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Chapter 5

Joint Probability Distributions

- 5.1 Jointly Distributed Random Variables
- 5.2 Expected Values, Covariance, and Correlation
- 5.3 Statistics and Their Distributions**
- 5.4 The Distribution of the Sample Mean
- 5.5 The Distribution of a Linear Combination

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Simple Random Sample

The rvs X_1, X_2, \dots, X_n form a **simple random sample** of size n if

1. The X_i are independent rvs
2. Every X_i has the same probability distribution

We also say X_1, \dots, X_n are **iid**.

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Statistic

A **statistic** is a function of a sample.

A **statistic** is itself a rv and will be denoted by a capital letter. Examples:

$$\bar{X} = \frac{1}{n} \sum_{i=1}^n X_i \quad S^2 = \frac{1}{n-1} \sum_{i=1}^n (X_i - \bar{X})^2$$

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Example

An automobile service center charges \$40, \$45, and \$50 for a tune-up of four-, six-, and eight-cylinder cars, respectively. Suppose 20% of its tune-ups are done on four-cylinder cars, 30% on six-cylinder cars, and 50% on eight-cylinder cars. Suppose on a particular day only two servicing jobs involve tune-ups.

- Find the sampling distribution of the sample average
- Find the sampling distribution of the sample variance

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