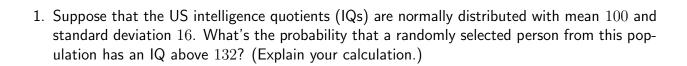
BST 140.651 Final Exam

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.
- There are three pages containing 9 questions. You can omit one question.
- Good luck!

signature and **printed name**



2. (Refer to the previous question.) Suppose that in a sample of 5 children 4 have IQs above 132. What is the probability of such an occurrence? What assumptions did you use to calculate this probability?

3. Let X_1,\ldots,X_{10} be iid exponential random variables with mean 1 and Y_1,\ldots,Y_{10} be iid exponential random variables with mean 2. A friend claims that \bar{X}/\bar{Y} should be approximately normal with mean 1/2 and variance 1/5. Briefly describe how you could verify this claim using simulation.

The next three questions (4 and 5) involve the following setting: A random sample of 40 United States men contained 25% smokers. Let p be the true prevalence of smoking amongst males in the United States.

4. Calculate and interpret a 95% confidence interval for the prevalence of smoking amongst males in the United States.

5. Refer to Problem 4. Write out the likelihood for p (do not draw it, just write it out). Is p=.35 or p=.15 better supported given the data (why, and by how much)? What value of p is best supported (just give the number, do not derive)?

6. If X is what is called a Poisson random variable with population mean μ , then it is known that

$$\frac{X - \mu}{\sqrt{X}} = \frac{\mathsf{Estimate} - \mathsf{Estimand}}{\mathsf{Std} \ \mathsf{Error}} \sim \mathsf{N}(0, 1)$$

is approximately normal. Derive a 95% confidence interval for $\mu.$

The next three questions (7, 8 and 9) involve the following setting: Suppose that
systolic blood pressures were taken on 16 oral contraceptive users and 16 controls at baseline
and again then two years later. The average difference from follow-up SBP to the baseline
(followup - baseline) was $11\ mmHg$ for oral contraceptive users and $4\ mmHg$ for controls.
The corresponding standard deviations of the differences was $20\ mmHg$ for OC users and 28
mmHg for controls.

7. Calculate and interpret a 95% confidence interval for the change in systolic blood pressure for oral contraceptive users; assume normality.

8. Does the change in SBP over the two year period appear to differ between oral contraceptive users and controls? Create the relevant 95% confidence interval and interpret. Assume normality and a common variance.

9. Suppose, instead, that in questions 7 and 8 we had calculated the intervals using the *log ratios* from followup to baseline (rather than the differences) and exponentiated result. What would each of the interval estimate?

EXTRA CREDIT (1 point). What brewery did William Gosset work for?