call this the leading digit.

The sum of all the digits is **16: 8 + 1 + 6 + 1 = 16**

This is twice the leading digit: **16 = 2 x 8**

So **8161** is a 4-digit spook number.

a. Find an even 5-digit spook number.

b. What is the smallest 4-digit spook number? Explain why it is the smallest.

c. What is the largest spook number? Explain why it is the largest.

d. What is the largest spook number which has all its digits different? Explain why it is the largest.

Spook numbers Solutions

a. **82222, 71114, 81214** are examples. There are many more. The smallest is **51112** and the largest is **94212**.

b. The leading digit of a spook number is the sum of the other digits. The smallest digit which is the sum of three other non-zero digits is **3 = 1 + 1 + 1**. This is the only way this can be done, so the smallest 4-digit spook number is **3111**.

c. The largest possible leading digit is **9**. The more digits that follow the **9**, the greater the place value of the 9 and the larger the number. A sum of **9** using the greatest number of digits is **9 = 1 + 1 + 1 + 1 + 1+ 1 + 1 + 1 + 1**. Therefore, the largest spook number is **9111111111**.

d. No spook number with all its digits different can have more than four digits. This is so since the smallest set of four different non-zero digits is **1, 2, 3** and **4**. These sum to **10**, which is more than one digit.

Of the possible 4-digit spook numbers with different digits, the largest will have leading digit **9**. The sets of different digits which add to **9** are **1, 2** and **6; 1, 3** and **5; 2, 3** and **4**. So the largest spook number with four different digits is **9621**.