Statistics

Lecture 8

Feb 19-8:47 AM

SG13

8 new people were hired.

4 Morning, 3 afternoon, and 1 night shift.

5 females & 3 males.

Focus on afternoon shift.

1) $P(\text{all females}) = \frac{5}{8} \cdot \frac{4}{7} \cdot \frac{3}{6} = \boxed{\frac{5}{28}}$

2) $P(\text{all males}) = \frac{3}{8} \cdot \frac{2}{7} \cdot \frac{1}{6} = \boxed{\frac{1}{56}}$

3) $P(\text{are same gender}) = P(FFF \text{ or } MMM)$

$= \frac{5}{28} + \frac{1}{56} = \boxed{\frac{11}{56}}$

4) $P(\text{not same gender}) = P(\overline{\text{Same gender}})$

$= 1 - P(\text{Same gender})$

$= 1 - \frac{11}{56} = \boxed{\frac{45}{56}}$

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5) $P(\underbrace{\text{at least 1 Female}})$

$= 1 - P(\text{No Females})$

Total Prob.

$= 1 - P(\text{all Male})$

$= 1 - \frac{1}{56} = \boxed{\frac{55}{56}}$

6) $P(\underbrace{\text{at least 1 male}}) = 1 - P(\text{No males})$

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

$= 1 - \frac{5}{28} = \boxed{\frac{23}{28}}$

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7) P(exactly 1 Female)

F M M

M F M

M M F

$= 3 \cdot \frac{5}{8} \cdot \frac{3}{7} \cdot \frac{2}{6} = \boxed{\frac{15}{56}}$

8) P(exactly 2 Females)

F F M

F M F

M F F

$= 3 \cdot \frac{5}{8} \cdot \frac{4}{7} \cdot \frac{3}{6} = \boxed{\frac{15}{28}}$

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# F	P(# F)
3	5/28
2	15/28
1	15/56
0	1/56

L1   L2

Clear all lists

#F → L1

P(#F) → L2

STAT → CALC

1:1-Var Stats

List:L1

FreqList:L2

Calculate

L1, L2

enter

$\bar{x} = 1.875$

$S = S_x =$ Blank

$n = 1$ ← Total Prob.

Oct 17-11:55 AM

A piggy bank has 2 Quarters & 3 dimes,
take 2 Coins with replacement

QQ   QD   DQ   DD

50¢   35¢   20¢

$P(50¢) = P(QQ) = \frac{2}{5} \cdot \frac{2}{5} = \frac{4}{25} = \boxed{.16}$

$P(35¢) = P(QD \text{ or } DQ) = 2 \cdot \frac{2}{5} \cdot \frac{3}{5} = \frac{12}{25} = \boxed{.48}$

$P(20¢) = P(DD) = \frac{3}{5} \cdot \frac{3}{5} = \frac{9}{25} = \boxed{.36}$

¢	P(¢)
50	.16
35	.48
20	.36

¢ → L1, P(¢) → L2

use 1-Var Stats with L1 & L2

$\bar{x} = 32$

S = blank

Total Prob. → $n = 1$

Oct 17-12:02 PM

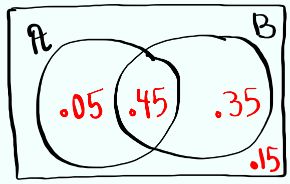
$P(A) = .5$, $P(B) = .8$, $P(A \text{ and } B) = .45$

1) $P(\bar{B}) = 1 - P(B) = \boxed{.2}$

2) $P(\overline{A \text{ and } B}) = 1 - .45 = \boxed{.55}$

3) $P(A \text{ or } B)$
$= P(A) + P(B) - P(A \text{ and } B)$
$= .5 + .8 - .45 = \boxed{.85}$

4) Construct Venn diagram.



