

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.
- Please be neat and write legibly. Use the back of the pages if necessary.
- Good luck!

signature and **printed name**

1. Two large hospitals were monitored for the number of bacterial infections relating to a surgical procedure. Counts of the infections, person-time at risk and relevant notation are given below.

Facility	Number outbreaks	Person-time at risk in years
1	$Y_1 = 150$	$t_1 = 200$
2	$Y_2 = 310$	$t_2 = 120$

Researchers would like to know whether hospital 2 has more than twice the infection rate of hospital 1.

- a. State the relevant hypotheses, define any notation you use.
- b. Calculate the expected counts under the null hypothesis.
- c. Perform the relevant test and state conclusions in the terms of the problem.

2. A topical rash treatment was applied to a portion of a rash on 5 patients. A quantitative measure of redness was calculated for the treated and untreated regions of the rash. A sign of + was given when the treated area was less red than the untreated area and a - sign when it was not. It is desired to know whether the treatment improves the rash. Let π be the true proportion of subjects with improvement from the treatment.
- State relevant hypotheses for this problem defining any new notation that you use.
 - Find the rejection region to guarantee a Type I error rate no larger than .05.
 - For the rejection region calculated in the previous problem, calculate the power of the test if $\pi = .9$.

3. A matched retrospective case/control study was conducted to investigate an airborne environmental toxicant's effect on lung cancer. The data are given below

Controls	Cases	
	Exposed	Unexposed
Exposed	243	54
Unexposed	189	153

- Estimate the marginal odds ratio.
- Consider testing whether the proportion of exposed cases is the same as the proportion of exposed controls. State the relevant hypotheses defining any notation that you use.
- Perform the relevant test for part b. stating your conclusions in the terms of the problem.
- State the assumptions that you used to perform the test.

4. You have 2 continuous measurements from one group (group A) and 2 from another (group B). Let W be the sum of the ranks for group B after ranking the measurements disregarding the group labels.
- Calculate the distribution of W .
 - Suppose it is desired to test whether measurements from group B are generally larger than those of group A. An observed value of W of 7 is obtained. What is the associated P-value?
 - What are the assumptions that go into the test just performed?