

Stat 312: Lecture 2

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Definitions.

1. A *statistic* is a random variable from a random sample. If $X_1, \dots, X_n$ is a random sample, a statistic is a function of them.
2. A *point estimate* of population parameter θ is a single number that estimates θ .
3. A *point estimator* of θ is a statistic that estimates θ at given sample data.
4. The *Bias* of $\hat{\theta}$ is the difference $\mathbb{E}(\hat{\theta}) - \theta$.
5. The point estimator $\hat{\theta}$ is an *unbiased estimator* of θ if $\mathbb{E}(\hat{\theta}) = \theta$, i.e. no bias.

Propositions. $\bar{X}$ and S^2 are unbiased estimators of μ and σ^2 respectively.

In-Class Problems Example 6.2.

```
> library(Devore5)
> data(xmp06.02)
> attach(xmp06.02)
> mean(Voltage)
[1] 27.793
> max(Voltage)
[1] 30.88
> min(Voltage)
[1] 24.46
> (max(Voltage)+min(Voltage))/2
[1] 27.67}
```

Extra Problems

Do it yourself. Example 6.3., 6.4. What is an unbiased estimator of μ^2 ?

Assignment I Due Feb 4 11:00am. Do necessary numerical computations using $\mathbb{R}$.

Exercise 6.2., 6.4., 6.10, 6.16., 6.20, 6.22.

Bonus Problem (Hard). You are not required to hand in this problem but if you do, you get extra-credit. If $X_i \sim^{i.i.d.} N(0, 1)$ and S^2 is the sample variance, compute $\mathbb{E}(S^4)$. No partial credit will be given for this problem unless you solve it correctly.