STAT 263

Notes For Term Test

Chapter 1

Statistical techniques - Allow us to extract information.
Lurking variable - Variable that is not accounted for.

2 Types of Stats

Inferential - estimates, uses sample from population.
Descriptive - Using numbers & graphs

Categorical Data vs Numerical Data

Categorical Data
- has categories

Numerical Data
- Ordinal Data (has an order) - Grades
- Interval Data (add / subtract) - Inches
- Ratio Data (absolute 0) - temp

Mutually Exclusive - the two events can NOT occur at the same time. (getting red/Black card, one pull)

Dichotomous - has 2 levels (sex, T/F)

Chapter 2

- Dot Plots are used for small data sets

Stem & Leaf Plots

Leading Digits : Stem
Trailing Digit : Leafs

EX

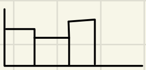
25	67
26	234
27	1
28	9
29	788

can look Stretched/compressed

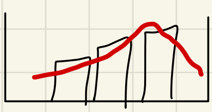
Range = max - min
Range ÷ classes = Class interval

Relative Frequencies can be expressed as a %

Bar Chart is used for categorical Data



Frequency Polygon



- gives us variability and shape.

Frequency Ogive

- Same as frequency Polygon but for cumulative Freq.

Pareto Diagrams

- Start high, get Lower

Pareto Relationship

- Can go both ways

One Way Freq D

Sex	Frequency
Female	12
Male	13
Total	25

Two Way Freq D

		under grads		
		Grads	Drop outs	Total
Sex	Female	5	2	7
	Male	6	3	9
	Total	11	6	16

Chapter 3: Measures of Location

- Less variability means more accuracy
- More variability means less accuracy
- Bias is an estimater on higher/lower side

The sample mean is an unbiased estimator of the population mean.

Sample mean: $\bar{x} = \frac{\sum x}{n}$

Sample is less than 30

Population Mean: $\mu = \frac{\sum x}{N}$

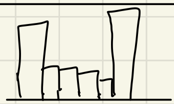
Note:
- The mean takes outliers into account
- Can be used for analysis

- weighted mean:

x	F
5	3
7	2
9	2
14	1

$\bar{x} = 7.625$

Bimodal Distribution:



Mode is best for categorical data

Median:

index position $= \frac{n+1}{2}$

$\tilde{x}$ = median for sample

$\tilde{\mu}$ = median for population

50th Percentile = Median

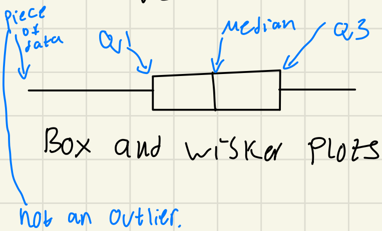
$IQR = Q3 - Q1$

Index percentile: $\frac{P}{100}(n+1)$

The 5 Number Summary

- Minimum
- max
- Median
- Q1
- Q3

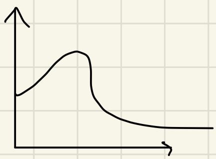
Step = 1.5 IQR



Box and wisker Plots

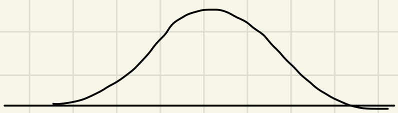
Upper Fence: Q3 + Step 1
Lower Fence: Q1 − Step 1

Positive Skew



Negative Skew

Normal Distributed



Class boundaries are : − 0.05
always end in 5.
have 1 more digit than data.

Class interval = nice number

$$\tilde{x} = L + \frac{j}{F} C$$

index − last cum fr finished

L: Lower boundar

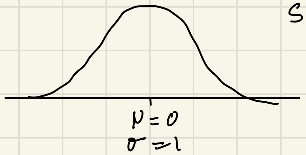
F: Frequency

C: Class interval

J ≠ negative

$$\tilde{x} = 74.95 + \frac{5.2}{8} 25$$
$$= 91.2$$

Chapter 4: Measures of Variation



Standard Normal Distribution

z score tells us how far it is from mean μ

Standardization Score z

$z = \dfrac{x - \mu}{\sigma}$ This converts to S.N.D

Always get shaded area to the left of the distributions

90th percentile?

Inverse normal:
Area = 0.9
$\sigma = 1.5$
$\mu = 18.6$

$x = 20.5$

Sample variance $= s^2$

Standard Deviation $= s$

Chebyshevs Theorem

$1 - \dfrac{1}{k^2}$

Ex
$\bar{x} = 20$
$\sigma = 2$
14 − 26?

