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 18-8:05 AM

Let x be a discrete Random Variable

$\underbrace{x \text{ be a discrete Random}}$ → Countable

with prob. dist. $P(x)$,

what is prob. dist.?

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

1) It could be in the form of chart or table
2) It could be in the form of a graph
3) It could be using certain formula.
4) we could find it by using Prob. Concept.

Oct 18-8:08 AM

Some rules:

1) $0 \leq P(x) \leq 1$

2) $\sum P(x) = 1$ Sum of all Prob. $= 1$

3) $P(x) = 0 \iff$ Impossible event

4) $P(x) = 1 \iff$ Sure event

5) $0 < P(x) \leq .05 \iff$ Rare event

Oct 18-8:12 AM

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

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

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

$.2 + .5 + .3 = 1$ ✓

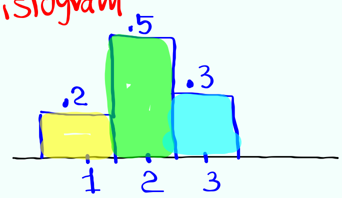
2) $P(x \leq 2) = .2 + .5 = \boxed{.7}$

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

4) Draw Prob. dist. Histogram

$x \rightarrow$ Midpoint

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



Oct 18-8:14 AM

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) $P(x = 4)$

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

Total Prob.

$= 1 - .8 = \boxed{.2}$

2) $P(x = 2 \text{ or } x = 3) = .25 + .4 = \boxed{.65}$

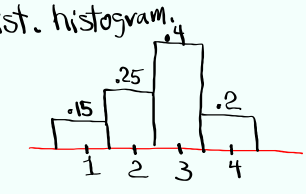
3) $P(x \geq 2) = 1 - P(x = 1) = 1 - .15 = \boxed{.85}$

Total Prob.

4) Draw Prob. dist. histogram.

$x \rightarrow$ Midpoint

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



Oct 18-8:20 AM

A piggy bank has 2 dimes & 3 nickels.

Take 2 coins, No replacement

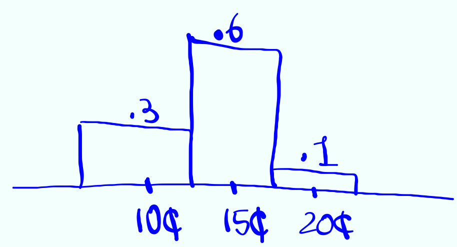
Sample space

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

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

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

Total ¢	P(Total ¢)
10¢	.3
15¢	.6
20¢	.1



Oct 18-8:27 AM

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) Find $\sum xp(x)$

$= 1.9$

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

4) Compute $\sum x^2 p(x) - \left(\sum xp(x)\right)^2 \quad = 4.1$

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

5) $\sqrt{\text{last ans.}} = \sqrt{.49} = \boxed{.7}$

Oct 18-8:34 AM

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 $\sum P(x) = 1$

$.1 + .2 + .4 + .3 = 1 \checkmark$

2) find $\sum xP(x)$

$= \boxed{2.9}$

3) find $\sum x^2P(x)$

$= \boxed{9.3}$

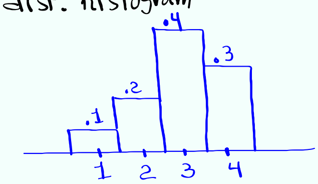
4) Compute $\sum x^2 P(x) - \left(\sum xP(x)\right)^2$

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

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

6) $P(x \neq 1) = \underset{\text{Total Prob.}}{1} - P(x=1) = 1 - .1 = \boxed{.9}$

7) Draw Prob. dist. histogram



Oct 18-8:41 AM

4 Females 6 Males Select 3 people

Let x be # of Females

Sample space

FFF — $x = 3$

FFM, FMF, MFF — $x = 2$

FMM, MFM, MMF — $x = 1$

MMM — $x = 0$

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

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

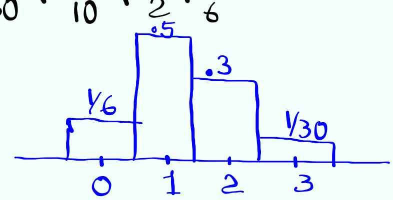
$P(x=1) = 3 \cdot \frac{4}{10} \cdot \frac{6}{9} \cdot \frac{5}{8} = \frac{1}{2}$

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

Verify $\sum P(x) = 1$

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

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



Oct 18-8:51 AM

Mean μ (mu)

Variance σ^2 (Sigma^2)

standard dev. σ (Sigma)

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

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

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

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

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

2) $\mu = \sum x p(x)$
$= 1(.2) + 2(.5) + 3(.3) = \boxed{2.1}$

3) $\sigma^2 = \sum x^2 p(x) - \mu^2$
$= 1^2(.2) + 2^2(.5) + 3^2(.3) - 2.1^2 = \boxed{.49}$

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

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.

