Review Session

$H_0: p_c = p_s$ ← [0][1][0][1][0][0]... Cal

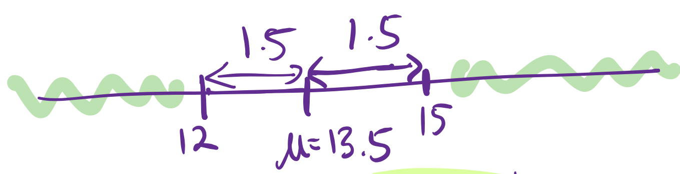
$H_A: p_c \neq p_s$ [0][1][1] .....

	W	L	
Cal	15	5	20 Total Cal played
Stanford	12	8	20 Total S played
	Total Won 27	Total Lost 13	Total # of games 40

$N = 40$
$G = 27$

Now pretend we draw a sample of size 20 (Cal)

$$\mathbb{E}(\text{games won}) = 20 \times \frac{27}{40} = \frac{27}{2} = 13.5$$



X = # of games won by Cal

$X \sim HG(40, 27, 20)$

$$P(|X - 13.5| \geq 1.5)$$

$$= P(X \leq 12) + P(X \geq 15) = \sum_{k=0}^{12} P(X=k) + \sum_{k=15}^{20} P(X=k)$$

$$P(X=k) = \frac{\binom{27}{k}\binom{13}{20-k}}{\binom{40}{20}}$$

$X \sim HG(40, 27, 20)$

$p = \frac{27}{40} = p_c = p_s$

$X \sim Bin\left(20, \frac{27}{40} = p\right)$

$\mathbb{E}(X) = 13.5$

$$P(|X - 13.5| \geq 1.5)$$

$= P(X \leq 12) + P(X \geq 15)$

$$= \sum_{k=0}^{12} P(X=k) + \sum_{k=15}^{20} P(X=k)$$

$$P(X=k) = \binom{20}{k} p^k (1-p)^{20-k}, \quad p = \frac{27}{40}$$

~~Discrete Um~~

~~Ber~~

Named dsns

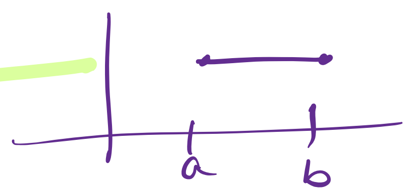
1. Discrete Uniform (n) (think n-sided dice)
2. Bernoulli (p) (single coin toss, $P(H)=p$)
3. Binomial (n,p) (n tosses, # of H)
4. Geometric (p) (Toss until first H, count # of tosses)
5. Neg. Binomial (r, p) (Toss until r H's count # of tosses)
   (Waiting time)
   combination of Binomial & Geom
   ex. Toss coin until 5th H.

→ 6. Poisson(λ) (Either you will be told Poisson, or you will use Poisson to approximate Bin (n,p) where n is very large, p is small)

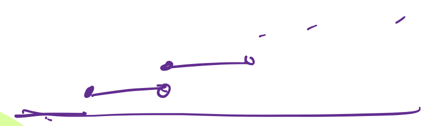
→ 7. HG (N, G, n)

CONTINUOUS

8. Uniform dsn on (a,b)

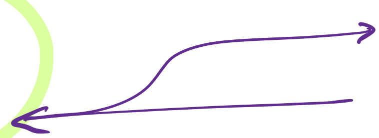


9. Exponential (λ)
10. Normal (μ, σ^2)



$f(x)$ pdf, ① $f(x) \geq 0$

② $\int_{-\infty}^{\infty} f(x)dx = 1$



$$F(x) = \int_{-\infty}^{x} f(t)dt \longleftrightarrow F'(x) = f(x)$$

$$\boxed{F(x) = P(X \le x)}$$

Q8

#7 Tossing a coin

H: Ewen wins

T: Seunghoon wins

H_0: $P(H) = P(T)$

H_A: $P(H) > P(T)$

7.1. SH loses 3 rounds in a row

X = # of rounds out of 3 that SH loses

H_0 implies $X \sim Bin(3, \frac{1}{2})$

observed value of $X = 3$

p-value is the chance of seeing values of X at least as extreme as the observed value

$$P(X \geq 3 \mid X \sim Bin(3, \tfrac{1}{2})) = P(X = 3 \mid X \sim Bin(3, \tfrac{1}{2}))$$

$$= \binom{3}{3}\left(\frac{1}{2}\right)^3 = \frac{1}{8}$$

7.2 SH If I lose n games in a row then p-value < 0.01, then I will reject Erwen's claim (H_0)

$X = \#$ of games lost in n rounds

H_0 implies $X \sim Bin(n, \frac{1}{2})$

$$P(X \geq n \mid H_0) = P(X \geq n \mid X \sim Bin(n, \tfrac{1}{2}))$$
$$= P(X = n \mid X \sim Bin(n, \tfrac{1}{2}))$$
$$= \binom{n}{n} \left(\tfrac{1}{2}\right)^n < \tfrac{1}{100}$$

What is n such that $\left(\frac{1}{2}\right)^n < \frac{1}{100}$

$$\frac{1}{2^n} < \frac{1}{100} \Rightarrow 100 < 2^n$$

$n \geq 7$

2, 4, 8, 16, 32, 64, 128 smallest value of n s.t. $P(X = n \mid X \sim Bin(n, \frac{1}{2}))$ is 7.