Statistics

Fall 2022

Lecture 17

Class QZ 14 $\quad \Sigma P(x) = 1 \checkmark$

Use the chart below

x	P(x)
1	.05
2	.15
3	.25
4	.35
5	.20

Find

1) $\mu = 3.5 \checkmark$

2) $\sigma = 1.118 = 1.1 \checkmark$ ($\bar{x}$, σ_x) } Round to 1-decimal

3) σ^2 in Reduced Fraction

$\frac{5}{4} = 1.25 \checkmark$

clear all lists.

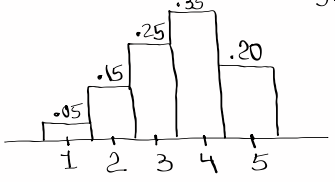
ReSet all lists.

$x \to L1$, $P(x) \to L2$

STAT CALC 1:1-Var Stats L1 & L2 Enter

VARS 5: Statistics 4: σ_x x^2 Math 1: ▸Frac Enter

Draw Prob. dist. Histogram



68% Range

$\mu \pm \sigma = 3.5 \pm 1.1$

$\Rightarrow$ 2.4 to 4.6

Usual Range $\Rightarrow \mu \pm 2\sigma = 3.5 \pm 2(1.1) \Rightarrow$ 1.3 to 5.7

At a Fundraiser, 4000 Tickets wer sold @ $100 each.

One ticket is randomly drawn, the winner gets a brand new boat worth $10,000.

Find expected Value per ticket Sold for the fundraisers.

	Net gain	P(Net gain)
Winning TKT ⇒	100 − 10,000	1/4000
Losing TKT ⇒	100 − 0	3999/4000

Net gain → L1

P(Net gain) → L2

E.V. = $\mu = \bar{x} =$ **$97.5**

Per ticket, fundraisers make $97.50

A piggy bank has 2 quarters and 13 dimes. Randomly take 2 coins, No replacement

DD → 20¢ → $P(20¢) = \frac{13}{15} \cdot \frac{12}{14} = \frac{156}{210}$

DQ, QD → 35¢ → $P(35¢) = = \frac{52}{210}$

QQ → 50¢ → $P(50¢) = \frac{2}{15} \cdot \frac{1}{14} = \frac{2}{210}$

Total ¢	P(Total ¢)
20	156/210
35	52/210
50	2/210

Find

$\mu = 24$

$\sigma = 6.949$

σ^2 (Reduced fraction) $= \frac{338}{7}$

Binomial Prob. Dist.: SG 15

1) n independent events

2) Each event has only two outcomes.

$P(\text{Success}) = p$ $\quad$ $P(\text{Failure}) = q$

3) p & q remain unchanged for all events

$p + q = 1$, $q = 1 - p$

4) x is the number of Successes.

$$P(x) = {}_nC_x \cdot p^x \cdot q^{n-x}, \quad x \geq 0$$

Consider a binomial Prob. dist. with $n = 10$, and $p = .4$.

Find

1) $q = 1 - p$ $= .6$

2) $np = 10(.4)$ $= 4$

3) $npq = 10(.4)(.6)$ $= 2.4$

Let x be # of Successes, find

4) $P(x = 3) = {}_{10}C_3 \cdot (.4)^3 \cdot (.6)^7 = .215$

($x \to 3$, $n - x \to 7$)

Using the formula (n, x, p, q)

Use [^] For exponent

Consider a binomial prob. dist with $n=20$ and $p=.3$.

Find

1) $q = 1-p$
$= .7$

2) $np = 20(.3)$
$= 6$

3) $npq = 20(.3)(.7)$
$= 4.2$

4) $\sqrt{npq} = \sqrt{4.2} \approx 2.049$

Let x be # of successes, find

5) $P(x=8) = {}_{20}C_{8} \cdot (.3)^{8} \cdot (.7)^{12} = .114$

($x \to 8$, $n-x \to 12$; n, x, p, q)

Let's toss a fair coin 100 times, and assume landing tails is a success.

$P(\text{Tails}) = \frac{1}{2}$
$P(\overline{\text{Tails}}) = 1/2$

1) $n = 100$

2) $p = .5$

3) $q = .5$

4) $np = 100(.5)$
$= 50$

5) $npq = 100(.5)(.5)$
$= 25$

6) $\sqrt{npq} = \sqrt{25}$
$= 5$

Let x be # of tails

7) $P(\text{exactly } 45 \text{ tails}) = P(x=45)$ ($x=45$; $x \to 45$, $n-x \to 55$)

$= {}_{100}C_{45} \cdot (.5) \cdot (.5)$

(n, x, p, q)

$= .048$

Doing Binomial Prob. Dist. by TI:

From last example: $n=100$, $p=.5$

$P(x=45)$ = binompdf(100, .5, 45) Enter

2nd VARS ↓ ↓ ↓ ... = .048

$P(x=50)$ = binompdf(100, .5, 50) = .080

↑ Exactly 50 Tails

$P(x=75)$ = binompdf(100, .5, 75) =

↑ Exactly 75 tails

1.9×10^{-7}

E-7

Consider a binomial Prob. dist. with $n=125$ and $p=.8$.