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

$\boxed{x^2}$ $\boxed{\text{Enter}}$ $\sigma^2 = .49$

Oct 18-9:19 AM

Remember 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

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

$\sigma = \sigma_x = 3$ $\sigma^2 = 9$

$n = 1$

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

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

Oct 18-9:30 AM

Remember # Female example

# F	P(#F)
3	1/30
2	.3
1	.5
0	1/6

Clear all lists

#F → L1

P(#F) → L2

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

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

$\sigma = \sigma_x = .748$

$n = 1$ ← Total Prob.

Find σ^2 in reduced fraction. $\boxed{\sigma^2 = \frac{14}{25}}$

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

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

Oct 18-9:34 AM

Consider the chart below

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

1) $P(x=1)$

$= 1 - [.1 + .2 + .3 + .2] = .2$

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

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

3) Find μ & σ

x → L1

P(x) → L2

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

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

$\sigma = \sigma_x = 1.4$

$n = 1$

4) Find σ^2 in reduced fraction.

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

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

68% Range $\mu \pm \sigma = 3 \pm 1$

$\Rightarrow \boxed{2 \text{ to } 4}$

Usual Range 95% "

$\mu \pm 2\sigma = 3 \pm 2(1)$

$\Rightarrow \boxed{1 \text{ to } 5}$

Oct 18-9:40 AM

Expected Value → μ → $\bar{x}$

I am Selling 25 TKts for \$10 each. \$250

I am giving away a Calc. worth \$100

Net Profit \$150

Net	P(Net)
\$10 − \$100	1/25
\$10 − 0	24/25

winning TKt

losing tkts.

Expected Value Per TKt

$\frac{\$150}{25 \text{ tkt}} = \boxed{\$6}$

Net → L1

P(Net) → L2

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

$E.V. = \mu = \bar{x} = \boxed{\$6}$

Oct 18-9:48 AM

You are going on a trip.

You buy insurance for your luggage at \$50.

Any damages, airline pays you \$1000

Prob. of damage is .2% → .002

Expected Value per policy sold.

Net	P(Net)	
50 − 1000	.002	Damage
50 − 0	.998	$\overline{\text{Damage}}$

Net → L1

P(Net) → L2

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

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

$\boxed{E.V. = \$48}$

Airline makes \$48 Per Policy Sold.

Oct 18-9:54 AM

Pay me $5

Draw one Card from a full deck of Playing Cards.

If you draw an Ace → I give You $50

" " " a face → " " " $10

Any other Card → I give You nothing.

Expected Value per bet for the house.

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

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

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

$ −1.15

House is losing $.

SG 14 & 15 ✓

Oct 18-10:00 AM

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 → # of Succeses

$n - x$ → # of failures

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

?

${}_nC_r$ n choose r   No replacement order does not matter

${}_5C_2$

5 $\boxed{\text{Math}}$ $\boxed{\text{PRB}}$ $\boxed{{}_nC_r}$ 2 $\boxed{\text{Enter}}$ 10

${}_{12}C_5$

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

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

Oct 18-10:20 AM

Consider a binomial Prob. dist. with
$n = 10$ & $P = .6$

1) $q = 1 - P = \boxed{.4}$ 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) $P(x=7) = {}_{10}C_{7} \cdot (.6)^{7} \cdot (.4)^{3} = \boxed{.215}$

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

$\boxed{\wedge}$ Power Key

$\div$

Oct 18-10:30 AM

Consider a binomial Prob. dist. with
$n = 20$ and $P = .5$.

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

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

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

binompdf(20, .5, 12)

$= \boxed{.120}$

Using TI Command

$\boxed{\text{2nd}}$ $\boxed{\text{VARS}}$ $\boxed{\downarrow}$ $\boxed{\text{binompdf}}$

Trials : 20
P : .5
x-Value : 12
$\boxed{\text{Paste}}$ $\boxed{\text{Enter}}$

No Menu
20, .5, 12
$\boxed{\text{Enter}}$

Oct 18-10:36 AM

I flip a loaded Coin 100 times.

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

Success is to land tails.

1) $n = 100$ 2) $p = .7$ 3) $q = .3$

4) $np = 100(.7) = \boxed{70}$

5) $npq = 100(.7)(.3) = \boxed{21}$

6) $\sqrt{npq} \approx \boxed{5}$

Round to whole #

7) $P(\underbrace{\text{exactly } 75}_{x=75} \text{ Tails})$

$P(x=75) = \text{binompdf}(100, .7, 75) = \boxed{.050}$

8) $P(\underbrace{\text{at most } 75}_{x \le 75} \text{ tails})$

$P(x \le 75) = \text{binomcdf}(100, .7, 75) = \boxed{.886}$

Oct 18-10:44 AM

Class Quiz 4

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

Find

1) $\mu = 3.5 \approx \boxed{4}$

2) $\sigma = 1.118 \approx \boxed{1}$

} Round to whole #

3) $\sigma^2 = \frac{5}{4}$

} Reduced fraction

Oct 18-10:53 AM