Chapter 1.2 Frequency Viewpoint

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Chapter 1 Probability, A Measure of Uncertainty

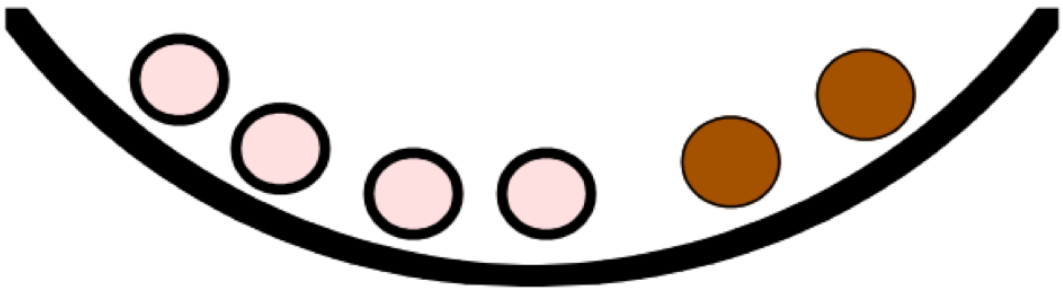
Introduction

- Observe some phenomena (say, the rolls of two dice) where the outcome is random.
- Write down the list of all possible outcomes, and believe that each outcome in the list has the same probability.
- Then the probability of each outcome will be

$$\mathit{Prob}(\text{Outcome}) = \frac{1}{\text{Number of outcomes}}. \tag{1}$$

Balls in Bowl Example

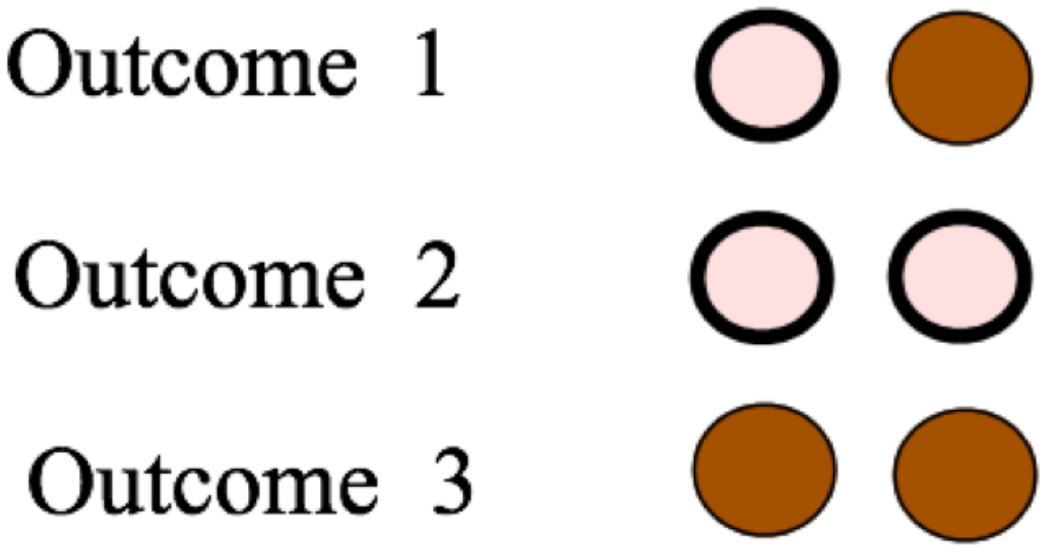
- Suppose one has a bowl with 4 white and 2 brown balls and two balls from the bowl are drawn at random.



- Assume that the balls are drawn without replacement
- What are possible outcomes?

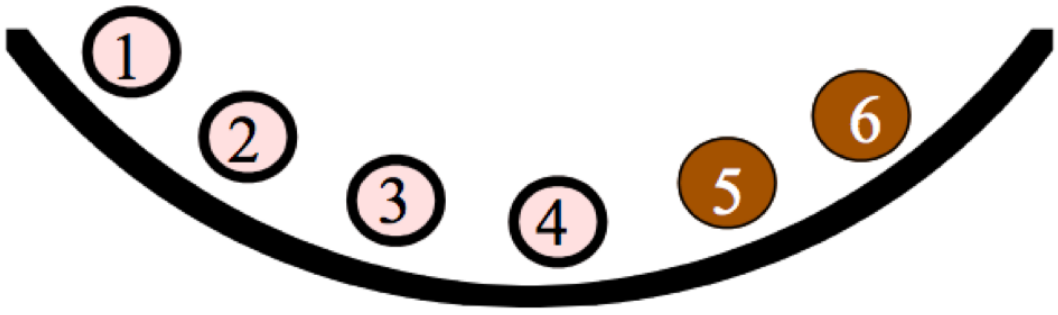
One Way to Think About Outcomes

- Suppose you don't distinguish between balls of the same color
- Then there are three possible outcomes – one chooses 0 brown, 1 brown, or 2 brown balls.



Another Way to Think About Outcomes

- Supose one does distinguish between the balls of the same color.
- Label the balls in the bowl and then write down 15 distinct outcomes.



Outcome 1 (1)(2)	Outcome 6 (3)(4)	Outcome 11 (1)(6)
Outcome 2 (1)(3)	Outcome 7 (1)(5)	Outcome 12 (2)(6)
Outcome 3 (1)(4)	Outcome 8 (2)(5)	Outcome 13 (3)(6)
Outcome 4 (2)(3)	Outcome 9 (3)(5)	Outcome 14 (4)(6)
Outcome 5 (2)(4)	Outcome 10 (4)(5)	Outcome 15 (5)(6)

Which is the more appropriate way of listing outcomes?

- To apply the classical view of probability, one has to assume that the outcomes are all equally likely.
- In the first list of three outcomes, one can't assume that they are equally likely. It is more likely to choose two white balls than to choose two brown balls.
- On the other hand, since one are choosing two balls at random from the basket, it makes sense that the 15 outcomes in the second listing are equally likely.
- So one applies the classical notion and assign a probability of $1/15$ to each of the possible outcomes.