6/12/17

Fractions - Percents - Decimals H.W #1

Fractions → decimals → Percent

ex: $\frac{3}{4} = .75 = 75\%$

move decimal 2 places →, add % sign or multi by 100, add % sign

ex: $\frac{4}{7} = .571 = 57.1\%$

Round to 3 decimal places

$.571 \cdot 100 = 57.1\%$

In a servey, 82% of 1463 people have cell phones.

(a) What is 82% of 1463?
(b) Could this be the actual #?
(c) Whas is the actual #?

(a) $1463(82\%) = 1463(.82) = \boxed{1199.66}$

(b) No, can't have .66 of a person

(c) Probably 1200 actual #

ex: 33 of 115 people have cell phones. what % is that? Round to 2 decimal places.

$\frac{33}{115} = .\underbrace{28}69565 = 28.69\cancel{565}\% = \boxed{28.70\%}$

To round to 2 decimal places %, you need 5 decimal places.

TRY: In a survey, 37% of 992 people have seen a UFO.

ⓐ what is 37% of 992

ⓑ what is the actual # who's seen a UFO

ⓐ
$$\begin{array}{r} 992 \\ \underline{\times .37} \\ 367.04 \end{array}$$
← 37%

calculate

ⓑ 367

TRY: If 211 of 763 have seen a UFO, what % is that, round to 2 decimal places.

$211/763 = .\underbrace{27}653 = 27.65\cancel{3}\% = 27.65\%$

greenroom

Binomial Distrubution H.W 11

A random veriable X that has the binomial distrubution, has a mean, (expected value) μ = mean and a standard deviation σ = sigma

$\mu = np =$ (# of trials) $\cdot$ (probability of success)

$\sigma = \sqrt{npq}$ $q = 1 - p$

Range of usual value (rouv)
$= [\mu - 2\sigma, \mu + 2\sigma]$

ex: X = # of heads in 10 flips, Find μ, σ, rouv

$\mu = np = 10(.5) = 5$
$\sigma = \sqrt{npq} = \sqrt{10(.5)(.5)} = 1.5 \rightarrow \boxed{1.6}$

rouv $= [\mu - 2\sigma, \mu + 2\sigma]$
$= [5 - 2(1.6), 5 + 2(1.6)]$
$= [\boxed{1.8}, \boxed{8.2}]$

6.26.17

H.W Help #10 Finish

Ex: An airplane that 94% of people who buy a ticket actually show up. If an airline sells 25 tickets with 23 seats, find the probability (not enough seats)

= P (more than 23 successes)

= 1 - binomcdf (25, .94, 23) = .553

Ex: (acceptance sampling) In a large batch of aspirin P(good one) = .999. A batch is accepted if among 6 asprin, there is at most 1 bad. Find P(batch accepted)

Bad one is success, so P(success = 1 - .999 = .001
Rule of complements:

P (at most 1 success) = binomcdf (6, .006, 1) = .999

TRY: A batch is accepted if among 15 tires there are at most 2 bad. Find P(batch accepted)

n = 15, P = .007, X = 2 ; (15, .007, 2) = .999
binomcdf

1

greenroom

(1) wrong: HW: 11

change to % move decimal
over!! not .99 / right 99.33

د. ألفت

6/12/17

Fractions - Percents - Decimals H.W #1

Fractions → decimals → Percent

ex: $\frac{3}{4} = .75 = 75\%$

move decimal 2 places →, add % sign or multi by 100, add % sign

ex: $\frac{4}{7} = .571 = 57.1\%$

Round to 3 decimal places

$.571 \cdot 100 = 57.1\%$

In a servey, 82% of 1463 people have cell phones.

ⓐ What is 82% of 1463?
ⓑ Could this be the actual #?
ⓒ Whas is the actual #?

ⓐ $1463(82\%) = 1463(.82) = \boxed{1199.66}$

ⓑ No, can't have .66 of a person

ⓒ Probably 1200 actual #

greenroom®

ex: 33 of 115 people have cell phones. what % is that? Round to 2 decimal places.

$\frac{33}{115} = .2869565 = 28.69565\% = \boxed{28.70\%}$

To round to 2 decimal places %, you need 5 decimal places

TRY: In a survey, 37% of 992 people have seen a UFO.

ⓐ what is 37% of 992
ⓑ what is the actual # who's seen a UFO

ⓐ 992
x .37 ← 37%
367.04 calculate

ⓑ 367

TRY: If 211 of 763 have seen a UFO, what % is that, round to 2 decimal places.

211/763 = .27653 = 27.653% = 27.65% ②

greenroom

6/12/17

Discriptive Statistics, CH3

3.2 Measure of Center

1. mean
2. medean
3. mode
4. Med Range
5. Weighted mean

ex. You got 78, 85, 88, and 93 on 4 tests, what was the mean?

Data Points: 78, 85, 88, 93
X_1 X_2 X_3 X_4

4 data points

$$\bar{X} = \sum^{n} x_k = \frac{(78+85+88+94)}{4} = 86$$

$\bar{X}$ ↓ sample mean

ex: Maple leaf won 42, 24 and 37 games past 3 years, find the mean

$$\bar{X} = \frac{(42+24+37)}{3} = 34.33 \approx 34.3$$

Round off for $\bar{X}$: to one more decimal Place then data points

Descriptive Statistics

median = If you make a sorted list low to high of the data, median is the data point in the middle of the list

ex: Find the median 16, 22, 14, 17, 43
Sorted list 14, 16, 17, 22, 43
median = 17

ex: Find median 22, 18, 51, 35
Sorted list 18, 22, 35, 51

median = mean these 2 #'s

$= \left(\frac{22+35}{2}\right) = 28.5$

mode = Data point that occurs most often

ex: Find mode: (a) 2,2,2,2,2,2 mode = 2
(b) 1,2,1,2,1,2 bimodal, modes = 1,2
(c) no repeat = no mode

midrange = mean of $\frac{\text{high} + \text{low}}{2}$ →

Ex: Find the midrange for 6, 12, 25, 3, 14

midrange = $\frac{25+3}{2} = 14$

midrange

Low | high

H.W #3

weighted mean = mean in which data points are assigned "weights"

Example of weight mean: GPA

Find the GPA

	Grade	units
Theory mes.	B = 3	4
Topology	A = 4	3
Diff. Geo	C = 2	5
Set Thory	B = 3	5

multiply Grade points units for each class

3, 4, 2, 3

Add all up, ÷ results by total # units

4, 3, 5, 5

GPA: $\frac{(3\cdot4 + 4\cdot3 + 2\cdot5 + 3\cdot5)}{(4+3+5+5)} = 2.88$

greenroom

Find GPA

	Grade	Units
math	B = 3	4
English	A = 4	5
Poli Si	A = 4	3
Art	A = 4	4

GPA: $\frac{(3\cdot4+4\cdot5+4\cdot3+4\cdot4)}{(4+5+3+4)} = 3.75$

TRY: Find GPA

	Grade	Units
math	C = 2	5
English	B = 3	3
Poli Si	B = 3	5
Pho	D = 1	3

GPA: $\frac{(2\cdot5+3\cdot3+3\cdot5+1\cdot3)}{(5+3+5+3)}$ $\frac{37}{16} = 2.31$

Measure of Variation

Range
Standard Deviation
Variance
"Usual Values"

Range is high - low

ex: Find range: 2, 16, 14, 22, 116

range = 116 - 2 = 114

range = 114
2 116

no variation
ex: Find $\bar{X}$ ⓐ 50, 50, 50, 50 : $\bar{X} = 50$

Lots variation
ⓑ 1, 99, 2, 98 $\bar{X} = 50$

Standard Deviation S is a mesure of the variation in a data set

no variation what-so-ever, example Ⓐ
$S = 0$

Formula: $S = \sqrt{\frac{\sum (x_i - \bar{X})^2}{n-1}}$

$X_i - \overline{X}$ = Distance from each data point to the mean of data set

÷ the sum of those distance by n-1, gives us, sort of, the mean distance of the data points to the mean of the data set

ex: Find Std. dev. of 27, 47, 16, 25, 33, 15

$\boxed{\text{Calculate}}$

STAT Button → clear list

Clr List

2nd L1 → Enter

Done

STAT

Edit Enter, enter list #'s Enter

STAT → $\boxed{\text{Calc}}$ → 1 Var Enter

2nd → L1 → Enter

$\overline{X} = 26.3$ = mean

this one!

$Sx = S = 10.3$ = Std. dev (round 1 decimal)

$\sigma x = \sigma = 9.4$ (not this one)

Population std. dev.

greenroom

Inferential Statistics

Given Sample data make an inference about the population

1. Confidence intervals
2. Hypothesis testing

ex: Kitchen Sink

Find mean - Std. dev - Variance - range of $\boxed{\text{Usual Value}}$ and identify any usual values of following data Set

16, 18, 7, 33, 14, 11, $\boxed{365}$

mean = $\overline{X}$ = 66.293 ← Round

Std. dev = S_x = 131.97

$$\text{Variance} = S^2 = \frac{\Sigma(X_i - \overline{X})^2}{n-1}$$

Sq. ALL the digits of S and then round off for S^2

S^2 = variance = $(131.9743842)^2$ = 17417.2

Range of Usual Value is
$(\overline{X} - 2s, \overline{X} + 2s)$

ALL the value within 2 standard deviation of the mean

unusual | usual / values | usual

$\overline{X} - 2s$ $\quad$ $\overline{X}$ $\quad$ $\overline{X} + 2s$

ex: $\overline{X} = 66.3$
$S = 132$

$(\overline{X} - 2s, \overline{X} + 2s)$

$= (66.3 - 2(132), 66.3 + 2(132))$
$\quad -197 \qquad\qquad 330.3$

= range of usual value

$\boxed{365}$ is Unusual

$\boxed{365}$ ← unusual

-197.7 $\quad$ 66.3 $\quad$ 330.3

6-14-2015

Measures of Variation H.W 3

1. Range
2. STd. dev.

Kit... Sink

ex: Find mean, std. dev, range of usual values, and identify any unusual values:

2, 41, 68, 69, 75, 84, 116

$\boxed{\text{Calculate}}$

STAT
Clear List Clr list
2nd → L1 → Enter → Done
STAT → Edit → Enter
enter # List → Enter
STAT → $\boxed{\text{Calc}}$ → [1 Var]
Enter → 2nd → L1 → Enter

$\overline{X} = 65$ range
$S = 35.7$ std. dev.
ROUV $= [\overline{x} - 2s, \overline{x} + 2s]$
$= [65 - 2(35.7), 65 + 2(35.7)]$
$= [-6.4, 136.4]$ no unusual values

TRY: Find $\bar{x}$, S, rouv, Identify any unusual: 77, 65, 63, 45, 33, 189

$\bar{X}$ = 75.3

S = 52.1

ROUV = $[\bar{x} - 2s, \bar{x} + 2s]$

= [75.3 − 2(52.1), 75.3 + 2(52.1)]

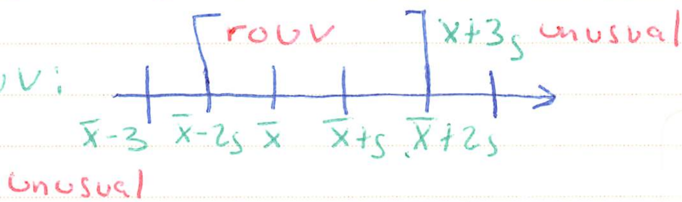
= [−28.9, 179.5] unusual 189

Measure of Relative Standing

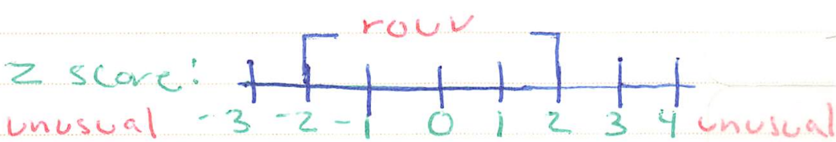
<u>H.W #4</u> Z-Scores:

Are measuring data points in terms of units of standing deviations above or below the mean

ROUV:



Z score:



Formula: $Z = \dfrac{X - \bar{X}}{S}$ mean std. dev.

H.W 4

Measure of Relative standing

Ex! Find Z if $X = 14.7$, $\bar{X} = 14.3$, $S = 2.5$

$$Z = \frac{\overset{\text{Point}}{14.7} - \overset{\text{Pop. Avg.}}{14.3}}{\underset{\text{Std. dev.}}{2.5}} = .16 \text{ usual}$$

Round 2 decimal

Ex! Same Question

$X = 3.8$, $\bar{X} = 7.2$, $S = .45$

$$Z = \frac{\overset{\text{Point}}{X} - \overset{\text{Pop. Avg}}{\bar{X}}}{\underset{\text{Std. dev.}}{S}} = \frac{3.8 - 7.2}{.45} = -7.56$$

unusual

Usual Z in [-2, 2]

unusual if $Z > 2$ or $Z < -2$

TRY! Find Z, usual or Unusual?

$$\frac{X = 42.6 \quad \bar{X} = 40.5}{S = 1.3}$$

$$Z = \frac{42.6 - 40.5}{1.3} = 1.62 \text{ usual}$$

A characterization of Z scores!