14 to 26 = 20(k)(2)

k is whatever takes same distance

k = 3

$1 - \dfrac{1}{3^2} = \dfrac{8}{9}$ atleast $\dfrac{8}{9}$ falls tween 14 − 26

- use normal CD to find area
- use inverse normal if your given area
- The Emperical Rule
  for mount shaped Distributions
- CV coeffecient variance

Chapter 5 - possibilities & Probabilities

Permutations - order Matters.
Combination - order does not matter.

mn Rule:
when m does not affect n.

52! ways to Shuffle cards.

$P(s) = \frac{s}{n}$ ← success

↑ success   ↖ # of outcomes

Monte Carlo - using repeated Sampling with CPU

Gamblers fallacy - previous data doesn't matter

Chapter 6 - Some Rules of Probability

Replacement Probability - Binomial

Binomially Distributed:

$_{20}C_7 (0.35)^7 (1-P)^{13}$

(20: Total chances; 7: success; (1-P): not success)

Not replaced - hypergeometric

- n - # taken out
- A - # of successes in whole
- b - # of failures
- x - # of successes in n trials

A ∩ C means intersection
A and C.

A ∪ C means Union
A and/or C.

Mutually exclusive
- Can't Both happen

Probabilities / odds

$\frac{a}{b} = \frac{p}{1-p}$ ← will occur / ↖ will not

odds → $\frac{4}{1} = \frac{\frac{4}{5}}{\frac{1}{5}} = \frac{0.8}{0.2}$

Bayes Theorem:

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

$$P(A \cap B) = P(A)\,P(B|A)$$

$$\frac{10}{4} = \frac{\frac{10}{14}}{\frac{4}{14}} = \frac{0.714285}{0.285714} =$$

Chapter 8

- Random Variable value determined by outcome of random experiment.

Binomial Distribution

- Trials are independent of one another.

Poisson PP = Exactly

Poisson CD = adjust lambda

Chapter 9

- correction

① adjust Probability pg 75

② $\sigma = \sqrt{np(1-p)}$

③ $\mu = np$

④ Normal CD. ← plug in

Chapter 11 — Problems of Estimation

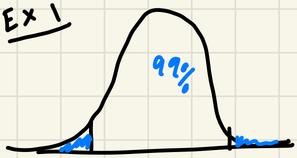
- $\bar{x}$ is an estimator of μ

$$E = z_{\frac{\alpha}{2}} \frac{\sigma}{\sqrt{n}}$$

You can always use any inverse normal to get $z_{\frac{\alpha}{2}}$

α - the risk of being wrong.
Defaults to 0.05

Ex 1



$= 0.005$

x inv $= 2.576$

Conclusion: with 99% confidence we know $\mu = 15.26 \pm 1.27$.

Central Limit Theorem

applicable if $n > 30$.
you can use $s = \sigma$ sometimes

Degrees of Freedom $= n-1$.
use T table if you have 1, 5, 10% confidence intervals

Estimation variance and standard dev.

$$\chi^2 = \frac{(n-1)\, s^2}{\sigma^2}$$

chisquare

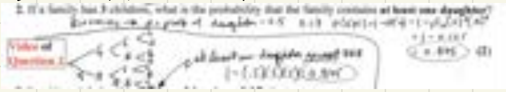
mound shaped data.

Practise Term Tests

Types of Questions

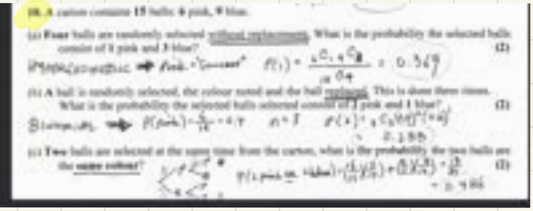
Without replacement - hypergeometric
replacement - binomial

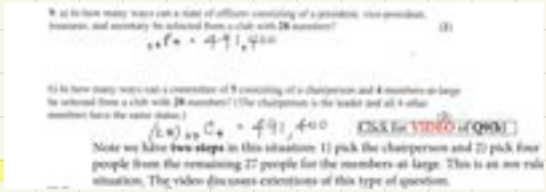
Binomial/Probability:



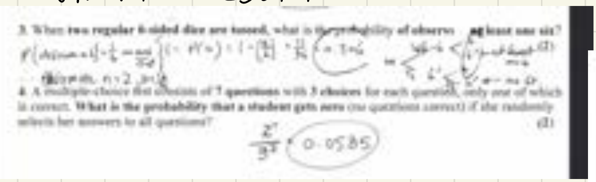
Binomial is used when its replaced, $P(2) = {}_3C_2 (0.4)^2 (0.6)$

