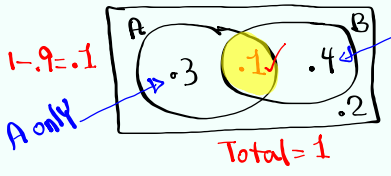
Statistics

Lecture 11

Feb 19-8:47 AM

Class QZ 7

1) Complete the Venn Diagram below



1) $P(A) = .4$ ✓

2) $P(A \text{ and } B) = .1$

3) $P(A|B) = \frac{P(A \text{ and } B)}{P(B)} = \frac{.1}{.5} = \frac{1}{5} = .2$ ✓

Given

$P(B|A) = \frac{P(A \text{ and } B)}{P(A)} = \frac{.1}{.4} = \frac{1}{4} = .25$

$P(A \text{ only or } B \text{ only}) = .3 + .4 = .7$

$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

$= .4 + .5 - .1 = .8$

Apr 1-3:58 PM

SG 14

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

Apr 13-1:55 PM

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

What is Prob. dist.? It is a method to provide the prob. of all possible outcomes.

- It could be in the form of a table or chart.
- It could be in the form of a graph.
- It could be in the form of a formula.
- Just use the concept of Prob.

Apr 13-1:58 PM

Some rules:

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

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

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

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

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

Apr 13-2:03 PM

Consider the chart below

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

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

$.2 + .5 + .3 = 1$ ✓

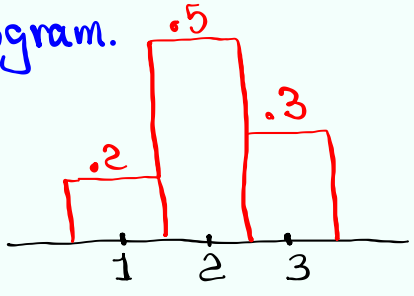
2) $P(x \ge 2) = .5 + .3 = .8$

3) $P(x \le 2) = .5 + .2 = .7$

4) Draw Prob. dist. histogram.

$x \rightarrow$ Midpt

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



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Consider the chart below

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

1) $P(x=4) = 1-(.1+.2+.5) = 1-.8 = .2$ (Total Prob.)

2) $P(x=2 \text{ or } x=3)$

$.2 + .5 = .7$

3) $P(x \geq 2)$

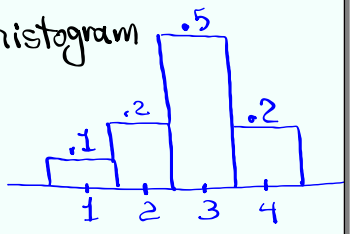
$= .2 + .5 + .2 = .9$

$= 1 - P(x=1) = 1 - .1 = .9$

4) Draw Prob. dist. histogram

$x \rightarrow$ MP

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



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Complete the chart below

x	P(x)	xP(x)	$x^2P(x)$
2	.2	.4	.8
3	.5	1.5	4.5
4	.3	1.2	4.8

1) $\sum P(x) = 1$ ✓

2) $\sum xP(x) = 3.1$ ✓

3) $\sum x^2P(x) = 10.1$ ✓

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

$= 10.1 - 3.1^2 = .49$

5) Find $\sqrt{\text{Last Answer}} = \sqrt{.49} = .7$

Apr 13-2:19 PM

Complete the chart below

x	$P(x)$	$xP(x)$	$x^2P(x)$
1	.2	.2	.2
2	.3	.6	1.2
3	.3	.9	2.7
4	.2	.8	3.2

1) $P(x=1) = 1 - [.3+.3+.2] = .2$

2) $P(x=1 \text{ or } x=4) = .2 + .2 = .4$

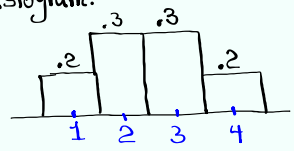
3) $\sum xp(x) = 2.5$

4) $\sum x^2p(x) = 7.3$

5) Compute $\sum x^2p(x) - (\sum xp(x))^2 = 7.3 - 2.5^2 = 1.05$

6) $\sqrt{\text{last answer}} = \sqrt{1.05} \approx 1.025 \approx 1$

7) Draw Prob. dist. Histogram.