1. If $Z < 0$ (ie Z = neg) datapoint, below mean
2. If $Z > 0 \Rightarrow$ datapoint above mean
3. If $Z = 0 \Rightarrow$ datapoint = to the mean

ten

greenroom

Probability <u>HW # 5</u>

1. Basic Definitions
2. Addition rule
3. multiplication rule
4. At least 1 principle
5. Conditional probability

when they say 20% chance of rain,
... they look at all situations in database that are simular to current situation, and determine that 20% of the time in these situations it rained.

Ex: Probability by "relitive frequency"

Find Wilt's free throw % if he made 263 of 572 free throws.

263/572 = 46% .459

Ex: A bag has 72 mm's with 29 red ones. If an mm is randomly selected find

$P(red) = \frac{29}{72} = .403$ 40%

3 decimal places for P = probability

EX! A sack contains 43 potatos & 22 onions
If one is randomly selected, find

$$P(\text{onions}) = \frac{\#\text{ onions}}{\text{total}} \quad \frac{22}{(43+22)} = .338$$

TRY: A bag has 26 red & 41 yellow mm's
Find P(red) $\frac{26}{(26+41)} = .388$

Basic Probability
1. Relitive Frequency
2. Space of Equality
3. Complements
4. Certain and Impossible

Experiment: A fair coin is flipped once.
Space of Equality likely outcomes

{H, T} (a set)

Find $P(H) = \frac{\#\text{ outcomes that are "H"}}{\text{Total \# of out comes}} = \frac{1}{2}$

greenroom

Experiment: A coin is flipped twice. Find space of equally likely outcomes, and use it to find P(at lest 1 head)

{HH, HT, TH, TT}

P(at lest 1 head) = $\frac{\text{\# w/ at least 1 Head}}{\text{total}}$ = P $\frac{3}{4}$ ←

P(exactly 2 tails) = $\frac{\text{\# w exactly 2 tails}}{\text{total}}$ = P = $\frac{1}{4}$ ←

Experement: 3 Flips
write sclo and use it to find
P(exactly 1 Head)

Sclo: {HHH, HHT, HTH, HTT, TTT, TTH, THT, THH}

P(exactly 1 head = $\frac{\text{\# w/ exactly 1 Head}}{\text{total}}$ = P = $\frac{3}{8}$ = .375

greenroom

TRY: Find P(at lest 1 tail) = 7

$\frac{7}{8} = .875$

Find ALL heads = $1 = \frac{1}{8} = .125$

P(at lest one tail) is "complement"

The thing to notice P(All heads) + P(at lest one tail) = $\frac{1}{8} + \frac{7}{8} = 1$

Rule of Complaments:

A is an event

$\bar{A}$ is a complement

rule of complements: $P(A) + P(\bar{A}) = 1$

Event: A = It rains, $\bar{A}$ = no rain

Example: A = Wilt makes free throws

$\bar{A}$ = Wilt misses free throws

Event: A maple Leafs win, $\bar{A}$ maple loses

Example: P(wilts make free throws) = .53

Find P(Wilt misses) →

8

$P(A) + P(\overline{A}) = 1$

$.53 + P(\overline{A}) = 1$

P (wilt misses) = $1 - .53 = .47$

Example: P (rain) = .281

Find P (doesn't rain) = 1 - .289

= .719

<u>One more thing</u>

Thanksgiving will be on Thursday

= 1 always

P (certain event, will happen)

P (cats fall from sky) = 0

P (impossible event) = 0

For all probability: $0 \le P(A) \le 1$

greenroom

6-15-2017
H.W # 6

Probability: Addition Rule

We will use 2-way tables to apply the additional rule:

	Peanut	Plain
red	14	22
green	61	9

If an mm is randomly selected
Find P(red or peanut)

$$= \frac{\text{\# that are red or peanut (or both)}}{\text{total \#}}$$

$$= \frac{(14+22+61)}{(14+22+61+9)} = .915$$

Probability: Additional Rule

HW 6

1

greenroom

	red	yellow
Potatos	42	116
onions	21	3

P(yellow or onion)

$$\frac{(116+21+3)}{(116+21+3+42)} = .769$$

TRY:

	Apple	Orange
green	51	16
red	23	41

$$\frac{(51+23+41)}{(51+23+41+16)} = .878$$

"Addition Rule": why is this called?

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$\cup$ → or → union

$\cap$ → and → Intersection

P(red / apple) = P(red) + P(apple)

− P(red and apple)

$P(\text{red}) = \frac{64}{131} + P(\text{apple})\ \frac{74}{131} - P(\text{Both})\ \frac{23}{131}$

$= .878$

Sometimes, you have to make up the 2-way table from the info. given in the question to apply the additional rule. →

Ex: On a drug test of 117 pos. results, there were 22 faulse pos. Of 261 neg. results, there were 41 faulse neg. If a subject is randomly selected, Find: P(tested neg. or used drugs)

$$= \frac{41 + 95 + 220}{41 + 95 + 220 + 22} = .942$$

	neg.	Pos.
used	41	*95
not used	⊛220	22

* 117 - 22 = 95 used

⊛ 261 - 41 = 220 didn't

TRY: On a drug test on a 125 pos., there were 27 faulse pos., of 532 neg., there were 22 faulse neg.

Find: P(test neg. or didn't use drugs)

	neg	pos
used	22	98
not used	510	27
	+ 532	+ 125

$$\frac{532+27}{532+125} = \frac{559}{657} = .851$$

Probability: Multiply Rule

1. Dependent & Interdependent events
2. Acceptance Sampling] applications
3. Redundancy

Coin toss: If you have 2 events, and what happened on the 1st event doesn't affect the probability of the 2nd event, the events are called independent

Ex: 1st coin toss has no effect on the probability of the 2nd coin toss.

greenroom

If the outcome of the 1st event does affect the probability of the 2nd event, then the events are called dependent.

Ex: Classic Dependent

An urn contains 42 blue marbles and 16 red marbles. If 2 are selected without replacement,

Find: P(1st red, 2nd blue)

$$\begin{array}{rl} 16 & \text{red} \\ +42 & \text{Blue} \\ \hline 58 & \text{total} \end{array}$$

$$\underbrace{\left(\frac{16}{58}\right)}_{\text{1st red}} \cdot \underbrace{\left(\frac{42}{57}\right)}_{\text{2nd Blue}} = .203$$

6-18-2017

HW #7 Probability: Multiplication Rule

1. Dependent / independent events
2. Sampling w/ w/o replacement
3. Acceptance sampling
4. Redundancy

cont...

A and B are independent of P(B) is not affected by outcome of A and:

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

If P(B) can change depending on outcome of A, then A, B are dependent

$$P(A \text{ and } B) = P(A) \cdot P(B \text{ given } A)$$

$P(B/A)$

↓
given

Ex w/o replacement:

A urn contains 44 blue marbles and 61 red marbles. If 2 are randomly selected w/o replacement, Find P(1^{st} red, 2^{nd} blue)

61 red
+44 blue
105 total

$$\frac{61}{105} \cdot \frac{60}{104} = .335$$

second Red

Ex with Replacement:

100 letters in scrabble of which there are 12 letter "E". If 2 are randomly selected with replacement, Find P(1st "E", 2nd "E")

$\frac{12}{100} \cdot \frac{12}{100}$ or $(12/100)^2 = .014$

100 pieces

1st E 2nd E

TRY: A bag contains 42 pink starburst and 37 yellow. If 2 are selected w/o replacment Find P(1st pink, 2nd yellow)

$$\begin{array}{r} 42 \\ +37 \\ \hline 79 \end{array} \qquad \frac{42}{79} \cdot \frac{37}{78} = .252$$

greenroom®

Probability: Acceptance Sampling

EX: out of 9832 scales in air ports, there are 216 defective. If inspectors test 4 scales w/o replacement
Find P(4 good)

"cumbersome calculation"
P(1st good) • P(2nd good) • P(3rd good) • P(4th ...

$$\begin{array}{r} 9832 \\ -\ 216 \\ \hline 9616 \end{array} \leftarrow \text{good}$$

$$\frac{9616}{9832} \cdot \frac{9615}{9831} \cdot \frac{9614}{9830} \cdot \frac{9613}{9829} = .915$$

$\leftarrow$ 1 less

5% Rule: Book uses, how to avoid "Cumbersome Calculation"

If the sample is less then 5% of the total # of item, you can assume the sampling is done w/ replacement

greenroom

Ex: Sample was 4 scales, and there were 9,832 total scales.

$\frac{4 \text{ sample size}}{9832 \text{ total}} = 4.068348251E-4 \times 10^{-4}$

$= .0004$

way less 5%

if the sample is w/replacement

$P(4 \text{ good}) = \left(\frac{9616}{9832}\right)^4$ raise 4th power $= .915$

w/replacement

$\boxed{\text{Fried DO}}$

Ex: A buyer accepts a shipment of bulbs if 5 good ones are randomly selected.

P(good one) = .989 Raise 5th power

Find (shipment accepted) $(.989)^5 = 946$

Ex: A buyer accepts a batch of tires if 4 good ones are randomly selected.

Find P(batch accepted) if P(bad one) = .037

2 steps: Rule of compliment

① P(good one) = 1 - .037 = 9.63

② $P(4 \text{ good}) = .963^4 = .86$

TRY: A shipment of flash drives is accepted if 6 good ones are randomly selected.
Find P(accepted) if P(1 bad) = .008

Rule of complement

① P(1 good) = 1 − .008 = .992
② P(6 good) = $.992^6$ = .953

6 power

Good not need Rule of complement
Bad need rule of Complement

Redundancy:

Ex: An airplane has an electrical system and a back-up electrical system
If P(electrical works) = .99
P(back-up works) = .987

Find P(both fail)

P(Both fail) = P(electric fail) • P(Back-up fail)

By rules of complements:
P(electrical fails) = 1 − .99 = .01
P(Back-up fail) = 1 − .987 = .013
P(Both fail) = (.01)(.013) = 1.3×10^{-4}
E−4 = 10^{-4} = 00013

Ex: P(1 alarm clock fail) = .003
P(2nd alarm clock fail) = .002

You set both alarm clocks

Find P(Both fail)

$= (.003)(.002)$

$= 6 \times 10^{-6} = .000006 = 6E{-6}$

TRY: P(alarm works) .992
P(alarm 2 works) .999

Find P(both fail)

P(alarm 1 fail) $= 1 - .992 = .008$

P(alarm 2 fail) $= 1 - .999 = .001$

P(Both fail) $= (.008)(.001) = 8 \times 10^{-6}$

Probability: At Least one Principle

B-Day problem: 5 people have diff. Birth days

$$\frac{364}{365} \cdot \frac{363}{365} \cdot \frac{362}{365} \cdot \frac{361}{365}$$

2 pp 3 pp 4 pp 5 pp

At least 1 B-Day match among 5 people is actually the complementary event to no B-Days match

P(no B-Days match in 5 people)

$$1 - \underbrace{\frac{364}{365} \cdot \frac{363}{365} \cdot \frac{362}{365} \cdot \frac{361}{365}}_{365^4 \text{ days in year}} = .0271$$

Ex: P(Wilt makes free throws) = .51 of 5 free throws Find

P(Wilt makes at lest 1)

Complement event: Wilt misses ALL

P(wilt makes at least 1 = 1 - P misses ALL 5)

P(Wilt misses 1) = 1 - .51 = .49 = $1 - .49^5$ 7

= .972

6-19-17

Probability: A least one Principle cont.

P(at least 1)...
= 1 - P(all are the opposite of...)

ex: P(maple Leafs win at least one game of 5) = 1 - P(they less ALL 5)

ex: P(at least 1 head in 4 flips)
= 1 - P(ALL Tails)

ex: P(wilt musses at least 1 of 7 free throws) = 1 - P(makes ALL 7)

ex: If P(maple leafs win 1 game) of 6 games, Find P(win at least 1)

① given P(wins) = .582
Find P(lose) = 1 - .582 = .418

② At least 1 principle:
P(at least 1 win) = 1 - P(lose ALL 6)
$= 1 - .418^6 = .995$

Ex: P (Steph makes free throws) = .9
of 5 free throws find the
P(misses at least 1)

① P(makes) .9
P(misses) 1 − .9 = .1

② P (at least 1 miss) = 1 − P (make all 5)
$= 1 - .9^5 = .410$

Ex: P (get right answer) = .25
of 5 questions
Find P(at least 1 right)

① P(1 right) = .25
P(1 wrong) = 1 − .25 = .75

② P(At least 1 right) = 1 − P(5 wrong)
$= 1 - .75^5 = .763$

TRY = P(Leafs win 1 game) = .532
of 6 games, Find P(Leafs lose at least 1)

① P(win one game) .532
P(lose one game) 1 − .532 = .468

② 1 − P(win all 6)
$= 1 - .532^6 = .977$

H.W: #8 Continual Probability

we will use a 2-way table and direct our attention to only the spacific parts of the table.

Ex:

	Plain	Peanut
green	16	$\boxed{21}$
red	9	+ $\boxed{60}$
		81 total,

$\frac{21}{21+60} = .259$

If an mm is randomly selected,
Find P(green, given it is $\boxed{\text{Peanut}}$)

only look at Peanut

oval around part of the chart that comes after the word given in the question, only consider what's in the oval to calculate probability

Ex:

	Thick	Thin
light	61	33
Dark	28	74

greenroom

Elementary Statistics p. 37
Formulas

Birth Weights: Listed below are the weights (grams) of newborn babies from Albany Medical Center Hospital. What value is obtained when those weights are added and total devided by number of weights? (This result called the mean, is discussed in ch 3.)

