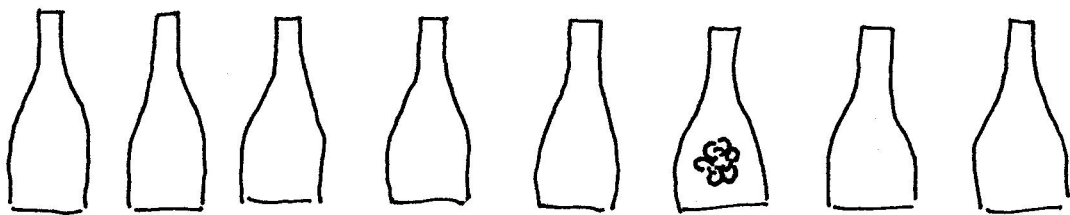


HAMMING CODE

A presentation by Wilfredo Molina

American mathematician Richard Hamming invented what are now called Hamming Codes circa 1950. They are a family of error-correcting codes in the field of telecommunications. Students will work on a simple instance of a Hamming Code:



Given eight water bottles, one of which contains an undetectable pathogen, figure out which bottle is contaminated provided that the pathogen induces symptoms at a specific time the next day.

Any number of people can be hired per day at a cost of \$10 per person per day to taste bottles in any way. The goal of the activity is to save time and money as well.

One solution, although far from the best, is to hire one person and order them to taste one bottle per day. In the worst case scenario, it will take 7 days at a total cost of \$70 to find the contaminated bottle.

There is an optimal solution: \$30 and one day.

I will explain it.

The numbers from 0 to 7 in binary format are as follows:

$$0_{10} = 000_2$$

$$1_{10} = 001_2$$

$$2_{10} = 010_2$$

$$3_{10} = 011_2$$



$$4_{10} = 100_2$$

$$5_{10} = 101_2$$

$$6_{10} = 110_2$$

$$7_{10} = 111_2$$

I now label my eight bottles with the numbers from 0 to 7 in binary, written vertically:

	0	1	2	3	4	5	6	7
								
A	0	0	0	0	1	1	1	1
B	0	0	1	1	0	0	1	1
C	0	1	0	1	0	1	0	1

I hire three people, A, B, and C, and assign them to the above rows. Here, a 0 means don't drink, and a 1 means drink.

If bottle 5 is contaminated, then A and C will wake up sick, and B will wake up healthy.