Sec 8.1

Randomly guess answers → 40 MC SAT questions

1) 2 Outcomes (Success / Failure)
2) P(Success) = .2 (Constant)
3) Guesses are independent
4) X = # correct guesses out of 40

Binomial Setting

X = # Successes from fixed number observations (n)

Notation

$$B(n, p) \rightarrow B(40, .2)$$

observations

P(Success)

1) Find probability that you get exactly 10 questions correct $P(X=10)$

a) Use binomial formula

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

$$\uparrow$$

$${}_nC_k = \frac{n!}{k!(n-k)!}$$

$$P(X=10) = \binom{40}{10} (.2)^{10} (.8)^{30} = .1075$$

b) Use Calculator

$\boxed{\text{DISTR}} \rightarrow$ binompdf $(\underset{n}{40}, \underset{p}{.2}, \underset{k}{10}) = .1075$

2) Find probability that you get 0 correct.

a) $P(X=0) = \binom{40}{0}(.2)^0(.8)^{40} = .00013$

b) binompdf $(40, .2, 0) = .00013$

3) Find probability that you get 10 or less correct $P(X \leq 10)$

a) Formula Inefficient :(

X	0	1	2	3	...	10
$P(X)$						

b) Calculator

$\boxed{\text{DISTR}} \rightarrow \text{binomcdf}(\underset{n}{40}, \underset{p}{.2}, \underset{k}{10}) = .8392$

4) Find probability of getting more than 10 correct $P(X > 10)$

a) Use Formula ... Probably Not

b) Use Calculator / Complement Rule

$$P(X > 10) = 1 - P(X \leq 10) = 1 - .8392 = .1608$$

If $B(n, p)$ then ...

$$\mu_x = np = (40)(.2) = 8$$

$$\sigma_x^2 = np(1-p) = (40)(.2)(.8) = 6.4$$

$$\sigma_x = \sqrt{\sigma^2_x} = \sqrt{6.4} = 2.5298$$

If $B(n,p)$ and ...

$$np \geq 10 \qquad n(1-p) \geq 10$$

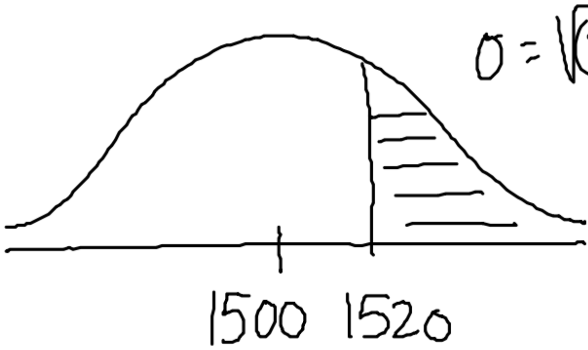
then normal distribution rules <u>can</u> be used

Ex $B(2500, .6)$, find $P(X \geq 1520)$

$np = (2500)(.6) = 1500 \geq 10$ ✓

$n(1-p) = (2500)(.4) = 1000 \geq 10$ ✓

$\sigma = \sqrt{(2500)(.6)(.4)} = 24.49$



a) normalcdf $(1520, 10000, 1500, 24.49) \approx .2071$

b) $1-$binomcdf $(2500, .6, 1519) \approx .2131$

Sec 8.2

Geometric Setting

Same as Binomial

1) 2 outcomes - success/failure
2) P(success) = constant
3) observations independent

4) X = # trials required to get 1st success

Binomial

- Number of trials fixed (n)
- Number of successes varies

Geometric

- Number of trials varies
- Number of successes fixed (at one)

Geometric Probability Formulas

$$P(X = n) = \underbrace{p}_{P(S)}\ \underbrace{q}_{1-P(S)}{}^{n-1}$$

1st Success on nth trial

$$P(X > n) = q^n$$

More than n trials before 1st Success

Mean / Standard Deviation Formulas

$$\mu_x = \frac{1}{p}$$

$$\sigma_x = \sqrt{\frac{1-p}{p^2}} = \frac{\sqrt{1-p}}{p}$$

Ex Roll a standard die

1) Determine the probability of getting a "3" on the second roll

a) Use Formula

$$P(X=2) = \left(\frac{1}{6}\right)\left(\frac{5}{6}\right)^{2-1} = .1389$$

b) Use calculator

$\boxed{\text{DISTR}} \rightarrow$ geometpdf $(1/6, 2) = .1389$

2) Determine probability of getting a "3" on 1st, 2nd, 3rd or 4th roll.

a) Use formula ?

$P(X \le 4) = P(X=1) + P(X=2) + P(X=3) + P(X=4)$

b) Use calculator

$\boxed{\text{DISTR}} \rightarrow$ geometcdf (1/6, 4) = .5177

3) Determine probability that it takes more than 20 rolls before getting a "3"

$$P(X > 20) = \left(\frac{5}{6}\right)^{20} = .0261$$

4) How many times would you expect to roll a die before getting your first "3"?

μ

$$\mu = \frac{1}{p} = \frac{1}{\frac{1}{6}} = 6$$