Statistics

Lecture 8

Feb 19-8:47 AM

S&14

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

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

It gives the Prob. of all possible outcomes.

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

Oct 21-6:52 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 21-6:57 PM

Consider the chart below

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

1) verify $\sum P(x) = 1$ ✓

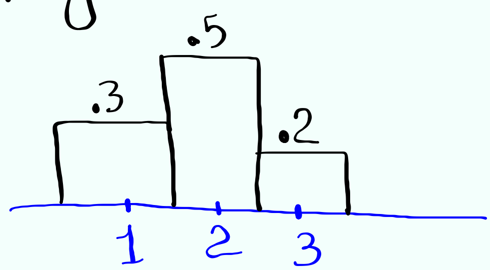
$.3 + .5 + .2 = 1$ ✓

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

3) Draw Prob. dist. histogram

$x \rightarrow$ Midpoint

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



Oct 21-7:00 PM

Consider the Chart below

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

1) Find $P(x=4)$

$= 1 - (.1+.3+.4) = 1 - .8 = \boxed{.2}$

Total Prob.

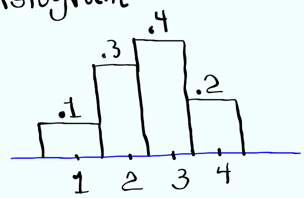
2) Find $P(2 \le x \le 3)$

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

3) Draw Prob. dist. histogram

$x \to$ MP

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



4) Clear all lists.

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

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

with L1 & L2

$\bar{x} = 2.7$

$S = S_x =$ blank

$n = 1$ ← Total Prob.

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A piggy bank has 3 nickels & 2 dimes.

Take 2 Coins $\boxed{\text{with replacement.}}$

NN ND DN DD

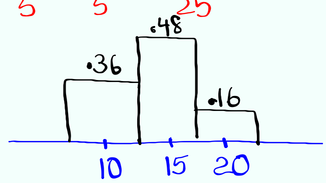
10¢ 15¢ 20¢

$P(10¢) = P(NN) = \frac{3}{5} \cdot \frac{3}{5} = \frac{9}{25} = \boxed{.36}$ ✓

$P(15¢) = P(ND \text{ or } DN) = 2 \cdot \frac{3}{5} \cdot \frac{2}{5} = \frac{12}{25} = \boxed{.48}$ ✓

$P(20¢) = P(DD) = \frac{2}{5} \cdot \frac{2}{5} = \frac{4}{25} = \boxed{.16}$ ✓

¢ (L1)	P(¢) (L2)
10	.36
15	.48
20	.16



¢ → L1, P(¢) → L2

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

with L1 & L2

$\bar{x} = 14$

$S = S_x =$ Blank

$n = 1$ ← Total Prob.

Oct 21-7:16 PM

Working with x & $P(x)$:

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

mu

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

Sigma

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

Oct 21-7:28 PM

Complete the chart below

x	$P(x)$	$xP(x)$	$x^2P(x)$
2	.3	.6	1.2
3	.5	1.5	4.5
4	.2	.8	3.2

1) $\sum P(x) = \boxed{1}$

2) $\sum xp(x) = \boxed{2.9}$

3) $\sum x^2 p(x) = \boxed{8.9}$

4) $\mu = \sum x p(x) = \boxed{2.9}$

5) $\sigma^2 = \sum x^2 p(x) - \mu^2 = 8.9 - 2.9^2 = \boxed{.49}$

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

68% Range $\mu \pm \sigma = 2.9 \pm .7 \rightarrow \boxed{2.2 \text{ to } 3.6}$

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Using TI to find μ, σ, and σ^2:

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

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

$\mu = \bar{x}$ $\sigma = \sigma_x$ $\sigma^2 = .49$

L1	L2
2	.3
3	.5
4	.2

$\mu = \bar{x} = 2.9$

$\sigma = \sigma_x = .7$

$n = 1$

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

Oct 21-7:40 PM

Consider the chart below

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

Verify $\sum P(x) = 1$

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

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

with L1 & L2

$\mu = \bar{x} = \boxed{3.6}$ $\sigma = \sigma_x = \boxed{1.2}$ $\sigma^2 = \frac{36}{25}$ Reduced fraction

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

Oct 21-7:45 PM

A piggy bank has 3 nickels & 2 dimes.

