Statistics

Lecture 10

Feb 19-8:47 AM

SG 16

Binomial Prob. Dist.:

1) we have n independent events.

2) Each event has only two outcomes

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

$p + q = 1$

p & q remain unchanged for all events.

3) $x \rightarrow$ # Successes $\qquad n-x \rightarrow$ # failure

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

$${}_nC_x = \frac{n!}{x! \cdot (n-x)!}$$

it gives us the # of ways that different Combination can happen.

5 items, take 2 items, How many ways can this happen?

$${}_5C_2 = \frac{5!}{2! \cdot (5-2)!} = \frac{5!}{2! \cdot 3!} = \frac{5 \cdot \cancel{4}^{2} \cdot \cancel{3 \cdot 2 \cdot 1}}{\cancel{2} \cdot 1 \cdot \cancel{3 \cdot 2 \cdot 1}} = \boxed{10}$$

order does not matter.

Using TI:

5 [Math] [→] PRB [↓] [nCr] 2 [Enter]

Jul 15-4:32 PM

12 players, Coach needs 5 to play.

How many different combination?

$${}_{12}C_5 = \frac{12!}{5!\cdot(12-5)!}$$

$$= \frac{12!}{5!\cdot 7!} = \frac{\cancel{12}\cdot 11\cdot \cancel{10}\cdot 9\cdot 8\cdot \cancel{7!}}{\cancel{5}\cdot\cancel{4}\cdot\cancel{3}\cdot\cancel{2}\cdot 1\cdot\cancel{7!}}$$

$$= 11\cdot 9\cdot 8 = \boxed{792}$$

12 $\boxed{\text{Math}}$ $\boxed{\rightarrow}$ $\boxed{\text{PRB}}$ $\boxed{\downarrow}$ $\boxed{{}_nC_r}$ 5 $\boxed{\text{enter}}$

CA Lotto, 50 numbers, choose 5

\# of Combination

${}_{50}C_5$ $\boxed{2,118,760}$

50 $\boxed{\text{Math}}$ $\boxed{\rightarrow}$ $\boxed{\text{PRB}}$ $\boxed{\downarrow}$ $\boxed{{}_nC_r}$ 5 $\boxed{\text{enter}}$

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Consider a binomial Prob. dist. with

$n = 10$ and $p = .4$.

independent events

Prob. of Success Per event

1) $q = 1 - p = 1 - .4 = \boxed{.6}$

2) P(exactly 3 Successes) = $P(x=3)$

Formula ${}_nC_x \cdot p^x \cdot q^{n-x}$

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

$\boxed{\rightarrow}$

10 $\boxed{\text{Math}}$ $\boxed{\text{PRB}}$ $\boxed{{}_nC_r}$ 3 $\boxed{\times}$ .4 $\boxed{\wedge}$ 3 $\boxed{\times}$ .6 $\boxed{\wedge}$ 7

$\boxed{\text{Enter}}$

$\approx \boxed{.215}$

Jul 15-4:49 PM

I flipped a fair coin 12 times.
Success is to land tails.

1) $n=12$ 2) $p=.5$ 3) $q=.5$

4) Compute $np=12(.5)=\boxed{6}$

5) Compute npq $=12(.5)(.5)=\boxed{3}$

6) Compute $\sqrt{npq}=\sqrt{3}\approx 1.732$

7) P(exactly 5 tails) $=P(x=5)$

Formula $_nC_x \cdot p^x \cdot q^{n-x}$

$_{12}C_5 \cdot (.5)^5 \cdot (.5)^7 \approx \boxed{.193}$

12 [Math] [PRB] [nCr] 5 [×] .5 [^] 5 [×] .5 [^] 7 [enter]

Now using TI Command

[2nd] [VARS] [↓] [binompdf]

No Menu
n, p, x

binompdf(12,.5,5)

