

**Solution to 3.3.23**

Let  $X_i$  be the lifetime of battery  $i$  in weeks. We will need more than 26 replacements in two years iff  $S = X_1 + \cdots + X_{27} < 104$ . Note that it is 27 instead of 26 as the first battery must run out before starting to count replacements. Then

$$E(S) = 27E(X_1) = 27(4) = 108$$

and

$$SD(S) = \sqrt{27}SD(X_1) = \sqrt{27}(1) = 5.1962$$

Therefore:

$$P(S < 104) \approx \Phi\left(\frac{104 - 108}{5.1962}\right) = \Phi(-0.77) = 1 - \Phi(0.77) = 1 - 0.7794 = \mathbf{0.2206}$$