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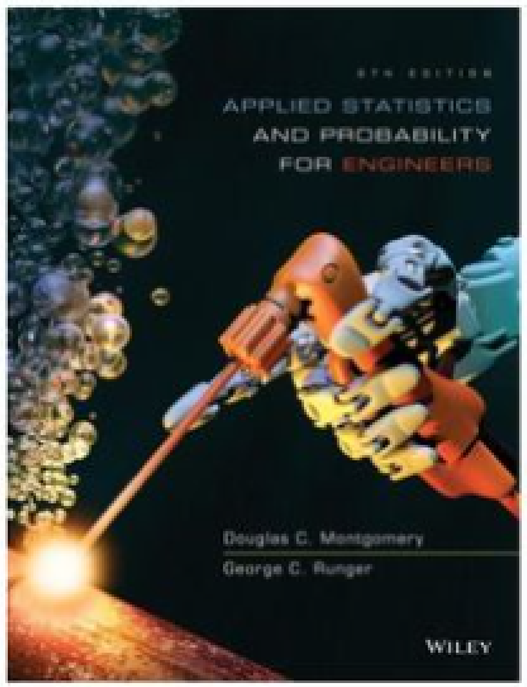


Applied Statistics and Probability for Engineers

Sixth Edition

Douglas C. Montgomery George C. Runger

Chapter 2
Probability

2 Probability

CHAPTER OUTLINE

Chapter 2 Title and Outline

Learning Objectives for Chapter 2

After careful study of this chapter, you should be able to do the following:

1. Understand and describe sample spaces and events
2. Interpret probabilities and calculate probabilities of events
3. Use permutations and combinations to count outcomes
4. Calculate the probabilities of joint events
5. Interpret and calculate conditional probabilities
6. Determine independence and use independence to calculate probabilities
7. Understand Bayes' theorem and when to use it
8. Understand random variables

* Experiment → Tossing a coin
                → Roll a die

* sample space (all possible outcomes)
  → toss a coin → S = {Head, Tail}
  → die → S = {1, 2, 3, 4, 5, 6}

sample space

Discrete
Countable
* No. of.
* (whole number)
X = 1 , X = 2

Continous
Measurable
* (decimals)
* Interval → ما بين

X < 3,
2 < x < 4

Ex: Age, weight, height, time

Random Experiment

- An experiment is a procedure that is
  - carried out under controlled conditions, and
  - executed to discover an unknown result.
- An experiment that results in different outcomes even when repeated in the same manner every time is a random experiment.

Sample Spaces

- The set of all possible outcomes of a random experiment is called the sample space, *S*.
- *S* is discrete if it consists of a finite or countable infinite set of outcomes.
- *S* is continuous if it contains an interval of real numbers.

Example 2-1: Defining Sample Spaces

- Randomly select a camera and record the recycle time of a flash. $S = R^+ = \{x \mid x > 0\}$, the positive real numbers. → continous
- Suppose it is known that all recycle times are between 1.5 and 5 seconds. Then