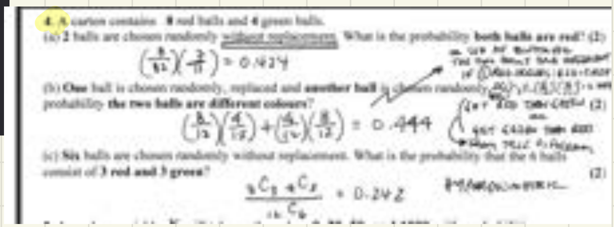
of success



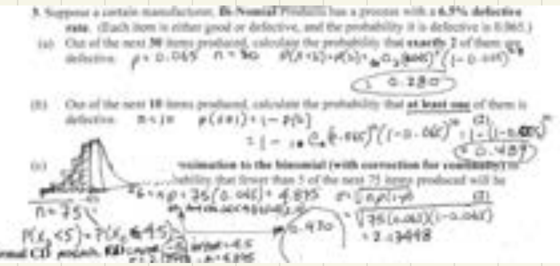


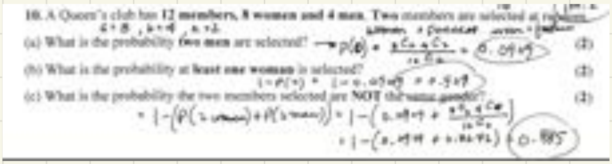
Random questions

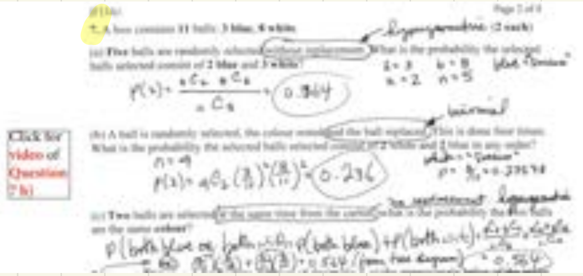




Binomial - a







$P(2) = 4C2 \left(\frac{3}{11}\right)^2 \left(\frac{8}{11}\right)^2 = 0.236$

amt of blue balls; amt of white; Total balls; successes; Prob of blue; Prob of white

Poisson Distribution

Exactly = PD
lessthan/greater = CD
each hour means square/cube etc

7. The number of calls received by a telephone switchboard is well modelled by the Poisson distribution with an average of **3.0 calls per hour**.

$\lambda = 3.0$ per hour

a) What is the probability of observing **exactly 4** calls in the next **two hours**? (2)

$\lambda = (3.0)(2) = 6.0$ per 2 hours $P(4) = \frac{e^{-6.0} 6.0^4}{4!} = 0.134$ Poisson PD

b) What is the probability of observing **at least one** call in the next **30 minutes**? (2)

$\lambda = \frac{3.0}{2} = 1.5$ per 30 minutes $P(x \geq 1) = 1 - P(0) = 1 - e^{-1.5} = 1 - 0.223 = 0.777$

c) What is the probability of observing **exactly 2** calls in **each** of the next **three hours**? (2)

the calls in each hour are independent of each other.

$P(2 \text{ in any hour}) = P(2) = \frac{e^{-3.0} 3.0^2}{2!} = 0.22404$ ← Poisson PD → $P(2 \text{ in each of next 3 hours}) = \left(\frac{e^{-3.0} 3.0^2}{2!}\right)^3 = 0.22404^3 = 0.0112$

8. The age of students after their freshman year (X) has $\mu = 18.2$ years and $\sigma = 1.2$ that the distribution of the ages of these students is a normal distribution:

5. The number of calls received by a telephone switchboard is well m[odelled by the Poisson] distribution with an average of **4.4 calls per hour**.

$\lambda = 4.4$ per hour

a) What is the probability of observing **exactly 2** calls in the next **15 minutes**? (2)

$\lambda = \frac{4.4}{4} = 1.1$ per 15 minutes (¼ hr) $P(x) = \frac{e^{-\lambda}\lambda^x}{x!}$ Poisson PD

$P(2) = \frac{e^{-1.1} 1.1^2}{2!} = 0.201$

b) What is the probability of observing **one or fewer** calls in the next **half-hour**? (2) Poisson CD

$\lambda = 2.2$ calls per ½ hr

$P(x \leq 1) = P(1) + P(0) = \frac{e^{-2.2} 2.2^1}{1!} + e^{-2.2} = 0.355$

c) What is the probability of observing **exactly 3** calls in **each hour** of the next **2 hours**? (2)

calls per hr. independent

$\lambda = 4.4$ per hour $P(3 \text{ in any hr}) = \frac{e^{-4.4} 4.4^3}{3!} = 0.174305$ Poisson PD

$P(3 \text{ in each of next 2 hrs}) = \left(\frac{e^{-4.4} 4.4^3}{3!}\right)^2$

6. Find the 12th percentile [redacted] distribution.

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7. Suppose flaws (cracks, chips, specks, etc.) occur on the surface of one type of glass with density of **3 per m²** and the number of flaws is well modelled by the **Poisson distribution**.

