

Stat 312: Lecture 3

Moo K. Chung
mchung@stat.wisc.edu

January 28, 2003

Concepts

1. There may be many unbiased estimators of θ . The *Minimum variance unbiased estimator* (MVUE) is an unbiased estimator with the smallest variance. Given a random sample $X_1, \dots, X_n$ with population mean μ and population variance σ^2 , $\bar{X}$ is MVUE of μ .
2. $\hat{\theta}_1$ and $\hat{\theta}_2$ are two unbiased estimator of θ . If $V(\hat{\theta}_1) \leq V(\hat{\theta}_2)$, $\hat{\theta}_1$ is more efficient than $\hat{\theta}_2$. MVUE is the most efficient estimator. An efficient estimator $\hat{\theta}$ will produce an estimate closer to the true parameter θ .
3. The k -th sample moment is $M_k = \sum_{j=1}^n X_j^k / n$.
4. The *moment estimators* of population parameters are obtained by solving $E(X) = M_1, E(X^2) = M_2, E(X^3) = M_3$, etc.

In-class problems

Let X_1, X_2 be a random sample. Among all estimator of the form $\hat{\mu} = aX_1 + bX_2$, find MVUE.

Exercise 6.25. Assume that shear strength is normally distributed. Find the moment estimators of μ and σ^2 .

```
> str(ex06.25)
'data.frame':  10 obs. of  1 variable:
 $ strength: int  392 376 401 367 389 362 409 415 358 375
> X<-strength
> M1<-mean(X)
> M2<-sum(X^2)/10
> M1
[1] 384.4
> M2
[1] 148119
> sigma<-sqrt(M2-M1^2)
> sigma
[1] 18.85842
```

Example 6.11.

Self-study problems

Example 6.5, Example 6.7. Example 6.12.