STAT 213 Practice Discrete RV

On the eve before the 2019 federal election:

- Conservatives polled to have 33% of popular vote
- Liberals had 31% of pop. vote
- one polling station expected to receive 50 votes per hour

a. say you plan to ask 100 randomly selected Canadians if they are voting conservative. What is the probability that at least 40 will say yes?

$P(\text{con}) = 0.33 \quad n = 100$

let x be # (of 100) who say con $\quad x \sim \text{Bin}(n=100, p=0.33)$

$P(x \geq 40) = P(x=40) + P(x=41) \ldots = \binom{100}{40}(0.33)^{40}(1-0.33)^{100-40}$

= sum(dbinom(40 100, size = 100, prob = 0 33)

b. A ballot box is known to have 330 Liberal votes, 352 Conservative, and 318 votes for "others". If you count 15 votes from this box what is the probability between 5 & 12 of them are for Liberals?

let y be # liberal votes from 15 $\quad y \sim \text{hyper}(r=330, N-r=670, n=15)$

$P(5 \leq y \leq 12) = P(y=5) + \ldots + P(y=15)$

$= \frac{\binom{330}{5}\binom{670}{10}}{\binom{1000}{15}} + \ldots + = \text{sum}(\text{dhyper}(5:12, 330, 670, 15))$

c. A polling station worker is at their station from 7:30am to 7:30pm (12 hours). What is the probability that they served 650 voters during their shift? $\lambda = 50$ votes/hr $\rightarrow \lambda = 600$ votes/12 hr

let w be # votes in 12 hrs $\quad w \sim \text{pois}(\lambda = 600)$

$P(w=650) = \frac{e^{-\lambda}\lambda^w}{w!} = \frac{e^{-600}600^{650}}{650!} = \text{dpois}(650, 600)$

(x, λ)

d. What is the probability that the 12^{th} vote cast is the 4^{th} Conservative vote cast?

$P(\text{con}) = 0.33$

Prob(0.33) which is 4th con

1 2 3 4 5 6 7 8 9 10 11 | 12

3 con, 8 con^c

$\binom{11}{3}0.33^3(1-0.33)^8$ for first 11 binomial $\quad (0.33)$ 1 additional success this 12th person