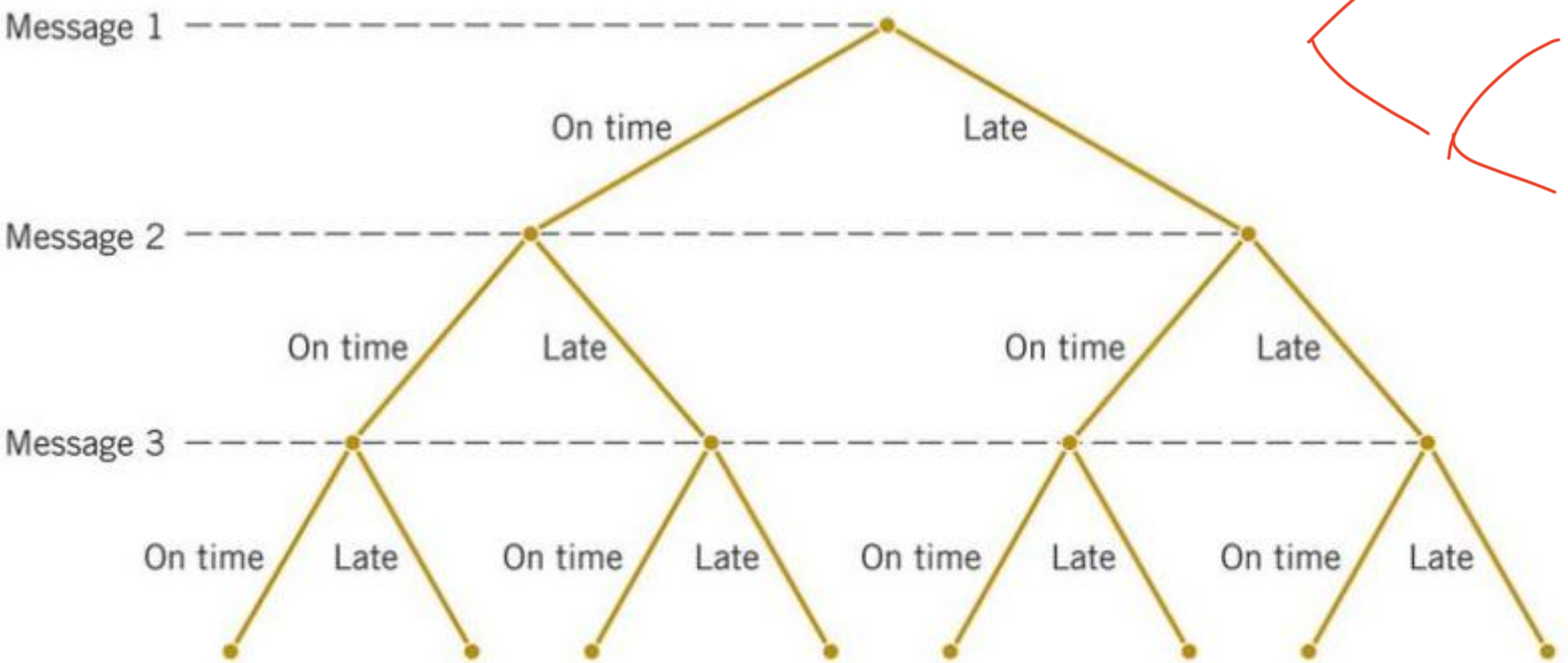
  $S = \{x \mid 1.5 < x < 5\}$ is continuous.
- It is known that the recycle time has only three values(low, medium or high). Then $S = \{low, medium, high\}$ is discrete.
- Does the camera conform to minimum recycle time specifications?

  $S = \{yes, no\}$ is discrete.

Sample Space Defined By A Tree Diagram

Example 2-2: Messages are classified as on-time(o) or late(l). Classify the next 3 messages.

