Statistics

Lecture 10

Feb 19-8:47 AM

Ch. 1

Data
1) Qualitative
(Non-Numerical)

2) Quantitative
Numerical
1) Discrete
Countable
2) Continuous
Measurable

Jan 30-4:55 PM

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

Prob. dist is a way to give the Prob. for all possible outcomes.

1) Could be in the form of table, chart, graph, or formula.

Jan 30-4:57 PM

Some rules:

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

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

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

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

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

Jan 30-4:59 PM

Consider the chart below

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

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

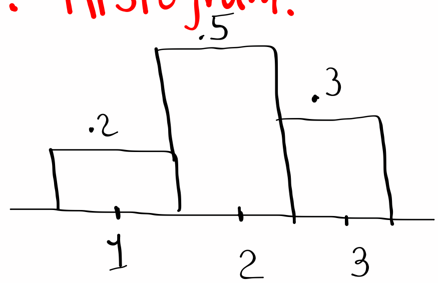
$.2 + .5 + .3 = 1$ ✓

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

3) Draw prob. dist. histogram.

$x \to$ Midpoint

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



Jan 30-5:02 PM

A box has 2 dimes, 3 nickels.

Take 2 Coins with replacement

Let x be # of dimes

DD $\to x = 2$ $\quad P(x=2) = \frac{2}{5} \cdot \frac{2}{5} = \frac{4}{25} = .16$

DN, ND $\to x = 1$ $\quad P(x=1) = 2\left(\frac{2}{5} \cdot \frac{3}{5}\right) = \frac{12}{25} = .48$

NN $\to x = 0$ $\quad P(x=0) = \frac{3}{5} \cdot \frac{3}{5} = \frac{9}{25} = .36$

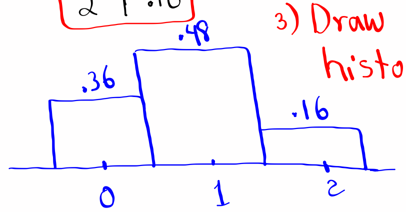
x	$P(x)$
0	.36
1	.48
2	.16

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

$.36 + .48 + .16 = 1$ ✓

2) $P(x \ge 1) = .48 + .16 = \boxed{.64}$

3) Draw Prob. dist. histogram



Jan 30-5:06 PM

Consider the chart below

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

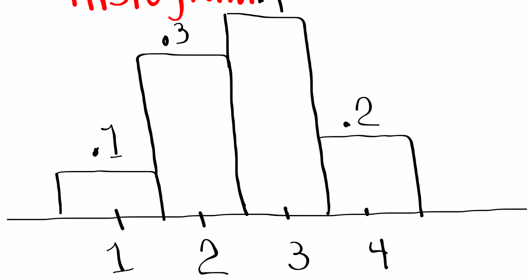
1) $P(x=4)$

$= 1 - [.1 + .3 + .4] = \boxed{.2}$

2) $P(x=2 \text{ or } x=4) =$

$.3 + .2 = \boxed{.5}$

3) Draw Prob. dist. histogram.



Jan 30-5:14 PM

4 Women

6 Men

Select 2 different people

No replacement

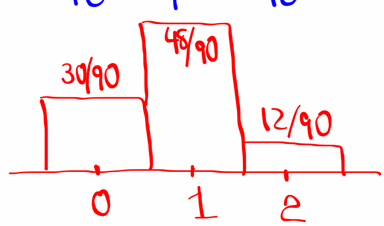
Let x be # of women selected

$x=0$ $\quad P(MM) = \frac{6}{10} \cdot \frac{5}{9} = \frac{30}{90}$

$x=1$ $\quad P(1W, 1M) = 2\left(\frac{4}{10} \cdot \frac{6}{9}\right) = \frac{48}{90}$

