Review - Exam 1
Ch 1 - 6

Variables

1) Numeric
   a) discrete
   b) continuous

2) Categorical
   a) ranked
   b) unranked

3) Relative Frequency
   how to compute it
Tables / Graphical Displays

1) Dot Plot
2) Stem and Leaf Plot
3) Box Plots
4) Bar Graph
5) Pie Chart
6) Frequency Distribution
7) Histogram
- Descriptive Statistics vs Inferential Statistics

- Distinction between sample population & population
\[ \frac{i(m-n)m}{i} = \frac{m}{u} \]

\[ \frac{u}{z(xz)^2} = \frac{xz}{2} \]

\[ (x-x)^2 \]

\[ z(xz)^2 \]

\[ xz \]

Calculations
Averages - Centers of Data

Mean: $\bar{x} = \frac{\sum x}{n}$

Median: $\frac{1}{2} (n+1)^{th}$ ranked observation

Mode: most frequent observed value

- Which is sensitive to the outliers?
Sample Standard Deviation

\[ S = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}} \]

or

\[ S = \sqrt{\frac{\sum x^2 - (\sum x)^2}{n}} \]

Interpretation
Interpretation

Value of $s$ indicates how "spread out" the data is

1) $s = 0$ → No variation in the data; values all the same

2) $s$ "small" → the data values are not widely dispersed

3) $s$ "large" → the data values are widely dispersed
S small

0  20  40

S large

0  20  40

S = 0
Probability: Relative Frequency Definition

Def: Suppose an experiment consists of $n$ trials, and $k$ of these trials result in event $E$. Then

\[ \hat{P}(E) = \frac{k}{n} = \frac{\# \text{successful repetitions}}{\text{total \# repetitions}} \]

Note: This is called the empirical probability of an event or the relative frequency of the event.
Probability - Equally Likely Outcomes

Def: Suppose an experiment can result in one of \( m \) equally likely outcomes. Suppose that \( r \) of these outcomes result in event \( A \) occurring. Then the theoretical probability of event \( A \) is

\[
P(A) = \frac{r}{m}
\]

\[
= \frac{\text{# outcomes in event } A}{\text{total # possible outcomes}}
\]

Note: For each outcome in S.S.

\[
P(\text{outcome}) = \frac{1}{\text{total # possible outcomes}}
\]
A discrete probability distribution is a list (or description) of the values the random variable can have, along with the associated probabilities.

What is Sample space? S$S$
Rules

The probability of an event $E$ is always between 0 and 1, inclusive:

$$0 \leq P(E) \leq 1$$

$P(E) = 0 \quad \rightarrow \quad \text{event } E \text{ cannot occur}$

$P(E) = 1 \quad \rightarrow \quad \text{event } E \text{ must always occur}$
2) The probability of event $A$ is equal to the sum of the probabilities of the outcomes in event $A$

$$P(A) = \sum_{\text{all outcomes in } A} P(\text{outcome})$$

Complementary Event

Def: Suppose $A$ is an event. The complement of event $A$, denoted "not $A$", is the event "$A$ does not occur".

Rule of Complementary Events

$$P(\text{not } A) = 1 - P(A)$$
The compound event
\[ E_1 \cap E_2 = E_1 \text{ and } E_2 \]
ocurs if and only if both event \( E_1 \) occurs and event \( E_2 \) occurs.

The compound event
\[ E_1 \cup E_2 = E_1 \text{ or } E_2 \text{ or both} \]
ocurs if \( E_1 \) happens or if \( E_2 \) happens or if both events happen.
Two events are mut. excl. if the occurrence of one event precludes the occurrence of the other event.

If event $E_1$ and event $E_2$ are mut. excl. then

\[ P(E_1 \text{ and } E_2) = 0 \]

\[ P(E_1 \mid E_2) = 0 \]

\[ P(E_2 \mid E_1) = 0 \]
Gen. Add. Law ("or")

\[ P(E_1 \text{ or } E_2) = P(E_1) + P(E_2) - P(E_1 \text{ and } E_2) \]

Spec. Add. Law (Mut. excl. events)

\[ P(E_1 \text{ or } E_2) = P(E_1) + P(E_2) \]
Conditional Prob.
\[ P(E_2 \mid E_1) \]

Gen. Mult. Law ("Amp")
\[ P(E_1 \text{ and } E_2) = P(E_1) P(E_2 \mid E_1) = P(E_2) P(E_1 \mid E_2) \]

Spec. Mult. Law (Ind. Events)
\[ P(E_1 \text{ and } E_2) = P(E_1) P(E_2) \]