What is noble about these values, and what does it tell us about how the weights are measured?

$$\frac{3600+1700+4000+3900+3100+3800+2200+3000}{8}$$

Six Children Jule Cole is a founder of Mabel's Labels, and she is the mother of six children. The Probability that six randomly selected children are all girls is found by evaluating

0.5^6

Tallest Person Robert Wadlow (1918-1940) is the tallest know person to have lived. The expression below converts his hight of 272 cm to a standard score. Find this value and round the result to two decimal places. Such standard scores are considered to be significantly high if they are greater than 2 or 3. Is the result significantly high?

$$\frac{272-176}{6} = \frac{96}{6} = \boxed{16}$$

yes

Body Temperture The given expression is used for determining the likelihood that the average (mean) human body temperture is diffrent from the value 98.6°F that is commonly used. Find the given value. Round to two decimal places.

samp. mean

$$\frac{98.2 - 98.6}{\left(\frac{0.62}{\sqrt{106}}\right)}$$

← population mean

std. div. →

1st step

↑ samp. size

$\boxed{\text{Z-score Formula}}$

calculate: $(98.2 - 98.6)/(.62/\sqrt{106})$

answer: $\boxed{-6.64}$

Determining Sample Size

The given expression is used to determine the size of the sample necessary to estimite the proportion of college students who have the profound wisdom to take a statistics course. Find value, round to nearest whole number.

$$\frac{1.96^2 \cdot 0.25}{0.03^2}$$

Calculate: $1.96^2 = 3.8416$

Ans * $0.25 = 0.9604$

Ans/ $0.03^2 = 1067.11$

Answer: $\boxed{1067}$

Standard Deviation

The standard deviation is an extremely important concept. Using sample data from Exersize one "Birth weights", Part of the calculation for standard Deviation is shown in the expression below. Evaluate the expression.

$$\frac{(3600 - 3165.2)^2}{7}$$

Find P(thin, given the sock is dark)

$= \frac{7}{74+28} = .725$

#9 H.W, Probability Distribution

① Discrete
② Continuous

In any Probability Distribution, there is a random variable X. In a Discrete Distrubution, the random variable can take on only finitly many values, and there is a probability associated with each value. In a continuous Distribution, the random variable can take on infinitly many values, we calculate the probability the random variable is in an interval.

ex: Discrete Distribution:

X	P(X)
0	1/4
1	2/4
2	1/4

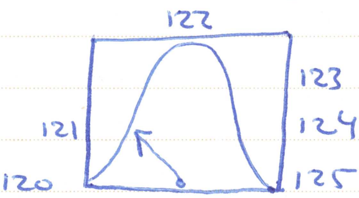
X = # of heads in 2 flips
X Could be 0, 1, or 2
[HH, HT, TH, TT] coin toss

Note: $\frac{1}{4} + \frac{2}{4} + \frac{1}{4} = \underline{1}$

ie $\sum P(X) = \underline{1}$

In continuous distrubution, the random varable X is measured on some kind of a dial typically.

Ex: X = reading on a volt meter at 2pm



X could be any of the infinitly meny #'s in the Interval [120, 125]

In a continuous Distrubution we don't calculate the probability that X takes on any particular value, but we calculate probability X is in an internal, such as

$P(121 < X < 124)$

One example of Discrete Distrubution, the binomial distrubution, and our example of a continuous distrubution the normal distrubution

In any discrete distrubution, the following 2 conditions must be met.

① $0 \leq P(x) \leq 1$ all probabilities must be between 0, 1

② $\underset{\text{sum}}{\Sigma} P(x) = 1$

Ex: Is this a Probability Distribution?

X	P(X)
2	.3
6	.4
9	.3

① $0 \leq P(x) \leq 1$ yes

② $.3 + .4 + .3 = 1$ yes

greenroom

Ex: Is this a Probability Distrubution?

X	P(X)
2	.2
4	.2
6	.2
8	.5

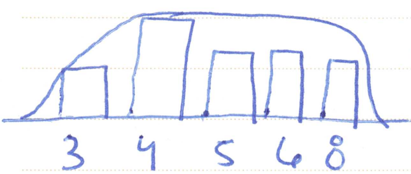
① $0 \leq P(X) \leq 1$ yes

② $.2 + .2 + .2 + .5 = 1.1$ No!

Binormial Distrubution

of heads out of 10 flips = 5 (class)

X = # of heads in 10 flips



Possible value for X:
0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Word Questions:

Find P (exactly 4 heads)

P (more than 5 heads)

P (at most 3 heads)

By an unskientific simulation we got,

P (exactly 4 heads)

$= \frac{6}{19} = .316$

Formula: P (exactly 4 heads in 10 flips)

= binomopdf (10, .5, 4)

caculator:

binompdf

trials: 10

p: .5

X value: 4

Past Enter .205

greenroom

Characteristics of a Binomial Probability Distribution

① There are n independent trials
(in our experiment there were 10 flips)

② For each trial, there are 2 possible outcomes, one is called "success", the other is called "failure".
(We call heads a "success" and tails a "failure")

③ for each trial the probability
$P(\text{Success}) = p$
$P(\text{failure}) = q = 1 - p$

$(P(\text{head}) = .5,\ P(\text{tail}) = .5)$

④ Random variable X = # of successes in n trials

(X = # of heads in 10 trials)

This whole set-up is an example of a discrete probability distrubution, w/ random varable X taking finitely many values, each w/ an associated probability.

In our exprement:

X	$P(X)$
0	
1	
2	
3	
4	
⋮	
10	$\sum P(X) = 1$

How can we find $P(X)$?
Answer on the calculator we will use: binompdf

n — # of trials
p — Probability of Success
X — # of success

Ex: A coin is flipped 10 times.
Find P(exactly 7 heads)

1. $N = 10$ # trials
2. $P = .5$ Prob. of Success
3. $X = 7$ # of success

$= \text{binompdf}(10, .5, 7) = .117$
2nd → DISTR → A: binompdf

greenroom

ex: P(maple leafs win) = .426
of 7 games, Find P(maple leafs win exactly 2)

n = 7 trials
p = .426 probability success
x = 2 # of actual success

P(maple leafs win 2 of 7)
binompdf(7, .426, 2) = .237

TRY: P(pearl in an oyster) = .163
of 8 oysters, Find P(exactly 3 pearls)

n = 8 trials
p = .163 prob success
x = 3 # success

= binompdf(8, .163, 3) = .099 = .100

ex: P(wilt makes free throw) = .51
of 5 free throws, Find P(wilt makes at most 2) →

X	P(X)
0	✓
1	✓
2	✓
3	0
4	0
5	+

n = 5 trials
p = .5 prob. success
X = 2 # success

At most = P(at most 2) = P(exactly 0) + P(exactly 1) + P(exactly 2)

binomcpdf(5, .51, 0) + binomcpdf(5, .51, 1) + binomcpdf(5, .51, 2) = .481

We can use a short cut!

binom$\underset{\downarrow}{c}$ pdf (n, p, X)

cumulative

n = # of trials
p = Probability of success
X = Adds probability of success from 0 up to X

P(at most 2) = binomcpdf (5, .51, 2 = .481

TRY! P(Leafs win) = .432 of 6 games, Find P(Leafs win at most 3)

X	P(X)
0	✓
1	✓
2	✓
3	✓
4	O
5	U
6	T

calculate!

2nd → DISTR → B: binomcdf

binomcdf(6, .432, 3)

= .774

Answer write on test

6-22-2017

Binomial Distrubution cont.

① P(exactly X successes in n trials)
= binompdf (n, p, X)

② P (at most X successes in trials)
= binom$\underline{c}$df (n,p, X)

③ Ex: If P(red pea in a pod) = .172
Find P(less than 2 red peas in 7 pods)
↓
means (P of "0" + P(1))

= binom$\underline{c}$df (7, .172, 1)

Ex: P(A's win) = .427

On a 6 game road trip, Find
P (A's win less than 4 games)
= binom$\underline{c}$df (6, .427, 3) = .781

5 Rules

1. P(exactly X seccesses) = binompdf (n, p, X)

2. P(at most X seccesses) = binom≤df (n, p, X)

3. P (less than X seccesses) = binom≤df (n, p, X−1)

4. P (more than X seccesses) = 1 − binom≤df (n, p, X)

5. P (at least X seccesses) = 1 − binom≤df (n, p, X−1)

one down

④ Ex: P(Wilt makes free throws) = .51
of 8 free throws, Find P(Wilt makes
more than 5)

6, 7, or 8 free throws

complement to 6, 7, or 8 is
0, 1, 2, 3, 4, 5 ⇒ binom≤df (8, .51, 5)

By rule of complements
P(Wilt makes more than 5)
= 1 − (wilt makes 0, 1, 2, 3, 4, 5)
= 1 − binom≤df (8, .51, 5) = .158

Ex: P(pearl in oyster) = .422
of 11 oysters, Find P(more than 3 people)

Complement 1, 2, 3

= 1 − binom≤df(11, .422, 3) = .753
calculator

TRY: P(Shaq makes) = .527 of 7
free throws. Find P(Shaq makes more than 5)

1 − binom≤df(7, .527, 5)

Ex: P(Leafs win) = .431 of 7 games.
Find P(Leafs win at Least 2)

That means win 2, 3, 4, 5, 6, 7

complement win 0, 1

Rule of Complements:
P(Win at Least $\boxed{2}$) = 1 − P(win 0, 1)
= 1 − binom≤df (7, .431, $\boxed{1}$) = .878
one down

Ex: P(Stef makes) = .91 of 10 free throws. Find P(Stef makes at least $\boxed{8}$)

= 1 - binomcdf(10, .91, $\boxed{7}$) = .946

↓

one less

6.26.17

H.W Help #10 Finish

Ex: An airplane that 94% of people who buy a ticket actually show up. If an airline sells 25 tickets with 23 seats, find the probability (not enough seats)

= P (more than 23 successes)

= 1- binomcdf (25, .94, 23) = .553

Ex: (acceptance sampling) In a large batch of aspirin P(good one) = .994. A batch is accepted if among 6 asprin, there is at most 1 bad. Find P(batch accepted)

Bad one is success, so P(success = 1-.994 = .006
Rule of complements:

P (at most 1 success) = binomcdf (6, .006, 1) = .999

TRY: A batch is accepted if among 15 tires there are at most 2 bad. Find P(batch accepted)

n=15, P=.007, X=2 | (15, .007, 2) = .999
binomcdf

Binomial Distrubution H.W 11

A random veriable X that has the binomial distrubution, has a mean, (expected value) μ = mean and a standard deviation σ = sigma

$\mu = np$ = (# of trials) • (probability of success)

$\sigma = \sqrt{npq}$ $\quad q = 1-p$

Range of usual value (rouv)
$= [\mu - 2\sigma, \mu + 2\sigma]$

ex: X = # of heads in 10 flips, Find μ, σ, rouv

$\mu = np = 10(.5) = \underline{5}$
$\sigma = \sqrt{npq} = \sqrt{10(.5)(.5)} = 1.5 \rightarrow \boxed{1.6}$

rouv $= [\mu - 2\sigma, \mu + 2\sigma]$
$= [5 - 2(1.6), 5 + 2(1.6)]$
$= [\boxed{1.8}, \boxed{8.2}]$

2

greenroom®

H.W 11 Distrubution

Ex: P(Giants win) = .423 of 162 games.

Find μ, σ, rouv

$\mu = np = 162(.423) = 68.5$

$\sigma = \sqrt{npq} = \sqrt{162(.423)(.577)} = 6.3$

$\phantom{\sigma = \sqrt{npq} = \sqrt{}}$ n $\quad$ p $\quad$ q

rouv = $[\underbrace{68.5 - 2(6.3)}_{55.9}, \underbrace{68.5 + 2(6.3)}_{81.1}]$

TRY: P(Pearl in oyster) = .241 of 18 oysters. Find μ, σ, rouv

$\mu = np = 18(.241) = 4.3$

$\sigma = \sqrt{18(.241)(.759)} = 1.8$

1-.241

rouv = $\underbrace{4.3 - 2(1.8)}_{.7}, \underbrace{4.3 + 2(1.8)}_{7.9}$

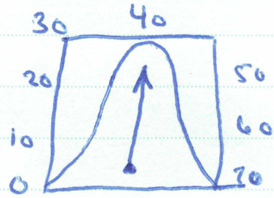
$\mu = np = 18(.241) = 4.3$ $\qquad \boxed{1.8}$

$\sigma = \sqrt{npq} = \sqrt{np(1-p)} = \sqrt{18(.241)(.759)}$

greenroom®

Continuous Probability Distribution

Ex: The reading on the speedometer of my old '66 Dart



X = any # between "0" and 70
could be 55, $\sqrt{7}$ any real # between 0 and 70. Infinitely many possibilities.

recall: Discreet X we had a table:

X	P(X)
1	.4
2	.2
3	.4
	1

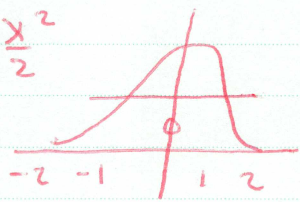
$\Sigma P(X) = 1$

For a continuous random variable we don't speak about the probability it takes on any particular value, we speak of the probability that it is inside some interval.