(a) What is the probability of there being **exactly 4 flaws on a 0.5 m² sheet** of this glass? (2) Poisson PD

$\lambda = 1.5$ per 0.5 m²

$P(4) = \frac{e^{-\lambda}\lambda^x}{x!} = \frac{e^{-1.5} 1.5^4}{4!} = 0.0471$

(b) What is the probability of there being **one or more flaws on a 1 m² sheet** of this glass? (2)

$\lambda = 3$ $P(x \geq 1) = 1 - P(0) = 1 - e^{-3} = 1 - 0.0498 = 0.950$ Poisson PD

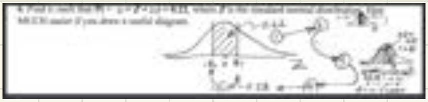
8. The heights of male college freshmen are normally distributed with $\mu = 71$ inches and $\sigma = 3.2$

Negative skew = mode last

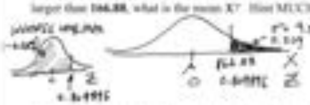
positive skew

mean = tail, wherever the tail goes

Distribution Questions



13. A random variable X has a normal distribution with $\sigma = 9.55$. If the probability is **0.209** that larger than **166.88**, what is the mean X? Hint MUCH easier if you draw a useful diagram.

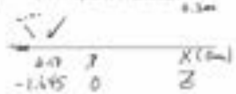


$Z = \frac{X - \mu}{\sigma}$

$\mu = 166.88 - 0.80995(9.55)$

$= 159.15$

18. The distribution of lengths of adult scorpions of a certain variety is normally with a standard deviation, $\sigma = 0.200$ cm. You dozed off when the lecturer stated the mean length, but you did hear that the 5[th] percentile of this distribution is 2.17 cm. What is the mean of the distribution, to two places of decimal?



$Z = \frac{X - \mu}{\sigma}$

$-1.645 = \frac{2.17 - \mu}{0.200}$ ⟹ $\mu = 2.17 + 1.645(0.200) = 2.499 = 2.50$

16. If a **pair of dice** are rolled **twenty-four times**, what is the probability of observing **at least one roll totaling twelve (that is: a six uppermost on both dice)?** (2)

$P(12) = \left(\frac{1}{36}\right)$ ∴ $P(12') = \text{not } 12 = \frac{35}{36}$ can be seen as binomial

$p = \frac{1}{36} = (0.02777)$

$P(X \geq 1) = 1 - P(0) = 1 - \left(\frac{35}{36}\right)^{24} = 0.491$

$n = 24$

$= 1 - (0.972)^{24} = 0.491$

$1 - p = \frac{35}{36} = (0.972)$

Video of Question 16

15. For a given data set with $n = 100$ numbers:

min = 223, Q_1 = 300, median = 320, Q_3 = 345, max = 425

Furthermore, the first few value and last few values of the data set, and the corresponding index numbers are:

data values	223	234	259	299	—	401	405	422	425
index values	1	2	3	4	—	97	98	99	100

a) a data value below what number will be considered an outlier? → $Q_1 - 67.5 = 300 - 67.5 = 232.5$

b) a data value above what number will be considered an outlier? → $Q_3 + 67.5 = 345 + 67.5 = 412.5$

c) the right whisker will extend from Q3 to what value? → 405 (because 422 & 425 are both outliers)

d) the left whisker will extend from Q1 to what value? → 234 (because 223 is an outlier)

$IQR = Q_3 - Q_1 = 345 - 300 = 45$

$\text{step} = 1.5(IQR) = 1.5(45) = 67.5$

Discrete to Continous

$(m < x \le n) = P(x \le n) - P(x \le m)$

$(m \le x < n) = P(x \le n-1) - P(x \le m-1)$

$(m \le x \le n) = P(x \le n) - P(x \le m-1)$

$(m < x < n) = P(x \le n-1) - P(x \le m)$

17. Fill in the blanks in the following equations for a **DISCRETE** probability situation
(this is NOT a correction for continuity situation)

a) $P(6 \le X < 21) = P(X \le$ 20 $) - P(X \le$ 5 $)$
b) $P(17 < X \le 35) = P(X \le$ 35 $) - P(X \le$ 17 $)$
c) $P(8 \le X \le 15) = P(X \le$ 15 $) - P(X \le$ 7 $)$
d) $P(3 < X < 9) = P(X \le$ 8 $) - P(X \le$ 3 $)$