$x=2$ $\quad P(WW) = \frac{4}{10} \cdot \frac{3}{9} = \frac{12}{90}$

x	$P(x)$
0	30/90
1	48/90
2	12/90



Jan 30-5:18 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) $\sum xp(x) = 1.9$

2) $\sum x^2p(x) = 4.7$

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

$= 4.7 - 1.9^2 = \boxed{.49}$

4) Compute $\sqrt{\text{Last Answer}} = \sqrt{.49} = \boxed{.7}$

Jan 30-5:25 PM

Complete the chart below

x	$P(x)$	$xP(x)$	$x^2p(x)$
1	.1	.1	.1
2	.4	.8	1.6
3	.3	.9	2.7
4	.2	.8	3.2

1) $\sum P(x) = 1$ ✓

2) $\sum xp(x) = 2.6$

3) $\sum x^2p(x) = 7.6$

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

$7.6 - (2.6)^2 = \boxed{.84}$

5) Compute $\sqrt{\text{Last answer}} = \sqrt{.84} \approx \boxed{.917}$

Jan 30-5:31 PM

Mean μ mu

Variance σ^2 Sigma^2

Standard deviation σ Sigma

How To find them:

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

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

Jan 30-5:38 PM

How to find μ & σ using TI:

$x \to L1$

$p(x) \to L2$

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

STAT → CALC

1:1-Var Stats

List: L1

FreqList: L2

Calculate

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

$\sigma = \sigma_x = .7$

$n = 1$

what about σ^2?

VARS

5: Statistics

4: σ_x x^2 Enter .49

MATH 1: ▶Frac Enter $\frac{49}{100}$

Jan 30-5:41 PM

Consider the chart below

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

1) $\sum P(x) = 1$ ✓

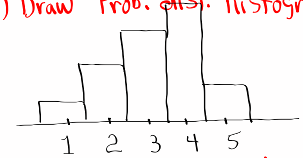
2) $P(x=2 \text{ or } x=5)$

$.15 + .20 = \boxed{.35}$

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

$.15 + .25 + .35 = \boxed{.75}$

4) Draw Prob. dist. histogram



5) Find μ, σ, and σ^2.

$x \to L1$

$P(x) \to L2$

$\mu = \bar{x} = 3.5$

$\sigma = \sigma_x = 1.118$

$\sigma^2 = 1.25 = \frac{5}{4}$

STAT → CALC

1: 1-Var Stats

List : L1

Freq List : L2

Calculate

VARS

5: Stat...

4: σx

x^2

Enter

MATH

1: ▸Frac Enter

Jan 30-5:50 PM

4 Women

8 Men

Select 3 people

W W W

Some W

Some M

M M M

$P(\text{All Women}) = \frac{{}_4C_3}{{}_{12}C_3} = \frac{4}{220}$

$= \frac{1}{55}$

$P(\text{All Men}) = \frac{{}_8C_3}{{}_{12}C_3} = \frac{56}{220} = \frac{14}{55}$

P(at least 1 woman)

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

$= 1 - P(\text{All Men}) = 1 - \frac{14}{55} = \boxed{\frac{41}{55}}$

P(at least 1 man) $= 1 - P(\text{No man})$

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

$= 1 - \frac{1}{55} = \frac{54}{55}$

P(1W & 2M)

W M M

M W M

M M W

$= \frac{{}_4C_1 \cdot {}_8C_2}{{}_{12}C_3} = \frac{112}{220} = \frac{28}{55}$

$P(2W \,\&\, 1M) = \frac{{}_4C_2 \cdot {}_8C_1}{{}_{12}C_3} = \frac{48}{220} = \boxed{\frac{12}{55}}$

P(Same gender) = P(WWW OR MMM)

