Statistics

Lecture 8

Feb 19-8:47 AM

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

Oct 17-6:52 PM

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

what is Prob. dist.?

It is a way to give prob. of all possible outcomes.

1) It could be in the form of a chart or table.

2) It could be in the form of a graph

3) It could be in using some formulas.

4) It could be computed using Traditional Prob.

Oct 17-6:54 PM

Consider x with Prob. dist. $P(x)$

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

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

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

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

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

Oct 17-6:58 PM

Consider the chart below

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

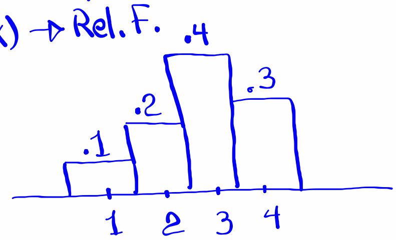
1) Verify $\sum P(x) = 1$

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

2) Draw Prob. dist. Histogram

$x \to$ Midpoint

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



Clear all lists

Reset all lists

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

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

$\bar{x} = 2.9$

$S_x =$ blank

$n = 1$ ← Total Prob. = 1

Oct 17-7:01 PM

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

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

1) Find $P(x=5)$

$P(x=5) = 1 - [.1 + .25 + .35 + .25]$

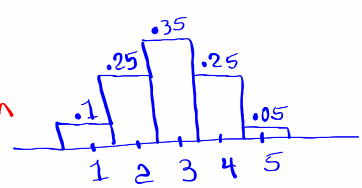
Total Prob.

$= 1 - .95$

$= \boxed{.05}$

2) Draw Prob. dist. histogram

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



Clear all lists

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

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

$\bar{x} = 2.9$

$S_x =$ Blank

$n = 1$

Oct 17-7:06 PM

Complete the chart below:

x	$P(x)$	$xP(x)$	$x^2P(x)$
1	.2	.2	.2
2	.5	1.0	2.0
3	.3	.9	2.7

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

2) $\sum xP(x) = 2.1$

3) $\sum x^2 P(x) = 4.9$

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

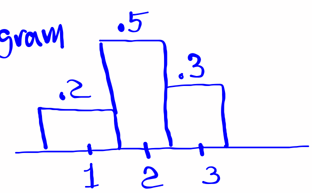
$= 4.9 - 2.1^2 = \boxed{.49}$

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

6) Draw Prob. dist. histogram

$x \to$ Midpoint

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



Oct 17-7:14 PM

Use the chart below for x & $P(x)$

x	$P(x)$	$xP(x)$	$x^2P(x)$
1	.1	.1	.1
2	.2	.4	.8
3	.3	.9	2.7
4	.4	1.6	6.4

1) $P(X=2) =$

$1 - [.1 + .3 + .4] =$

$1 - .8 =$

$\boxed{.2}$

2) $\sum xP(x) = \boxed{3}$

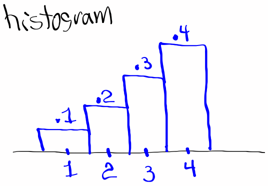
3) $\sum x^2 p(x) = \boxed{10}$

4) Find $\underbrace{\sum x^2 p(x)}_{10} - \underbrace{\left(\sum x p(x)\right)^2}_{3^2} =$

$10 - 3^2 = \boxed{1}$

5) $\sqrt{\text{last answer}} = \sqrt{1} = \boxed{1}$

6) Draw Prob. dist. histogram



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

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

L1 & L2 To find

$\bar{x} = 3$

$S_x =$ blank

$n = 1 \leftarrow$ Total Prob.