14. Assume you were using a cumulative probability distribution (CDF) to find the probabilities asked for below. Fill in the blank values of the continuous random variable, **note this is NOT a correction for continuity situation.**

a) Probability X is larger than 17 but less than 27 = $P(X \le$ 26 $) - P(X \le$ 17 $)$ (2)

…16 17 [18 … 26] 27 28 …

a) Probability X is at least 9 but less than or equal to 24 = $P(X \le$ 24 $) - P(X \le$ 8 $)$ (2)

… 8 [9 10 11 … 23 24] 25 …

14. Fill in the blank values in the following equations, assuming X is a discrete random variable, **note this is NOT a correction for continuity situation.** (Enter answers on page 4.)

a) Probability $(12 < X \le 20) = P(X \le$ 20 $) - P(X \le$ 12 $)$ (1)

a) Probability $(16 \le X < 24) = P(X \le$ 23 $) - P(X \le$ 15 $)$ (1)

15, [16, 17, 18, 19, 20, 21, 22, 23], 24, 25

190. 3. The random variable X is **binomially distributed** with $n = 20$ and $p = 0.35$

(a) Find $P(X = 7)$: ${}_{20}C_7 (0.35)^7 (0.65)^{13} = 0.184$ (2)

Video of Question 3

(b) Use the **normal approximation to the binomial (with correction for continuity)** to approximate $P(X > 10)$ (2)

$\mu = np = 20(.35) = 7$ $\sigma = \sqrt{np(1-p)}$

$= \sqrt{20(0.35)(0.65)} = 2.133$

$P(X_b > 10) \approx P(X_c > 10.5)$

Normal CD, lower 10.5, sigma 2.133
mu 7, upper any high value = 7+3(2.133)

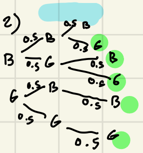
$= 0.0504$ 0.0505

Term test Winter 2012

1) $\bar{x} = 118.86$

$\sigma = 87.56$

Index $= 0.65(8)$
$= 5.2$
$= 121 + 0.2(205-121)$
$= 137.8$ ✓

2) 

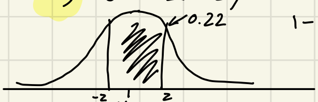
$P = 0.875$ ✓

3) a) $P = 0.206$ ✓
b) $P = 0.357$ ✓

4) ${}_{46}P_4 = 3916440$ ✓

5) 56.53 ✓

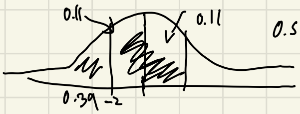
6) $P(-z < Z < z) = 0.22$



$\mu = 0$
$\sigma = 1$

$1 - 0.22$
$= 0.78$

$z = 0.772$ ✗



$0.5 - 0.11$
$=$

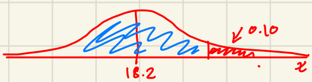
Inverse Normal Area $= 0.61$
$-z = -0.279$
$z = 0.279$

7) a) $P = 0.134$ ← Poisson PD $x = 4$, $\lambda = 2 \times 3$ ✗
$\lambda = 6$

b) $1 - P(0) = P(x \geq 1)$
$= 1 - 0.273$ $= 0.777$ ✗

c) Poisson PD
$x = 2$, $\lambda = 3$
$P = 0.224$ → in 3 hours means p^3
$= 0.224^3$ $= 0.0112$ ✗

8) a) $\mu = 18.2$ Upper Bound $= 16.1$
$\sigma = 1.2$ lower Bound $= 0$
$P = 0.04$ ✓

b) 

Inverse normal Area $= 0.90$
$\sigma = 1.2$
$\mu = 18.2$

z inv $= 19.73$

9) index $= 0.78(44)$
$= 34.32$

$303 + (6)(0.32)$
$= 304.9$ ✓

10) a) ~~$6C1 \times 9C3 = 504$~~

Hypergeometric: $\frac{\text{\# of success}}{\text{Total takes}}$

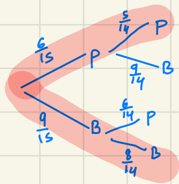
Total : $15C4$
: $6C1 \times 9C3$ ⟶ $\frac{6C1 \times 9C3}{15C4}$

$= 0.369$

b) $\frac{6C2 \times 9C1}{15C6 \times 15C9} = 5.4 \times 10^{-5}$

Binomial: $\frac{6}{15} = 0.4$, $n = 3$
$\frac{9}{15} = 0.6$

$P(2) = 3C2\,(0.4)^2(0.6)$
$= 0.288$

c) 

$= \left(\frac{6}{15}\right)\left(\frac{5}{14}\right) + \left(\frac{9}{15}\right)\left(\frac{8}{14}\right)$

