BST 140.652 Midterm Exam

Notes:

- You may use your one 8.5 by 11 formula sheet.
- Please use only the basic mathematical functions on your calculator.
- Show your work on all questions. Simple "yes" or "no" answers will be graded as if blank.
- Please be neat and write legibly. Use the back of the pages if necessary.
- Good luck!

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signature and **printed name**

1. In a review of the author Jane Austen's work, scholars found the following relative frequencies of the words "an", "that" and "this"

an	that	this
.53	.35	.12

An new story claimed to be Austen's was discovered with the word "an" 140 times, the word "that" 100 times and the word "this" 50 times. Give the steps that you would use to perform a **Monte Carlo exact goodness of fit test** for this data.

Let $\hat{p}$ be the sample proportion from a binomial experiment with n trials. Recall that the standard error of $\hat{p}$ is $\sqrt{\hat{p}(1-\hat{p})/n}$. Define $f(\hat{p}) = \log\{\hat{p}/(1-\hat{p})\}$ as the sample log odds. Note, the following fact might be useful:

$$f'(x) = \frac{1}{x(1-x)}$$

2. Give the delta method estimate to create a confidence interval for the sample log odds.

3. Refer to problem 2. Let $\hat{p}_1$ be the sample proportion from one binomial experiment with n_1 trials and $\hat{p}_2$ be the sample proportion from a second with n_2 trials. Define the log odds ratio to be $f(\hat{p}_1) - f(\hat{p}_2)$. Use your answer to part 2 to derive a confidence interval for the log odds ratio.

4. Two drugs, A and B , are being investigated in a randomized trial with the data are given below. Investigators would like to know if the Drug A has a greater probability of side effects than drug B.

	None	Side effects	N
Drug A	1	3	4
Drug B	3	1	4

State relevant null and alternative hypotheses and perform the relevant test.

5. A sample of 100 heterosexual couples were asked (yes/no) whether or not they had fun during sex. The results are given below

	Female		Total
Male	Yes	No	
Yes	43	4	47
No	8	45	53
Total	51	49	100

At a glance, do the male and female ratings of sexual fun appear to be independent? State the relevant hypothesis and perform the relevant test.