Statistics

Lecture 9

Feb 19-8:47 AM

SG 14 & 15

Data

1) Qualitative
   Non-Numerical

2) Quantitative
   Numerical

   1) Discrete
      Countable

   2) Continuous
      Measureable

Jul 10-4:30 PM

Discrete Random variable x with

Prob. dist. of $P(x)$.

What is prob. dist.?

It is a method that provides the Prob. of all possible outcomes.

a) Form of a table or chart

b) Form of a graph

c) based on some formula.

Jul 10-4:33 PM

For Prob. dist. $P(x)$

1) Sum of all probabilities must be 1.

2) $0 \le P(x) \le 1$

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

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

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

Jul 10-4:36 PM

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

1) Let's verify $\sum P(x) = 1$

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

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

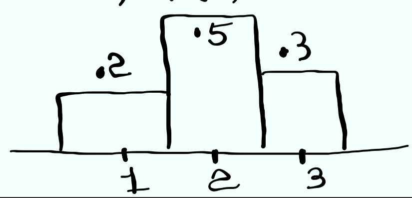
$.5 + .3 = \boxed{.8}$

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

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

4) Draw Prob. dist. histogram

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



Jul 10-4:39 PM

Complete the chart below

x	$P(x)$	$x \cdot P(x)$	$x^2 \cdot P(x)$
1	.2	.2	.2
2	.4	.8	1.6
3	.3	.9	2.7
4	.1	.4	1.6

1) $\sum P(x)$

$= .2 + .4 + .3 + .1 = \boxed{1}$ ✓

2) $\sum x \cdot P(x)$

$= .2 + .8 + .9 + .4 = \boxed{2.3}$

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

$= .2 + 1.6 + 2.7 + 1.6$

$= \boxed{6.1}$

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

$= 6.1 - (2.3)^2 = \boxed{.81}$

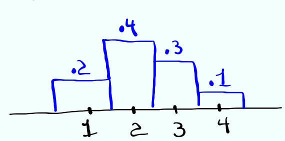
5) $\sqrt{\text{Last answer}} = \sqrt{.81} = \boxed{.9}$

6) Find $P(x = 2 \text{ or } x = 3) = .4 + .3 = \boxed{.7}$

7) Draw Prob. dist. histogram

$x \to MP$

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



Jul 10-4:44 PM

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

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

1) $P(x=5)$

$= 1 - [.1 + .2 + .3 + .3] = 1 - .9 = \boxed{.1}$

Total Prob.

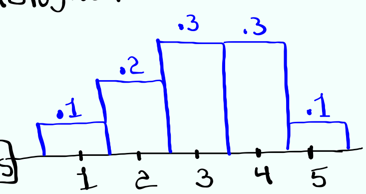
2) $P(2 \le x \le 4)$

$= .2 + .3 + .3 = \boxed{.8}$

3) Draw Prob. dist. histogram

$x \to$ MP

$P(x) \to$ Rel. F



$x \to L1$ use $\boxed{\text{1-Var Stats}}$ with L1 & L2 to find $\to$ $\bar{x} = 3.1$

$P(x) \to L2$

S = Blank

n = 1 $\leftarrow$ Total Prob.

Jul 10-4:54 PM

3 Females & 5 Males, Select 2 people

order does not matter

M M

M F

F M

F F

$P(2 \text{ Males}) = \frac{5}{8} \cdot \frac{4}{7} = \frac{20}{56}$

$P(1 \text{ Male}) = 2 \cdot \frac{5}{8} \cdot \frac{3}{7} = \frac{30}{56}$

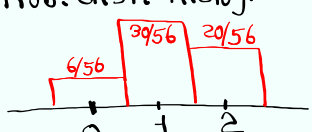
$P(0 \text{ Male}) = \frac{3}{8} \cdot \frac{2}{7} = \frac{6}{56}$

# Males	P(# Males)
2	20/56
1	30/56
0	6/56

P(at least 1 Male)

$= \frac{20}{56} + \frac{30}{56} = \frac{50}{56} = \frac{25}{28}$

Prob. dist. histogram



Males $\to x \to L1$

P(# Males) $\to P(x) \to L2$

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

$\bar{x} = 1.25$ Sx = Blank n = 1

Jul 10-5:03 PM

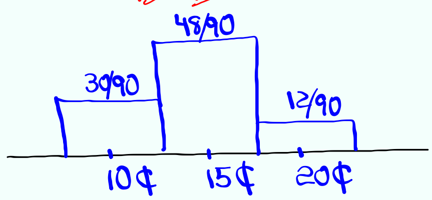
4 Dimes 6 Nickes, Select 2 coins

No replacement

NN → 10¢ $\qquad P(10¢) = \frac{6}{10} \cdot \frac{5}{9} = \frac{30}{90}$

ND, DN → 15¢ $\qquad P(15¢) = 2 \cdot \frac{6}{10} \cdot \frac{4}{9} = \frac{48}{90}$

DD → 20¢ $\qquad P(20¢) = \frac{4}{10} \cdot \frac{3}{9} = \frac{12}{90}$



Total ¢	P(Total ¢)
10¢	30/90
15¢	48/90
20¢	12/90

Total ¢ → x → L1

P(Total ¢) → P(x) → L2

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

$\bar{x} = 14$ $\quad$ Sx = Blank $\quad$ n = 1

Jul 10-5:13 PM

Mean μ (mu)

Variance σ^2 (Sigma²)

Standard deviation σ (Sigma)

$\boxed{\mu = \sum x\,p(x)}$ $\qquad$ $\boxed{\sigma^2 = \sum x^2 p(x) - \mu^2}$

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

Jul 10-5:21 PM

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

$x \to L1$

$P(x) \to L2$

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

L1 & L2

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

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

what about σ^2?

