STAT 230
F2017

MY UNOFFICIAL
REVIEW NOTES

CHAPTER 5

CHAPTER 5 DISCRETE FUNCTIONS

HERE, PROB DISTRIBUTIONS ARE GIVEN TO US, WE JUST NEED TO FIGURE OUT WHICH ONE TO USE.

① HYPERGEOMETRIC :

- LIMITED OR FINITE POOL TO DRAW FROM
- WITHOUT REPLACEMENT
- SUCCESS OR FAILURE
- CHOOSE SAMPLE SIZE K
- X IS # OF SUCCESSES IN THE DRAW OF K.

POOL OF FISH

$N = 200$ FISH

75 GREEN
125 BLUE

$\longrightarrow$ CHOOSE SAMPLE OF 30 FISH FROM 200. WHAT IS PROBABILITY OF 10 GREEN IN THE 30?

$$f(x) = \frac{\binom{r}{x}\binom{N-r}{n-r}}{\binom{N}{n}} = f(10) = \cancel{\binom{30}{10}}$$

$$= \frac{\binom{75}{10}\binom{125}{20}}{\binom{200}{30}}$$

$\leftarrow$ NOTE THIS IS (SUCCESSES)(FAILS)

BINOMIAL

- LIKE GEOMETRIC BUT POOL IS INFINITE OR WITH REPLACEMENT.
- SO WE DON'T KNOW # OF SUCCESSES WE ONLY KNOW PROB OF SUCCESS P.

OCEAN

$P(\text{BLUE}) = .25 \Rightarrow p = .25$

$P(\text{GREEN}) = .75 = 1-p$

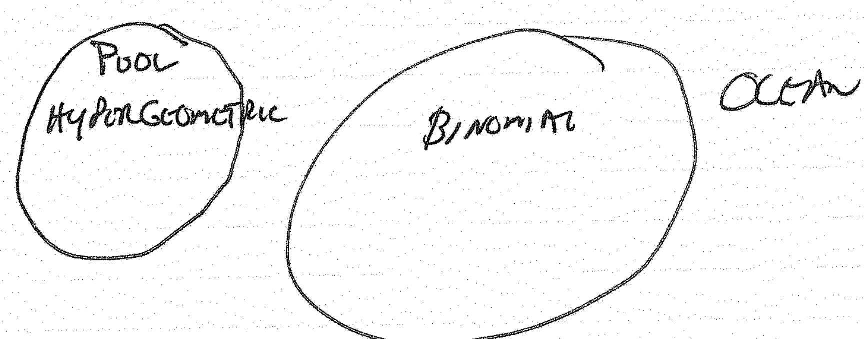
THEN $f(x) = \binom{N}{x} p^x (1-p)^{N-x}$

10 FISH SELECTED, WHAT IS PROB. 8 BLUE?

$$\binom{N}{x} p^x (1-p)^{N-x} = \binom{10}{8} \cdot .25^8 \cdot .75^2$$

BINOMIAL TO APROX HYPERGEOMETRIC:

IF N IS LARGE → SO POOL GOES BIG, AND SMALL SAMPLE SIZE, THEN BIN ≈ HYPER



SO 10 000 CHOOSE 10 (HYPER) IS CLOSE TO BINOMIAL WITH N=10

NEGATIVE BINOMIAL: X = HOW MANY FAILURES TO GET K SUCCESSES. BE CAREFUL! $X \neq$ NUMBER OF TRIALS!

$X+k$ = NUMBER OF TRIALS.

PROB(X FAILURES TO GET K SUCCESSES)

$$f(x) = \binom{x+k-1}{x} p^k (1-p)^x$$

NOTE, INFINITE POOL OR WITH REPLACEMENT

GEOMETRIC - LIKE NEGATIVE BINOMIAL, BUT TO FIRST SUCCESS,

SO EXACTLY NEG. BINOMIAL WITH $K=1$.

$$f(x) = \binom{x+k-1}{x} p^k (1-p)^x \quad \text{WITH } k=1$$

$$f(x) = p(1-p)^x$$

POISSON: - EVENTS HAPPEN OVER TIME
- RATE OF OCCURENCE IS UNIFORM WITH λ EVENTS PER UNIT OF TIME
- EVENTS ARE INDEPENDENT.

PROB OF x EVENTS IN 1 UNIT OF TIME:

$$f(x) = \frac{\lambda^x e^{-\lambda}}{x!}$$

SCALES BY TIME, SO IF OVER 2 UNITS, USE 2λ i.e

$$f(x) = \frac{(2\lambda)^x e^{-(2\lambda)}}{x!}$$

NOTES:

SECTION 5.9 COMBINING POISSON WITH OTHER MODELS. TRICK IS TO USE POISSON TO FIND PROBABILITY, FIRST, THEN USE THIS 'p' IN 2ND DISTRIBUTION

Page 99 SECTION 5.9 EX (b) - 10 TREES PICKED AT RANDOM, WHAT IS PROB. 8 HAVE >3?
SO FIGURE POISSON TO GET $p>3$, THEN BINOMIAL USING p.