Instructions. Complete each of the following five questions. Please show all appropriate work in your solutions in order to obtain maximum credit. You may use a calculator.

1. (16 pts) Short answers (2pts each).

(a) What is a Type I error in an hypothesis test?

(b) Explain what the level of significance $\alpha$ is for an hypothesis test.

(c) In terms of $P$-values and $\alpha$, when should the null hypothesis be rejected?

(d) If a two tailed test reports a test statistic of $z = 2.23$, what is the $P$-value for the test?

(e) What value of $z_c$ should be used for a 94% confidence interval?

(f) What sample size should be used in a population with a standard deviation of $\sigma = 7.2$ to estimate the population mean to within $\pm 1$ in a 95% confidence interval?
1. (g) What is the standard deviation for the sampling distribution of \( \overline{x} \) based on samples of size
\( n = 64 \) for a population with a standard deviation of 18?

(h) What sample size should the Gallup organization use if it wishes to estimate the percentage of Americans who support troop escalation in Iraq to an accuracy of plus or minus 3 percent 19 times out of 20?

2. A recent poll reported that 23% of adult Americans surveyed approve of the way the United States has handled the war in Iraq. Moreover, the polling organization reported their methods were as follows.

“These results are based on telephone interviews with a randomly selected national sample of 1,006 adults, aged 18 and older, conducted Feb. 24-26, 2007. For results based on this sample, one can say with 95% confidence that the maximum error attributable to sampling and other random effects is ±3 percentage points. In addition to sampling error, question wording and practical difficulties in conducting surveys can introduce error or bias into the findings of public opinion polls.”

(a) (2 pts) What is the confidence interval that polling organization is suggesting for the proportion of adult Americans favoring the way the U.S. has handled war in Iraq?

Interval: __________________________  Level of Confidence: __________________________

(b) (3 pts) Find a 99% confidence interval for the proportion of adult Americans that approve of the way the United States has handled the war in Iraq.

Ans: __________________________

(c) (1 pt) Explain (or show) why the conditions necessary for constructing a confidence interval on a proportion are satisfied in this case.
3. Suppose the mean life span of English Springer Spaniel dogs is normally distributed with a mean of 13 years and a standard deviation of 1.5 years.

(a) (2 pts) What is the probability that a randomly selected English Springer Spaniel will live to be 14 years or older?

Ans: ________________

(b) (2 pts) What is the probability that a randomly selected sample of 25 English Springer Spaniels will have a mean life span of 14 years or more?

Ans: ________________

(c) (2 pts) What is the probability that a randomly selected sample of 25 English Springer Spaniels will have a mean life span between 12.5 and 14 years?

Ans: ________________

4. A government official wishes to determine if there has been “grade inflation” for graduating seniors in her state’s high schools over the last 10 years. So she took random sample of 900 graduating seniors GPA’s in 1996 and found the sample to have a mean GPA of 3.13 and a standard deviation of .56, and she found a sample of 1225 graduating seniors in 2006 had a mean GPA of 3.29 with a standard deviation of .53.

(a) (3 pts) Help this official by constructing a 99% confidence interval for the difference of the population means, use the 1996 GPA’s as population 1. Assume the standard deviations given are also the population standard deviations.

Ans: ______________________

(b) (2 pts) Describe in words (like a news reporter) what the interval in (a) means.

(c) (1 pt) Based on your answer in (a), would you be convinced that there has been grade inflation in that state? Explain.
5. The recent survey of gasoline prices found that the average price for regular gas in Riverside was $2.838 per gallon. However, we have reason to suspect the gas price in Riverside is higher than this. Conduct an hypothesis test to determine whether the average price for regular gasoline in Riverside is more than 2.838 per gallon, and test at $\alpha = .05$.

To do this hypothesis test, prices at 34 randomly selected gas stations were computed to have a sample mean of $2.891 with a sample standard deviation of .19.

(a) (2 pts) State the null and alternative hypothesis.

**Null Hypothesis:**

**Alternative Hypothesis:**

(b) (3 pts) Report the P-value of the test

**P-value:**

(c) (2 pts) Should you reject or not reject the null hypothesis? Explain basis for your decision.

(d) (1 pt) Interpret your conclusion in (c) in ordinary language.