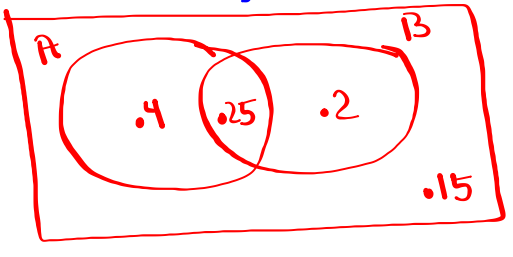
Math 110
Winter 2021
Lecture 11

Class QZ 6

Given: $P(A) = .65$ $P(B) = .45$ $P(A \text{ and } B) = .25$

1) Venn Diagram



2) $P(\overline{B})$

$= 1 - .45 = \boxed{.55}$

3) $P(A \text{ or } B)$

$= .4 + .25 + .2$

$= \boxed{.85}$

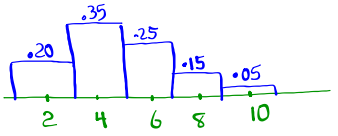
Consider the Following Chart

x	$P(x)$
2	.20
4	.35
6	.25
8	.15
10	.05

1) Find $P(x=2)$

$= 1 - [.35 + .25 + .15 + .05] = 1 - .8 = .2$

2) Draw Prob. dist. histogram



3) Find μ & σ

$x \to L1$ STAT CALC 1-Var Stats L1 & L2

$P(x) \to L2$ $\mu = 5$ $\sigma = 2.236$

4) Find exact value of σ^2

VARS | 5: | 4: | x^2 | Math | 1: | Enter

$\mu = 5.0$ $\sigma = 2.2$ $\sigma^2 = 5$

5) Round μ & σ to 1-decimal, then find its usual Range "95% Range"

$\mu \pm 2\sigma = 5.0 \pm 2(2.2)$

$= 5.0 \pm 4.4 \Rightarrow$ 0.6 to 9.4

I Sold 50 tickets, $20 each.
One ticket is drawn, the winner get a tablet worth $250. Find expected value per ticket.

$Net	P($Net)
20 − 250	$\frac{1}{50}$
20 − 0	$\frac{49}{50}$

$Net → L1

P($Net) → L2

Expected Value = $\mu = \bar{x} = \$15$

$15/Ticket

You are having a Surgery.

You buy insurance for $500. If You don't make it, insurance company pays $100,000 to Your family.

Prob. that You don't make it out of the Surgery is .5% Find expected value per policy Sold.

$Net	P($Net)
500-100,000	.5% = .005
500 - 0	99.5% = .995

$Net → L1

P($Net) → L2

E.V. = $\mu = \bar{x} = \boxed{0}$

No Profit, No Loss

A box has 3 Dimes & 12 Nickels.

Shake it to get 2 Coins.

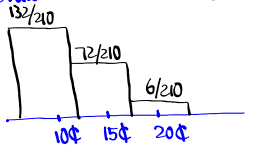
DD → 20¢ $P(20¢) = \frac{3}{15} \cdot \frac{2}{14} = \boxed{\frac{6}{210}}$

DN, ND → 15¢ $P(15¢) = 1 - \left[\frac{6}{210} + \frac{132}{210}\right] = 1 - \frac{138}{210} = \boxed{\frac{72}{210}}$

NN → 10¢ $P(10¢) = \frac{12}{15} \cdot \frac{11}{14} = \boxed{\frac{132}{210}}$

Collect ¢	P(Collect ¢)
10¢	$\frac{132}{210}$
15¢	$\frac{72}{210}$
20¢	$\frac{6}{210}$

Draw Prob. Dist. histogram



Collect ¢ → L1

P(Collect ¢) → L2

Find $\mu = 12$ $\sigma = 2.726$ $\sigma^2 = \frac{52}{7}$

Round μ & σ to a whole #, Find 68% Range

$\mu = 12$ & $\sigma \approx 3$

$\mu \pm \sigma$

$= 12 \pm 3$

$\Rightarrow$ 9 to 15

Exam II Next Monday

Binomial Prob. Dist.

1) n independent events

2) Each event has only two outcomes.

. Success . Failure

3) P(Success) = P P(Failure) = q

P + q = 1 q = 1 − P

P & q remain unchanged for all n events

4) x is # of Successes

$$P(x) = {}_nC_x \cdot p^x \cdot q^{n-x}$$

Given a binomial Prob. dist with $n=25$ and $P=.6$

Find $P(x=10) = {}_{25}C_{10} \cdot (.6)^{10} \cdot (.4)^{15}$

$= .021$

$$P(x) = {}_nC_x \cdot p^x \cdot q^{n-x}$$

25 math Prb nCr 10 * .6 ^ 10 * .4 ^ 15 Enter

You are making random guesses on a True/False exam with 40 questions.

