**MATH 4720 TEST 1 Feb. 10, 2017 NAME\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Please show all work for partial credit. Point totals are shown to the left of each problem.

1. The government would like to estimate the proportion of adults that have been contacted by a phishing scheme.
2. How many adults should be sampled if the government wants their estimate to be within 0.05 of the true proportion with 98% confidence?

(5)

1. If the government takes a random sample of 500 adults, find the probability that the sample proportion will be within 0.05 of the true proportion. Assume the true proportion is 0.40.

(5)

1. Let Y1 … Yn be a random sample from

Show that is a sufficient statistic for .

(10)

1. Let Let Y1 … Yn be a random sample from Y~ EXP(θ). Find the mean square error for

(12)

1. In a study of the relationship between birth order and college success, an investigator found that 126 in a sample of 180 college graduates were firstborn or only children; in a sample of 100 non-graduates of comparable age and socioeconomic background, the number of firstborn or only children was 54. Estimate the difference in the proportions of firstborn or only children for the two populations from which these samples were drawn. Give a bound for the error of estimation.

(8)

1. Let Y1 … Yn be a random sample from . Show that is consistent for .

(12)

1. Let Let Y1 … Yn be a random sample from .
2. Use the method of moment generating functions to show that is a pivotal quantity.

(5)

1. If a sample of size 10 yields a sample mean of , find 95% upper confidence interval for .

(5)

1. A city health department wishes to estimate the mean bacteria count per unit volume of water at a lake beach. A researcher collected 50 water samples of unit volume and found the average bacteria count to be 193.7 with a standard deviation of 21.0.
2. Find a 99% lower confidence interval for the true mean bacteria count per unit volume at the lake beach.

(8)

1. The beach manager claims the average bacteria count is below 180. Use your answer to part (a) to support or refute the manager’s claim.

(2)

1. A researcher would like to compare two different brands of pain medication. The sample data (in minutes) for both brands is listed below:

Brand sample size mean relief time standard deviation of relief time

A 15 44 11

B 12 53 9

Construct a 98% confidence interval for the difference in mean relief times for the two brands of pain medication. Assume relief times are approximately normally distributed. Is there a significant difference in the two brands of pain medications?

(8)

1. UVU is experimenting with hybrid courses for MATH 1050, College Algebra. The math department is concerned that in hybrid courses, the variabilityof grades will increase. With conventional instruction, the variance is . A random sample of 51 students who took MATH 1050 as a hybrid was collected and the average grade was with a standard deviation of . Assume grades are normally distributed. Find a 90% lower confidence bound for for the hybrid courses. Should the math department be concerned?

(8)

1. Let Y1 … Yn be a random sample from
2. Show that and are unbiased.

(4)

1. Find the relative efficiency of to .

(8)