Instead of the table of X and P(X) we have a "probability distribution function" (pdf) and probabilities are calculated as geometric areas bounded by the probability distribution function.

Although there are many diffrent probability distrubution function, we will focus on the standard normal distrubution Function.

$$F(X) = \frac{1}{\sqrt{2\pi}} e^{-\frac{X^2}{2}}$$



Graph comment: Graph has the X-axis as a horizontal asymetric in both directions.

Graph is symmetric w/respect to y-axis

and: If X is standard ~~norml~~ normal random variable, we calculate probabilities associated w/X as geometric area under the standard normal distrubution function.

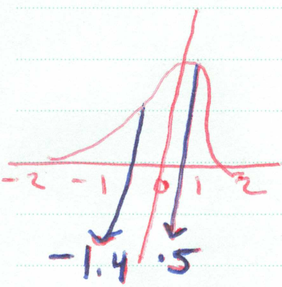
Ex: If X is a standard normal,
Find $(0 < X < 1)$

upper x boundary

normal cdf $(0, 1, 0, 1) = .341$

lower "X" boundary
mean
std. dev.

Ex: X is a Standard normal
Find $P(-1.4 < X < .5) =$ normal cdf $(-1.4, .5, 0, 1)$
$= .611$



greenroom®

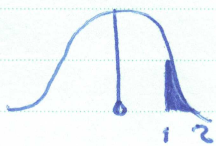
6.27.2017

Standard Normal Distribution

1. Normalcdf (low X, high X, μ, σ)
2. Percentiles
3. Critical z-value

Ex: X is std. normal. $\boxed{\text{Calculator}}$

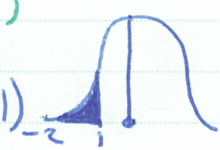
Find $P(1 < X < 2)$ = normalcdf (1, 2, 0, 1) = .136



Ex: X is a standard normal

$P(-2 < X < -1.5)$

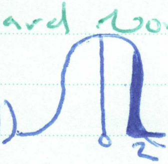
normalcdf (-2, -1.5, 0, 1) = .044



Ex: X is a standard normal

$P(X > 2)$

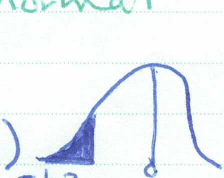
normalcdf (2, 999, 0, 1) = .023



Ex: X is standard normal

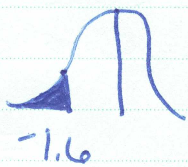
$P(X < -1.3)$

normalcdf (-999..., -1.3, 0, 1) = .097



TRY: X is Std. Normal

Find $P(X > -1.6)$



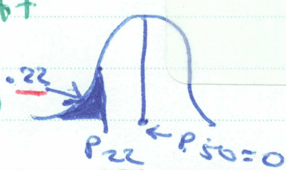
normalcdf(-1.6, -999, 0, 1)

= .945

So far, I've given you the X-boundary values, you find the probability as an area.

Probabilities P_{22} = value along X-axis with .22 area to its left

0 (has ½ the area to its left)

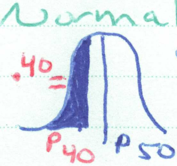


$\boxed{\text{Calculator}}$ P_{22} = invNorm(.22, 0, 1) = -.77

area ← .22, μ ← 0, σ ← 1

Ex: X stand. Normal

Find P_{40}

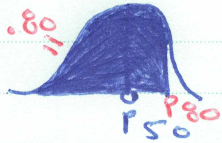


invNorm(.4, 0, 1)

= -.25

Ex: X is Stand. Normal

Find P_{80} .80

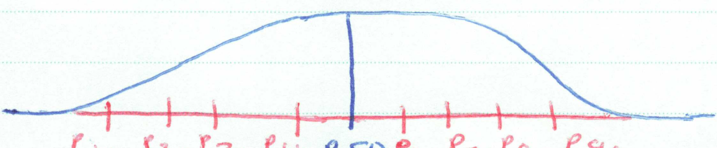


InvNorm(.8, 0, 1) = .84

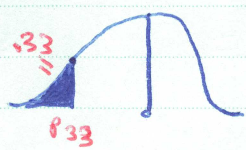
If the percentile is less than 50 ⇒
X-value on negitive side, the smaller the percentile the more negitive it is.

If the percentile is greater than 50 ⇒
X-value is on positive side, larger the percentile the more positive it is.

If percentile = 50 ⇒ X = 0 (for stand. normal)

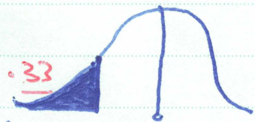


Ex: Find P_{33} .33



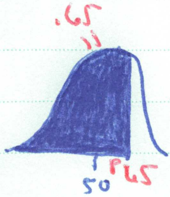
InvNorm(33, 0, 1) = .44

Turn it around: If X is Stad. Normal
Find $P(X < -.44)$



$-.44$ = normalcdf$(-999..., -.44, 0, 1)$
$= \underline{.33}$

TRY: Find P_{65}



InvNorm(.65,0,1)
$= .39$

Area to Right, Critical Z-value

Z_α = Z-value w/ area = α to its ® →
alpha

Why are we calling this a Z-value when it's relating to the Stand. Normal distrabution w/ $\mu = 0$ $\sigma = 1$

recall! $z = \frac{X \bar{X}}{s}$ sample data

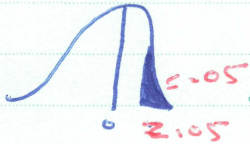
$z = \frac{X - \mu}{\sigma}$ population data

$z = \frac{X - 0}{1} = X$ for Standard Normal

So if X is a Standard Normal, X = Z, for Critical Z-values, we're still talking about the same old Standard Normal X.

Z_α = Z-value w/ area α to its Right → and typically α is a small value like .05 or .07...

Ex: Find $Z_{.05}$



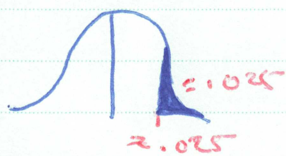
If .05 is area to Right than 1−.05 is area to the Left, and that's what we need for InvNorm

$Z_{.05}$ = Invnorm (1−.05, 0, 1) = 1.64

no comma

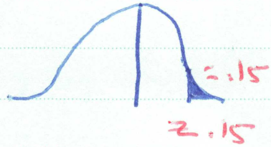
ie. $\boxed{\text{FLIP}}$ Normalcdf (1.64, 999..., 0, 1) = .05

Ex: Find $Z_{.025}$



InvNorm (1−.025, 0, 1) = 1.96

TRY: Find $Z_{.15}$



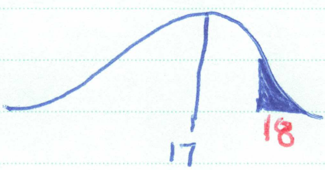
InvNorm (1−.15, 0, 1) = 1.04

no Comma

greenroom®

Next item: X will be a normally distributed random variable (not standard normal)

If hight of a giraffes X is normally distributed with $\mu = 17$ ft., std def. $= 2.4$ ft. Find probability a randomly selected giraffe is taller than 18ft.



normalcdf(18, 999..., 17, 2.4)
$= .338$

6·28·17

Normal Distrabutions

1. Standard Normal ($m=0, \sigma=1$)
   a. normalcdf
   b. percentsal] invnorm
   c. Critical z-value]

2. Any normal Distribution
   a. normalcdf
   b. Invnorm

3. Central Limit Theorum

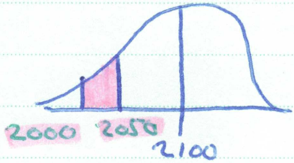
Ex: Weight of elephants X is normal distributed mean = 2100 lbs., std. dev. = 125 lbs. If an elephant is randomly selected,
Find P(2000 < X < 2050)

normal cdf

Formula: std. normal

$$f(x) = \frac{1}{\sqrt{2\pi}} e^{-\frac{x^2}{2}}$$

in general: $f(X) = \frac{1}{\sqrt{2\pi}} e^{-\frac{(x-m)^2}{2\sigma}}$



$P(2000 < X < 2050)$

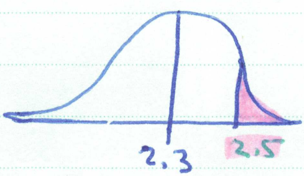
$= \text{normalcdf}(2000, 2050, 2100, 125)$

low high μ σ

$= .133$

Ex: The height X of raccoons is normally distrubution

$\mu = 2.3$ ft.
$\sigma = .27$ ft.



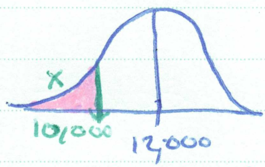
Find $P(X > 2.5)$

$= \text{normalcdf}(2.5, 999\ldots, 2.3, .27) = .229$

low high μ σ

Ex: The weight of planets X
is normally distributed with
mean = 12,000 whatever std dev. 1,500

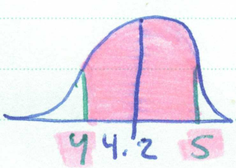
Find: P(X < 10,000) less = neg.



normalcdf (-999..., 10,000, 12,000, 1,500)
= .091 ↑ less

TRY: The hight of porcupines X
is normally distributed
μ = 4.2 ft
σ = .8 ft Find P(4 < X < 5)

normalcdf (4, 5, 4.2, 8) = .440



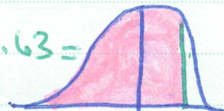
Ex! A standardized test score is normally distributed with

$\mu = 100$

$\sigma = 15$

Congrats! Your child was in the 63^{rd} percentile (P_{63}) What was the score?

.63 =



100 $P_{.63}$ = invnorm(.63, 100, 15) = 105.0

area to left ←, mean, std. dev.

P = left, Z = Right

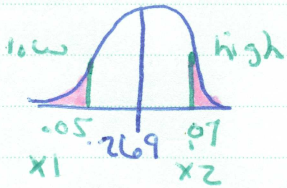
Ex: Length of pregnancy is normally distributed

μ = 269 days

σ = 6 days

A hospital has to give special care for babies in the lowest 5% and highest 7% of this distribution.

Find the cutoff point. →



low

$X1 = invnorm(.05, 269, 6)$
$= 259.1$

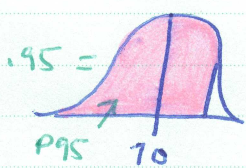
high

$X2 = invnorm(1 - .07, 269, 6)$
$= 277.9$

Flip side area to (L)

Ex: Men's hights are normally distributed with $\mu = 70$ in.
$\sigma = 5$ in

An airline, it's entrence hight to admit 95% of men w/o hitting their heads. How high shold it be?

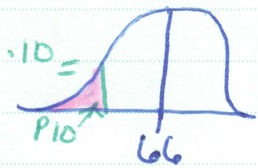


$= invnorm(.95, 70, 5) = 78.2$

TRY! Woman's hights are normally distributed $\mu = 66$ in
$\sigma = 3.5$ in

The army will not accept recruits in the lowest 10% of all women's hights.

What's the minumum hight for a female recruit?



invnorm(.10, 66, 3.5) = 61.5

6.28.17

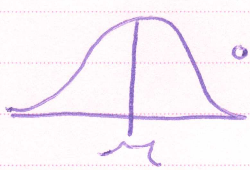
The Central Limit Theorem

If a population is normally distributed w/ mean $= \mu$, std dev. $= \sigma$ and sample of size n are randomly selected, and the mean of each sample is computed, then:

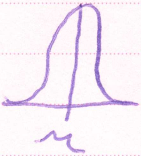
① the mean of the sample means denoted $\mu_{\bar{x}} = \mu$ (equals the population mean)

② The standard deviation of the sample means, denoted $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$ (population dev. devided)

If $n > 30$, the original population need not be normally distribution theorem to be true.



original population (at uvc)



Less dispersed, this population (of classes) (smaller std. dev.)

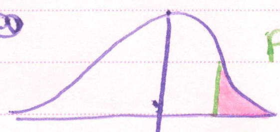
greenroom®

Ex! NVC students ages are normally distributed w/ mean = 22, $\sigma = 5$

ⓐ Find $P(X > 28)$

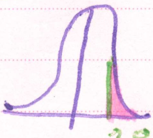
ⓑ If sample of size 30 are selected, Find probability mean age of a sample is > 28

ⓐ



$P(X > 28) =$ normalcdf
$(28, 999\ldots, 22.5, 5)$
$= .115$

ⓑ



normalcdf $= (28, 999\ldots, 22, 5/\sqrt{30})$
$= 2.48 \times 10^{11}$
$= .00000000000248$

ie. The ~~chang~~ chance of an "outlier" in ways less for the sample means than it is for the individuals in the original population.

