p.143

39. $Bmo(n=9, p=.48)$ ① Identify

$$p(x) = \binom{9}{x} .48^x .52^{9-x}$$ ② Write the exact formula

$$P(X \geq 3) = p(3) + p(4) + p(5) + p(6) + p(7) + p(8) + p(9)$$

OR

$$P(X \geq 3) = 1 - P(X < 3)$$
$$= 1 - [p(0) + p(1) + p(2)]$$
$$= 1 - [.0028 + .0231 + .0853] = .8888$$

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40. $Bmo(n=33, p=.9)$

$$p(x) = \binom{33}{x} .9^x .1^{33-x}$$

$$P(X \geq 30) = p(30) + p(31) + p(32) + p(33)$$
$$= .2313 + .2014 + .1133 + .0309$$
$$= .5769$$

Hypergeometric Experiment

- Start with a population of N items
- S of the N items have a certain property
- Take a sample of size n, without replacement
- X counts the number in the sample, having the property

Hyper(N, S, n)

- n: sample size
- N: population size
- S: # successes in the pop.

$$p(x) = \frac{\binom{S}{x}\binom{N-S}{n-x}}{\binom{N}{n}}$$

Example: From a pool of 120 females and 80 males, randomly select a jury of 12 people. Find the prob. that the jury has exactly 6 females.

Hyper(N = 200, S = 120, n = 12)

$$p(x) = \frac{\binom{120}{x}\binom{80}{12-x}}{\binom{200}{12}}$$

$$p(6) = \frac{\binom{120}{6}\binom{80}{6}}{\binom{200}{12}} = .1797$$

Example: Deal 5 cards from a deck of 52. Find the probability of getting exactly 2 aces.

Hyper ($N = 52$, $S = 4$, $n = 5$)

$$p(x) = \frac{\binom{4}{x}\binom{48}{5-x}}{\binom{52}{5}}$$

$$p(2) = \frac{\binom{4}{2}\binom{48}{3}}{\binom{52}{5}} = .0399$$

Example: Receive a shipment of 100 computer monitors. 5 of them are defective.

We will randomly select 10 monitors to test. Find the prob. that the sample contains no defects.

Hyper ($N = 100$, $S = 5$, $n = 10$)

$$p(x) = \frac{\binom{5}{x}\binom{95}{10-x}}{\binom{100}{10}}$$

$$p(0) = \frac{\binom{5}{0}\binom{95}{10}}{\binom{100}{10}} = .5838$$

Hypergeometric $\mu = np$, where $p = \frac{S}{N}$

$$\sigma^2 = np(1-p)\frac{N-n}{N-1}$$

Poisson Experiment

- Observe a process over a fixed amount of time or space
- X counts the number of occurrences of a particular type

Examples: - Count the number of hits on a web site in 1 hour
- Count the number of customers entering a bank in 2so minutes
- Count the number of flaws on a silicon disk.

$$P(x) = \frac{\mu^x e^{-\mu}}{x!} \qquad \mu = E(X)$$

Example. Watch the bank entrance for 20 minutes. Assume that the bank gets an average of 30 customers per hour. Find the probability of seeing exactly 5 customers in 20 minutes.

$\text{Pois}(\mu = 10)$

$$p(x) = \frac{10^x e^{-10}}{x!}$$

$$p(5) = \frac{10^5 e^{-10}}{5!} = .0378$$

Binomial	Hypergeometric	Poisson
$\text{Bino}(n, p)$	$\text{Hyper}(N, S, n)$	$\text{Pois}(\mu)$
$p(x) = \binom{n}{x} p^x (1-p)^{n-x}$	$p(x) = \frac{\binom{S}{x}\binom{N-S}{n-x}}{\binom{N}{n}}$	$p(x) = \frac{\mu^x e^{-\mu}}{x!}$
$\mu = np$	$\mu = np \left(p = \frac{S}{N}\right)$	$\mu = \mu$ (given)
$\sigma^2 = np(1-p)$	$\sigma^2 = np(1-p)\cdot\frac{N-n}{N-1}$	$\sigma^2 = \mu$
$X = 0, 1, \ldots, n$	$x = 0, \ldots, \min(S, n)$	$X = 0, 1, \ldots$

Hw p. 161 #46a, 47a, 48ah, 49a

Midterm Tuesday: 25 multiple choice

12 questions: Descriptive Stats

13 questions: remainder of material through 3-2.

z-scores, Chebyshev's Rule, Empirical Rule
probabilities & Counting rules
random variables, $\mu = E(X)$, $\sigma^2 = V(X)$