Statistics

Lecture 8

Feb 19-8:47 AM

SG 14

Data
1) Qualitative
   Non-Numerical
2) Quantitative
   Numerical
   1) Discrete
      Countable
   2) Continuous
      Measureable

Oct 18-11:33 AM

Let x be a discrete random variable with Prob. dist. $P(x)$.

Countable

Prob. dist. provides prob. of all Possible outcomes.

Prob. dist. can be

1) in the form of a chart or table
2) in the form of a graph
3) in using some formula.
4) we could find it by concept of Prob.

Oct 18-11:35 AM

Some rules:

1) $0 \leq P(x) \leq 1$
2) $\sum P(x) = 1 \Rightarrow$ Sum of all prob. $= 1$
3) $P(x) = 1 \Leftrightarrow$ Sure event
4) $P(x) = 0 \Leftrightarrow$ Impossible event
5) $0 < P(x) \leq .05 \Leftrightarrow$ Rare event

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Consider the chart below for discrete random variable x with prob. dist. $P(x)$.

x	$P(x)$
1	.2
2	.5
3	.3

1) Verify $\sum P(x) = 1$

$.2 + .5 + .3 = 1$

2) $P(x \le 2) =$

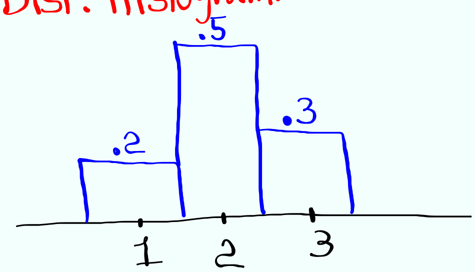
$.2 + .5 = .7$

3) $P(x \ge 2) = .5 + .3 = \boxed{.8}$

4) Draw Prob. Dist. Histogram.

$x \to$ Midpoint

$P(x) \to$ Rel. F.



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Consider the chart below for discrete random variable x with prob. dist. $P(x)$:

x	$P(x)$
1	.15
2	.25
3	.4
4	.2

1) Find $P(x=4)$

$= 1 - [.15 + .25 + .4]$

Total Prob. $= \boxed{.2}$

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

$= .25 + .4 = \boxed{.65}$

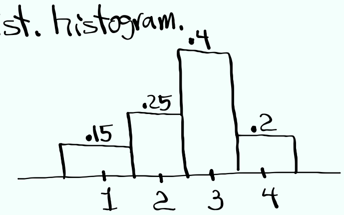
3) Find $P(x \ge 2) = 1 - .15 = \boxed{.85}$

Total Prob.

4) Draw Prob. dist. histogram.

$x \to$ Midpoint

$P(x) \to$ Rel. F.



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A piggy bank has 2 Dimes & 3 Nickels

Take 2 Coins, No replacement

Sample Space

NN → 10¢ $P(10¢) = \frac{3}{5} \cdot \frac{2}{4} = \frac{6}{20} = .3$

ND, DN → 15¢ $P(15¢) = 2 \cdot \frac{3}{5} \cdot \frac{2}{4} = \frac{12}{20} = .6$

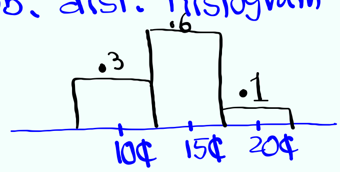
DD → 20¢ $P(20¢) = \frac{2}{5} \cdot \frac{1}{4} = \frac{2}{20} = .1$

Total ¢	P(Total ¢)
10	.3
15	.6
20	.1

P(Total is 10¢ or 20¢)

$= .3 + .1 = \boxed{.4}$

Prob. dist. histogram



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Complete the chart below

x	$P(x)$	$xP(x)$	$x^2P(x)$
1	.3	.3	.3
2	.5	1.0	2.0
3	.2	.6	1.8

1) Verify $\sum P(x) = 1$

$.3 + .5 + .2 = 1$ ✓

2) $\sum xp(x) =$

$.3 + 1.0 + .6 = 1.9$

3) $\sum x^2 p(x) =$

$.3 + 2.0 + 1.8 = 4.1$

4) Compute $\sum x^2 p(x) - \left(\sum xp(x)\right)^2$

$= 4.1 - 1.9^2 = \boxed{.49}$

5) $\sqrt{\text{Last Ans.}} = \sqrt{.49} = \boxed{.7}$

Oct 18-12:04 PM

Complete the chart below

x	$P(x)$	$xP(x)$	$x^2P(x)$
1	.1	.1	.1
2	.2	.4	.8
3	.4	1.2	3.6
4	.3	1.2	4.8

1) Verify $\sum P(x) = 1$

$.1 + .2 + .4 + .3 = 1$ ✓

2) $\sum x\,p(x)$

$\boxed{2.9}$

3) $\sum x^2 p(x)$

$\boxed{9.3}$

4) Compute $\sum x^2 p(x) - \left(\sum x\,p(x)\right)^2$

$= 9.3 - 2.9^2 = \boxed{.89}$

5) $\sqrt{\text{last Ans.}} = \sqrt{.89} \approx \boxed{.943}$

6) $P(x \neq 1) = \underset{\uparrow \text{ Total Prob.}}{1} - P(x=1)$

$= 1 - .1 = \boxed{.9}$

Oct 18-12:12 PM

4 Females, 6 Males, Select 3 people

Let x be # of Females

Sample space:

