Quiz Section 8, Suppl. Exercise #6

$X \sim \text{Bin}(100, 0.9)$ is the number of crash-free days.

$E[X] = 90$, $\text{Var}(X) = 9$

$$P(X \geq 87) = P(X > 86.5) = P(86.5 < X < 100.5)$$

$$= P\left(\frac{86.5-90}{3} < \frac{X-90}{3} < \frac{100.5-90}{3}\right)$$

$$= P(-1.17 < \tfrac{X-90}{3} < 3.5)$$

$$\approx \Phi(3.5) - \Phi(-1.17)$$

$$= \Phi(3.5) + \Phi(1.17) - 1$$

$$\approx 0.8790$$

$\Phi(3.5) \approx 0.9998$, so $\Phi(1.17)$ is a good approximation.

This is what would have come from using $P(X > 86.5)$.

If $np(1-p) \geq 10$, you can always ignore $P(X > n)$.

Examples of continuity correction:

$$P(X \geq 87) = P(X > 86.5)$$
$$P(X > 87) = P(X > 87.5)$$
$$P(X \leq 87) = P(X < 87.5)$$
$$P(X < 87) = P(X < 86.5$$

In all cases, note that the integers X satisfying the left inequality are exactly the same as the set of integers X satisfying the right inequality.