

WEIGHING COINS, PROBABILITY, AND MORE

EARLY ELEMENTARY CIRCLE 1/27/12

Find the bag with the fake coins. Last time, we solved the following problem:

Given 10 bags full of coins (one bag containing fake coins, and the other bags containing real coins), find out which bag contains the fake coins in just one weighing using a digital scale. (Note that a fake coin weights 9 grams while a real one weights 10 grams).

- (1) One way to solve the problem is to put the following combination of coins on the digital scale:
- 1 coin from the first bag;
 - 2 coins from the second bag;
 - 3 coins from the third bag;
 - ...;
 - 10 coins from the tenth bag;

(a) How many coins in all are you placing on the scale?

- (b) If all the coins were real, how much would the coins weigh all together?

Given that one of the bags contains fake coins, make a table showing what the total possible weight of the coins is and how this tells you which bag contains the fake coins.

Number of Fake Coins from a bag	Total Weight
1	549

- (2) Rita, a Kindergarten student, placed some number coins from all of the bags on the scale:
- Exactly five of the coins are from bag 3;
 - Exactly five of the coins are from bag 4;
 - The rest of the coins are from other bags;

(a) She thinks she can always determine which of the bags contains the fake coins in just one weighting. Is Rita right?

(b) Can she get lucky and be able to determine what bag contains the fake coins? If yes, explain how this can happen.

(c) What happens when the fake coins are in bag 3 or 4?

- (3) Tyler, a Junior circle student, thinks that it is enough to place the coins from only 9 bags on the digital scale in order to find out which of the bags contains the fake coins. Do you think he is right? If yes, explain what he has in mind. If not, explain why not.

A probability game: throw the dice twice and add the numbers. We will start our study of probability with the following experiment:

- Throw two dice simultaneously.
- Find the sum of the two numbers (that is, add the two numbers up).
- Record the date you obtain on the bar graph given to you.
- Repeat this 30 times.

(You can do this with a partner – one of you will throw the dice, the other records the sum on the bar graph).

(5) What number came up most often as the sum?

Let's try to use our knowledge of mathematics to explain the experimental data we obtained.

(1) Construct the addition table for numbers from 1 to 6.

+	1	2	3	4	5	6
1						
2						
3						
4						
5						
6						

(2) What is the smallest sum in the addition table?

(3) What is the largest number in the addition table?

- (4) Does the addition table help you explain the data you obtained in your experiment?

Calendar problems.

- (1) Today is a Thursday. Kate's birthday is in 5 days. What day of the week is Kate's birthday?
- (2) Thomas has to write a long essay for this English class. He got this assignment on Tuesday, March 12th. The assignment is due on Thursday, April 18th. Thomas plans to work on the essay every Monday and every Friday. How many days does he allow himself to work on the essay? (Note that there are 31 days in March).