Geo Distr. Formulas are NOT on formula sheet

8.2I pg. 543 41, 44, 49, 51ab, 52ab

8.2II pg. 550 48, 50 a-g, 53-55, 59-60, 67 a-l, 68

8.2 Geometric Distributions

Geometric Setting

1. Each observation is either success or failure
2. Observations are independent
3. Probability of success is the same for each observation
4. n is the number of trials required to obtain the first success. Not fixed

Example 8.15 / 8.16 Geometric setting?

Example 8.15 Situations

Probability of rolling a 3 on the:

1st roll $\frac{1}{6}$

2nd roll $\frac{5}{6} \cdot \frac{1}{6} = \frac{5}{36}$

3rd roll $\frac{5}{6} \cdot \frac{5}{6} \cdot \frac{1}{6} = \frac{25}{216}$

Pattern?

Geometric Probability Calculations

$P(X = n) = (1-p)^{n-1} p$

n = trial of success

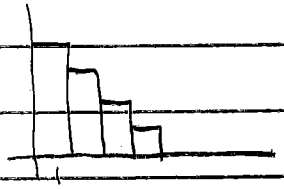
p = probability of success

1 − p = probability of failure

Slide 8.2 Part I

Geometric Probability Histogram (pg. 543) will always be skewed right

First bar gives probability



Exercise 41

(a) yes; success = tail, failure = heads
trial - flipping a coin $p = .5$

(b) no; success is number of times both shots are made, not trials until 1st is made

(c) yes; success = jack fail = not a jack $p = 1/13$

(d) yes; success = match all 6 fail = not matching
$p = 1 : \binom{44}{6} = 1 : 7059052$

(e) no; trials have different probabilities for each draw because of non-replacement

Exercise 44

(a) $P(x=4) = (1-.5)^3 .5 = .0625$

Mean and Standard Deviation of Geometric Random Var

$$\mu = \frac{1}{p} \qquad \sigma = \frac{\sqrt{1-p}}{p} \qquad \text{variance} = \frac{1-p}{p^2}$$

move to after Examples of $P(x>n)$

How many rolls would you expect to roll before rolling a 3? Expected value = μ

$\mu = \frac{1}{1/6} = \boxed{6}$

How many flips of a coin before a heads?

$\mu = \frac{1}{1/2} = \boxed{2}$

$P(x>n) = (1-p)^n$

Probability that it takes more than n trials to achieve success.

8.2 Cont'd

Example Suppose you are rolling a pair of dice and trying to get a sum of 4.

(a) What is the probability you get a sum of 4 on the first roll?

Total possible = $6 \cdot 6 = 36$

Total sums of four: $1+3, 3+1, 2+2 = 3$

$3/36 = (1/12)$

(b) What is the probability that you don't get a sum of 4 until the 10th roll?

$P(x=10) = (1 - 1/12)^{10-1} (1/12)$

$\approx \boxed{.038}$

Example. About 10% of the population has type B blood

(a) What is the probability that we will have to check at most 3 donations to get one B?

$P(x \leq 3) = P(x=1) + P(x=2) + P(x=3)$

$.1 + .9(.1) + .9^2 .1 = \boxed{.271}$

(b) What is the probability we will have to check at least 4 donations to get type B?

$P(x \geq 4) = 1 - P(x < 3) = 1 - .271 = (.729)$

(c) What is the probability we will have to check more than 5 donations to get B?

$P(x > 5) = (1 - .1)^5 = (.590)$

$P(x>3) = (1-.1)^3 = (.729)$

(2nd)

$1 - P(x \leq 5) = 1 - (.1 + .9(.1) + \ldots .9^4(.1)) = .590$

Example About 85% of Americans over age 25 have graduated from high school. You are randomly sampling and interviewing individual adults for an opinion poll that applies only to high school graduates.

(a) What are the expected value and standard deviation of the number of interviews you must conduct to get the first HS graduate?

BITS? B- grad / not grad

I- independent due to random sample

T- 1st grad

S- .85 each trial

$\mu_x = 1/.85 = \boxed{1.176 \text{ interviews}}$

$\sigma_x = \frac{\sqrt{1-.85}}{.85} = \boxed{.456 \text{ interviews}}$

(b) What are the mean and standard deviation to get the first ten?

$\mu_x = 10(1.176) = 11.765$

(Ch. 7)

$\sigma_x = \sqrt{(.456)^2 + (.456)^2 \ldots (.456)^2}$

$= \sqrt{10(.456)^2}$

$= \boxed{1.441 \text{ interviews}}$

Calculator

Geometpdf P(x=n) (p, n)

Geometcdf P(x≤n) (p, n)

* Keystrokes not a sign of work shown *