Problem 1

Imagine an automobile company looking for additives that might increase gas mileage. As a pilot study , they send 30 cars fueled with a new additive on a road trip from Boston to Los Angeles. Without the additive, those cars are known to average 25.0mpg with a standard deviation of 2.4 mpg. Suppose it turns out that the thirty cars averaged 26.3 mpg with the additive.

a) What should the company conclude? Is the additive effective? Let α=0.01. Use three methods : the p-value , the critical value approach and the confidence Interval method.

b) Find the power of the test when μ is actually
  (i)   25.750
  (ii)   26.8
         What effect does increasing the distance between the true value of μ and hypothesized value μ=25

c) Find the power of the test when μ is actually 25.750 and n=100 ,α=0.01. What effect does increasing the sample size have on the power of the test?

d) Find the power of the test when μ is actually 25.750 and n=30. What effect does increasing alpha have on the power of the test? Use α=0.05 .

e) What would be the effect on power when μ is actually 25.750 (n=30, α=0.01) if σ could be reduced from 2.4 mpg to 1.2 mpg?

Problem 2

The public relations officer for a particular city claims the average monthly cost for childcare outside the home for a single child is $700. A potential resident is interested in whether the claim is correct. She obtains a random sample of 64 records and computes the average monthly cost of this type of childcare to be $689 with a standard deviation of $40.

a) Perform the appropriate test of hypothesis for the potential resident using α =0.01
b) Find the p-value for the test in the previous question.
c) What effect, if any, would there be on the conclusion of the test of hypothesis if you changed
   α to 0.05?
d) Find the power of the test when μ is actually $685 and α=0.05.
e) Describe what a type I error would be . Describe what a type II error would be.

Problem 3

In August 2004, Time magazine reported the results of a random telephone poll commissioned by the Spike network. Of the 1302 men who responded, only 39 said that their most important measure of success was their work.
(a) Estimate the percentage of all American males who measure success primarily from their work. Use a 99% confidence interval.
(b) Some believe that a few contemporary men judge their success primarily by their work. Suppose we wished to conduct a hypothesis test to see if the fraction has fallen below the 3.5% mark. Without actually carrying out the hypothesis test, what does your confidence interval indicate (and for which significance level)?
(c) Carry out the hypothesis test in (b).Let α=0.1.Use three methods .
(d) Find the power of the test when p is actually 0.03 and α=0.1.

Problem 4

Some people claim that they can tell the difference between a diet soda and a regular soda in the first sip. A researcher wanting to test this claim randomly sampled 80 such people. He then filled 80 plain white cups with soda, half diet and half regular through random assignment, and asked each person to take one sip from their cup and identify the soda as diet or regular. 53 participants correctly identified the soda.

(a) Do these data provide strong evidence that these people are able to detect the difference between diet and regular soda, in other words, are the results significantly better than just random guessing?
(b) Interpret the p-value in this context.
(c) Which type of error could have occurred in your hypothesis test?

Problem 5.Healthy Eating Americans are becoming more conscious about the importance of good nutrition, and some researchers believe we may be altering our diets to include less red meat and more fruits and vegetables. To test the theory that the consumption of red meat has decreased over the last 10 years, a researcher decides to select hospital nutrition records for 400 subjects surveyed 10 years ago and to compare their average amount of beef consumed per year to amounts consumed by an equal number of subjects interviewed this year. The data are given in the table.

	Ten Years Ago	This Year
Sample Mean	73	63
Sample Standard Deviation	25	28

a. Do the data present sufficient evidence to indicate that per-capita beef consumption has decreased in the last 10 years?

   Test at the 1% level of significance (citical value and p-value approaches

b. Find a 99% lower confidence bound for the difference in the average per-capita beef consumptions for the two groups.

   Does your confidence bound confirm your conclusions in part a? Explain. What additional information does the confidence bound give you?

Problem 6.Hormone Therapy and Alzheimer's Disease In the last few years, many research studies have shown that the purported benefits of hormone replacement therapy (HRT) do not exist, and in fact, that hormone replacement therapy actually increases the risk of several serious diseases. A four-year experiment involving 4532 women, reported in *The Press Enterprise,* was conducted at 39 medical centers. Half of the women took placebos and half took Prempro, a widely prescribed type of hormone replacement therapy. There were 40 cases of dementia in the hormone group and 21 in the placebo group.13 Is there sufficient evidence to indicate that the risk of dementia is higher for patients using Prempro? Test at the 1% level of significance (use three methods)