$= \frac{2}{15} + \frac{12}{35}$

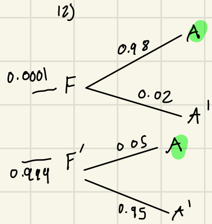
$= 0.486$

11) Binomial CD
$n = 49$
$P = 0.32$
$x = 19$

$P(x \leq 19) = 0.8779$
$= 0.879$

Normal CD: Lower $= 0$
upper $= 19$
$\sigma = 3.65$
$\mu = 15.68$

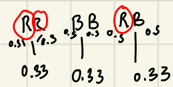
$=$

12) 

a) $0.0001 \times 0.98 + (0.999)(0.05)$
$= 0.05$

b) $\frac{0.0001 \times 0.98}{0.05}$

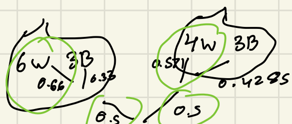
$= 0.0196$

13) 

$P = \frac{2}{3}$

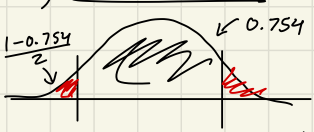
$P = 0.667$

14) a) $7.00 - 7.49$
a) 7.245 ✓
b) 6.995 ✓

15) 

$P = 0.33 + 0.2855$
$P = 0.616$ ✓

16) Term test 2



area $= \frac{1 - 0.754}{2}$
$\sigma = 1$
$\mu = 0$

$-z = -1.16$
$z = 1.16$

Term Test Fall 2012

1) $\bar{x} = 128.3$
$\sigma = 54.96$
index $= (0.83)(n+1)$
$= 5.81$
$= 150 + (0.81)(83)$
$= 218.85$

2) $_{23}P_4 = 212520$

3) whenever you have Q, with atleast 1, this means: $1 - P(0) = 1 - \left(\frac{5}{6}\right)^2$ $P = 0.306$
P(0) = probability you dont get a 1. $\therefore \frac{5}{6}$

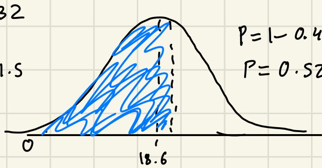
4) Q1 — Pr = 0.33, Pw = 0.66
Q2 — Pr = 0.33, Pw = 0.66
$\frac{2^7}{3^7} = 0.0585$
chances getting all wrong (2^7); Total options (3^7)

5) $\sigma x = 99.98$

6) a) $P = 0.088$
b) $P = 1 - P(x \leq 1)$
$P = (1 - 0.376)$
$P = 0.624$

7) Poisson Distribution
$\lambda = 6.4$ /hr
a) $\lambda = 1.6$ /15 min
$P = 0.258$
b) PD
$x = 4$ $\lambda = 6.4$
$P = 0.116$ → one hour
$P = 0.116 \times 2$
$P = 0.232$

8) $\mu = 18.6$, $\sigma = 1.5$
$P(x < 19) = P(x \leq 18)$
$= 0.473$



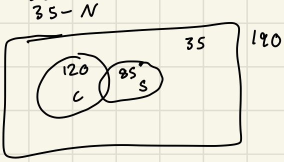
$P = 1 - 0.473$
$P = 0.527$

9) a) $\bar{x} = 128.38$
b) $\sigma = 2.82$
c) $i = (34+1)(0.7)$
$i = 24.5$
2
12
28
$125.7 + (0.5)(129.2 - 125.7)$
70^{th} Percentile $= 127.45$

10) a) $\frac{4C2}{12C2}$ $P = 0.09$
use inverse normal if your given P.
b) $P = 1 - (x \leq 0)$
$P = 1 -$
$\frac{8C1}{12C1} = 0.667$
c) $1 - P(s)$ $\frac{4C2 \times 8C2}{12C2} = \frac{34}{66}$
$= 0.51515$
$1 - 0.51515$
$P = 0.485$

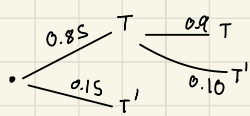
11) $\sigma = 9.55$
$P(x > 166.88) = 0.209$
x inv = 7.734

12) $190C1 = 190$
120 – C
85 – S
35 – N
$190 - 35 = 155$ ← People in stats or chem



$240 - 190 = 50$
That means 50 must be in both.
$\frac{50}{190} = 0.263$

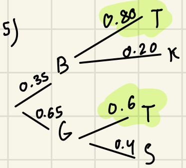
13)



$= 0.765$
$n = 0.9$
$P(T') = 0.10$
$\frac{0.85 \times n}{0.85} = \frac{0.765}{0.85}$

