

BST 140.652 Final 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.
- Any p-value, confidence interval, test, power or sample size calculation must be accompanied with an interpretation.
- Please be neat and write legibly. Use the back of the pages if necessary.
- Here are the point break downs: Question 1 = 25 points, Question 2 = 45 points, Question 3 = 30 points. Total = 100 points.
- Good luck!

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signature

1. A new drug was developed to relieve eye redness due to hay fever. In the experiment the drug was administered to a randomly selected eye and a placebo is administered to the other eye. The data are given; + represents more improvement in redness for the drug-treated eye while – represents more improvement in the placebo-treated eye. The experiment was then repeated on a *seperate group* of 22 patients considering itching.

Redness		Itching	
+	–	+	+
–	+	–	+
–	+	+	+
+	–	–	+
–	+	+	+
+	–	+	+
–	+	+	
–	–	+	

- a. Does the drug appear to be effective for relieving redness? (Explain your answer and back up your claim with relevant statistics. 10 points.)
- b. Does the drug appear to be more effective for redness or itching? (Explain your answer and back up your claim with relevant statistics. 15 points.)

2. The table below gives the children's genders in a random sample of 1,000 two children families.

Second child	First child				Total
	Male		Female		
	Male	Female	Male	Female	
Count	218	227	278	277	1,000

- a. It is typically thought that the gender of offspring within a family are independent and identically distributed with males and females being equally likely. Is this hypothesis supported by the data above? (Explain your answer and back up your claim with relevant statistics. 15 points.)

Suppose that you reject the hypothesis in Part a. Now you would like to follow up by answering the following questions:

- b. Is there any evidence to suggest that the probability of having a male first child is different than having a male second child? (Explain your answer and back up your claim with relevant statistics. 15 points.)
- c. Is there evidence to suggest that the first child's gender is independent of the second child's? (Explain your answer and back up your claim with relevant statistics. 15 points.)

3. The following data set compare three groups of x-ray exposures, 1 - high exposure, 2 - low exposure, 3 - no exposure. Subjects were followed and the number of incidences of cancer and the person years are given.

Group	Events	Person-years
1	20	1000
2	10	5000
3	10	5000

- a. Let λ_1 , λ_2 and λ_3 represent the incidence rates for groups 1, 2 and 3 respectively. Perform a Chi-squared test of

$$H_0 : \lambda_1 = \lambda_2 = \lambda_3 = \lambda$$

versus the alternative that at least two are not-equal. If you construct your test correctly, it will be Chi-squared with 2 degrees of freedom under the null hypothesis. (15 points.)

- b. A researcher is interested in estimating $\sqrt{\lambda_1}$. Use the delta method to derive an interval estimate. (Hint, if $f(x) = \sqrt{x}$ then the derivative of f is $\frac{1}{2\sqrt{x}}$.) Apply your interval to the data above. (15 points.)