MATH 5010 – Quiz 11

Name:

Date:

5.16 The annual rainfall (in inches) in a certain region is normally distributed with $\mu = 40$ and $\sigma = 4$. What is the probability that, starting with this year, it will take over 10 years before a year occurs having a rainfall of over 50 inches? Assume that the rainfall in each year is independent of other years. Express your answer in terms of the cdf, $\Phi(x)$, of a standard normal distribution, $N(0,1)$.

Let X_i = rainfall in year i $(i = 1, 2, \ldots, 10)$

Then $X_i \sim iid\ N(40, 4^2)$.

$$\mathbb{P}(X_i < 50) = \mathbb{P}\left(\frac{X_i - 40}{4} < \frac{10}{4}\right) = \Phi\left(\frac{5}{2}\right)$$

$$\mathbb{P}\left[(X_1 < 50) \cap (X_2 < 50) \cap \ldots \cap (X_{10} < 50)\right]$$

$$= \prod_{i=1}^{10} \mathbb{P}(X_i < 50) = \left[\Phi\left(\frac{5}{2}\right)\right]^{10}$$