IST 05

(3) $n=600$ $p=\frac{1}{4}$ 600 coin flips, probability of tails is $\frac{1}{4}$

(a) Binomial distribution to calculate X... number of heads $\mathbb{P}(|X-450| \leq 10)$

$\mathbb{P}(|X-450| \leq 10) = \mathbb{P}(440 \leq X \leq 460) = \mathbb{P}(X \leq 460) - \mathbb{P}(X < 440)$

$$= \sum_{k=0}^{460} \binom{600}{k} \left(\frac{3}{4}\right)^k \left(\frac{1}{4}\right)^{600-k} - \sum_{k=0}^{439} \binom{600}{k} \left(\frac{3}{4}\right)^k \left(\frac{1}{4}\right)^{600-k} = \sum_{k=440}^{460} \binom{600}{k} \left(\frac{3}{4}\right)^k \left(\frac{1}{4}\right)^{600-k}$$

$= pbinom(460, 600, \frac{3}{4}) - pbinom(439, 600, \frac{3}{4})$

$\approx 0,6778428$

(b) Use Normal approximation to calculate the probability

$Bin(n,p) \approx N(np, np(1-p))$ in our case we have $Y \sim N(600\frac{3}{4}, 600\frac{3}{4}\frac{1}{4})$

$\mathbb{P}(X \leq 460) - \mathbb{P}(X \leq 439) = pnorm(460, 600\frac{3}{4}, \sqrt{600\frac{3}{4}\frac{1}{4}}) - pnorm(439, 600\frac{3}{4}, \sqrt{600\frac{3}{4}\frac{1}{4}})$

$\approx 0,6772637$ without continuity correction

$\mathbb{P}(X \leq 460,5) - \mathbb{P}(X - 439,5) \approx 0,6778012$ with continuity correction