Total = 1

5) $P(B|A) = \dfrac{P(A \text{ and } B)}{P(A)} = \dfrac{.45}{.5} = \boxed{.9}$

6) $P(A|B) = \dfrac{P(A \text{ and } B)}{P(B)} = \dfrac{.45}{.8} \approx \boxed{.563}$

Oct 17-12:11 PM

$P(\text{Pants}) = .4$

$P(\text{shoes}) = .5$

$P(\text{Pants} \mid \text{shoes}) = .6$

$P(\text{Shoes} \mid \text{Pants}) = ?$

$= \dfrac{P(\text{Shoes } \& \text{ Pants})}{P(\text{pants})}$

$= \dfrac{.3}{.4} = \dfrac{3}{4} = \boxed{.75}$

$P(\text{Shoes } \& \text{ Pants})$

$P(\text{Pants} \mid \text{Shoes}) = \dfrac{P(\text{Shoes } \& \text{ Pants})}{P(\text{Shoes})}$

$.6 = \dfrac{P(\text{Shoes } \& \text{ Pants})}{.5}$

Cross-Multiply

$P(\text{Shoes } \& \text{ Pants}) = (.5)(.6) = \boxed{.3}$

Oct 17-12:19 PM

$P(A) = .5 \qquad P(B) = .6 \qquad P(A \text{ and } B) = .3$

1) $P(B \mid A) = \dfrac{P(A \text{ and } B)}{P(A)} = \dfrac{.3}{.5} = \dfrac{3}{5} = \boxed{.6}$

2) $P(A \mid B) = \dfrac{P(A \text{ and } B)}{P(B)} = \dfrac{.3}{.6} = \dfrac{3}{6} = \boxed{.5}$

Independent Events

Oct 17-12:25 PM

SG 14

Data
- 1) Qualitative
- 2) Quantitative
  - 1) Discrete
  - 2) Continuous

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

Prob. dist. gives the prob. of all possible outcomes.

1) Table or chart
2) Graph
3) Formula
4) by def. of Prob.

Oct 17-12:46 PM

Some rules

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

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

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

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

5) $0 < P(x) \le .05 \longleftrightarrow$ Rare event

Oct 17-12:50 PM

Consider the chart below

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

1) verify $\sum P(x) = 1$ ✓

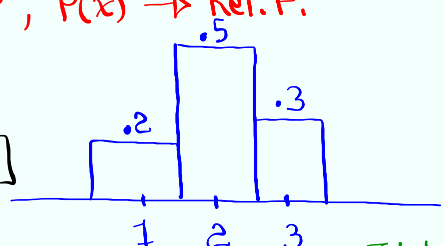
$.2 + .5 + .3 = 1$

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

$.5 + .2 = \boxed{.7}$

3) Draw Prob. dist. histogram

$x \to$ class MP , $P(x) \to$ Rel. F.



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

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

with L1 & L2

$\bar{x} = 2.1$ $\quad S = S_x =$ blank $\quad n = 1 \leftarrow$ Total Prob.

Oct 17-12:53 PM

Consider the chart below

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

1) Find $P(X=4)$

$= 1-(.2+.3+.4)$

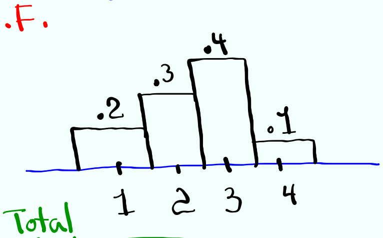
$= 1 - .9 = \boxed{.1}$

2) Find $P(2 \le x \le 3)$

$= .3 + .4 = \boxed{.7}$

3) Draw Prob. dist. Histogram

$x \to$ class MP, $P(x) \to$ Rel. F.



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

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

with L1 & L2

Total Prob.

$\bar{x} = 2.4$ $\quad S = S_x = \text{blank}$ $\quad n = 1$

Oct 17-1:00 PM

A piggy bank has 2 quarters & 3 dimes.

Take 2 Coins, No replacement

QQ $\quad$ QD $\quad$ DQ $\quad$ DD

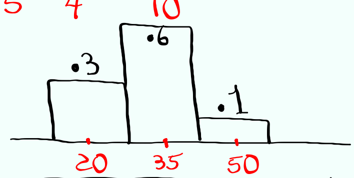
50¢ $\quad$ 35¢ $\quad$ 20¢

$P(50¢) = P(QQ) = \frac{2}{5} \cdot \frac{1}{4} = \frac{1}{10} = \boxed{.1}$

$P(35¢) = P(QD \text{ or } DQ) = 2 \cdot \frac{2}{5} \cdot \frac{3}{4} = \frac{3}{5} = \frac{6}{10} = \boxed{.6}$

$P(20¢) = P(DD) = \frac{3}{5} \cdot \frac{2}{4} = \frac{3}{10} = \boxed{.3}$

¢	P(¢)
50	.1
35	.6
20	.3



¢ $\to x \to L1$

$P(¢) \to P(x) \to L2$

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

$\bar{x} = 32$ $\quad S = S_x = \text{blank}$ $\quad n = 1$

Total Prob.

