83. Solution: B
Let $X_1, \ldots, X_n$ denote the life spans of the $n$ light bulbs purchased. Since these random variables are independent and normally distributed with mean $3$ and variance $1$, the random variable $S = X_1 + \ldots + X_n$ is also normally distributed with mean
\[ \mu = 3n \]
and standard deviation
\[ \sigma = \sqrt{n} \]
Now we want to choose the smallest value for $n$ such that
\[ 0.9772 \leq \Pr[S > 40] = \Pr\left[ \frac{S - 3n}{\sqrt{n}} > \frac{40 - 3n}{\sqrt{n}} \right] \]
This implies that $n$ should satisfy the following inequality:
\[ -2 \geq \frac{40 - 3n}{\sqrt{n}} \]
To find such an $n$, let’s solve the corresponding equation for $n$:
\[-2 = \frac{40 - 3n}{\sqrt{n}} \]
\[-2\sqrt{n} = 40 - 3n \]
\[3n - 2\sqrt{n} - 40 = 0 \]
\[(3\sqrt{n} + 10)(\sqrt{n} - 4) = 0 \]
\[\sqrt{n} = 4 \]
\[n = 16 \]