MATH 5: WORKSHEET 10
BINARY NUMBERS. n-ARY NUMBERS.

1. You have scales, a 1 gram weight and a large bag of sugar. What would be the fastest way to measure exactly 8 grams of sugar? exactly 128 grams? exactly 100 grams?

2. Is it possible to encode every letter of English alphabet by a 4-digit binary number? You can choose any way you like — for example encoding A as 0000, B as 0001, or by any other method.
   Would it be possible if we used 5-digit binary numbers?

3. A car has traveled 125 miles during some period. During the same period, another car, which is faster by 10 mph, has traveled 150 miles. What is the speed of the faster car?

4. Do the following arithmetic operations with binary numbers. Try doing them without converting the numbers to decimal form.

   (a) $110101_b + 111011_b$ (b) $10101_b \times 1011_b$ (c) $(10101_b + 1101_b) \times 10110_b$

5. The following is a beginning of a computer file. Can you decode it (assuming it is written in the standard, Latin 1, encoding)?

01010100 01101111 01110000 00100000 01110011 01100101 01100011 01110010 01100101 01110100 00001010

6. Fish head weighs as much as the tail and half of the body together. The body weighs as much head and tail together, and the tail weighs 1 kg. How heavy is the fish?

7. You are given several coins, one of which is fake. The weight of the fake one is different from the weight of the real ones, but it is not known whether it is heavier or lighter. Can you find whether the fake one is heavier or lighter than the real one using two measurements with the scales (2 platforms, no weights) if the total number of coins is:

  (a) 100   (b) 99   (c) 98

You do not have to find which coin is the fake one.