14) a) $P = (x \leq 26) - P(x \leq 17)$
b) $P = (x \leq 24) - P(x \leq 8)$

15)



$\frac{P(B)}{P(T)}$
$\frac{(0.35 \times 0.80)}{(0.65 \times 0.6) + (0.35)(0.80)}$
$P = \frac{0.28}{0.67}$
$P = 0.418$

Term Test Fall 2013

1) $\bar{x} = 60.75$
$\sigma = 35.94$
$i = (n+1)(0.5)$
$i = 4.5$
$m = 39 + (0.5)(6)$
$m = 42$
$84^{th} = (n+1)(0.84)$
$84^{th} = 7.56$
$84^{th} = 86 + (0.56)(57)$
$84^{th} = 117.92$

2) $\bar{s}x = 20.28$

5) $\lambda = 4.4$

a) $\lambda = 1.1$, Poison PD
$x = 2$
$P = 0.201$

b) $P(x \le 1) = 0.354$
$\lambda = 2.2$

c) $x = 3$ $\lambda = 4.4$
$P = 0.1748^2$
$P = 0.0305$

6)

$1 - 0.12 = 0.88$

$\sigma = 1$
$\mu = 0$

$x = -1.125$

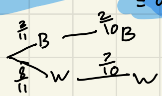
Area $= 0.12$
Inv normal $= -1.175$

7.) a) $\frac{3C2 \; 8C3}{11C5} = \frac{168}{462} = 0.364$

b) $\frac{3C2 \times 8C2}{11C4} = \frac{84}{330} = 0.255$

$P(W) = 0.727^2 = 0.5285$
$P(B) = 0.272^2 = 0.07398$
$= 4C2(0.5285)(0.07398) = 0.236$

c)



$= \left(\frac{3}{11}\right)\left(\frac{2}{10}\right) + \left(\frac{8}{11}\right)\left(\frac{7}{10}\right)$
$= \frac{31}{55} = 0.563$

8) 122.2, 125.7, 129.2, 132.7, 136.2
5, 19, 12, 7, 3

$\bar{x} = 127.98$
$\bar{s}^2 = 3.778^2$
$s = 14.3$

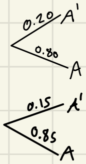
$\tilde{x} = L + \frac{j}{F} C$ → Class interval
(j: percentile index; L: Lower boundar; F: Frequency)

index $= (0.5)(47)$
$= 23.5$

median $= 123.95 + \frac{18.5}{19}(35)$
$= 127.4$

9) $\bar{x} = 72.500$
$\sigma = 42.057$

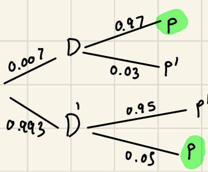
10)



0.80×0.85
$= 0.68$

12) a) $25P4 = 303600$
b) $25C4 \times 25C1 = 265650$

11) D = Drug user
D' = Non Drug user

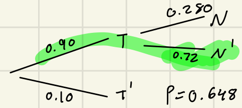


actually is Positive

$\frac{(0.007)(0.97)}{(0.007)(0.97) + (0.05)(0.993)}$
$= \frac{0.00679}{0.05644}$
$P = 0.120$

13) ~~a~~ ~~b~~ ~~c~~ ~~d~~ e (f)

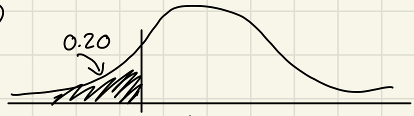
14)



$P = 0.648$

15) $1.5 \times IQR$
Step $= 67.5$
a) 232.5
b) 412.5
c) 405
d) 234

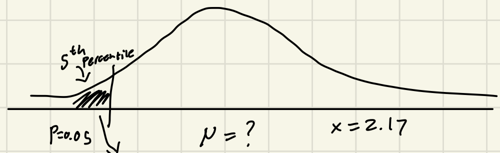
16)



$\mu = 82.3$
$\sigma = 11.7$
Inv normal
$x = 72.453$

17) Normal cd
$P = 0.0838$

18) $\sigma = 0.2$



$\mu = ?$ $x = 2.17$

$Z = \frac{x - \mu}{\sigma}$
↓
Scale the Distribution into Z

For Z, $\sigma = 1$, $\mu = 0$
inverse normal $= -1.16448$

$-1.16448 = \frac{2.17 - \mu}{0.2}$
$-2.40 = -\mu$
$\mu = 2.40$

Q3) Binomial PD? ✓
a) $P = 0.28$ ✓
b) $n = 10$, $P = 0.065$, $x = 0$
$1 - P(0)$
$= 1 - 0.51$ ✓
$P = 0.49$