Oct 17-7:22 PM

For discrete random variable x with Prob. dist. $P(x)$,

Mean μ "mu"

Variance σ^2 "sigma^2"

Standard deviation σ "sigma"

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

$x \to L1$
$P(x) \to L2$
Use $\boxed{\text{1-Var Stats}}$
with L1 & L2

$\mu = \bar{x}$

$\sigma = \sigma_x$

$\sigma^2 = \sigma_x^2$

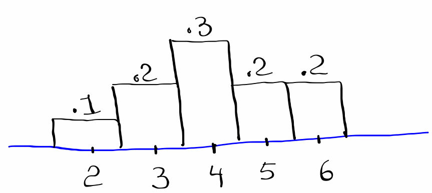
Oct 17-7:32 PM

x	$P(x)$
2	.1
3	.2
4	.3
5	.2
6	.2

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

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

2) Draw Prob. dist. histogram



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

Use 1-Var Stats with L1 & L2 to find

$\mu = \bar{x} = 4.2$

$\sigma = \sigma_x = 1.249$

$n = 1$

Find σ^2 in Reduced Fraction

$\boxed{\text{VARS}}$ $\boxed{\text{5: Statistics}}$ $\boxed{4: \sigma_x}$ $\boxed{x^2}$ $\boxed{\text{MATH}}$ $\boxed{\text{1: Frac}}$ $\boxed{\text{Enter}}$

$$\boxed{\sigma^2 = \frac{39}{25}}$$

Oct 17-7:37 PM

A piggy bank has 3 quarters & 7 Nickels.

Take 2 Coins with replacement.

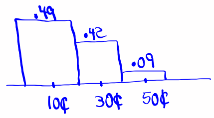
NN
NQ
QN
QQ
} Sample Space — Complete list of all possible outcomes

NN → 10¢ $P(10¢) = \frac{7}{10} \cdot \frac{7}{10} = .49$

NQ, QN → 30¢ $P(30¢) = 2 \cdot \frac{7}{10} \cdot \frac{3}{10} = .42$

QQ → 50¢ $P(50¢) = \frac{3}{10} \cdot \frac{3}{10} = \boxed{.09}$

Total	P(Total)
10¢	.49
30¢	.42
50¢	.09



Total → L1
P(Total) → L2

Use 1-Var Stats with L1 & L2 to find

$\mu = \bar{x} = 22$

$\sigma = \sigma_x = 12.961$

$n = 1$ ← Total Prob.

Find σ^2 in reduced fraction

$\boxed{\text{VARS}}$ $\boxed{\text{5: Statistics}}$ $\boxed{4: \sigma_x}$ $\boxed{x^2}$

$\boxed{\text{MATH}}$ $\boxed{\text{1: Frac}}$ $\boxed{\text{Enter}}$

$\boxed{\sigma^2 = 168}$

Oct 17-7:45 PM

A piggy bank has 4 dimes & 6 nickels.

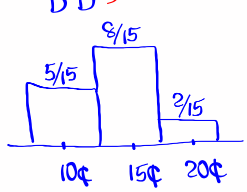
Take 2 Coins without replacement

NN
ND
DN
DD
} Sample Space

$P(NN) = P(10¢) = \frac{6}{10} \cdot \frac{5}{9} = \frac{1}{3} = \frac{5}{15}$

$P(ND \text{ or } DN) = P(15¢) = 2 \cdot \frac{6}{10} \cdot \frac{4}{9} = \frac{8}{15}$

$P(DD) = \frac{4}{10} \cdot \frac{3}{9} = \frac{2}{15}$



Total	P(Total)
10¢	5/15
15¢	8/15
20¢	2/15

Total → L1
P(Total) → L2

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

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

$\sigma = \sigma_x = 3.266$

$n = 1$

Find σ^2 in reduced fraction.

$\sigma^2 = \frac{32}{3}$

Oct 17-8:11 PM

68% Range $\Rightarrow \mu \pm \sigma$

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

99.7% Range $\Rightarrow \mu \pm 3\sigma$

Suppose $\mu = 40$ & $\sigma = 8$

68% Range $\Rightarrow \mu \pm \sigma = 40 \pm 8 \Rightarrow \boxed{32 \text{ to } 48}$

Usual Range $\Rightarrow$ 95% Range $\Rightarrow \mu \pm 2\sigma \Rightarrow 40 \pm 2(8)$