Take 2 Coins $\boxed{\text{without replacement}}$

NN ND DN DD

10¢ 15¢ 20¢

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

$P(15¢) = P(ND \text{ or } DN) = 2 \cdot \frac{3}{5} \cdot \frac{2}{4} = \frac{6}{10} = \boxed{.6}$

$P(20¢) = P(DD) = \frac{2}{5} \cdot \frac{1}{4} = \frac{1}{10} = \boxed{.1}$

¢	P(¢)
10	.3
15	.6
20	.1

$\bar{c} \to L1$, $P(\bar{c}) \to L2$

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

$\mu = 14$

$\sigma = \sigma_x = 3$

$\sigma^2 = 9$

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

Usual Range

"95% Range"

$\mu \pm 2\sigma = 14 \pm 2(3) \Rightarrow \boxed{8 \text{ to } 20}$

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Application:

Expected Value $= \mu = \bar{x}$

I sold 25 tkts for $10 each.

one ticket is randomly drawn

owner gets a calc. worth $100.

Expected Value per ticket sold.

Net	P(Net)	
10 − 100	1/25	winning Tkt
10 − 0	24/25	losing tkts

Net → L1, P(Net) → L2

$E.V. = \mu = \bar{x} = \boxed{6}$ House makes $6 / TKT

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

Find σ^2

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

$\sigma^2 = 384$

Oct 21-8:13 PM

You buy insurance policy for \$100 to protect your luggage.

Any damages, airline pays you \$1000.

Prob. of damage is .5%

Expected Value per policy Sold.

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

Net → L1

P(Net) → L2

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

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

Find $\sigma^2 = \boxed{4975}$

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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.

E.V. per bet for the house

$\mu = \bar{x} = \boxed{0}$

$\boxed{\sigma^2 = \frac{2250}{13}}$ in reduced fraction

SG 14 & 15

Oct 21-8:28 PM

Binomial Prob. dist.: (SG16)

1) n independent events

2) Each event has only two outcomes.

$P(\text{Success}) = p \qquad P(\text{Failure}) = q$

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

p & q remain unchanged for all events.

3) $x \to$ # of Successes

$n - x \to$ # of failures

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

# of combinations of x Successes in n events.

Find ${}_5C_2 = 10$

5 $\boxed{\text{Math}}$ $\boxed{\to}$ PRB $\boxed{\downarrow}$ $\boxed{3{:}\,{}_nC_r}$ 2 $\boxed{\text{enter}}$

Find ${}_{10}C_3 = \boxed{120}$

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

Oct 21-8:36 PM

Consider a binomial Prob. dist with $n = 5$ and $p = .6$

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

P(exactly 2 Successes)

$P(x = 2) = {}_5C_2 \cdot (.6)^2 \cdot (.4)^3$

$P(x) = {}_nC_x \cdot p^x \cdot q^{n-x} \qquad 5 - 2 = 3$

$= 10 \cdot (.6)^2 \cdot (.4)^3$

$\boxed{\wedge}$

$\boxed{\div}$

$\approx \boxed{.230}$

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Consider a binomial Prob. dist with

$n = 10$ $\quad p = .4$

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

P(exactly 6 successes)

$P(x=6) = {}_{10}C_6 \cdot (.4)^6 \cdot (.6)^4$

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

$= 210(.4)^6 \cdot (.6)^4$

$= \boxed{.111}$

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We flip a fair coin 20 times.

$n=20$

$p=.5$

$q=.5$

Find the prob. that it lands exactly 12 tails.

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

$= 125970 \cdot (.5)^{12} \cdot (.5)^8$

$= \boxed{.120}$

using TI:

$\boxed{2nd}$ $\boxed{VARS}$ ↓↓↓… $\boxed{binompdf(}$

n, p, x

20, .5, 12

$\boxed{Enter}$

$n \rightarrow$ Trials : 20

$p = .5$

x-Value : 12

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

$\boxed{.120}$

Your work

$P(x=12) = \text{binompdf}(20, .5, 12)$
$= .120$

Oct 21-8:56 PM

You are taking a quiz, multiple-choice.

$n=10$

10 questions, each question has 4 choices

but only one correct choice. $p=\frac{1}{4}=.25$

$q=\frac{3}{4}=.75$

You are making random guesses.

P(Correctly guess on exactly 6 questions)

$P(x=6)=\text{binompdf}(\underset{n}{10}, \underset{p}{.25}, \underset{x}{6})$

$=\boxed{.016}$

P(Correctly guess on all questions)

$P(x=10)=\text{binompdf}(\underset{n}{10}, \underset{p}{.25}, \underset{x}{10})$

$=\boxed{9.54\times10^{-7}}$

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