$\frac{1}{55} + \frac{14}{55} = \frac{15}{55} = \boxed{\frac{3}{11}}$

Jan 30-6:11 PM

5 Dimes 10 Nickels

Select 3 Coins, No replacement

$P(3D) = \frac{{}_5C_3}{{}_{15}C_3} = \frac{2}{91}$

$P(3N) = \frac{{}_{10}C_3}{{}_{15}C_3} = \frac{24}{91}$

$P(\text{at least } 1\ D) = 1 - P(\text{No } D)$

$= 1 - P(\text{All } N) = 1 - \frac{24}{91} = \boxed{\frac{67}{91}}$

$P(\text{at least } 1\ N) = 1 - P(\text{No } N)$

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

$= 1 - \frac{2}{91} = \frac{89}{91}$

P(all Same denomination)

$= P(NNN \text{ OR } DDD) = \frac{24}{91} + \frac{2}{91} = \boxed{\frac{26}{91}}$

$= \boxed{\frac{2}{7}}$

Jan 30-6:24 PM

25 TKts Sold for \$10 each

one TKT drawn → winner gets a Calc worth \$100.

Net Pay	P(Net pay)
10 − 100	1/25
10 − 0	24/25

Net pay → X → L1

P(Net pay) → P(X) → L2

$\boxed{\text{STAT}}\ \boxed{\rightarrow}$ CALC

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

List: L1

FreqList: L2

$\boxed{\text{Calculate}}$

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

I make \$6/TKT

$\boxed{\text{Expected Value}}$

Jan 30-6:32 PM

You are flying out of town.

You have a very expensive item.

You buy insurance for \$50, Any damages, airline pays you \$1000.

Prob. of damage is .2% Per AAA.

Net	P(Net)	
50 − 1000	.2% = .002	Damage
50 − 0	.998	No damage

Find expected Value Per policy sold for the airline.

Net → L1

P(Net) → L2

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

\$48

\$48/Policy

Jan 30-6:37 PM

Pay me \$5

Draw one card from a standard deck of Playing Cards

Ace → \$25

Face → \$5

otherwise → Nothing

Net	P(Net)	
5 − 25	4/52	Ace
5 − 5	12/52	Face
5 − 0	36/52	other Cards

Net → L1

P(Net) → L2

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

≈ \$1.92 / bet

1-Var Stats

SG 14 & 15 ✓

Jan 30-6:43 PM

Binomial Prob. dist.:

1) There are n independent events (Trials).

2) Each event has only two outcomes

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

$p + q = 1$

p & q remain unchanged for all trials

3) $x \rightarrow$ # of Successes

$n - x \rightarrow$ # of failures

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

Jan 30-6:50 PM

You flip a fair coin 10 times.

Success is to land tails.

$n = 10$

$p = .5$

$q = .5$

P(land 6 tails)

$$P(x=6) = \underset{n}{10}C_{\underset{x}{6}} \cdot (\underset{p}{.5})^{\underset{x}{6}} \cdot (\underset{.5}{.5})^{\underset{n-x}{4}} = \boxed{.205}$$

Jan 30-6:54 PM

You are taking a multiple-choice exam.

There are 12 questions. $n = 12$

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

You make random guesses. $q = \frac{3}{4} = .75$

P(guess exactly 5 correct Ans.)

$$P(x=5) = {}_{12}C_5 \cdot (.25)^5 \cdot (.75)^7 = \boxed{.103}$$

Jan 30-6:59 PM

FedEx says each package has 90% chance to arrive ontime or earlier. $n=40$

Randomly select 40 packages. $p=.9$

$q=.1$

P(exactly 35 arrive ontime or sooner) =

$$P(x=35) = {}_{40}C_{35} \cdot (.9)^{35} \cdot (.1)^5 = \boxed{.165}$$

using TI:

2nd VARS ↓ ↓ binompdf $= \boxed{.165}$

Trials: 40

p: .9

x value: 35

Paste Enter

$P(x=35) = \text{binompdf}(40, .9, 35)$

$= \boxed{.165}$

P(38 packages arrive ontime or sooner)

$P(x=38) = \text{binompdf}(40, .9, 38) = \boxed{.142}$

Jan 30-7:05 PM