$n=40$, $P=.5$, $q=.5$

P(25 correct ans) =

$P(x=25) = {}_{40}C_{25} * (.5)^{25} * (.5)^{15} = .037$

2nd | VARS | ↓↓... | binom PdS

Menu

Trials: 40

P: .5

x-value: 25

Paste | Enter

No Menu

binompdf(40, .5, 25) Enter

n, P, x

= .037

A loaded coin is tossed 80 times.

Prob. of landing tails is .6

P(exactly 50 tails) = P(x = 50)

= binompdf(80, .6, 50)

= .083

P(at most 55 tails) =

$P(x \leq 55)$ = binomcdf(80, .6, 55) = .958

You are taking an exam with 50 multiple-choice questions.

Each question has 4 choices. Only one correct choice.

You are making random guesses.

$n = 50 \qquad p = \frac{1}{4} = .25 \qquad q = \frac{3}{4} = .75$

P(exactly 15 correct ans) = $P(x = 15)$

= binompdf(50, .25, 15)

= .089

P(fewer than 20 correct ans) =

$P(x < 20) = P(x \leq 19)$ = binomcdf(50, .25, 19)

= .986

UPS says prob. that any package is ontime is .9.

80 packages were randomly selected.

1) P(exactly 70 are on time) =

$P(x = 70)$ = binompdf(80, .9, 70) = .103

2) P(at most 75 are on time) =

$P(x \leq 75)$ = binomcdf(80, .9, 75) = .912

3) P(at least 65 on time) =

$P(x \geq 65) = 1 - P(x \leq 64) = 1 -$ binomcdf(80, .9, 64)

64 65

= .995

100 Newborn babies were randomly Selected.

$n=100 \quad P=.5 \quad q=.5$

P(exactly 40 boys) = P(x=40)

= binompdf(100, .5, 40)

= .011

P(fewer than 60 girls) = P(x<60)

= P(x ≤ 59)

= binomcdf(100, .5, 59)

= .972

P(more than 45 boys) =

P(x > 45) = P(x ≥ 46)

= 1 − P(x ≤ 45) = 1 − binomcdf(100, .5, 45)

= .816

P(x = a) = binompdf(n, P, a)

P(x ≤ a) = binomcdf(n, P, a)

P(x ≥ a) = 1 − binomcdf(n, P, a−1)

P(a ≤ x ≤ b) = binomcdf(, b) −

binomcdf(, a−1)

Reduce by 1

Consider a binomial Prob. dist with n=120, and P=.8

Find P(95 ≤ x ≤ 110)

= binomcdf(120, .8, 110) −

binomcdf(120, .8, 94) = .641

Prob. of full recovery from certain surgery is .85. 145 of these surgeries are randomly selected. Find the prob. that from 110 to 130 of them have full recovery.

$n = 145$, $P = .85$

$P(110 \le x \le 130)$ — Reduce by 1

$= \text{binomcdf}(145, .85, 130) - \text{binomcdf}(145, .85, 109)$

$= \boxed{.958}$

Binomial Prob. Dist:

Mean μ $\quad \boxed{\mu = np}$

Variance σ^2 $\quad \boxed{\sigma^2 = npq}$

Standard Deviation σ $\quad \sigma = \sqrt{\sigma^2}$

Toss a fair coin 400 times.

$n=400 \quad p=.5 \quad q=.5$

$\mu = np \quad \mu = 400(.5) \quad \boxed{\mu = 200}$

$\sigma^2 = npq \quad \sigma^2 = 400(.5)(.5) \quad \boxed{\sigma^2 = 100}$

$\sigma = \sqrt{\sigma^2} = \sqrt{100} = \boxed{10}$

Usual Range

$\mu \pm 2\sigma$

$= 200 \pm 2(10)$

$= 200 \pm 20$

$\Rightarrow \boxed{180 \text{ to } 220}$

You are making random guesses on a test with 200 questions. Each question has 5 choices with only one correct choice. Success is to get a correct answer.

1) $n = 200$

2) $p = \frac{1}{5} = .2$

3) $q = \frac{4}{5} = .8$

4) $\mu = np$

$= 200(.2)$

$= \boxed{40}$

5) $\sigma^2 = npq$

$= 200(.2)(.8)$

$= \boxed{32}$

6) $\sigma = \sqrt{\sigma^2}$

$= \sqrt{32}$

$= \boxed{5.657}$

Round μ & σ to a whole #, Find $\mu = 40, \sigma = 6$

7) Usual range

95% Range $\mu \pm 2\sigma = 40 \pm 2(6) = 40 \pm 12$

$\Rightarrow \boxed{28 \text{ to } 52}$

8) P(between 28 and 52 Correct ans, inclusive)

$= P(28 \le X \le 52) =$ binomcdf(200, .2, 52) −

Reduce by 1 binomcdf(200, .2, 27) $= \boxed{.973}$