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Mean μ (mu) $\quad \mu = \sum xp(x)$

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

Standard deviation σ (Sigma) $\quad \sigma = \sqrt{\sigma^2}$

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

$\mu = \sum xP(x) = .6 + 1.5 + .8 = \boxed{2.9}$

$\sigma^2 = \sum x^2P(x) - \mu^2 = 1.2 + 4.5 + 3.2 - 2.9^2 = \boxed{.49}$

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

Now using TI

clear all lists

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

STAT CALC

1-Var Stats

▸List: L1, Freq List: L2

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

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

$n = 1$ ✓

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

VARS

5: Statistics

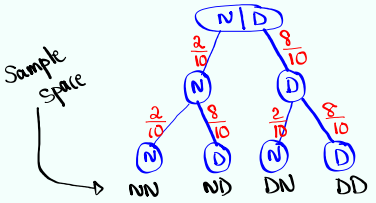
4: σ_x x^2

Enter

Apr 13-2:40 PM

A piggy bank has 2 nickels and 8 dimes.

Select 2 coins with replacement.



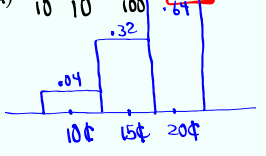
Tree diagram

NN → 10¢ $P(10¢) = \frac{2}{10} \cdot \frac{2}{10} = \frac{4}{100} = \boxed{.04}$

ND, DN → 15¢ $P(15¢) = 2 \cdot \frac{2}{10} \cdot \frac{8}{10} = \frac{32}{100} = \boxed{.32}$

DD → 20¢ $P(20¢) = \frac{8}{10} \cdot \frac{8}{10} = \frac{64}{100} = \boxed{.64}$

Total	P(Total)
10¢	.04
15¢	.32
20¢	.64



Total → X → L1

P(Total) → P(X) → L2

Use 1-Var Stats

with L1 & L2

$\mu = \bar{x} = 18$

$\sigma = \sigma_x = 2.828$

$n = 1$ ✓

VARS

5: Statistics

4: σ_x x^2

Enter

$\sigma^2 = 8$

Apr 13-3:01 PM

$\mu = 18 \qquad \sigma \approx 3$

68% Range $\rightarrow \mu \pm \sigma = 18 \pm 3 \rightarrow$ 15 to 21

95% Range $\rightarrow \mu \pm 2\sigma = 18 \pm 2(3) \rightarrow$ 12 to 24

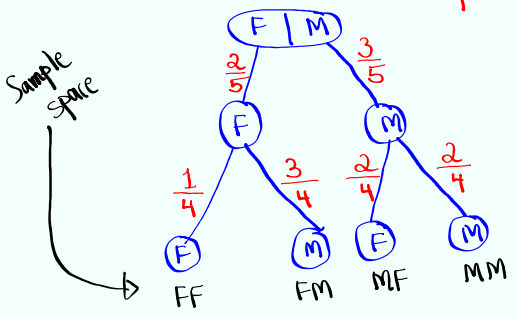
Usual Range

99.7% Range $\rightarrow \mu \pm 3\sigma = 18 \pm 3(3) \rightarrow$ 9 to 27

Apr 13-3:12 PM

2 females, 3 males, Select 2 people

No replacement

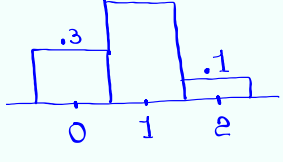


$P(2 \text{ Females}) = P(FF) = \frac{2}{5} \cdot \frac{1}{4} = \frac{2}{20} = \frac{1}{10} = .1$

