(7.2) a) Both of estimators are unbiased since $E[\bar{X}] = \mu$ and $E[U] = \mu$.

AM

b) Suppose the variance of X_i are σ^2.

Then $\text{Var}(\bar{X}) = \frac{\sigma^2}{2}$ and $\text{Var}(U) = \frac{5}{9}\sigma^2$.

So the estimator $\bar{X}$ is more efficient.

The efficiency of $\bar{X}$ relative to U is

$$\frac{\frac{5}{9}\sigma^2}{\frac{1}{2}\sigma^2} = 111\%$$

The sample mean is about 11% more efficient than the U.

(7.8)

a)

b) - Gun B biased

- Gun B seen to have minimum variance.
  (can argue Gun C has minimum variance)
- Largest MSE (where MSE = (variance) + (bias)^2)
  = Gun A
- Most efficient = Gun C
- Least efficient = Gun A.

(7.9) smallest MSE $\equiv$ min{(variance) + (bias)^2}

$MSE(A) = 100 + 0^2 = 100$

$MSE(B) = 0 + (-10)^2 = 100$

$MSE(C) = 25 + (5)^2 = 50$

$MSE(D) = 64 + (2)^2 = 68$

	A	B	C	D
bias	0	-10	5	2
sd	10	0	5	8
var	100	0	25	64

$\Rightarrow$ Gauge C has the smallest MSE (greatest accuracy).