Find

1) $q = 1-p$ = .2

2) $np = 125(.8)$ = 100

3) $npq = 125(.8)(.2)$ = 20

4) $\sqrt{npq} = \sqrt{20} \approx 4.472$

Let x be # of Successes, find

5) $P(x=110)$ = binompdf(125, .8, 110)

= .006

6) $P(x \le 110) = P(x=110) + P(x=109) + P(x=108) + \cdots + P(x=0)$

= binomcdf(125, .8, 110)

Cumulative

= .993

You are taking a True/False exam with 400 questions. P(True) = .5, P(False) = .5

You are making random guesses.

Let x be # of correct guesses.

1) $n = 400$ 2) $p = .5$ 3) $q = .5$

4) $np = 400(.5) = 200$ 5) $npq = 400(.5)(.5) = 100$ 6) $\sqrt{npq} = \sqrt{100} = 10$

7) P(guess exactly 220 correct answers) $x = 220$

$P(x = 220) = \text{binompdf}(400, .5, 220) = .005$

8) P(guess at most 220 correct answers) $x \leq 220$

$P(x \leq 220) = \text{binomcdf}(400, .5, 220) = .980$

9) P(guess fewer than 200 correct answers) $x < 200$ $= .480$

$P(x < 200) = P(x \leq 199) = \text{binomcdf}(400, .5, 199)$

100 new born babies are randomly selected.

Success is having a girl.

1) $n = 100$ 2) $p = .5$ 3) $np = 100(.5) = 50$

4) $q = 1 - p = .5$ 5) $npq = 100(.5)(.5) = 25$ 6) $\sqrt{npq} = \sqrt{25} = 5$

7) P(exactly 50 girls) $x = 50$

$P(x = 50) = \text{binompdf}(100, .5, 50) = .079$

8) P(at most 60 girls) = $x \leq 60$

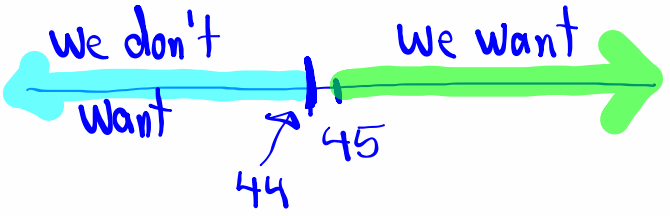
$P(x \leq 60) = \text{binomcdf}(100, .5, 60) = .982$

9) P(at least 45 girls)

$x \geq 45$

Total Prob.

$P(x \geq 45) = 1 - P(x \leq 44) = 1 - \text{binomcdf}(100, .5, 44)$



$= \boxed{.864}$

You are taking a multiple-choice exam with 80 questions.

Each question has 4 choices but only 1 correct choice.

$P(\text{correct}) = \frac{1}{4} = \boxed{.25}$

$P(\overline{\text{correct}}) = \frac{3}{4} = \boxed{.75}$

You are making random guesses.

Success is to guess correct answer.

1) $n = 80$ 2) $p = .25$ 3) $q = .75$

4) $np = 80(.25) = \boxed{20}$

5) $npqq = 80(.25)(.75) = \boxed{15}$

6) $\sqrt{npqq} = \sqrt{15} \approx 3.873$

7) P(fewer than 25 correct guesses) $\approx \boxed{14}$

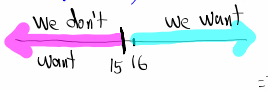
$x < 25$

$P(x < 25) = P(x \leq 24) = \text{binomcdf}(80, .25, 24) = \boxed{.876}$

8) P(more than 15 correct guesses)

$x > 15$

$P(x > 15) = P(x \geq 16) = 1 - P(x \leq 15)$



Total Prob.

$= 1 - \text{binomcdf}(80, .25, 15)$

$= \boxed{.879}$

$P(a \le x \le b) = \text{binomcdf}(n, p, b) - \text{binomcdf}(n, p, a-1)$

Reduce by 1

from last example

$P(15 \le x \le 25) = \text{binomcdf}(80, .25, 25) - \text{binomcdf}(80, .25, 14)$

Reduce by 1

$= .846$ ✓