Outcome	x
FFF	$x=3$
FFM	$x=2$
FMF	$x=2$
FMM	$x=1$
MFF	$x=2$
MFM	$x=1$
MMF	$x=1$
MMM	$x=0$

$P(x=3) = \frac{4}{10}\cdot\frac{3}{9}\cdot\frac{2}{8} = \boxed{\frac{1}{30}}$

$P(x=2) = 3\cdot\frac{4}{10}\cdot\frac{3}{9}\cdot\frac{6}{8} = \boxed{\frac{3}{10}}$

$P(x=1) = 3\cdot\frac{4}{10}\cdot\frac{6}{9}\cdot\frac{5}{8} = \boxed{\frac{1}{2}}$

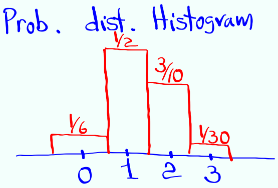
$P(x=0) = \frac{6}{10}\cdot\frac{5}{9}\cdot\frac{4}{8} = \boxed{\frac{1}{6}}$

# F	P(# F)
3	1/30
2	3/10
1	1/2
0	1/6

$\sum P(x) = 1$

$\frac{1}{30} + \frac{3}{10} + \frac{1}{2} + \frac{1}{6} = 1$ ✓

Prob. dist. Histogram



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Mean μ (mu)

Variance σ^2 (Sigma^2)

Standard dev. σ (Sigma)

$$\boxed{\begin{aligned} \mu &= \sum x\,p(x) \\ \sigma^2 &= \sum x^2 p(x) - \mu^2 \\ \sigma &= \sqrt{\sigma^2} \end{aligned}}$$

From earlier example

x	$P(x)$
1	.2
2	.5
3	.3

$\mu = \sum x\,p(x)$

$= 1(.2) + 2(.5) + 3(.3) = \boxed{2.1}$

$\sigma^2 = \sum x^2 p(x) - \mu^2$

$= 1^2(.2) + 2^2(.5) + 3^2(.3) - 2.1^2$

$= .49$

$\sigma = \sqrt{\sigma^2} = \sqrt{.49} = \boxed{.7}$

Now using TI:

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

Use $\boxed{\text{1-Var Stats}}$

with L1 & L2

$\mu = \bar{x} = 2.1$

$\sigma = \sigma_x = .7$

$n = 1 \leftarrow$ Total Prob.

$\boxed{\sigma^2 = .49}$

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

$\boxed{4{:}\ \sigma_x}$ $\boxed{x^2}$ $\boxed{\text{Enter}}$

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From 2-Coin example

Total ¢	P(Total¢)
10	.3
15	.6
20	.1

Total $\to$ L1

P(Total) $\to$ L2

Use $\boxed{\text{1-Var Stats}}$

with L1 & L2

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

$\boxed{4{:}\sigma_x}$ $\boxed{x^2}$ $\boxed{\text{Enter}}$

$\sigma^2 = 9$

$\mu = \bar{x} = 14$

$\sigma = \sigma_x = 3$

$n = 1$

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from female example

# F	P(# F)
3	1/30
2	3/10
1	1/2
0	1/6

F → L1

P(# F) → L2

Use $\boxed{\text{1-Var Stats}}$

with L1 & L2

$\mu = \bar{x} = 1.2$

$\sigma = \sigma_x = .748$

$n = 1$

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

$\boxed{4{:}\ \sigma_x}$ $\boxed{x^2}$ $\boxed{\text{Math}}$ $\boxed{1{:}\blacktriangleright\text{Frac}}$ $\boxed{\text{Enter}}$

$\sigma^2 = \frac{14}{25}$

Oct 18-1:04 PM

Consider the chart below

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

1) $P(x=5)$

$= 1 - (.2 + .1 + .2 + .3)$

Total Prob. $= 1 - .8$

$= \boxed{.2}$

2) $P(2 \le x \le 4)$

$= .1 + .2 + .3 = \boxed{.6}$

clear all lists

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

3) find μ & σ , $\boxed{\text{Round up}}$ to whole #

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

$\mu = \bar{x} = 3.2$ $\mu = 4$

$\sigma = \sigma_x = 1.4$ $\sigma = 2$

68% Range

$\mu \pm \sigma$

$= 4 \pm 2 \to \boxed{2 \text{ to } 6}$

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

$= 4 \pm 2(2)$

$\to \boxed{0 \text{ to } 8}$

find σ^2 in reduced frac.

