

Question 3(10-Points)

A standard fluorescent tube has a life length that is normally distributed with mean of 7,000 hours and standard deviation of 1,000 hours. A competitor has developed a compact fluorescent lighting system that will fit into incandescent sockets. It claims that the new compact tube has a normally distributed life length with mean 7,500 hours and a standard deviation 1,200 hours.

a. Which fluorescent tube is more likely to have a life length **grater than** 9,000 hours?

The old fluorescent tube has: $N(\mu = 7000, \sigma = 1000)$

The new = = = : $N(\mu = 7500, \sigma = 1200)$

- For the old one:

$$p(X > 9000) = p\left(\frac{X - 7000}{1000} > \frac{9000 - 7000}{1000}\right) \\ = p(Z > 2) = 1 - p(Z \leq 2)$$

- For the new one: $= 1 - \Phi(2) = 1 - 0.9772 = 0.0228$

$$p(X > 9000) = p\left(Z > \frac{9000 - 7500}{1200}\right) = p(Z > 1.25)$$

$$= 1 - \Phi(1.25) = 1 - 0.8944 = 0.1056$$

∴ The new fluorescent tube is more likely to have a life length grater than 9000 hours.

b. Which tube is more likely to have a life length **less than** 5,000 hours?

For old one:

$$p(X < 5000) = p\left(Z < \frac{5000 - 7000}{1000}\right) \\ = \Phi(-2) = 0.0228$$

For new one:

$$p(X < 5000) = p\left(Z < \frac{5000 - 7500}{1200}\right) \\ = \Phi(-2.08) \\ = 0.0188$$

∴ The old fluorescent tube is more likely to have a life length less than 5,000 hours