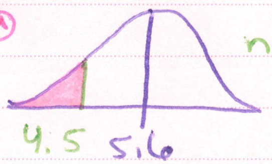
②

Ex: Hight of alians is normally distributed w/ $\mu = 5.6$ ft
$\sigma = 1.2$ ft

ⓐ If a single alian is selected
Find P(less than 4.5 ft)

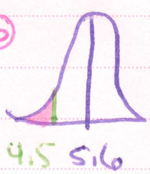
ⓑ If a sample of 43 alians is selected,
Find P(mean hight < 4.5 ft)

ⓐ



normalcdf(−999, 4.5, 5.6, 1.2)
= .180

ⓑ



normalcdf(−999, 4.5, 5.6, $1.2/\sqrt{43}$)
$= 9.2 \times 10^{-10}$
= .00000000092

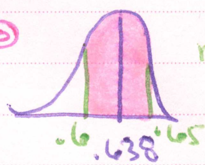
Ex: (sample means more centrally located) weight of gnats is normally distributed $\mu = .638$
$\sigma = .027$

ⓐ If a single gnate is selected, Find P(it's weight is between .6 & .65)

ⓑ If sample of 28 gnates is selected Find P(mean is between .6 and .65)

ⓐ


normalcdf(.6, .65, 638, .027)
= .592

ⓑ


normalcdf(.6, .65, .638, $.027/\sqrt{28}$)
= .991

7.4.2017

Inferential Statistics HW. 15

① Confidance Intervals (CI)

② Hypothesis Testing

CI

① Population proportions

② Population mean, σ known

③ Population mean, σ unknown

In a sample of 29 people 11 believe in ghosts construct a 95% CI containing the population proportion of people who believe in ghosts.

$\hat{p}$ = sample proportion

p = population proportion

$$\hat{p} = \frac{11}{29} = .379$$

Sample proportion $\hat{p}$ is the best "point estimate" for p, the population proportion.

We will construct a CI, using $\hat{p}$ as its center, of the form $(\hat{p} - E, \hat{p} + E)$ where E = margin of error that actual p is inside the CI.

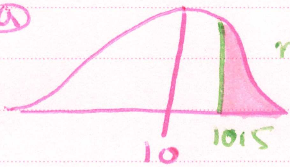
TRY: Weight of cats is normally distributed $\mu = 10$ lbs

$\sigma = 1.3$ lbs

ⓐ If a cat is selected, Find P(weights more than 10.5 lbs)

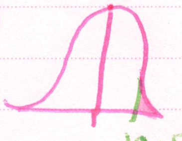
ⓑ If a sample of 22 cats is selected, P(mean weight more than 10.5)

ⓐ



normalcdf(10.5, 999, 10, 1.3)
$= .350$

ⓑ



normalcdf(10.5, 999, 10, $1.3/\sqrt{22}$
$= .036$

statistics

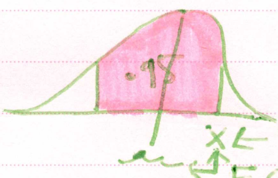
Theory behind CI

Samples of size n are normally distributed w/ mean = population ~~mean~~

$\updownarrow$

σ = standard deviation

These will vary depending on what kind of CI.



$\bar{x}$ ← where is this?

E (error) = $\bar{x} - \mu$

$$Z = \frac{X - \bar{X}}{S}$$ (sample data)

$$= \frac{X - \mu}{\sigma}$$ (population)

$$Z = \frac{E}{\sigma}$$ ($E = X - \mu$)

$$E = Z\sigma$$

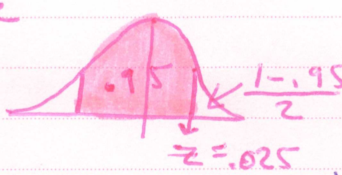
The error is equal to the appropriate z-value times the appropriate standard deviation. The appropriate z-value depends on what % CI you are constructing; and appropriate std. dev. depends on what kind of CI you are constructing (population proportion or population mean)

For population proportion, the appropriate formula for std. dev.

$$\sqrt{\frac{\hat{p}\,\hat{q}}{n}}$$

$\hat{p}$ = sample proportion
$\hat{q} = 1 - \hat{p}$
n = sample size

For a 95% CI, the appropriate z-value



calculator = .025

= InvNorm (1 - .025, 0, 1)
= 1.96

Ex: Construct 95% CI containing population proportion if 11 of 29 people believe in ghosts.

① $\hat{p} = \frac{11}{29}$ calculate $= .379$

② $\hat{q} = 1 - \hat{p} = 1 - .379 = .621$

③ $n = 29$

④ z:

$.025 =$ invnorm(1.025, 0, 1)
$= 1.96$

⑤ $E = z\sqrt{\frac{\hat{p}\hat{q}}{n}} = 1.96\sqrt{\frac{.379(.621)}{29}} = \boxed{.177}$

* $1.96 * \sqrt{(\boxed{.379} * .621)/29} = \boxed{.177}$ ← calculator

⑥ $(CI = \hat{p} - E, \hat{p} + E)$

$= (.379 - .177,\ .379 + .177)$ three decimal
$= \boxed{.202}$, $\boxed{.556}$

④

✓ on Calculator

Stat → test

↓

A 1-Prop Z-Int

x: 11

n: 29

C-level: .95

$\boxed{\text{Calculate}}$

(.20271, .55591)

$\hat{p} = .3793...$

n = 29

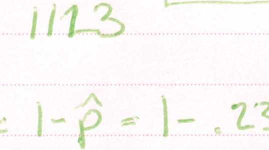
Ex: Construct a 96% CI containing population proportion of 262 of 1123 people have seen a UFO.

① $\hat{p} = \frac{262}{1123} = \boxed{.233}$ ← sample portion

② $\hat{q} = 1 - \hat{p} = 1 - .233 = \boxed{.767}$

③ $n = 1123$

④ $z =$



$\frac{1 - .96}{2} = .02$

$z = .02 = \text{invnorm}(1 - .02, 0, 1)$

$\boxed{= 2.05}$

⑤

⑤ $E = z\sqrt{\frac{\hat{p}\hat{q}}{n}} = 2.05\sqrt{\frac{.233(.767)}{1123}} = \boxed{.026}$

2.05 * √ .233 * 767/1123 = .026 calculator

⑥ $CI = (\hat{p} - E, \hat{p} + E)$

$= (.233 - .026, \; 233 + .026)$

$\boxed{.207} \qquad \boxed{.259}$

✓ STAT → TEST

↓

1prop ZInt:

X: 226

n: 1123

C-Level .96

calculate

(.20738, 25922)

$\hat{p} = .233$

n = 1123

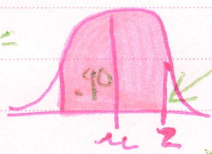
Ex: construct 90% CI for population proportion if 862 of 1477 people support prop # 216, 172

① $\hat{p} = \frac{862}{1477} = \boxed{.584}$

② $\hat{q} = 1 - .584 = \boxed{.416}$

③ $n = 1477$

④ $z =$



$\frac{1-.9}{2} = .5$

$.05 = \text{invnorm}(1-.05, 0, 1) = 1.64$

⑤ $E = z\sqrt{\frac{\hat{p}\hat{q}}{n}}$

$= 1.64\sqrt{\frac{.584(.416)}{1477}} = .021$

⑥ $CI\ (\hat{p} - E, \hat{p} + E)$

$= (\underbrace{.584 - .021}_{\boxed{.563}}, \underbrace{.584 + .021}_{\boxed{.605}})$

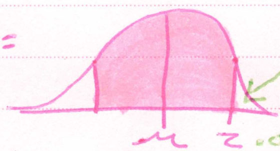
TRY: Construct 98% CI if 462 of 1135 have seen a USO.

① $\hat{p} = \frac{462}{1135} = .407$

② $\hat{q} = 1 - .407 = .539$

③ $n = 1135$

④ $z =$



$\frac{1-.98}{2} = .01$

$z_{.01} = \text{invnorm}(1-.01, 0, 1) = 2.326$

⑤ $E = z\sqrt{\frac{\hat{p}\,\hat{q}}{n}}$

$= 2.33\sqrt{\frac{.407(.539)}{1135}} = 0.034$

⑥ $.407 - .034 = .373$
$.407 + .034 = .441$ $\Big\rangle$ $(.373, .441)$

Ex: How many people should be surveyed to construct a 95% CI with error = 3% is p is estimated a .423

$$E = Z\sqrt{\frac{\hat{p}\hat{q}}{n}}$$

$$\frac{E}{Z} = \sqrt{\hat{p}\hat{q}}$$

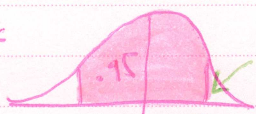
$$\frac{E^2}{Z^2} = \frac{\hat{p}\hat{q}}{n}$$

$$nE^2 = Z^2\hat{p}\hat{q}$$

$$n = Z^2\frac{\hat{p}\hat{q}}{E^2}$$

Formula: $n = Z^2\frac{\hat{p}\hat{q}}{E^2}$

$Z =$



$\frac{1-.95}{2} = .025$

$z_{.025}$ = invnorm(1-.025, 0, 1)
= 1.96

$\hat{p} = .423$, $\hat{q} = 1-\hat{p} = .577$, $E = .03$

greenroom®

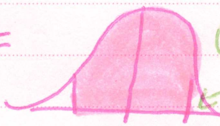
Formula: $n = \dfrac{(1.96)(.423)(.577)}{(.03)^2} = 10.42$

Round up no'12

If no estimate for $\hat{p}$ is given use
$\hat{p} = \hat{q} = .5$

ex: How many should be servyed to construct a 94% CI with error = 2%

$z =$



$\dfrac{(1-.94)}{2} = .03$

$z_{.03} = \text{invnorm}(1-.03, 0, 1) = 1.88$

$n = \dfrac{z^2 \hat{p}\hat{q}}{E^2} = \dfrac{1.88^2(.5)(.5)}{.02^2} = \boxed{2209}$

7.5.2017

CI cont.

① proportions

* ② population means (σ known)

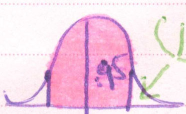
③ population means (σ unknown)

Ex! Construct 95% CI containing the population mean hight of giraffes is a sample of 41 giraffes has mean hight = 17.2 ft. and the population std. dev. for all giraffes is 1.7 ft.

$$CI: (\bar{X} - E, \bar{X} + E)$$

$$E = z \cdot \frac{\sigma}{\sqrt{n}}$$

$\bar{X} = 17.2 \quad n = 41 \quad \sigma = 1.7 \quad z = \downarrow$



$$\frac{(1-.95)}{2} = .025$$

$$z_{.025} = \text{invnorm}(1-.025, 0, 1) = 1.96$$

$$E = z \cdot \frac{\sigma}{\sqrt{n}} = 1.96 * 1.7/\sqrt{(41)} \leftarrow \text{calculator}$$

$$= 1.96 \cdot \frac{1.7}{\sqrt{41}} = .52$$

→

CI: $\bar{X} - E, \bar{X} + E = 17.2 - .52 = 16.68$

$17.2 + .52 = 17.72$

Calculator: STAT → TEST

↓

ZInterval → $\boxed{\text{stats}}$

σ: 1.7

$\bar{X}$: 17.2

C-level = .95

$\boxed{\text{calculate}}$

(16.68, 17.72)

$\bar{X} = 17.2$

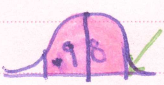
$n = 41$

Ex: Constructs 98% CI containing the mean number of choco. chips in a cookie if a sample of 33 cookies has $\overline{x} = 20.6$ and population std. dev. for all cookies is 5.3.

$$CI = \overline{X} - E, \overline{X} + E$$

$$E = Z \frac{\sigma}{\sqrt{n}}$$

$\overline{X} = 20.6$ $\sigma = 5.3$ $n = 33$ $Z = $ ↓



$$\frac{(1-.98)}{2} = .01$$

$z_{.01} = \text{invnorm}(1-.01, 0, 1) = 2.33$

$$E = Z \cdot \frac{\sigma}{\sqrt{n}} \quad 2.33 * 5.3/\sqrt{(33)}$$

$$2.33 \cdot \frac{5.3}{\sqrt{33}} = 2.15$$

$CI = \overline{X} - E, \overline{X} + E$ $20.6 - 2.15 = 18.45$

$20.6 + 2.15 = 22.17$

stat → test ↓

Zinval → $\boxed{\text{STATS}}$ ... $\boxed{\text{Calculate}}$

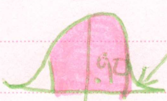
$\sigma = 5.3$ $\overline{X}$ 20.6 n 33 C-level ...