Your work

Trials: 12
P: .5
x Value: 5
[Paste] [Enter] $\boxed{.193}$

Jul 15-4:56 PM

Consider a binomial Prob. dist with

$n=40$ & $P=.8$

1) $q=1-P=1-.8=\boxed{.2}$

2) $np=40(.8)$ $=\boxed{32}$

3) $npq=40(.8)(.2)$ $=\boxed{6.4}$

4) $\sqrt{npq}=\sqrt{6.4}\approx\boxed{2.530}$

5) $P(x=35)$ = binompdf(40, .8, 35) = $\boxed{.085}$

exactly 35 Successes

6) $P(x\leq 35)=P(x=35)+P(x=34)+P(x=33)+\cdots+P(x=0)$

at most 35 Successes

= binomcdf (40, .8, 35) = $\boxed{.924}$

7) $P(x<35)=P(x\leq 34)$

below
less than

= binomcdf(40, .8, 34) = $\boxed{.839}$

Jul 15-5:07 PM

I flip a loaded coin 125 times.
Success is to land tails.
Prob. of landing tails per flip is .6

1) $n = 125$ 2) $p = .6$ 3) $q = .4$

4) $np = 125(.6) = \boxed{75}$

5) $npq = 125(.6)(.4) = \boxed{30}$

6) $\sqrt{npq} = \sqrt{30} \approx \boxed{5.477}$

7) P(land exactly 80 tails)

$= P(x = 80) = \text{binompdf}(125, .6, 80)$

$= \boxed{.049}$

8) P(land at most 80 tails) $= P(x \leq 80)$

$= \text{binomcdf}(125, .6, 80)$

$= \boxed{.842}$

9) P(land at least 80 tails) $= P(x \geq 80)$

$= 1 - P(x \leq 79)$

$= 1 - \text{binomcdf}(125, .6, 79)$

$= \boxed{.206}$

we don't want | we want
79 80

Jul 15-5:20 PM

You are taking a True-False exam with 100 questions.
You are making random guesses.
Success is to get a correct ans.

1) $n = 100$ 2) $p = .5$ 3) $q = .5$

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

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

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

7) P(guess exactly 60 correct answers)

$= P(x = 60) = \text{binompdf}(100, .5, 60) = \boxed{.011}$

8) P(guess at most 60 correct answers)

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

9) P(guess more than 60 correct answers)

$P(x > 60) = P(x \geq 61) = 1 - P(x \leq 60)$

$= 1 - .982$

$= \boxed{.018}$

we don't want | we want
60 61

Jul 15-5:34 PM

Working with $\boxed{\text{binomial Prob. dist.}}$

$$\boxed{\begin{array}{l} \text{Mean} \quad \mu = np \\ \text{Variance} \quad \sigma^2 = npq \\ \text{Standard Deviation} \quad \sigma = \sqrt{\sigma^2} \end{array}}$$

Consider a binomial Prob. dist with $n = 150$, and $p = .6$

1) $q = 1 - p = 1 - .6 = \boxed{.4}$

2) $\mu = np = 150(.6) = \boxed{90}$

3) $\sigma^2 = npq = 150(.6)(.4) = \boxed{36}$

4) $\sigma = \sqrt{\sigma^2} = \sqrt{36} = \boxed{6}$

5) Usual Range $= \mu \pm 2\sigma = 90 \pm 2(6)$

$= 90 \pm 12$

$\Rightarrow \boxed{78 \text{ to } 102}$

Jul 15-5:59 PM

400 Voters were randomly Selected.

Prob. that any voter is in favor of gun control is .8.

Success is being in favor of gun control.

1) $n = 400$ 2) $p = .8$ 3) $q = .2$

4) $\mu = np$
$= 400(.8) = \boxed{320}$

5) $\sigma^2 = npq$
$= 400(.8)(.2)$
$= \boxed{64}$

6) $\sigma = \sqrt{\sigma^2}$
$= \sqrt{64}$
$= \boxed{8}$

7) 68% Range $= \mu \pm \sigma = 320 \pm 8 \Rightarrow \boxed{312 \text{ to } 328}$

8) 95% Range = Usual Range $= \mu \pm 2\sigma$

$= 320 \pm 2(8)$

$= 320 \pm 16$

$\Rightarrow \boxed{304 \text{ to } 336}$

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9) P(# of Voters in favor of .... is 300)

$P(x = 300) = \text{binompdf}(400, .8, 300)$

$= \boxed{.002}$

10) P(# of voters in favor of ..... is below 325)

$P(x < 325) = P(x \le 324)$

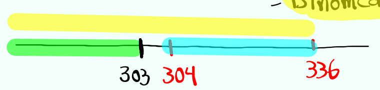
$= \text{binomcdf}(400, .8, 324)$

$= \boxed{.770}$

11) P(# of voters in favor of .... is between 304 and 336 inclusive)

$P(304 \le x \le 336) = P(x \le 336) - P(x \le 303)$

$= \text{binomcdf}(400, .8, 336) - \text{binomcdf}(400, .8, 303)$



$= \boxed{.961} \approx 96\%$

Jul 15-6:12 PM

400 newborn babies are randomly selected.

