Homework 3

- Collaboration: Homeworks are individual work. Visit here for more info on academic integrity.

- Formatting: You are supposed to upload a file `hw3_writeup.pdf` . You can produce the file however you like (e.g. LaTeX, Microsoft Word, scanner), as long as it is readable.

Create a pdf file `hw3_writeup.pdf`. Answer the problems in the pdf file only.

Problem 1 (Markov Transition Matrix)

Assume the status of an automobile is one of the following four: (Excellent, Good, OK, Poor) Assume an annual Markov transition matrix equals to

$$\begin{bmatrix} 1/2 & 1/4 & 1/8 & 1/8 \\ 0 & 5/8 & 1/4 & 1/8 \\ 0 & 0 & 3/4 & 1/4 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Calculate:

(a)[2pt] If a car is in excellent condition, the probability it is in good condition in 2 years.

(b)[2pt] If a car is in good condition, the probability it is still in good condition in half a year.

(c)[4pt] For a new car, the probability that it is in excellent condition over time (a graph)

(d)[4pt] For a new car, the probability that it is in poor condition over time (a graph)

Problem 2 (Statistical Analysis)

An insurance company undertook a study in one of its health care plans to assess whether customers' reports of plan satisfaction were related to their leaving the plan within 1 year of joining. In a random sample of 130 customers who reported that they were satisfied with the plan, 35 left that plan within 1 year. In another random sample of 140 customers who reported that they were not satisfied with the plan, 58 left within 1 year.

(a)[4pt] Treating "satisfaction" as the exposure and "leaving the plan within one year" as the outcome, construct a 2×2 table for these data, compute and interpret the relative risk (RR) and odds ratio (OR) for leaving the plan.

(b)[3pt] Compute the 95% confidence interval for the OR, do you think it is different from 1?

(c)[4pt] Confirm your observations of last question using both χ^2 and Z test with the hypothesis below:

$$H_0 : \text{OR} = 1 \text{ vs } . H_1 : \text{OR} \neq 1$$

(d)[2pt] What other options/tests could have been used in order to see if "satisfaction" is related to "leaving the plan within one year"?