Notes of Ch6: Estimation I, "introductory Statistics" by Wonnacott

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June 2019

1 Introduction

because population is fixed so the population parameters like mean μ and variance σ^2 are fixed (though generally unknown).
the sample mean $\bar{X}$ and sample variance s^2 are random variables, varying from sample to sample, with certain probability distribution. the random variables calculated from the observations in a sample are called sample statistic.
the point estimate of μ is the an estimation by computing one sample mean, but it is distributed around μ. so we must estimate that μ is bracketed by some interval –known as confidence interval– of the following form:

$$\mu = \bar{X} \pm \text{ an error allowance} \tag{1}$$

as we can be specific about distribution of $\bar{X}$, we can be specific about this error allowance.
How confident do we wish to be that our estimate is right about the μ? it is common to choose 95%100 confidence. to get this confidence level the smallest range under normal distribution of $\bar{X}$ that we just enclose a 95%100 probability. since the distribution is symmetric around the middle chunk, we can leave 2.5%100 probability in each side. we note that this involves going above(or below) the mean by 1.96 standard deviation of $\bar{X}$. we there for write:

$$p(\mu - 1.96\frac{\sigma}{\sqrt{n}} < \bar{X} < \mu + 1.96\frac{\sigma}{\sqrt{n}}) = 95\%$$
$$\Rightarrow p(-1.96 < \frac{\bar{X} - \mu}{\frac{\sigma}{\sqrt{n}}} < 1.96) = 95\%$$