(18.454, 22.746) $\overline{X}$ 20.6 n 33

greenroom®

TRY: Construct 90% CI containing population mean weight of gnats if a sample of 52 gnats has $\overline{x} = .265$ and population std. dev. for weight of all gnats is .053

$\overline{x}$ .265 σ .053 n 52 z ↓



$\frac{(1-.90)}{2} = .05$

μ $z_{.05}$ = invnorm(1 - .05, 0, 1) = 1.65

$E = 1.64 \frac{(.053)}{\sqrt{52}} = .012$

.265 − .012 = .253
.265 + .012 = .277

* recopy notes

wrong answer

Formula

$$E = \frac{z\sigma}{\sqrt{n}}$$

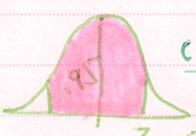
$$E\sqrt{n} = z\sigma$$

$$\sqrt{\ } = \frac{z\sigma}{E}$$

$$n = \frac{z^2\sigma^2}{E^2} = \left(\frac{z\sigma}{E}\right)^2$$

Ex: How many elephants should be weighed to construct a 95% CI with E = 40 lbs and the population std. dev. for all elephants is 150 lbs.

$$n = \frac{z^2\sigma^2}{E^2}$$

Z: 

$\frac{(1-.95)}{2}$

$z_{.025} = \text{invnorm}(1-.025, 0, 1) = \cancel{1.88}\ 1.96$

$$n: \frac{1.88^2(.25)^2}{(.05)^2}$$

[1.88^2*.25^2/.05^2 $= \boxed{89}$]

roundup - no 1/2

σ Unknown

Ex! Construct 95% CI containing mean hight of alians if a sample of 41 alians has mean hight = 5.2 ft std. dev. = .43 ft

Recall: Before $E = z \frac{\sigma}{\sqrt{n}}$

"Student distrubution"

$2^{nd} \rightarrow$ Distr
↓ tpdf

greenroom®

CI, means → σ unknown

When σ is not given, the sample std. dev. is given, and instead of using a Z-value, we will use a T-value and the formula for error

$E = \frac{ts}{\sqrt{n}}$ (compare to $E = z \cdot \frac{\sigma}{\sqrt{n}}$)

Student t-distrubution

A family of distrubution on "degree of freedom" df = n−1 (always one less than sample size)

On calculator:
InvT (area to the left, df, degree freedom)

Ex: Construct 95% CI containing population mean weight of raccoons if a sample of 26 raccoons has a mean weight = 14.6 lbs std dev = 1.3 lbs

CI $(\bar{X} - E, \bar{X} + E)$

$E = \frac{ts}{\sqrt{n}}$ $\bar{x}$ 14.6 S 1.3 n 26

→

$t =$ 

$\frac{1-.95}{2} = .025$

$t_{.025}$ $\text{invT}(1-.025, 25) = 2.060$

Dist → invT

$df = n-1,\ n = 26$

$$\frac{ts}{\sqrt{n}} = \frac{(2.06)(1.3)}{\sqrt{26}} = .53$$

* 2.06*1.3/√(26)

$CI = \bar{X} - E, \bar{X} + E$

$(14.6 - .53, 14.6 + .53)$

14.07 15.13

Ex: Construct 98% CI containing mean weight of cream-filling in Twinkies is a sample of 29 Twinkies has cream filling with mean weight = .83

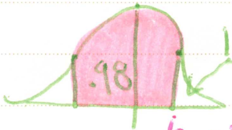
std dev = .06

$CI\ (\bar{X} - E, \bar{X} + E)$

$E = \frac{ts}{\sqrt{n}}$

X	.83
S	.06
n	29

$t =$



$\frac{1-.98}{2} = .01$

$t_{.01} = \text{invT}(1-.01, 28)$ 2.467

$$E = \frac{tS}{\sqrt{n}} = \frac{(2.467)(.06)}{\sqrt{29}} = .027$$

$$\bar{X} - E, \bar{X} + E$$

$(.83 - .027, .83 + .027)$

.803 .857

✓ STAT → TEST → Tintrval → Stats

(.802..., .857)

$\bar{X} = .83$

$Sx = .06$

$n = 29$

7-10-17

Hypothisis Testing

1. Proportion
2. mean
   - σ Known
   - σ Unknown

3. 2 proportions
4. 2 Independent means
5. 2 dependent means (matching pairs)
6. Corrlation regression

Steps of Hypothesis Testing

- Set it up
- Calculator for proper test
- Interpreat results

11 of 36 have seen a U.F.O

ex: With $\alpha = .05$, test the claim more than .25% of all people have seen a U.F.O if 11 of 36 have seen a U.F.O.

① Set-up

Claim $P > .25$ P·(population proportion)

opposite of Claim: $P \leq .25$

null Hypothesis

↓

H_0: $P = .25$ (not from origanal claim because origanal claim has no = sign)

alternate hypothesis

↓

H_1: $P > .25$ (one of the claim or its opposite that does not contain = sign)

↓

Right-tail test

② Calculator - 1prop z test

STATS → TESTS

↓

1 prop z test

P_0: .25 (p-value from H_0)

X: 11

n: 36

prop: $\neq p_0$ $< p_0$ $\boxed{> p_0}$ enter

match form of H_1

Draw

②

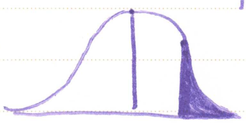
greenroom

1prop z test

Set-up

HW 15

Interpertation

3 

$z = .1698$ $\boxed{P = .2207}$ → ALL impotant "p-value"

↓

test statistic, used in "critical reason"

The "P-value" is probability of obtaining sample data at least as ~~extreem~~ extreme as the given sample data if H_0 is actually true.

If the "P-value" is really low, then the probability of obtaining the sample data assuming H_0 is true is very low, makes ~~up~~ us think about saying H_0 is not true, "reject H_0"

$\alpha = .05$ (α is called the "significance of the test") is the cut-off for rejecting H_0.

If $P < \alpha$ => reject H_0 if P is not $< \alpha$ = fail to reject H_0 in our example p=.2207 since .2207 not less than .05 =>

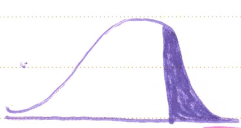
① Fail to reject H_0

② H_0 not from original claim
(from set-up) from chart
"not sufficient evidence to support claim"

ex! With $\alpha = .05$, test claim
at most 40% of people support
X if 395 of 947 support X.

Claim $p \leq .4$
opp $p > .4$
H_0 $p = .4$ (from original claim)
H_1 $p > .4$ (right-tail)

Calculate → 1prop z test



$z = 1.0746$ $\boxed{P = .1413}$

Hand out: not sufficient evidence
to ~~support~~ reject claim...

Since "P" is not less than $\alpha \Rightarrow$ fail to
reject H_0, H_0 from original claim

HW 16

Hypothesis Testing Algorithm

① Set-up

(A) Claim (B) opposite (C) H_0 (D) H_1

② Calculator

STAT → TEST (appropriate test)

↓

Enter data → Draw picture

③ Interpretation

ⓐ If $p < \alpha \Rightarrow$ reject H_0 if not, fail to reject H_0

ⓑ Write conclution from chart

Ex →

H.W #17, Book 409/17

Ex: With $\alpha = .05$, test claim Less than 33% of tennis challenges are successful if 172 of 611 are successful.

claim $p < .33$

opp $p \geq .33$

H_0 $p = .33$ (not organal)

H_1 $p < .33$ (Left-tail test)

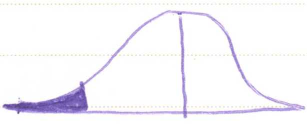
$\boxed{\text{Calculate}}$ 1Prop z test

p_0 .33

X 172

n 611

prop $< p_0$ enter → Draw



z -2.5493 P= .0054

Since $p < \alpha \Rightarrow$ reject H_0 not organal

$\Rightarrow$ data support claim ...

Ex: With $\alpha = .05$ test claim proportion who thought they voted for winning candidate is .43 if 308 out of 611 thought so.

Claim $p = .43$ opp $p \neq .43$ H_0 $p = .43$

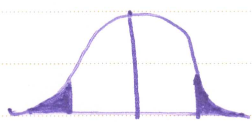
H_1 $p \neq .43$ 2-tail

From org.

1 prop test

p_0 .43 X 308 n 611 prop $\neq p_0$

Enter $\boxed{\text{Draw}}$



z 3.6993 $p = 2E-4$

$= 2 \times 10^{-4}$

$= .0002$

$P < \alpha \Rightarrow$ reject H_0 orginal $\Rightarrow$

suggificent data to reject claim...

TRY: Proportion who have been abducted by aliens is less than 5% if 27 out of 962 claim to have been abducted.

with $\alpha = .05$ test claim

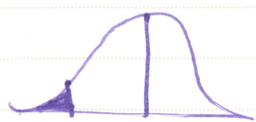
claim $.05 > p$

opp $p \geq .05$

Ho $p = .05$ not org

H_1 $p < .05$ left

1 prop Z test



$p = 9E^{-4}$

$p = 9 \times 10^{-4}$

$p = < \alpha \Rightarrow$ reject Ho, not org.

$\Rightarrow$ Data support claim

6-11-17

Hypothesis Test cont.

H.W 18

mean
- σ known (z-thing)
- σ unknown (t-thing)

use proper notation on test

If the population standard dev is given => use z-test

If sample dev is given => use T-test
Use μ instead of P when setting up the test

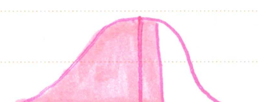
ex: with $\alpha = .05$ test the claim mean ft. of giraffes is at least 17ft. if a sample of 41 giraffes has mean ft = 17.55 ft and std dev = 1.3 ft.

μ → population mean
P → population proportion

population mean

$\boxed{\text{T-Test}}$ STAT → TEST → TTest → $\boxed{\text{Stats}}$

μ_0	17.5
$\bar{x}$	17.55
Sx	1.3
n	41
μ	$< \mu_0$



$t = .2463$

$\boxed{P = .5966}$

1

P not less than α =>
fail to reject Ho from org. claim
not sufficent evidence to reject claim...

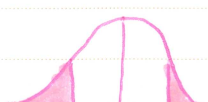
Book: 421/13 Ex!

With $\alpha = .05$ test the claim the mean weight of mm's <u>IS</u> .8535g. if a sample of 19 mm's mean weight = .8635 and std. dev for weight for <u>ALL</u> mm's is .057g.

claim $\mu = .8535$
opp $\mu \neq .8535$
H_0 $\mu = .8535$ (org. claim)
H_1 $\mu \neq .8535$

$\boxed{\text{Calculator}}$ z-test: STAT → TEST
↓
Z-TEST
↓
$\boxed{\text{Draw}}$

μ_0 .8535
σ .057
$\bar{x}$ .8635
n 19
$\mu \neq \mu_0$

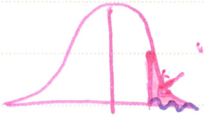


z=.7647 $\boxed{P=.4444}$

P is not less than α, fail to reject Ho from org. => not suff. evidence to reject claim...

Critical Region Mathod:

Suppose $\alpha = .05$ for a right-tail test.



.05

critical region

$z_{.05}$ "critical z value"

Calculate "test statistic" if the test statistic is in critical region => reject H_0.
If the test statistic NOT in critical ~~region~~ region => fail to reject H_0

Ex: Book 420/9

with $\alpha = .05$ test claim chips ahoy lowfat cookies has less than 24 chips if a sample of 40 has mean = 19.6 chips std. dev. = 3.8 chips

claim $\mu < 24$

opp $\mu \geq 24$ notorg.

H_0 $\mu = 24$

H_1 $\mu < 24$ left tail →

greenroom

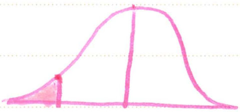
T-test

Stat → test

↓

T-test → Stat

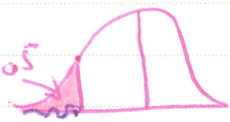
μ_0	24
$\bar{x}$	19.6
Sx	3.8
n	40
μ	< 0



T-Test: $t = -7.3232$, $\boxed{P=0}$

P is less than α => reject H_0 not org.
=> data support claim

.05



$t = \text{invT}(.05, 39) = -1.68$

↑ 1 less

critical region -1.68

TRY: With $\alpha = .05$ test claim mean weight of elephants is less than 2000 lbs if a sample of 28 elephants has mean weight = 1975 lbs and std dev for the weight of **ALL** elephants is 110.

Claim: $\mu < 2000$ lbs

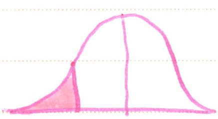
opp: $\mu \geq 2000$ not org.

H_0: $\mu = 2000$

H_1 $\mu < 2000$ left

$\boxed{\text{Calculate}}$ <u>Z-Test</u> "sample <u>ALL</u> Elephants"

population std. dev.



$z = -1.206$

$p = .1146$

since P-value is <u>not</u> less than α it fails, H0 is not from orignal. Evidence <u>not</u> suff. to support claim.

$\boxed{\text{On Final}}$ Claims about 2 proportions:

Ex: with $\alpha = .05$ test claim a higher proportion of women have X than men if 262 of 932 women have X, 273 of 1082 men have X

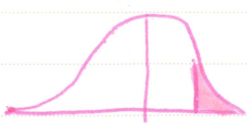
p_1 = woman
p_2 = men
Claim: $p_1 > p_2$
opp: $p_1 \leq p_2$
H_0: $p_1 = p_2$ not org.
H_1: $p_1 > p_2$ right tail

STAT → tests → 2prop z test

x_1 262
n_1 932

x_2 272
n_2 1082

$p1 > p2$ $\boxed{\text{Draw}}$



z=1.4717
P=.0105

P is not less than α, fail to reject Ho
not org.

⇒ not suff. evidence to support claim...

7-12-17

Hypothesis Testing cont.

