Name:

Math 30 – Mathematical Statistics

Midterm 2 Practice Exam 2

Instructions:

1. Show all work. You may receive partial credit for partially completed problems.

2. You may use calculators and a one-sided sheet of reference notes. You may not use any other references or any texts, apart from the provided tables, and distribution sheet.

3. You may not discuss the exam with anyone but me.

4. Suggestion: Read all questions before beginning and complete the ones you know best first. Point values per problem are displayed below if that helps you allocate your time among problems, as well as shown after each part of the problem.

5. Good luck!

Problem	1	2	3	Total
Points Earned				
Possible Points				40

1. A study of copper ore examined samples from 2 different locations in a mine and measured the amount of copper in grams for each ore specimen. 8 samples were collected from the first site, and yielded a sample mean of 2.6 and a sample standard deviation of .2138. From the second site, 10 samples were collected, with a sample mean of 2.3 and sample standard deviation of .1483.

a. Is there evidence to conclude that the two ore locations have different variances when measuring the amount of copper in grams at a .02 significance level?

b. Is there evidence to conclude that the first site has a higher mean copper ore content than the second site at a .01 significance level?

c. When performing multiple tests, the overall significance level is often divided up over the different tests, in what is known as a _____ correction.

2. A cough syrup was subjected to extensive testing to determine its alcohol content. Assuming that the alcohol content can be modeled by a normal distribution, in a Bayesian framework, the prior for $\mu \mid \tau$ is assigned to be a $Normal\left(8, \sqrt{\dfrac{1}{3\tau}}\right)$, and the prior on τ is assigned to be a $Gamma*(3,12)$. A random sample of 50 observations yields a sample average of 8.6 and sample standard deviation of 1.26.

a. Determine the numeric values of the four posterior hyperparameters.

b. Determine a 95% posterior credible interval for μ.

c. In the case when the Frequentist CI and Bayesian CI agree, the normal-gamma prior used must be (circle all that apply):

informative   uninformative   proper   improper

d. In Bayesian hypothesis testing, the main computation is to compute a Bayes _____, which involves numerical _____ rather than maximization, and which (circle one)

does   *does not*   make it possible to find evidence in favor of the null hypothesis.

3. Suppose you have a random sample of n Poisson random variables with unknown mean θ.

a. Develop a UMP test procedure that would allow you to test $H_0 : \theta = 1$ vs. $H_A : \theta < 1$. Be sure to highlight the test statistic used in your rejection region and state why your test is UMP.

b. If you decide the rejection region will reject the null only if the sum of the n Poisson RVs is 0, what is the probability of type I error if n=3?