$\boxed{\text{VARS}}$

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

$\boxed{4\text{: } \sigma_x}$

$\boxed{x^2}$ $\boxed{\text{Enter}}$

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

$49/100$

Jul 10-5:24 PM

Consider the chart below

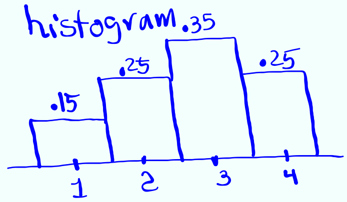
x	$P(x)$
1	.15
2	.25
3	.35
4	.25

1) $P(x=4)$

$= 1 - [.15 + .25 + .35]$

$= 1 - .75 = .25$

2) Draw Prob. dist. histogram



3) Find μ, σ, and σ^2.

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

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

$\mu = \bar{x} = 2.7$ $\qquad \mu \approx 3$

$\sigma = \sigma_x = 1.005$ $\qquad \sigma \approx 1$

$\sigma^2 = 1.01 = \frac{101}{100}$

68% Range $\mu \pm \sigma$

$= 3 \pm 1$

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

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

$= 3 \pm 2(1)$

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

Jul 10-5:29 PM

Expected Value

There are 25 Students.

25 Tickets sold for \$10 each.

Winning tkt gets a TI calc worth \$100.

Net gain	P(Net gain)	
10 - 100	$\frac{1}{25}$	Winning TKT
10 - 0	$\frac{24}{25}$	Losing TKTS

Net gain → x → L1

P(Net gain) → P(x) → L2

Expected Value Per TKT

$\mu = \bar{x} = \$6$

For the house

House makes \$6 / TKT

6(25) = \$150

Jul 10-5:50 PM

You are going on a trip.

You buy insurance for your luggage.

You pay \$100, Any damages, airline pays \$1000.

Airline says the prob. of possible damage is 2.5%. Find expected value per policy sold.

Net gain	P(Net gain)	
100 - 1000	2.5% = .025	Damage
100 - 0	97.5% = .975	$\overline{\text{Damage}}$

Net gain → x → L1

P(Net gain) → P(x) → L2

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

\$75

Jul 10-5:56 PM

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, You get nothing.

Net gain	P(Net gain)	
5 − 50	4/52	Ace
5 − 10	12/52	face
5 − 0	36/52	Any other cards

E.V. Per draw for the house

E.V. −1.15

SG 14 & 15

Jul 10-6:03 PM

SG 16

Binomial Prob. Dist.

1) There are n independent events.

2) Each event has two outcomes.

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

3) $p + q = 1$, $q = 1 - p$, p & q remain unchanged for all events.

4) x is # of Successes

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

Jul 10-6:08 PM

A loaded Coin is tossed 10 times.

Landing tails is a success.

P(land tails on each toss) = .6

$n = 10$ $\quad p = .6$ $\quad q = .4$

P(get exactly 7 tails)

$= P(x=7) = {}_{10}C_7 \cdot (.6)^7 \cdot (.4)^{\overset{n-x}{3}} = \boxed{.215}$

${}_nC_x \cdot p^x \cdot q^{n-x}$

Jul 10-6:14 PM

You are taking a quiz with 12 True/false questions.

You are making random guess,

$n = 12$ $\quad P = .5$ $\quad q = .5$

P(guess correctly for exactly 8 questions)

${}_nC_x \cdot p^x \cdot q^{n-x}$

$P(x=8) = {}_{12}C_8 \cdot (.5)^8 \cdot (.5)^4 = \boxed{.121}$

$\boxed{\text{2nd}}$ $\boxed{\text{VARS}}$ $\boxed{\downarrow}$ $\boxed{\text{binompdf}}$($\overset{n}{12}$, $\overset{p}{.5}$, $\overset{x}{8}$)

Trials : 12 $= \boxed{.121}$

P : .5

x-value : 8

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

P(guess at most 8 correct ans.)

$P(x \leq 8)$ = binomcdf (12, .5, 8)

$= \boxed{.927}$

Jul 10-6:22 PM

Nisha is taking a multiple-choice exam with 40 questions.

She is making random guesses.

Each question has 4 choices with only one correct choice.

$n = 40$ $\quad p = \frac{1}{4} = .25$ $\quad q = \frac{3}{4} = .75$

P(she guesses exactly 15 correct ans.)

$P(x = 15) = \text{binompdf}(40, .25, 15)$

$= \boxed{.028}$

P(she guesses fewer than 15 correct ans).

$P(x < 15) = P(x \le 14) = \text{binomcdf}(40, .25, 14)$

$= \boxed{.946}$

Jul 10-6:33 PM

P(she correctly guesses at least 10 correct Ans.)

$P(x \ge 10) = 1 - P(x \le 9)$

we don't want   we want

9   10

$= 1 - \text{binomcdf}(40, .25, 9)$

$= \boxed{.560}$

P(she guesses corretly between 15 & 25 correct ans, inclusive)

$P(15 \le x \le 25) = \text{binomcdf}(40, .25, 25)$

we want

15   25

$- \text{binomcdf}(40, .25, 14)$

14

$= \boxed{.054}$

Jul 10-6:42 PM

A plane has 50 seats. $n = 60$

Airline sells 60 tickets. $p = .95$

$q = .05$

there is a 95% chance that passenger with ticket show up.

what is the prob. that more than 50 show up for flight?

$P(x > 50) = P(x \geq 51)$

we don't want   we want

50 51

$= 1 - P(x \leq 50) = 1 - \text{binomcdf}(60, .95, 50)$

$= \boxed{.999}$

Jul 10-6:52 PM