

Using CLT,

$$\text{Let } X = \begin{cases} 1 & \text{WP } \frac{2}{3} \\ 0 & \text{WP } \frac{1}{3} \end{cases}$$

Since  $X_i$  are iid and Binomially distributed

$$\mu = E[X_i] = np = 1 \left( \frac{2}{3} \right) = \frac{2}{3}$$

$$\sigma^2 = \text{var}(X_i) = np(1-p) = 1 \cdot \frac{2}{3} \cdot \frac{1}{3} = \frac{2}{9}$$

$$S_{100} = \sum_{i=1}^{100} X_i$$

$$P[S_{100} \leq 50] = P\left[\frac{S_{100} - 100\mu}{\sqrt{100\sigma^2}} \leq \frac{50 - 66.6}{10\sqrt{\frac{2}{9}}}\right]$$

$$\begin{aligned} &= P\left[\frac{S_{100} - 100\mu}{\sqrt{100\sigma^2}} \leq -3.53\right] \\ &= 1 - \Phi(-3.53) \\ &= 1 - .99979 = .50021 \end{aligned}$$

$$\boxed{\approx 50\%}$$