Statistics

Lecture 15

Feb 19-8:47 AM

Consider the chart below

x	$P(x)$
1	.1
2	.2
3	.3
4	.35
5	.05

1) $P(x=5)$

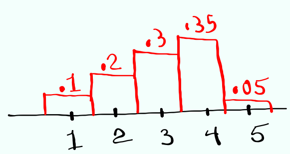
$= 1 - [.1 + .2 + .3 + .35] = \boxed{.05}$

2) $P(x \le 3) = .1 + .2 + .3 = \boxed{.6}$

3) $P(x=2 \text{ or } x=4)$

$= .2 + .35 = \boxed{.55}$

4) Draw Prob. dist. histogram



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

Use $\boxed{\text{1-Var Stats}}$ with L1 & L2

$\mu = \bar{x} = 3.05$

$\sigma = \sigma_x = 1.071$

$n = 1$

$\mu \approx 3$, $\sigma = 1$

6) Find σ^2 in Reduced Frac.

$\boxed{\text{VARS}}$ $\boxed{\text{5: Statistics}}$ $\boxed{\text{4: } \sigma_x}$

$\boxed{x^2}$ $\boxed{\text{Math}}$ $\boxed{\text{1: ▶Frac}}$ $\boxed{\text{Enter}}$

$\sigma^2 = \frac{459}{400}$

68% Range $\mu \pm \sigma \Rightarrow 2 \text{ to } 4$

95% Range $\mu \pm 2\sigma \Rightarrow 1 \text{ to } 5$

Oct 16-12:12 PM

I choose a number between 1 and 250.

Pay me \$10 and guess what I number I picked.

If you guess correctly, I pay you \$100 otherwise, I pay nothing.

Expected earning for me per play.

	Net	P(Net)	
L1	10 − 100	$\frac{1}{250}$	L2 Guess Correctly
	10 − 0	$\frac{249}{250}$	Wrong Guess

Expected Earning $= \mu = \bar{x}$ $\boxed{\$9.60}$

Oct 16-12:25 PM

Binomial Prob. dist. SG 16

1) n independent events

2) Each event has only two outcomes.

P(Success) = p P(Failure) = q

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

p & q remain unchanged for all events

3) $x \to$ # of Successes

$n - x \to$ # of failures

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

Oct 16-12:30 PM

Consider a binomial Prob. dist. with $n=8$ and $P=.6$.

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

2) $P(x=5) = {}_8C_5 \cdot (.6)^5 \cdot (.4)^3 = \boxed{.279}$

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

3) $P(x=4) = {}_8C_4 \cdot (.6)^4 \cdot (.4)^4 = \boxed{.232}$

4) $np = 8(.6) = \boxed{4.8}$

5) $npq = 8(.6)(.4) = \boxed{1.92}$

Oct 16-12:35 PM

I flipped a coin 10 times.

$P(\text{tails}) = .7$

1) $n = \boxed{10}$

2) $P = \boxed{.7}$

3) $q = \boxed{.3}$

4) $np = 10(.7) = \boxed{7}$

5) $npq = 10(.7)(.3) = \boxed{2.1}$

6) $P(\underbrace{\text{exactly } 6}_{x=6} \text{ tails}) = P(x=6)$

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

$= {}_{10}C_6 \cdot (.7)^6 \cdot (.3)^4$

$= \boxed{.200}$

7) $P(\underbrace{\text{exactly } 8}_{x=8} \text{ Tails}) = P(x=8)$

$= {}_{10}C_8 \cdot (.7)^8 \cdot (.3)^2$

$= \boxed{.233}$

Oct 16-12:43 PM

You are taking a True-False Test.

You are making random guesses.

There are 12 questions.

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

4) $np = 12(.5) = \boxed{6}$ 5) $npq = 12(.5)(.5) = \boxed{3}$ 6) $\sqrt{npq} = \sqrt{3} \approx 1.7...$

7) P(Guess $\underbrace{\text{8 questions}}_{x=8}$ Correctly)

$P(x=8) = {}_{12}C_8 \cdot (.5)^8 \cdot (.5)^4 = \boxed{.121}$

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

$\boxed{P(x=8) = \text{binompdf}(12, .5, 8) = .121}$

Using TI Command

$\boxed{\text{2nd}}$ $\boxed{\text{VARS}}$ ↓ $\boxed{\text{binompdf}}$ Menu

n → Trials: 12

p: .5

x: 8

$\boxed{\text{Paste}}$ $\boxed{\text{Enter}}$

no Menu

12, .5, 8 $\boxed{\text{Enter}}$

$\boxed{)}$ $\boxed{)}$

Oct 16-12:50 PM

You are taking an exam.

20 questions, Each question has 4 choices, but only one Correct choice per question.

You are making random guesses.

