

The number of admission X follows

$$X \sim \text{Bin}(450, 0.3)$$

Exact.

$$P(X \geq 150) = 1 - P(X \leq 149)$$

$$= 1 - \sum_{i=0}^{149} P(X=i)$$

$$= 1 - \sum_{i=0}^{149} \binom{n}{i} p^i (1-p)^{n-i}$$

$$= 0.0689276$$

Approximation

$$P(X \geq 150) = 1 - \sum_{i=0}^{149} P(X=i)$$

$$= 1 - \sum_{i=0}^{149} P\left(\frac{X - np}{\sqrt{np(1-p)}} = \frac{i - np}{\sqrt{np(1-p)}}\right)$$

$$\approx 1 - \sum_{i=0}^{149} \left[\Phi \left(\frac{\hat{a} + 0.5 - np}{\sqrt{np(1-p)}} \right) - \Phi \left(\frac{\hat{a} - 0.5 - np}{\sqrt{np(1-p)}} \right) \right]$$

$$= 1 - \Phi \left(\frac{149.5 - np}{\sqrt{np(1-p)}} \right) + \Phi \left(\frac{-0.5 - np}{\sqrt{np(1-p)}} \right)$$

$$= 0.06790214$$