Midterm I Practice
Math 181B, UCSD, Spring 2018

Exercise 1

To compare two kinds of bumper guards, six of each kind were mounted on a certain make of compact car. Then each car was run into a concrete wall at 5 miles per hour, and the following are the costs of the repairs (in dollars):

	Cost ($)	Mean	Std. Dev.
Bumper guard 1 :	127 168 143 165 122 139	144	19.06
Bumper guard 2 :	154 135 132 171 153 149	149	14.20

1. Construct a 98% confidence interval for the ratio of the variances of the costs for the two bumper guards.

2. Provide an interpretation of your confidence interval in Part 1. Based on your confidence interval, does it seem reasonable that the two bumper guards have the same variance in repair cost?

Exercise 2

A hundred people were asked whether the service provided by the fire department in the city was satisfactory. Shortly after the survey, a large fire occured in the city. Suppose that the same 100 people were asked whether they thought that the service provided by the fire department was satisfactory. The result are in the following table:

	Satisfactory	Unsatisfactory
Before fire	80	20
After fire	72	28

Data also show that exactly 70 people declared themselves satisfied both before and after the fire. At the level $\alpha = 5\%$, test whether or not the opinions changed after the fire.
(Hint: make a new contingency table)

Exercise 3

1. Given $X_1, \ldots, X_n \sim_{iid} Bernoulli(p)$ for some $p \in (0, 1)$, find the limiting distribution of the statistic $\hat{p}(1-\hat{p})$, where $\hat{p} = \frac{1}{n}\sum_{i=1}^{n} X_i$.

2. Assume that $p \notin \{0, 1/2, 1\}$. For $0 < \alpha < 1$, build an asymptotic confidence interval of level $1-\alpha$ for the parameter of interest $h(p) = p(1-p)$.

Exercise 4

Suppose that $X_1, \ldots, X_{n_1}$, $Y_1, \ldots, Y_{n_2}$, and $W_1 \ldots, W_{n_3}$ are independent random samples from normal distributions with respective unknown means μ_1, μ_2 and μ_3 and variances σ_1^2, σ_2^2, and σ_3^2.

1. Find the likelihood ratio statistic Λ associated to the test $H_0 : \sigma_1^2 = \sigma_2^2 = \sigma_3^2$ against the alternative H_1 of at least one inequality.

2. Find an asymptotic rejection region for the test in part 1. if n_1, n_2 and n_3 are large and $\alpha = .05$.