**Task session two (Estimation)**

1. A government agency was charged by the legislature with estimating the length of time it takes citizens to fill out various forms. Two hundred randomly selected adults were timed as they filled out a particular form. The times required had mean 12.8 minutes with standard deviation 1.7 minutes. Construct a 90% confidence interval for the mean time taken for all adults to fill out this form.

Sample mean (x) = 12.8 minutes

Standard deviation (σ) = 1.7 minutes

Sample size (n) = 200

Critical value (Z) for 90 % confidence level approximate value equal 1.645

Confidence interval 12.8 +- (1.645) \* (1.7/ √200)

Confidence interval 12.8 +- (1.645) \* (1.7/ √200)

Confidence interval 12.8 +- 0.1911

Lower bound = 12.8 – 0.1911=12.6

Upper bound 12.8 + 0.911= 12.99

2) Four hundred randomly selected working adults in a certain state, including those who worked at home, were asked the distance from their home to their workplace. The average distance was 8.84 miles with standard deviation 2.70 miles. Construct a 99% confidence interval for the mean distance from home to work for all residents of this state.

Sample Mean (x̄) = 8.84 miles Standard Deviation (σ) = 2.70 miles Sample Size (n) = 400 Critical Value (Z) for 99% confidence level ≈ 2.576

Confidence Interval = 8.84 ± (2.576) \* (2.70 / √400)

Confidence Interval = 8.84 ± (2.576) \* (2.70 / 20)

Confidence Interval = 8.84 ± 0.3528

Now, calculate the upper and lower bounds of the confidence interval:

Lower bound = 8.84 - 0.3528 = 8.4872 miles Upper bound = 8.84 + 0.3528 = 9.1928 miles

3) City planners wish to estimate the mean lifetime of the most commonly planted trees in urban settings. A sample of 16 recently felled trees yielded mean age 32.7 years with standard deviation 3.1 years. Assuming the lifetimes of all such trees are normally distributed, construct a 99.8% confidence interval for the mean lifetime of all such trees.

Sample Mean (x̄) = 32.7 years Standard Deviation (σ) = 3.1 years Sample Size (n) = 16 Critical Value (t) for 99.8% confidence level (with 15 degrees of freedom) ≈ 2.947

Confidence Interval = 32.7 ± (2.947) \* (3.1 / √16)

Confidence Interval = 32.7 ± (2.947) \* (3.1 / 4)

Confidence Interval = 32.7 ± 2.1779

Lower bound = 32.7 - 2.1779 = 30.5221 years Upper bound = 32.7 + 2.1779 = 34.8779 years

4) To estimate the number of calories in a cup of diced chicken breast meat, the number of calories in a sample of four separate cups of meat is measured. The sample mean is 211.8 calories with sample standard deviation 0.9 calorie. Assuming the caloric content of all such chicken meat is normally distributed, construct a 95% confidence interval for the mean number of calories in one cup of meat.

Margin of Error = (Critical Value) \* (Standard Deviation / √Sample Size)

Margin of Error = (3.1824) \* (0.9 / √4)

Margin of Error = 3.1824 \* 0.45

Margin of Error = 1.43608 calories

Lower bound = Sample Mean - Margin of Error

Lower bound = 211.8 - 1.43608

Lower bound = 210.36392 calories

Upper bound = Sample Mean + Margin of Error

Upper bound = 211.8 + 1.43608

Upper bound = 213.23608 calories

5) A security feature on some web pages is graphic representations of words that are readable by human beings but not machines. When a certain design format was tested on 450 subjects, by having them attempt to read ten disguised words, 448 subjects could read all the words.  
  
a. Give a point estimate of the proportion p of all people who could read words disguised in this way.  
b. Show that the sample is not sufficiently large to construct a confidence interval for the proportion of all people who could read words disguised in this way.

A )Point Estimate (p̂) = Number of people who could read the words / Total number of subjects

Point Estimate (p̂) = 448 / 450

Calculate p̂:

p̂ = 448 / 450

p̂ = 0.9956

B)

n = 450, and p̂ = 0.9956. Let's calculate np̂ and n(1 - p̂):

np̂ = 450 \* 0.9956 = 448.02

n(1 - p̂) = 450 \* (1 - 0.9956) = 1.98

Both np̂ and n(1 - p̂) are very close to 10, but they do not meet the condition of being strictly greater than 10.

6 ) In a random sample of 900 adults, 42 defined themselves as vegetarians.  
  
a. Give a point estimate of the proportion of all adults who would define themselves as vegetarians.  
  
b. Verify that the sample is sufficiently large to use it to construct a confidence interval for that proportion.  
  
c. Construct an 80% confidence interval for the proportion of all adults who would define themselves as vegetarians.

A)

Point Estimate (p̂) = Number of vegetarians in the sample / Total number of adults in the sample Point Estimate (p̂) = 42 / 900

Calculate p̂: p̂ = 42 / 900 p̂ = 0.0467

B)

n = 900, and p̂ = 0.0467. Let's calculate np̂ and n(1 - p̂):

np̂ = 900 \* 0.0467 = 42.03

n(1 – p̂) = 900 \* (1 – 0.0467) = 857.97

C)

p̂ is the sample proportion (0.0467)

Z is the critical value for an 80% confidence level (you can find this in a standard normal distribution table; it's approximately 1.282 for an 80% confidence level)

n is the sample size (900)

Now, calculate the confidence interval:

Confidence Interval = 0.0467 ± (1.282 \* √(0.0467 \* (1 - 0.0467) / 900))

Confidence Interval ≈ 0.0467 ± 0.0306

Lower bound = 0.0467 - 0.0306 = 0.0161 (approximately) Upper bound = 0.0467 + 0.0306 = 0.0773 (approximately)