Oct 17-1:06 PM

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) $\sum P(x) = 1$

2) $\sum xp(x) = 1.9$

3) $\sum x^2p(x) = 4.1$

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

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

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

$x \to L1$

$P(x) \to L2$

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

with L1 & L2

$\bar{x} = 1.9$

$S = S_x =$ blank

$n = 1$

Oct 17-1:18 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) $\sum p(x) = 1$

2) $\sum xp(x) = 2.9$

3) $\sum x^2p(x) = 9.3$

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

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

5) $\sqrt{\text{Last answer}}$

$= \sqrt{.89} \approx \boxed{.943}$

$x \to L1$

$P(x) \to L2$

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

with L1 & L2

$\bar{x} = 2.9$

$S = S_x$ blank

$n = 1$

Oct 17-1:25 PM

Working with x & $P(x)$

Mean mu $\mu = \sum x P(x)$ mu

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

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

From last example

$\mu = \sum x\, p(x) = 2.9$

$\sigma^2 = \sum x^2 p(x) - \mu^2 = .89$

$\sigma = \sqrt{\sigma^2} = \sqrt{.89} = .943$

Using TI

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

$\mu = \bar{x}$

$\sigma = \sigma_x$

For σ^2

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

Oct 17-1:32 PM

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

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

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

$\mu = \bar{x} = \boxed{3.1}$

$\sigma = \sigma_x = \boxed{.7}$

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

$\boxed{4: \sigma_x}$ $\boxed{x^2}$ $\boxed{\text{Enter}}$ $\to \sigma^2 = .49$

Oct 17-1:40 PM

family with 3 kids

$x \to$ # of boys

$P(x)$

x	$P(x)$
3	1/8
2	3/8
1	3/8
0	1/8

3 boys
BBB

1/2

2 Boys
BBG
BGB
GBB

1 Boy
BGG
GBG
GGB

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

use $\boxed{\text{1-Var Stats}}$ to find

$\mu = 1.5$

$\sigma = .866$

$\sigma^2 = .75$

$\boxed{\text{VARS}}$

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

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

Oct 17-1:43 PM

Application

Expected Value

I sold 20 tickets for \$10 each, draw 1 ticket, winner gets a calc. worth \$100.

$\underbrace{\text{expected value}}$ per ticket

$\mu = \bar{x}$

Collect $20(10) = 200$
Give away 100
Net $= \$100$

Net	P(Net)
$10-100$	1/20
$10-0$	19/20

winning TKT

$\overline{\text{winning}}$ TKT

$\dfrac{\$100 \text{ Net}}{20 \text{ TKts}} = \$5/\text{TKT}$

Net $\to L1$

P(Net) $\to L2$

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

$E.V. = \mu = \bar{x} = \boxed{5}$

Oct 17-2:00 PM

You Pay \$20 to buy a tkt
one ticket drawn
5% chance of winning a laptop (\$1000)
10% " " " a Calc. (\$100)
85% " " " nothing.

Net	P(Net)	
20-1000	.05	laptop
20-100	.10	Calc.
20 - 0	.85	Nothing to give

Net → L1
P(Net) → L2
$\boxed{\text{1-Var Stats}}$
E.V. = $\mu = \bar{x}$

house loses \$40 per ticket $\boxed{-40}$

Oct 17-2:08 PM

Pay me \$5, draw a Card from a full deck of playing Cards.

If you draw	I give you
Ace	\$50
Face	\$5
any other Card	\$0

Net	P(Net)	
5 - 50	4/52	Ace
5 - 5	12/52	Face
5 - 0	36/52	any other card

Net → L1
P(Net) → L2
E.V. = $\mu = \bar{x}$

$\boxed{0}$

Oct 17-2:13 PM

Buy insurance for your luggage for \$100

Any damages, airline pays you \$1000.

Prob. of possible damages is .5%.

Find Expected Value per policy Sold.

Net	P(Net)	
100-1000	.5% = .005	damage
100-0	.995	$\overline{\text{damage}}$

Net → L1

P(Net) → L2

1-Var Stats

SG 14 & SG 15 ✓

E.V. = μ = $\bar{x}$

$\boxed{\$95}$

Oct 17-2:18 PM