$\sigma^2 = \frac{49}{25}$

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

$\boxed{4{:}\ \sigma_x}$ $\boxed{x^2}$ $\boxed{\text{Math}}$ $\boxed{1{:}\blacktriangleright\text{Frac}}$ $\boxed{\text{Enter}}$

Oct 18-1:09 PM

Expected Value

I Sold 25 TKts @ \$10 each ⇒ \$250

I am giving away a Calc. ⇒ \$100

Net	P(Net)
10 − 100	1/25
10 − 0	24/25

Net Profit \$150

winning TKT Net Profit/TKT

Losing TKts

$\frac{\$150}{\$25} = \$6$

Net → L1

P(Net) → L2

Use $\boxed{\text{1-Var Stats}}$

with L1 & L2

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

\$ 6

Oct 18-1:20 PM

You are going on a trip.

You pay \$50 to insure your luggage

Any damages, Airline pays you \$1000

Prob. of any damage is .2% → .002

Find expected value per policy Sold.

Net	P(Net)	
50 − 1000	.002	Damage
50 − 0	.998	No Damage

Net → L1

P(Net) → L2

Use $\boxed{\text{1-Var Stats}}$

with L1 & L2

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

\$ 48

Oct 18-1:27 PM

Pay me \$5

Draw one card from a full-deck of playing cards.

If you draw an Ace → I give \$50

" " " a face → I give \$10

Any other card → I give you nothing

Net	P(Net)	
5 − 50	4/52	Ace
5 − 10	12/52	Face
5 − 0	36/52	Any other card

Net → L1

P(Net) → L2

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

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

\$ −1.15

SG 14 & 15 ✓

Oct 18-1:32 PM

SG 16

Binomial Prob. dist.:

1) n independent events (Trials)

2) Each trial has two outcomes.

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

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

p & q remain unchanged for all trials.

3) x → # of successes

$n - x$ → # of failures

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

↳ gives us how many ways we can have x successes.

Combination

${}_nC_r$ n choose r

${}_5C_2 = 10$ 5 $\boxed{\text{Math}}$ $\boxed{\text{PRB}}$ $\boxed{{}_nC_r}$ 2 $\boxed{\text{enter}}$

${}_{12}C_5 = 792$ 12 $\boxed{\text{Math}}$ $\boxed{\text{PRB}}$ $\boxed{{}_nC_r}$ 5 $\boxed{\text{Enter}}$

${}_{50}C_5$ 50 $\boxed{\text{Math}}$ $\boxed{\text{PRB}}$ $\boxed{{}_nC_r}$ 5 $\boxed{\text{enter}}$

$= \boxed{2{,}118{,}760}$

Oct 18-1:51 PM

Consider a binomial Prob. dist with

$n = 10$ and $p = .6$

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

2) $np = 10(.6) = \boxed{6}$

3) $npq = 10(.6)(.4)$
$= \boxed{2.4}$

4) $\sqrt{npq} = \sqrt{2.4}$
$\approx \boxed{1.549}$

5) $P(x = 7) = {}_{10}C_{7} \cdot (.6)^{7} \cdot (.4)^{3} \approx \boxed{.215}$

${}_{n}C_{x} \cdot p^{x} \cdot q^{n-x}$

^ $\boxed{\div}$

Oct 18-2:01 PM

Consider a binomial Prob. dist with

$n = 20$ & $P = .5$

1) $q = 1 - P$
$= 1 - .5 = \boxed{.5}$

2) $np = 20(.5) = \boxed{10}$

3) npq
$= 20(.5)(.5) = \boxed{5}$

4) $\sqrt{npq} = \sqrt{5} \approx \boxed{2}$

Round to whole #

5) P(exactly 12 Successes)

$P(x = 12) = {}_{20}C_{12} \cdot (.5)^{12} \cdot (.5)^{8} = \boxed{.120}$

${}_{n}C_{x} \cdot p^{x} \cdot q^{n-x}$

Using TI Command

[2nd] [VARS] [↓] [Binompdf]

Trials: 20
P: .5
x-Value: 12
[Paste] [Enter]

20, .5, 12
[enter]

Oct 18-2:07 PM

I flipped a loaded Coin 100 times

P(Tails) = .7

P(exactly 75 tails)

$x = 75$

$P(x = 75)$ = binompdf(100, .7, 75)

$= \boxed{.050}$

P(at most 75 tails)

$x \leq 75$

$P(x \leq 75)$ = binomcdf(100, .7, 75)

$= \boxed{.886}$

Oct 18-2:17 PM

You are taking a True - false exam with 400 questions

Success is to correctly guess.

You are making random guess.

$n = 400$ $P = .5$

P(guess Correctly exactly 200)

$x = 200$

$P(x = 200)$ = binompdf(400, .5, 200)

$= \boxed{.0398}$

P(at most 200 correct ans) = $\boxed{.520}$

$x \leq 200$

$P(x \leq 200)$ = binomcdf(400, .5, 200)

Oct 18-2:25 PM

Class Quiz 4

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

Find

1) $\mu = 2.9 \approx \boxed{3}$

2) $\sigma = 1.221 \approx \boxed{1}$

Round to whole #

3) $\sigma^2 = \boxed{\frac{149}{100}}$

Reduced fraction

Oct 18-2:31 PM