

# Basics of Probability\*

## Worksheet 6

1. Roll three fair dice.
  - (a) Keeping track of the order, how many different outcomes are possible?
  - (b) What values are possible for the sum on the three die?
  - (c) Give the number of outcomes that result in a sum of 2, 3, 4, and 5?
  - (d) Find  $P\{\text{sum is } x\}$  for  $x = 2, 3, 4,$  and  $5$ .
  - (e) Explain, in words, why  $P\{\text{sum is } x\} = P\{\text{sum is } 21 - x\}$ . (*Hint*: If the value  $v$  is showing on the die, then the value  $7 - v$  is opposite.)
  - (f) Find  $P\{\text{sum is even}\}$ . (*Hint*: Consider the cases for which the values on each of the three die are even or odd.)
  - (g) Use the `sample` command with the parameter `replace=TRUE` to simulate 10000 times the sum on the three dice. Give a table of outcomes and compare the proportion in the simulation to the probabilities computed in part (c).
  
2. Most desert tortoises live in creosote bush scrub habitat at elevations ranging from 1,000 to 3,000 feet above sea level, Their habitat covers over a relatively large region including the Mojave and Sonoran Deserts. In some areas, the number of desert tortoises has decreased by 90% due primarily to human activity. A study area in Organ Pipe Nationals Monument has 300 Sonoran desert tortoises. Fifty are captured, tagged, and released. A certain time later, 15 of the 300 are captured.
  - (a) What is the probability that exactly one of the 15 in the second capture are tagged? State clearly what assumptions you are using.
  - (b) Find the probability that  $x = 0, 1, 2, \dots, 15$  that are tagged. Check that the sum is 1.
  - (c) Use the `sample` command to perform 10000 simulations of the capture, tag, and release situation described above. Give a table of outcomes and compare the proportion in the simulation to the probabilities computed in part (b).

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