Sampling Distributions

I. Introduction

Recall the definitions of parameter and statistic. We are interested in finding the sampling distribution of a statistic.

Examples:

II. Sampling Distribution of $\bar{X}$

The probability distribution of a statistic is its sampling distribution.

a. Why we are interested in the distribution of the sample mean?

b. Properties of the sample mean:

- mean of the sample mean = mean of the population

- variance of the sample mean = variance of the population / sample size

- standard deviation of the sample mean =
  standard deviation of the population / square root of sample size
**Example:** Suppose the number of cars in households does have the following distribution:

<table>
<thead>
<tr>
<th>$x$</th>
<th>$p(x)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.50</td>
</tr>
<tr>
<td>3</td>
<td>0.40</td>
</tr>
<tr>
<td>5</td>
<td>0.10</td>
</tr>
</tbody>
</table>

We select samples of size two with replacement two from this population.
c. *The Central Limit Theorem*

For large samples \((n \geq 30)\), the sample mean is approximately normal with mean \(\mu\) and standard deviation \(\sigma/\sqrt{n}\).

**Example:** Safety of airline passengers.

An airliner can carry 42,000 pound (passengers + luggage). The weight of passengers (plus luggage) has a mean of 200 pounds with standard deviation of 40 pounds. If the airliner had 202 passengers, what is the probability of overloading?