$P(1 \text{ Female}) = P(FM \text{ or } MF) = 2 \cdot \frac{2}{5} \cdot \frac{3}{4} = \frac{12}{20} = .6$

$P(0 \text{ Female}) = P(MM) = \frac{3}{5} \cdot \frac{2}{4} = \frac{6}{20} = .3$

# F	P(#F)
2	.1
1	.6
0	.3



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#F → L1

P(#F) → L2

L1	L2
2	.1
1	.6
0	.3

Use 1-Var Stats with L1 & L2

List: L1

FreqList: L2

VARS

5: Statistics

4: σ_x χ^2

Math 1: ▶Frac Enter

$\sigma^2 = \frac{9}{25}$

$\mu = \bar{x} = .8$

$\sigma = \sigma_x = .6$

$n = 1$ ✓

Apr 13-3:23 PM

Expected Value:

I sold 20 TKTS for $10 each.

One TKT randomly drawn, winner gets a Calculator worth $120.

expected value per TKT sold.

Method I: 20 TKTS × $10 each = $200

$200 − $120 = $80 net Profit

$80 ÷ 20 TKTs = $4/TKT

Method II:

Net	P(Net)
10 − 120	1/20 House loses
10 − 0	19/20 House wins

$\sigma^2 = 684$

Net → L1

P(Net) → L2

1-Var Stats with L1 & L2

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

$\mu = \$4$

Apr 13-3:28 PM

You pay $100 to buy insurance for your luggage.

Any Accident → Policy pays $1000

Prob. of any accident is .2% → .002

Find expected value per policy sold.

Net	P(Net)	
100 − 1000	.002	Damage
100 − 0	.998	Damage

$\sigma^2 = 1996$

Net → L1

P(Net) → L2

1-Var Stats with L1 & L2

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

$98

Apr 13-3:35 PM

Pay me $10 and draw one card from a standard deck of playing cards.

If you draw Ace → I give you $50

If you " Face → I give you $10

Any other card → I give you nothing.

net	P(Net)	
10 − 50	4/52	Ace
10 − 10	12/52	Face
10 − 0	36/52	any other card

$\sigma^2 = \frac{30000}{169}$

Net → L1

P(Net) → L2

1-Var Stats with L1 & L2

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

≈ $3.85

Sec 14 & 15

Apr 13-3:42 PM

12 Students

8 Females, 4 Males, Select 3 Students

$P(\text{all Females}) = \frac{8}{12} \cdot \frac{7}{11} \cdot \frac{6}{10} = \boxed{\frac{14}{55}}$

$P(\text{all Males}) = \frac{4}{12} \cdot \frac{3}{11} \cdot \frac{2}{10} = \boxed{\frac{1}{55}}$

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

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

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

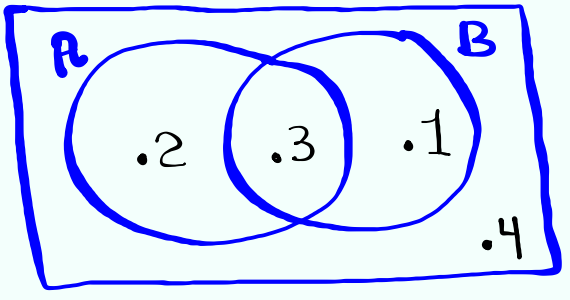
Apr 13-3:55 PM

$P(A) = .5$

$P(B) = .4$

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

1) Make Venn Diagram



2) $P(B|A)$

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

Apr 13-4:00 PM

$P(A) = .6$

$P(B) = .5$

$P(A|B) = .8$

Find $P(A \text{ and } B)$

$$P(A|B) = \frac{P(A \text{ and } B)}{P(B)}$$

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

Cross-multiply

$P(A \text{ and } B) = (.8)(.5) = \boxed{.4}$

Apr 13-4:05 PM