2 proportions

Ex! With $\alpha = .05$ test the claim people support X and Y equally if 262 of 511 support X, 311 of 601 support Y

p_1 support X

p_2 support Y

Claim $p_2 = p_2$

opp $p_1 \neq p_2$

H_0 $p_1 = p_2$ org

H_1 $p_1 \neq p_2$ 2-tail

$\boxed{\text{2-Prop Z test}}$

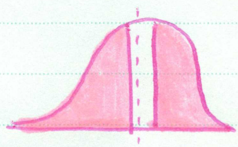
x1: 262

n1: 511

x2: 311

n2: 601

p1: $\neq p_2$



z= -158 P= .8745

P not less than α

=> Fail to reject H_0

=> Org. claim

=> not suff. evidance to reject claim

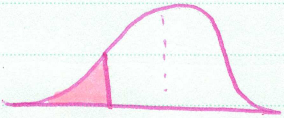
Ex! With $\alpha = .05$, test the claim fewer people have seen a U.S.O than U.F.O if 22% of 621 seen USO and 24% of 816 seen UFO

p_1 USO $621 \cdot .22 = 137$ round whole
p_2 UFO $816 \cdot .24 = 197$ round whole

$\boxed{\text{2 prop-z-test}}$

x_1: 137
n_1: 631
x_2: 196
n_2: 816
$< p2$ less than

claim $p_1 < p_2$
opp $p_1 > p_2$
H_0 $p1 = p2$ not org.
H_1 $p_1 < p2$ left



$z = -1.0344$ $P = .1505$

P not less than α
=> fail to reject H_0
=> not suff. data to support claim...

Book 450/8

Ex: with $\alpha = .01$ test claim ginkgo helps prevent dementia if of 1545 subjects given ginkgo had ~~dementia of~~ 246 developed dementia, had dementia of 1524 subjects given placebo, 277 developed dementia

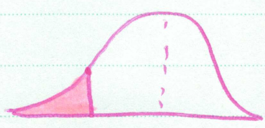
p_1 = given ginkgo
p_2 = given placebo

claim $p1 < p2$
opp $p1 \geq p2$
H_0 $p1 = p2$ not org
H_1 $p_1 < p2$ left

2 prop Z-test

x_1 246
n_1 1545
x_2 277
n_2 1524
$p1 < p2$

$\boxed{\text{Draw}}$



$z = -1.6601$ $p = .0484$

because $\alpha = .01$ (not the usual)
=> Fail to reject Ho
=> not org.
=> not suff. to support claim...

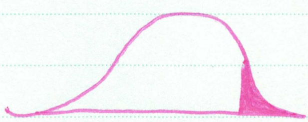
3

TRY: with $\alpha = .05$ test claim more people have X than Y if 362 of 521 have X, 185 of 288 have Y

claim $p_1 > p_2$
opp $p_1 < p_2$
H_0 $p_1 = p_2$ (not org)
H_1 $p_1 > p_2$ (right)

2-Prop test-Z

X1 362
n1 521
X2 185
n2 288
$p_1 > p_2$



p=.0634 more

H_0 not org claim
⇒ p is not less than α
⇒ Fail to reject H_0
⇒ There is not suff. evidence to support claim...

greenroom®

The Set-up (with .6 as #)

wording?	claim	opp	H_0	H_1
Less than	$p < .6$	$p \geq .6$	$p = .6$ ~~org.~~	$p < .6$ L
at most	$p \leq .6$	$p > .6$	$p = .6$ org.	$p > .6$ R
more than	$p > .6$	$p \leq .6$	$p = .6$ ~~org.~~	$p > .6$ R
at least	$p \geq .6$	$p < .6$	$p = .6$ org.	$p < .6$ L
"is" .6	$p = .6$	$p \neq .6$	$p = .6$ org.	$p \neq .6$ 2 tail

7.13.17

Hypothesis testing Cont. H.W 20

4 2 independent means

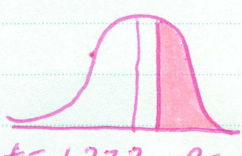
Ex. With $\alpha = .05$ Martians are taller than Venusians if a sample of 34 martians has $\bar{x} = 5.3$, $s = .6$
42 Venusians has $\bar{x} = 5.2$, $s = .8$

μ_1 = Martians
μ_2 = Venusians

Claim: $\mu_1 > \mu_2$
opp: $\mu_1 \leq \mu_2$
Ho: $\mu_1 = \mu_2$ orig.
H1: $\mu_1 > \mu_2$ R

STAT → test → 2-SampTTest

$\bar{X}1$: 5.3
Sx1: .6
n1: 34
$\bar{X}2$: 5.2
Sx2: .8
n2: 42
$\mu 1$: $> \mu 2$
↓
$\boxed{\text{Draw}}$



t=.6223 P=.2678

P not less than α
Fail to reject Ho
not original
not suff. data to support...

greenroom

9.3

Book 464/8

With $\alpha = .05$ test the claim, men speak less words per-day than women from following data:

	$\bar{X}$	S	n	
m	15668	8632	186	$\mu_1 \to$ men
w	16215	7301	210	$\mu_2 \to$ women

Claim: $\mu_1 < \mu_2$

opp: $\mu_1 \geq \mu_2$

H_0: $\mu_1 = \mu_2$ orig

H_1: $\mu_1 < \mu_2$ (L)

$\bar{X}$ 15668

SX_1 8632

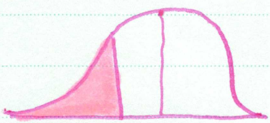
n_1 186

$\bar{X}_2$ 16215

SX_2 7301

n_2 210

$\mu < \mu_2$



t = .6762

p = .2497

P not less than α

Fail to reject

not from org. claim

not suff. data to support...

Book 464/11

TRY: With $\alpha = .05$ test claim skulls from 4000bc have same size as skulls from 150 ad if

n	$\bar{x}$	s	
30	131	5.1	$\mu_1 =$ 4000 bc
30	136	5.3	$\mu_2 =$ 150 Ad

Claim: $\mu_1 = \mu_2$

opp: $\mu_1 \neq \mu_2$

H_0: $\mu_1 = \mu_2$ org.

H_1: $\mu_1 \neq \mu_2$ 2-tail

$\bar{x}1$: 131 $\boxed{\text{Calculator}}$ 2-SampTTest

$Sx1$: 5.1

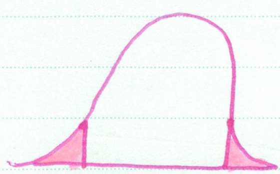
$n1$: 30

$\bar{x}2$: 136

$Sx2$: 5.3

$n2$: 30

μ: $\neq$



$t = 3.7233$

$P = 4E-4$

$\boxed{= 4 \times 10^{-4}}$

P is less than α

reject H_0 from original

there is suff. evidance to reject claim...

7-17-17

Hypothesis test Cont.

(3) Dependent means (match pairs)
(4) Correlation and regression

Book: Ex 461/1

Hight of the winner
189 173 183 180 179

Hight of the loser
170 185 175 180 179

List of data => matching pairs

with $\alpha = .05$ test claim winner is taller than the loser

μd = Mean difference between the first and second list

If the claim is that first list is bigger => claim: $\mu d > 0$. if the claim is that the second list is bigger => claim: $\mu d < 0$. if the claim is this list are equal => claim: $\mu d = 0$

Claim: $\mu d > 0$

opp: $\mu d \leq 0$

Ho: $\mu d = 0$ orig

H₁: $\mu d > 0$ (R)

① STAT → ClrList $\underbrace{L_1, L_2, L_3}_{2nd}$

② L_1 enter first list

L_2 enter second list

STAT → Edit → $\boxed{\text{enter}}$

L_1	L_2
189	170
173	185
183	175
180	180
179	178

$\boxed{\text{2nd Quit}}$ (get out)

③ from home screen

$L_1 - L_2 \rightarrow L_3$ $\boxed{\text{enter}}$

minus $\boxed{\text{Sto}}$

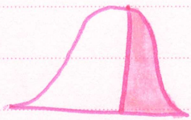
It shows: {19 -12 8 ∅ 1}

T-test ⇒ Data: STAT → Test → T-test

$\boxed{\text{Data}}$

μ_0: 0
List: L_3
Freq: 1
μ: $> \mu_0$

$\boxed{\text{Draw}}$



$t = .6283$ $P = .2819$

P not less than α
Fail to reject H_0
Not org.
Not suff. data to support claim...

Ex: With α .05 test claim blood pressure is the same in right and left arm from following data.

Right: 120 118 127 138 140 110

Left: 117 119 122 145 142 115

Claim: $\mu_d = 0$
opp: $\mu_d \neq 0$
H_0: $\mu_d = 0$ from org
H_1: $\mu_d \neq 0$ 2-tail

① STAT → Clr List L_1, L_2, L_3 2nd

② STAT → Edit → $\boxed{\text{enter}}$

L_1	L_2
120	117
118	119
127	122
138	145
140	142
110	115

2nd $\boxed{\text{Quit}}$

③ from home screen

$L_1, L_2 \to L_3$ $\boxed{\text{Enter}}$

$\boxed{\text{sto}}$

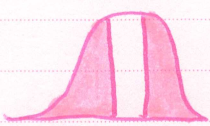
it shows: {3 -15 -7 -2 -5}

STAT → Test →

T-test → $\boxed{\text{Data}}$

P not less than α, Fail to reject Ho, from org., Not suff data to reject claim...

μ_0: 0
List: L_3
Freq: 1
μ: ≠



t=-.6241 P=.5599

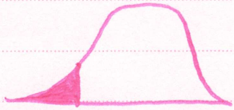
$\boxed{\text{Draw}}$

Ex: With α .05 test claim that Fri 13 is unlucky from following accident data

Fri 6: 8 10 7 11 8 7
Fri 13: 10 12 5 11 9 11

Claim: $\mu d < 0$
opp: $\mu d \geq 0$
Ho: $\mu d = 0$ org
H_1: $\mu d < 0$ L

$\boxed{\text{Calculator}}$ →



t = -1.4 P = .1102

Fail to reject
not org
not suff. data to support claim...
P is not less than α

5

TRY: with $\alpha = .05$, test claim spouse 1 speaks more words than spouse 2

Spouse 1: 68 71 62 111

Spouse 2: 60 81 22 106

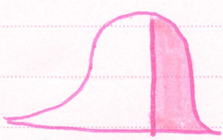
Claim: $\mu d > 0$

opp: $\mu d \leq 0$

H_0: $\mu d = 0$ org

H_1: $\mu d > 0$ R

{8 -10 11 -2 5} $\boxed{\text{calculator}}$



t=.6356 P=.2798

more

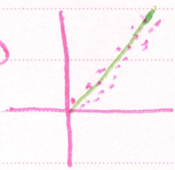
P is not less than α

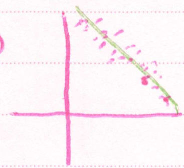
Ho not org

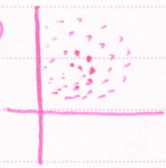
Fail to reject Ho

There is not suff evidance to support...

Corolation and Regression

1


2


3


Sample points from a population from data points. (ordered pair X, Y)

1 These data points are lenearly correlated to a streight line w/ positive slope r is close to 1

"Correlation coefficient"

3 These data points don't correlate to any streight line r is close to 0

2 These data points are lenearly correlated to straight line with negative slope r is close to -1

7

greenroom®

Where we are headed:

Give a set of sample data points:

① Do these points come from a linearly correlated population?

② If so, find the equation of the regression line.

7-18-17

Correlation and Regression cont.

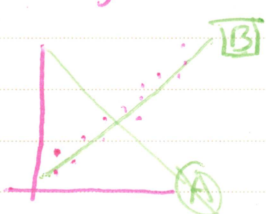
r = sample correlation coefficent

-1 neg slop | 0 no correlation | 1 positive slop

Ex! with $\alpha = .05$ test the claim, the following data from a linearly correlation population find r, the regression equation, use the regression equation to predict y when $X = 6$, plot the data and graph the regression line.

X: 1 2 3 4 5
y: 6 7 8 9 10

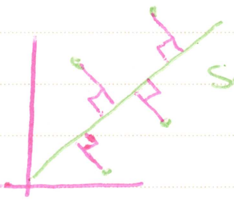
regression line



B closely hews to the data

greenroom

The regression line is the unequiely determined line that minimizes the data points to the line



sum of distance data point

sample	population	
$\bar{X}$	μ	mean
s	σ	std. dev.
r	ρ (rho)	correlation

Claim: $\rho \neq 0$ (not "0")

opp: $\rho = 0$

H_0: $\rho = 0$

H_1: $\rho \neq 0$

ρ close to $1 \Rightarrow$ correlation to a line w/ pos. slope

ρ close to $-1 \Rightarrow$ correlation to a line with neg. slope.

ρ close to $0 \Rightarrow$ no correlation

If there is correlation ρ close to 1 or -1, but not close to 0

On calculator:

① STAT
↓
clrlist L_1, L_2

② STAT → $\boxed{\text{edit}}$
* x-value → L_1: 1 2 3 4 5 ~~6~~
y-value → L_2: ~~6 7 8 9 10~~
2 5 7 9 10

③ STAT → Tests
↓
F: LinReg TTest

Xlist: L_1 $\boxed{\text{Vars}}$ → Y-vars
Ylist: L_2 ↓
Freq: 1 Function
ρ: $\neq$ 1: Y_1
RegEQ: Y_1 $\boxed{\text{Enter}}$

$P = .002128\ldots$

$\ldots a = .6$

$b = 2$

$s = .6324$

$r^2 = .9707$

$r = .9853$

Test claim: $P = .002$ "Does ... support claim"

P less than <

reject Ho

not org.

