StatisticsGuidedNotes

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Preface

In this document, I have worked to create a guided set of notes to aid in an efficient use of class time. Who loves writing exhaustive definitions in a notebook or copying figures when instead we could have an already prepared framework to speed note taking of important concepts?

I'm starting this in the middle of a school year, having recently come back from paternity leave so the beginning of this book will need to be updated later. Instead, I'll begin with the section we are examining currently - the beginning of **Chapter 5 - Continuous Random Variables**.

1 Chapter 5 Introduction

Continuous random variables have many applications: IQ scores, length of phone calls, money a person carries, time a computer chip lasts, SAT scores.

1.1 Quick Facts

- The graph of a continuous probability distribution is a curve.
- Probability is area under the curve
- Curve is called the **probability density function** or **pdf** and is represented by $f(x)$.
- **Area under the curve** is given by a different function called **cumulative distribution function** or **cdf** and evaluates probability as area.
- Outcomes are measured, not counted
- Area under curve and above x-axis is 1
- Probability is found for intervals of x values
- $P(c < x < d)$: Probability that random variable X is in interval and found as area under curve from $x = c$ to d
- $P(x = c) = 0$: Probability of any single value is 0. The area under the curve has no width at a single point.
- $P(c \leq x \leq d)$ is the same as $P(c < x < d)$

In general, calculus is required to find the area under a curve; to keep this course at a pre-calculus level we will focus on focus on geometry, formulas, or technology to find area. There are many continuous probability distributions that fit different situations best. We will discuss the normal, exponential, and uniform distributions and work example problems from the uniform distribution.

5.1 - Continuous Probability Functions

- Defined as a continuous function $f(x)$
- Functions are defined so that the area between the function and the x-axis is equal to a probability.
  - Since max probability is 1, the area under the curve must be 1.
- **Remember, for continuous probability functions, PROBABILITY = AREA**

Example 5.1

Consider the function $f(x) = 1/20$ for $0 \leq x \leq 20$ where x is a real number.

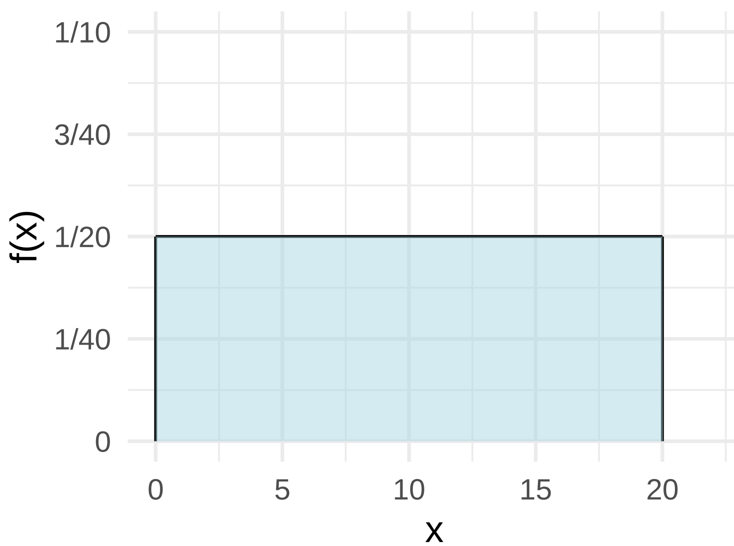
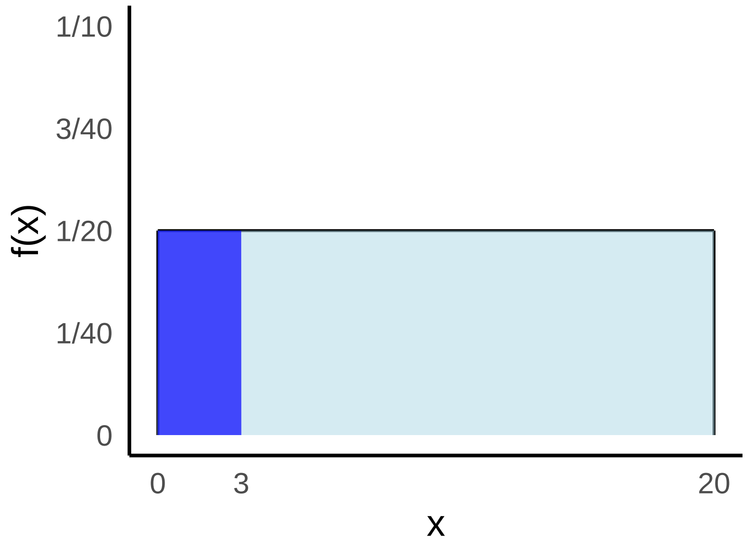


Figure 1.1: f(x) = 1/20

The area under the curve for this function is the area of a rectangle: $Area = b \times h = 20 \times \frac{1}{20} = 1$ So the total probability is 1. We can now find the probability of *ranges* of x-values as the area of different rectangles under the curve.

Suppose we want to find the area instead where $0 < x < 3$ instead:



Question:

What is the probability that x takes a value between 2.3 and 12.7?

Question: