

## An experiment with colorful candies

We are doing an experiment with drawing colorful candies. According to the predefined protocol, the experimenter will conduct an experiment behind the curtain and draw one colored candy. The protocol is unknown to the viewers and the only thing they can observe is the outcome of the experiment (the color of the drawn candy).

### Hidden extraction protocol (behind the curtain)

Candies are drawn from two containers, **B**(owl) and **P**(late), each of which holds exactly 15 candies. In the first container (Bowl) there are 8 lemon candies (**Y**ellow), 5 cherry candies (**P**urple) and 2 orange candies (**O**range). In the second container (**P**late) there are 2 lemon candies, 3 cherry candies and 10 orange candies.

$$\mathbf{B(owl)} = 8\mathbf{Y} + 5\mathbf{P} + 2\mathbf{O}$$

$$\mathbf{P(ate)} = 2\mathbf{Y} + 3\mathbf{P} + 10\mathbf{O}$$

The choice from which container to draw the candy is determined by the experimenter by tossing two unbiased coins (two Kuna coins), and always except in the first case chooses the bowl if both coins have landed heads (tuna fish), and the plate for the remaining three outcomes. However, when drawing the first candy in a row, the selection is the opposite, so a plate is chosen as the first container for drawing in the case of two heads (tunas), and a bowl for the remaining outcomes.

After randomly drawing a candy from a defined container, the candy is shown to the audience and returned to the same container from which it was drawn for a new experiment. This experiment is then repeated for as long as we like, thus creating an observation sequence whose statistics is defined by the parameters of the described experiment.

The task of the audience is to determine the protocol of the draw based solely on the observed sequence of colors of the drawn candies. If somehow the audience found out that it was a drawing from two different containers, they have to determine the unknown sequence of outcomes of tossing a pair of coins that affects the choice of the pot (i.e. the unknown states of the model) and all the associated probabilities of changing the state and the probabilities of observing the individual colors of the candies drawn, depending on which container each candy was taken from. So the actual task is to identify the stochastic model and its parameters from observations.