1) $n = 20$ 2) $p = \frac{1}{4} = .25$ 3) $q = \frac{3}{4} = .75$

4) $np = 20(.25) = \boxed{5}$ 5) $npq = 20(.25)(.75) = \boxed{3.75}$ 6) $\sqrt{npq}$

Round to whole #

$\sqrt{3.75} \approx \boxed{2}$

7) P(guess $\underbrace{\text{8 Questions}}$ Correctly)

$P(x=8) = \text{binompdf}(20, .25, 8) = \boxed{.061}$

8) P(Guess $\underbrace{\text{at most 8}}_{x \le 8}$ Correctly)

$P(x \le 8) = \text{binomcdf}(20, .25, 8) = \boxed{.959}$

Oct 16-12:59 PM

Consider a binomial Prob. dist with

$n = 400$ & $P = .8$

1) $q = 1 - P = \boxed{.2}$ 2) $np = 400(.8) = \boxed{320}$ 3) $npq = 400(.8)(.2) = \boxed{64}$

4) $\sqrt{npq} = \sqrt{64} = \boxed{8}$

5) $P(x = 325)$ = binompdf(400, .8, 325) = $\boxed{.042}$

6) $P(x \leq 330)$ = binomcdf(400, .8, 330) = $\boxed{.907}$

at most

7) $P(x < 310) = P(x \leq 309)$

309 310

= binomcdf(400, .8, 309)

= $\boxed{.096}$

Oct 16-1:09 PM

100 newborn babies were randomly Selected

Success is having a boy(girl)

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

4) $np = 100(.5) = \boxed{50}$ 5) $npq = 100(.5)(.5) = \boxed{25}$ 6) $\sqrt{npq} = \sqrt{25} = \boxed{5}$

7) P(have $\underbrace{\text{at least 40}}_{x \geq 40}$ boys)

$P(x \geq 40) = 1 - P(x \leq 39)$

We don't Want 39 40 we want

Total Prob.

= 1 − binomcdf(100, .5, 39)

= $\boxed{.982}$

Oct 16-1:21 PM

Prob. that you get full recovery from certain surgery is .9.

50 patients were randomly selected

1) $n = 50$ 2) $p = .9$ 3) $q = 1 - p = .1$

4) $np = 50(.9) = \boxed{45}$ 5) $npq = 50(.9)(.1) = \boxed{4.5}$ 6) $\sqrt{npq} = \sqrt{4.5} \approx 2$

Round to whole #

7) P($\underbrace{\text{exactly 40}}_{x=40}$ have full recovery)

$P(x=40)$ = binompdf$(50, .9, 40) = \boxed{.015}$

8) P($\underbrace{\text{at most 48}}_{x \leq 48}$ have full recovery)

$P(x \leq 48)$ = binomcdf$(50, .9, 48)$

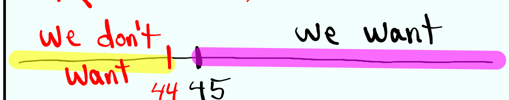
$= \boxed{.966}$

Oct 16-1:44 PM

9) P($\underbrace{\text{at least 45}}_{x \geq 45}$ have full recovery)

Total Prob.

$P(x \geq 45) = 1 - P(x \leq 44)$



$= 1 -$ binomcdf$(50, .9, 44)$

$= \boxed{.616}$

P($\underbrace{\text{between 40 and 46, inclusive}}_{40 \leq x \leq 46}$ have full-Recovery)

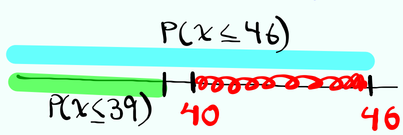
$P(40 \leq x \leq 46)$

$= P(x \leq 46) - P(x \leq 39)$

$=$ binomcdf$(50, .9, 46)$

$-$ binomcdf$(50, .9, 39)$

$= \boxed{.740}$



Oct 16-1:52 PM

You are taking a multiple-choice exam and making random guesses.

There are 120 questions, 5 choices per question, only one correct choice.

1) $n = 120$ 2) $p = \frac{1}{5} = .2$ 3) $q = \frac{4}{5} = .8$

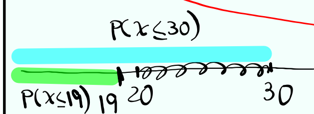
4) $np = 120(.2) = \boxed{24}$ 5) $npq = 120(.2)(.8) = \boxed{19.2}$ 6) $\sqrt{npq} \to \sqrt{19.2} \approx 4.4$

Round to 1-decimal

7) P(Correctly guess between 20 & 30, inclusive)

$P(20 \le x \le 30) = \text{binomcdf}(120, .2, 30) - \text{binomcdf}(120, .2, 19)$

Reduce by 1



$= \boxed{.776}$

Oct 16-2:02 PM

$\mu = np$ Mean

$\sigma^2 = npq$ Variance

$\sigma = \sqrt{\sigma^2}$ Standard dev.

Binomial Prob. Dist.

Consider a binomial Prob. dist. with $n = 250$ & $p = .6$

1) $q = 1 - p = .4$

2) $\mu = np = 250(.6) = 150$

3) $\sigma^2 = npq = 250(.6)(.4) = 60$

4) $\sigma = \sqrt{\sigma^2} = \sqrt{60} \approx 8$

68% Range $\mu \pm \sigma = 150 \pm 8$
$\to \boxed{142 \text{ to } 158}$

Usual Range $\mu \pm 2\sigma = 150 \pm 2(8)$
$\to \boxed{134 \text{ to } 166}$

Oct 16-2:11 PM

I was bored.

I flipped a fair coin 400 times.

Success is landing tails.

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) 95% Range $\mu \pm 2\sigma$

$= 200 \pm 2(10)$

$= 200 \pm 20 \rightarrow \boxed{180 \text{ to } 220}$

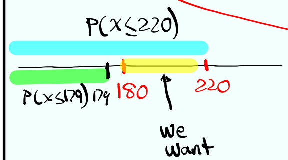
8) P(lands tails between 180 and 220, inclusive)

$P(180 \le x \le 220) = \text{binomcdf}(400, .5, 220)$

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

Reduce by 1

$= \boxed{.960}$



Oct 16-2:16 PM