**Estimation**

Suppose we want to make inference on the mean cholesterol level of a population of people in a north eastern American state on the second day after a heart attack. We have data of 28 patients, which are a realization of a random sample of size n = 28. The first thing we can do is to calculate the estimate of the population mean (μ) and of the population variance (σ 2 ). To do this we can use some functions of the random sample, such as the sample mean (X) and the sample variance (S 2 ), respectively,

x = 257 and s 2 = 32.

Note that X and S 2 are random variables, as they are functions of random variables, while x and s 2 are their values obtained for the particular values of the rvs; in this case, for the 28 patients who took part in the study. A different group of 28 patients who suffered a heart attack, would give different values of X and S 2 .

Let X 1 , . . . , X n be a random sample from a population (distribution) with a parameter θ. A random variable which is a function of the random sample, T (X 1 , . . . , X n ), is called an estimator of the population parameter θ, while its value is called an estimate of the

population parameter θ.

**Confidence Interval**

One of the major parts of inferential statistics is the development of ways to calculate confidence intervals. Confidence intervals provide us with a way to estimate a population parameter. Rather than say that the parameter is equal to an exact value, we say that the parameter falls within a range of values.  This range of values is typically an estimate, along with a margin of error that we add and subtract from the estimate.0

Attached to every interval is a level of confidence. The level of confidence gives a measurement of how often, in the long run, the method used to obtain our confidence interval captures the true population parameter.

If we know that 0.2 cm is the standard deviation of the tail lengths of all newts in the population, then what is a 90% confidence interval for the mean tail length of all newts in the population?

Since we know the population standard deviation, we will use a table of z-scores. The value of z that corresponds to a 90% confidence interval is 1.645. By using the formula for the margin of error we have a confidence interval of 5 – 1.645(0.2/5) to 5 + 1.645(0.2/5). (The 5 in the denominator here is because we have taken the square root of 25). After carrying out the arithmetic we have 4.934 cm to 5.066 cm as a confidence interval for the population mean.