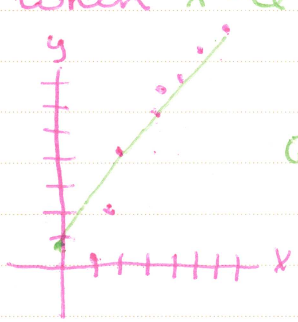
data support claim

Find r: .9853292782 copy **ALL**

regression equation: $y = a + bx$

$= .6 + 2x$

when $x = 6$: $y = .6 + 2(6) = \boxed{12.6}$



Graph and plot points on calculator

turn on

Plot 1 → enter

Y= key $1y = .6 + 2x$ (turn off...)

2nd stat plot → enter

On OFF

type

X List: L_1

Y List: L_2

mark : □ + .

Turn plot 1 on (arrow ↑ to it and enter is a toggle to turn it 'on/off')

Window Key

Xmin = 1 less than smallest x-value in data

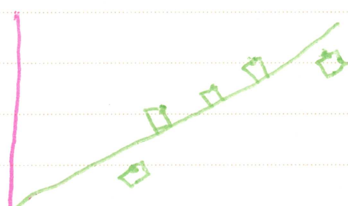
Xmax = 1 more than largest x-value

Xsc = 1

Ymin = 1 less than smallest y-value

Ymax = 1 more than largest y-value

Graph Key



for $\alpha = .05$

-1 | $-.818$ | not | $.818$ | 1

ex: with = .05

1. Test claim the data are from a linearly correlated population
2. find r
3. find regression equation
4. use regression to predict y when $x = 12$
5. graph points and equation

x:	2	4	6	8	10
y:	19	15	10	6	3

claim: $\rho \neq 0$

opp: $\rho = 0$

H_0: $\rho = 0$ (not org.)

H_1: $\rho \neq 0$ (2-tail)

Data in-put

LinRegTT test

$P = 2.22 \times 10^{-4}$
$= .000222$

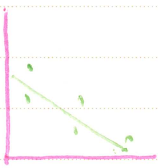
$R = -.9967441086$

$y = 22.9 - 2.05X$

P is less than α
reject Ho, not org., data support claim...

when $X = 12$ $y = 22.9 - 2.05(12) = -1.7$

Graph: 1, 11, 2, 20 (??)



greenroom

Ex: X: 2 4 6 8 10
y: 7 2 11 5 9

Claim: $\rho \neq 0$
opp: $\rho = 0$
H_0: $\rho = 0$ not org.
H_1: $\rho \neq 0$ 2-tail

$\boxed{\text{Calculator}}$ . . .

① P = .603, not less than α
Fail to reject H_0
Not org. claim
not suff. data to support claim

② r = .316875111

③ y = a + bx
y = 4.7 + .35 X

④ y = 4.7 + .35(12) = 8.9

⑤ Graph: Xmin 1 ymin 1
Xmax 11 ymax 12
Xscl 1

Regression Practice

①

X	1	2	3	4	5	$\boxed{6}$
y	11	9	6	4	2	?

$x = 6$

claim: $\rho \neq 0$

opp: $\rho = 0$

H_0: $\rho = 0$ not org

H_1: $\rho \neq 0$ 2-tail

$p = 1.8010^{-4} = .00018$

$r = .997176465$

$\alpha = .05$

$y = 13.3 + (-2.3)x$ $\quad a = 13.3$

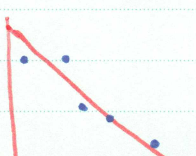
$13.3 - 2.3(6) = -.5$ $\quad b = -2.3$

when $X = 6$ $y = -.5$

P is less than α, reject Ho

Ho not org claim

The sample data support claim...



② X 2 4 6 8 10 $\boxed{12}$ x = 12
y 3 7 9 14 19 ?

claim: $\rho \neq 0$
opp: $\rho = 0$
Ho: $\rho = 0$ not org
H1: $\rho \neq 0$ 2-tail

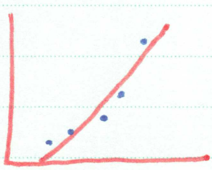
P= .001
r= .989962511

a=1.3
b=1.95
α .05

y= 1.3+1.95(12) 24.7

when X = 12 y = 24.7

P is less than org. claim
Reject Ho, Ho not from org. claim
sample data support claim...



③ X 1 2 3 4 5 $\boxed{6}$
y 7 3 5 1 4 ?

claim: $\rho \neq 0$
opp: $\rho = 0$
H_0: $\rho = 0$ not org.
H_1: $\rho \neq 0$ 2-tail

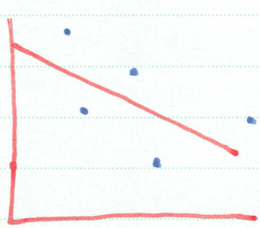
$p = .320$
$r = -.5656854249$

a = 6.4
b = -.8
$\alpha = .05$

$y = 6.4 - .8(6) = 1.6$

when X is 6 y = 1.6

p is not less than α
fail to reject H_0, not org.
Not suff. data to support claim...



③

greenroom®

Review: Hypothesis Test

1. 2 proportion
2. 2 independent means
3. 2 dependent means
4. Correlation - regression

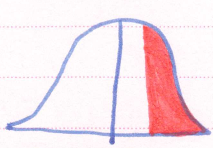
① Ex! with $\alpha = .05$, test the claim the Maple Leafs challenges have a higher proportion of success than Sharks Challenges if Maple Leafs were successful 62 of 173
Sharks successful 41 of 125

p_1 Leafs
p_2 Sharks

Claim $p_1 > p_2$
opp $p_1 \leq p_2$
H_0 $p_1 = p_2$ org
H_1 $p_1 > p_2$ Ⓡ

$\boxed{\text{2 Prop - Z test}}$

X1 62
n1 173
X2 41
n2 125



z = .5442
p = .2932

Fail to reject, not from org.
not suff. data to support claim...

② Ex: with $\alpha = .05$, test claim that cats are lighter than dogs if a

	$\bar{X}$	S	n
Cats	12.6	1.4	37
dogs	14.3	3.2	33

μ_1 = Cats μ_2 = dogs

claim $\mu_1 < \mu_2$

opp $\mu_1 \geq \mu_2$

Ho $\mu_1 = \mu_2$ org

H1 $\mu_1 < \mu_2$ L

$\boxed{\text{2 Samp TTest}}$

$\bar{X}1$ 12.6

Sx1 1.4

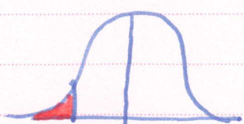
n1 37

$\bar{X}2$ 14.3

Sx2 3.2

n2 33

μ <



t = 2.8205

P = .0036

reject Ho, not org.

Data support claim...

③ Ex: With $\alpha = .05$, test claim when aliens from mars meets with aliens from Vulcan. Their hights are the same.

Mars	14	16	18	13	12	} STAT list
Vulcans	15	14	20	10	15	

claim $\mu d = 0$

opp $\mu d \neq 0$

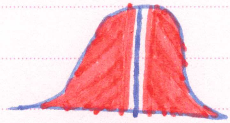
Ho $\mu d = 0$ org

H_1 $\mu d \neq 0$ 2-tail

$L_1 - L_2 \to L_3$ (-1 2 -2 3 -3)

$\boxed{\text{T-Test (data)}}$

$\mu \neq 0$



$t = -.1728$

$p = .8712$

Fail to reject Ho, from org.
not suff. data to reject claim.

④ Regression & Correlation

with $\alpha = .05$ test claim these data are from a linearly correlated population find r, reg eq., predict y when X = 30, graph all:

X	5	10	15	20	25	stat
y	120	130	137	142	153	list

X = 30   claim $\rho \neq 0$

opp $\rho = 0$

H_0 $\rho = 0$ org

H_1 $\rho \neq 0$ 2-tail

$\boxed{\text{LinReg TTest}}$

$P = 7.25 \times 10^{-4} = .000725$

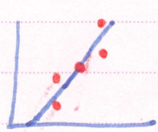
reject Ho, not org., data support claim...

$r = .9928454366$

$y = 113 + 1.56x$

$113 + 1.56(30) = 159.8$

$\boxed{\text{Y= Calculate}}$



X min ...   y min ...

X max ...   y max ...

Practice Test

① Believe in ghosts/alians

P1 Believe in ghosts

P2 Believe in aliens

$\boxed{\alpha = .05}$

216 of 1377

255 of 1711

more than

"higher"

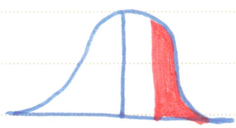
Claim: $p1 > p2$

opp $p1 \leq p2$

Ho $p1 = p2$ org

H1 $p1 > p2$ Ⓒ

$\boxed{\text{2 prop z-test}}$



$z = .6013$ $\boxed{P = .2738}$

P is not less than α, Ho not from org.
Fail to reject, there is not suff.
evidance to support claim

③ Raccoons v.s. Porcupines

$\mu 1$ raccoons

$\mu 2$ porcupines

$\boxed{\alpha = .05}$

61 raccoons

$\bar{x}$ 2.3 ft

S .3 ft

55 porc.

$\bar{x}$ 2.23 ft

S .31 ft

$\boxed{\text{2 sampTTest}}$

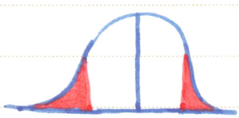
claim $\mu 1 = \mu 2$

opp $\mu 1 \neq \mu 2$

Ho $\mu 1 = \mu 2$ org

H1 $\mu 1 \neq \mu 2$ 2-tail

$\boxed{\text{Equal}}$



t=1.2331 $\boxed{P=.2201}$

P is not less thand

Ho from org., Fail to reject Ho

There is not suff. evd. to reject claim...

③ Fewer Words

stat List

Spouse 1 458 320 567 444 433 485

Spouse 2 455 301 508 492 403 513

claim $\mu d < 0$ $\qquad$ $\boxed{\alpha\ .05}$ less than

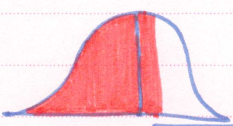
opp $\mu d \geq 0$

Ho $\mu d = 0$ org

H1 $\mu d < 0$ (L)

$\boxed{\text{T-Test "Data}}$

(319 59 -48 30 -28)



t=.3657 $\boxed{P=.6352}$

P is not less than α

Ho is not from org. claim

Fail to reject Ho

There is not suff. evidence

to support claim...

④ Blood Pressure

$\boxed{\text{stat List}}$

Right: 130 120 118 122 109 123

Left: 125 109 119 120 110 115

claim: $\mu d > 0$ — α .05

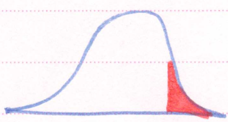
opp: $\mu d \leq 0$ — less than

Ho: $\mu d = 0$ orig

H_1: $\mu d > 0$ ⓐ

$\boxed{\text{T-Test "Data}}$

(5 11 -1 2 -1 8)



t=2 P=.051

P is not less than α

Fail to reject Ho,

Ho not from orig. claim

There is not suff. evidence

to support claim

(5) Correlation / Regression

X	1	2	3	4	5	$\boxed{6}$
y	9	7	6	4	1	?

X=6, α=.05

Claim $\rho \neq 0$

opp $\rho = 0$

H_0 $\rho = 0$ orig

H_1 $\rho \neq 0$ 2-tail

p=.002

r=.98510411

a=11.1

b=-1.9

$y = 11.1 - 1.9(6) = -.3$

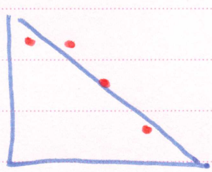
when X is 6 y=-.3

P is not less than α

fail to reject Ho,

Not original

There's not suff. evd. to support...



6

X	2	4	6	8	10	$\boxed{12}$	X=12
y	15	7	10	12	1	?	α .05

claim $\rho \neq 0$

opp $\rho = 0$

H_0 $\rho = 0$ not org

H_1 $\rho \neq 0$ 2-tail

P = .205

r = .6812012094

y = 15.9 − 1.15(12) = 2.1

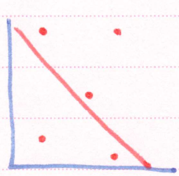
when X = 12 y = 2.1

P is not less than α

Fail to reject Ho

Ho not from org. claim

There's not suff. evd. to support...



$\overline{X}$ = Sample mean
μ = population mean

When a word problem asks for a sample, then we use $\overline{X}$ — such as a drug sample. When a word problem asks for <u>ALL</u> or population is used we use the μ sympol.

Ex: Constructs 98% CI containing the mean # of choco. chips in a cookie of <u>sample</u> of 33 cookies has $\overline{X}$ = 20.6 and population std. dev. for all cookies is 5.3.

Ex: with α = .05 test the claim $\overset{\mu}{\text{mean}}$ ft. of <u>giraffes</u> has mean ft = 17.55 ft and std dev. = 1.3 ft μ