$\Rightarrow \boxed{24 \text{ to } 56}$

$\bar{x}$ Sample Mean

s Sample Standard deviation

μ Population Mean

σ Population Standard deviation

Oct 17-8:21 PM

Pay me \$5, I give You a ticket

Suppose I Sell 100 tickets

We draw 1 Ticket, owner gets a Calc. worth \$100.

my Net gain	P(my Net gain)	
5 − 100	1/100	Winning TKT
5 − 0	99/100	losing TKTS

L1	L2
5 − 100	1/100
5 − 0	99/100

Use 1-Var Stats with L1 & L2 to find

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

Expected Value Per Ticket.

Oct 17-8:26 PM

Clarice is going on a trip.

She buys insurance for her luggage for $100.

Any damages to her luggage, Airline pays her $1000.

Prob. of damage is .5% = .005

Expected Value for airline per policy sold.

Net gain	P(Net gain)	
100 − 1000	.005	damages
100 − 0	.995	No damages

Net gain → L1

P(Net gain) → L2

$\Rightarrow$ E.V. = $\mu = \bar{x} =$ $\boxed{\$95}$

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

Oct 17-8:33 PM

Pay me $10, Draw a card from an ordinary deck of playing cards.

If you draw Ace → I give you $20

" " " Face → " " " $10

Any other card → I give you nothing

Find Expected Value per bet for the house

Net	P(Net)	
$10 − 20	4/52	Ace
$10 − 10	12/52	Face
$10 − 0	36/52	Any other Card

Net → L1

P(Net) → L2

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

Find E.V. = $\mu = \bar{x} =$ $\boxed{\approx \$\ 6.15}$

Find σ^2 in Reduced Fraction

$\boxed{\sigma^2 = \frac{6600}{169}}$

SG 14 & 15

Oct 17-8:40 PM

5 Females & 10 Males

Select 3 people.

FFF
FFM
FMF
FMM
MFF
MFM
MMF
MMM

Sample Space

$P(\text{3 Females}) = \dfrac{{}_5C_3 \cdot {}_{10}C_0}{{}_{15}C_3} = \boxed{\dfrac{2}{91}}$

$P(\boxed{2F} \text{ \& } 1M) = \dfrac{{}_5C_2 \cdot {}_{10}C_1}{{}_{15}C_3} = \boxed{\dfrac{20}{91}}$

$P(1F \text{ \& } 2M) = \dfrac{{}_5C_1 \cdot {}_{10}C_2}{{}_{15}C_3} = \boxed{\dfrac{45}{91}}$

$P(\text{3 Males}) = \dfrac{{}_5C_0 \cdot {}_{10}C_3}{{}_{15}C_3} = \boxed{\dfrac{24}{91}}$

Oct 17-8:48 PM

$P(\text{at least 1 Female}) = 1 - P(\text{None})$

$= 1 - P(\text{All Males})$

$= 1 - \dfrac{24}{91} = \boxed{\dfrac{67}{91}}$

$P(\text{at least 1 Male}) = 1 - P(\text{None})$

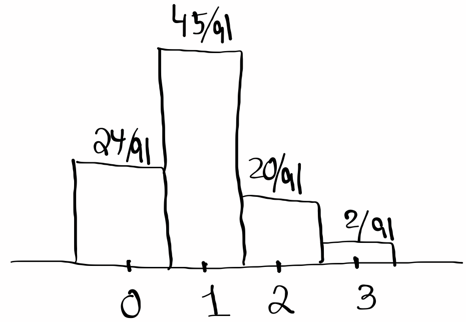
$= 1 - P(\text{All Females})$

$= 1 - \dfrac{2}{91} = \boxed{\dfrac{89}{91}}$

Oct 17-8:56 PM

L1 L2

# Females	P(# Females)
3	2/91
2	20/91
1	45/91
0	24/91



$\mu = 1$

$\sigma = .756$

$n = 1$

SG 14 & 15

Find σ^2 in Reduced fraction $\boxed{\frac{4}{7}}$

Oct 17-8:59 PM