Success is to have a boy.

1) $n = 400$

2) $p = .5$

3) $q = .5$

4) $\mu = np = 400(.5)$

$= \boxed{200}$

5) $\sigma^2 = npq$

$= 400(.5)(.5)$

$= \boxed{100}$

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

$= \sqrt{100}$

$= \boxed{10}$

7) Usual Range = 95% Range = $\mu \pm 2\sigma$

$= 200 \pm 2(10)$

$= 200 \pm 20$

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

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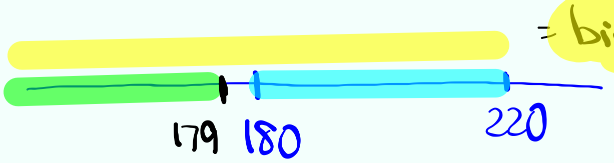
8) P(# of boys is between 180 and 220, inclusive)

$P(180 \le x \le 220) = P(x \le 220) - P(x \le 179)$

$= \text{binomcdf}(400, .5, 220) - \text{binomcdf}(400, .5, 179)$



$\approx \boxed{.960}$ 96%

Jul 15-6:27 PM

You are taking a multiple-choice exam with 60 questions.

You are making random guesses.

Success is to guess Correctly

Each question has 5 choices but only one Correct choice.

1) $n = 60$ 2) $p = \frac{1}{5} = .2$ 3) $q = \frac{4}{5} = .8$

4) $\mu = np$
$= 60(.2)$
$= \boxed{12}$

5) $\sigma^2 = npq$
$= 60(.2)(.8)$
$= \boxed{9.6}$

6) $\sigma = \sqrt{\sigma^2}$
$= \sqrt{9.6}$
$= 3.098$
$\approx \boxed{3}$

7) Usual Range $\mu \pm 2\sigma$
$= 12 \pm 2(3) = 12 \pm 6 \Rightarrow \boxed{6 \text{ to } 18}$

keep

9) $P(6 \le x \le 18) = P(x \le 18) - P(x \le 5)$

Subtract 1

$= \text{binomcdf}(60, .2, 18) - \text{binomcdf}(60, .2, 5)$

$= \boxed{.966} \approx 96.6\%$

SG 16
Last Page
use exact value of p & q

SG 16 ✓

Jul 15-6:32 PM

500 tickets are sold for \$2 each.

One ticket is drawn.

The winning tkt gets a laptop worth \$1000.

Find expected value per ticket for Fundraiser.

Net	P(Net)
2 − 1000	1/500
2 − 0	499/500

Net → L1

P(Net) → L2

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

1-Var Stats with L1 & L2

Set-up for buyers

Net	P(Net)
1000 − 2	1/500
0 − 2	499/500

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10 nickels 2 dimes Select 2 coins
No replacement

NN ND DN DD

10¢ Total 15¢ Total 20¢ Total

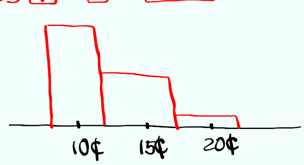
$P(10¢\text{ Total}) = P(NN) = \frac{10}{12}\cdot\frac{9}{11} = \boxed{\frac{15}{22}}$

$P(15¢\text{ Total}) = P(ND \text{ or } DN) = 2\cdot\frac{10}{12}\cdot\frac{2}{11} = \boxed{\frac{10}{33}}$

$P(20¢\text{ Total}) = P(DD) = \frac{2}{12}\cdot\frac{1}{11} = \boxed{\frac{1}{66}}$

15 ÷ 22 + 10 ÷ 33 + 1 ÷ 66 enter 1 ✓

T	P(T)
10¢	15/22
15¢	10/33
20¢	1/66



T → L1

P(T) → L2

1-Var Stats with L1 & L2

$\mu = \bar{x} = 11.\bar{6}$ $n = 1$ ✓

$\sigma = \sigma_x \approx 2.513$

$\sigma^2 = \frac{625}{99}$

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