

$$1) X \sim \text{Poi}(a) \quad \frac{X - a}{\sqrt{a}} \sim N(0, 1)$$

$$X = 200$$

$$\therefore a = X \pm 1.96 (\sqrt{a/n})$$

$$2) x_i \sim N(\mu, \sigma^2)$$

$$\bar{x} \sim N(\mu, \frac{\sigma^2}{n})$$

$$E(\bar{x}) = E\left(\frac{\sum x_i}{n}\right) = \frac{n\mu}{n} = \mu$$

$$\text{Var}(\bar{x}) = \frac{\text{Var}(\sum x_i)}{n^2} = \frac{1}{n^2} (n \cdot \sigma^2) = \frac{\sigma^2}{n}$$

$$\frac{(n-1)s^2}{\sigma^2} \sim \chi^2_{n-1}$$

$$E(s^2) = \frac{(n-1)\sigma^2}{(n-1)} = \sigma^2$$

$$\text{Var}(s^2) = \frac{2(n-1)\sigma^4}{(n-1)^2} = \frac{2\sigma^4}{n-1}$$

$$(50 < s^2 < 150) \left(\frac{1 \times 50}{100} < \chi^2_9 < \frac{9 \times 150}{100} \right)$$

4.5, 13.5

8) i) unbiased when $E(\hat{\theta}) = \theta$

ii) bias is when $E(\hat{\theta}) \neq \theta = 0$

iii) MSE is when $\theta = 0$