S = {ooo, ool, olo, oll, loo, lol, llo, lll}



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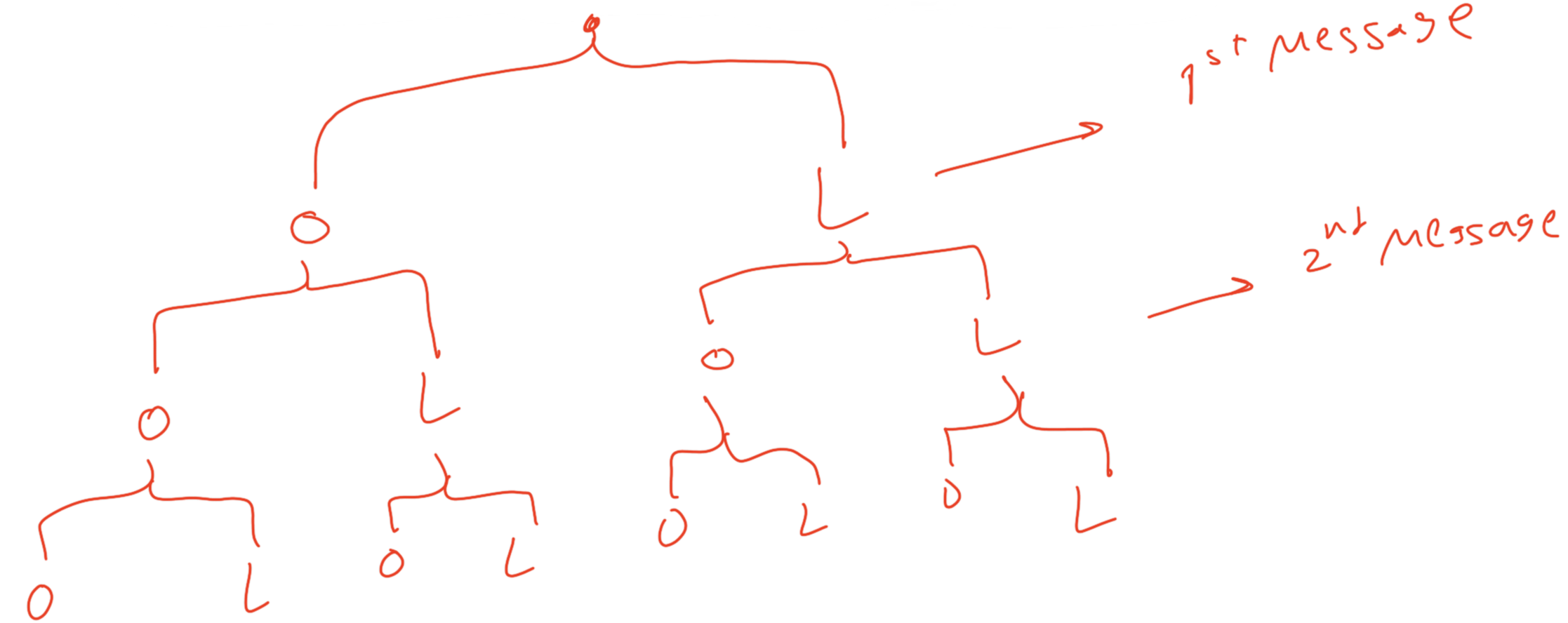
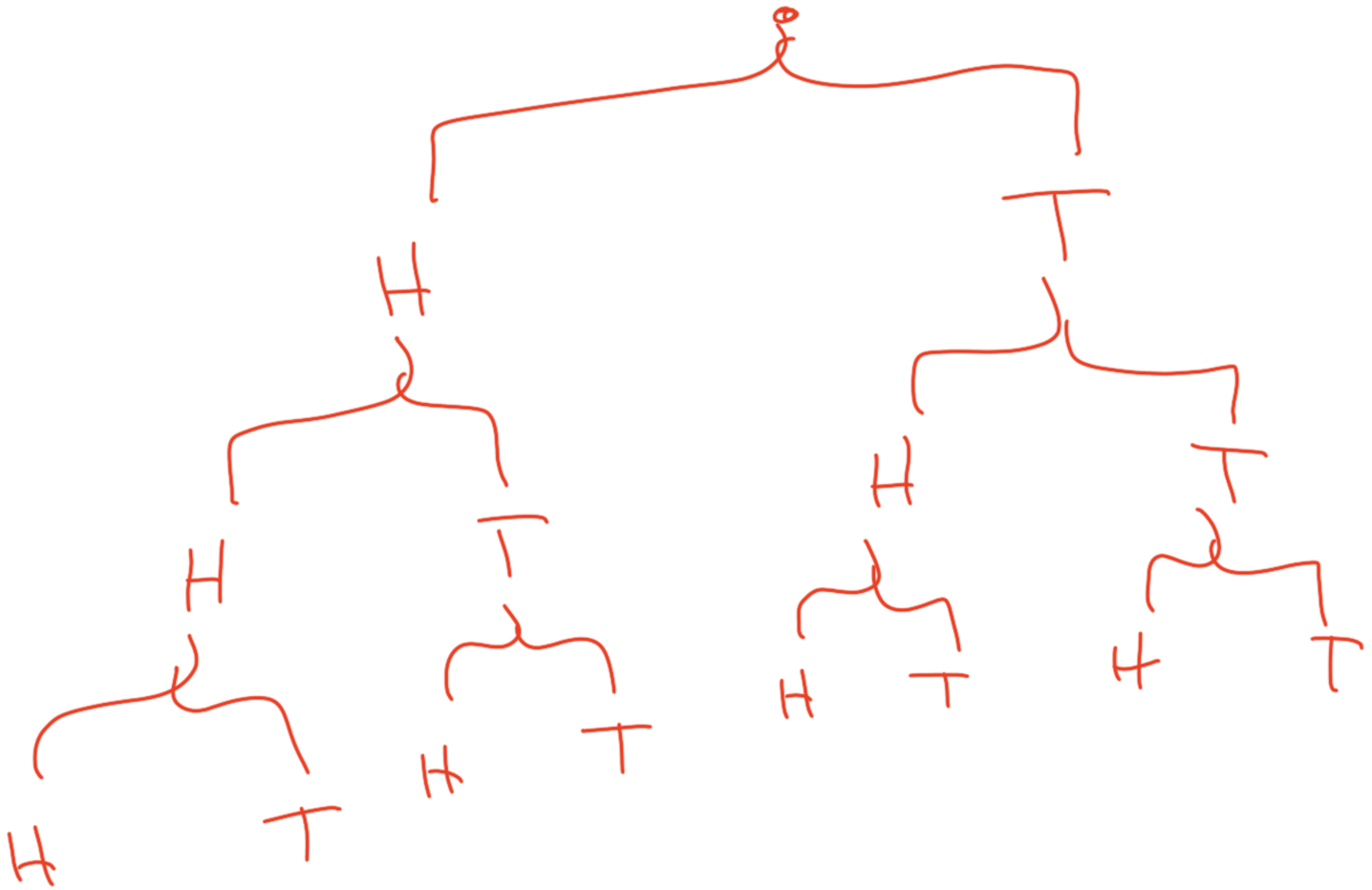


$S = \{ooo, ool, olo, oll, loo, lol, llo, lll\}$

* Coin is thrown 3 times



$S = \{HHH, HHT, HTH, HTT, THH, THT, TTH, TTT\}$.