Problem Set 2

STAT-S 520

Due on January 23th, 2023

Instructions:

- Submit your answers in Canvas.
- Your answers can be typed and/or handwritten, as long as your final submission is a single PDF file with answers in proper order.

Questions:

1. Using finite additivity and $P(S) = 1$, show that
    a. For any event $A \subset S$, $P(A^c) = 1 - P(A)$. Show also that $P(\emptyset) = 0$ (i.e., the probability of the empty set is zero)
    b. If $A \subset B$, then $P(A) \leq P(B)$
    c. $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
2. Toss a fair coin five times, so each possible outcome is considered equally likely. Find the probabilities for the following events:
    a. $A = \{$Exactly four of the coins show heads $\}$
    b. $B = \{$There are more heads than tails$\}$
    c. $D = \{$There are at least three tails$\}$
    d. $A^c \cup D$
    e. $B \cup D$
3. Suppose that $P(A) = 0.6, P(B) = 0.7$, and $P(A^c \cap B^c) = 0.12$
    a. Is it possible for A and B to be disjoint events? Why or why not?
    b. What is the probability of $A \cup B^c$?
    c. Is it possible for A and B to be independent events? Why or why not?
    d. What is the conditional probability of A given B?
4. Use the data frame `fandango` form package `fivethirtyeight` (recall you need to install and call the package before you can work with the data frame) and do the following:
    a. Read the description of the data frame and briefly comment the information it provides.
    b. Create an object from variable `rottentomatoes` and another from variable `metacritic`. For each find the sum, average, median, minimum, and maximum values, and report those values.
    c. Using the code and explanations from SIDS, section 2.3 (this is your second textbook) create a scatterplot for `rottentomatoes` against `metacritic`. Comment on your findings.
    d. Using SIDS, section 2.7 and 2.8, obtain a boxplot and a barplot `rottentomatoes`. Comment on your findings.
    e. Using SIDS, section 2.7, obtain a side-by-side boxplot of `rottentomatoes` scores split by `fandango_stars` (make sure use the factor version of `fandango_stars`)

Reading assignments

For Tuesday:

- SIDS 2, in particular 2.3, 2.7, and 2.8 (needed for question 4)
- ISI Examples 3.9 and 3.10 (pp. 60 - 64) Section 3.5 (pp. 69 - 76)

For Thursday:

- ISI 4.1, and 4.2 (pp.89 - 92)
- SIDS 3.1 - 3.5