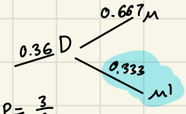
c) $np \ge 5$?
$4.875 \ge 5$? ∴ Not reasonable
$\sigma = \sqrt{np(1-P)} = 4.558$
$\sigma = 2.135$
upper $= 4.5$
$\mu = np$
$= 4.875$

$P(x < 5)$
$= P(x_c < 4.5)$

Term Test Winter 2013

1) $\bar{x} = 85.286$
$\sigma = 59.9$
index = (n+1)(0.33)
= 2.64
= 25 + (0.64)(33)
33rd %tile = 46.12 4

2) $_6C_3 \times {}_{20}C_5 = 310080$ 2

3)


$P = \frac{3}{9}$
$P = 0.333$ 2

4) a) $1 - P(R')$
$P(R) = \frac{{}_8C_2}{{}_{12}C_2}$
$P(R) = \frac{28}{66}$
$P(R) = 0.4242$
$P(R') = 0.5758$
$P = (R) = 0.424$ 2

b) $\left(\frac{8}{12}\right) = R$
$\left(\frac{4}{12}\right) = G$
$_{12}C_2 \times \left(\frac{8}{12}\right)\left(\frac{4}{12}\right) =$
× 1
$\left(\frac{8}{12}\right)\left(\frac{4}{12}\right) + \left(\frac{8}{12}\right)\left(\frac{4}{12}\right)$
$= 0.444$

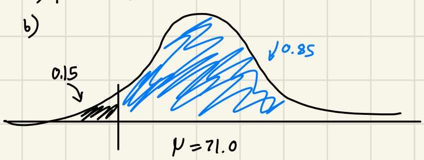
c) $\frac{{}_8C_3 \; {}_4C_3}{{}_{12}C_6} = \frac{56 \times 4}{924}$ 2
$P = 0.242$

5) $\sigma = 99.723$ 2

6) $P = 0.185$ 2
why $\lambda = 1.5$?

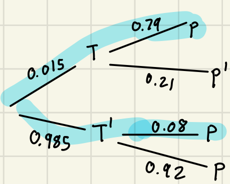
7) Poisson PD
a) $x = 4$ $\lambda = 6$ $P = 0.134$ ×

b) $P(x \geq 1) = P(1 - x = 0)$
$x = 0$ $\lambda = 3$
$P = (1 - 0.04978)$
$P = 0.950$ 2

8) a) $P = 0.600$ 2
b)


$\mu = 71.0$
$\sigma = 3.20$
$x_{inv} = 67.68$ 2

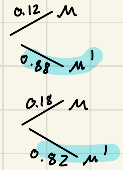
9) T = tumor P = positive
T' = no tumor P' = negative



$\frac{(0.015)(0.79)}{(0.015)(0.79) + (0.985)(0.08)}$
$= \frac{0.01185}{0.09065}$
$P = 0.130$ 2

10) a) 1.12
= 156.27 1
b) 157.40 − 0.005 1
= 157.395
c) Bin width = 2.25 1

11) $\bar{x} = \$2150$ 2

12)


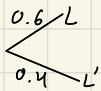
(0.88)(0.82)
= 0.722 2

13) $P(A) = 0.20$ $P(A)' = 0.80$
$P(E) = 0.15$ $P(A)' = 0.85$
$P(A \cap E) = 0.10$ ← Both have boring lectures
$P(A \cap E)' = 0.90$

$P(A|E) = \frac{P(A \cap E)}{P(E)}$ 2
$P = 0.667$

14) a) $P(12 < x \leq 20) = P(x \leq 20) - (x \leq 12)$ 1
b) $P(16 \leq x < 24) = P(x \leq 23) - (x \leq 15)$ 1
Make note*

15) L = lead L' = not lead



$P = 0.4$
$\sigma = \sqrt{np(1-p)}$
$\sigma = \sqrt{8(0.6)}$
$\sigma = \sqrt{3.6}$
$\sigma = 1.89$

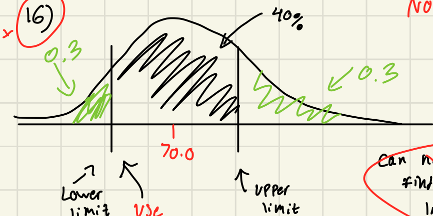
Lower = 5.5
Upper = 25 (anyway)
$\sigma = 1.89$
$\mu = 9$
$\mu = np$

+0.5
Binomial CD?

$P(x \leq 6) = P(x < 6.5) \rightarrow P(x_D \geq 6) \simeq P(x_c > 5.5)$

Normal CD:
$P = 0.968$

16) ×



P=0.3
0.7 = Area
$x_{inv} = 74.45$

~~Z = 67.84~~

~~Can not find upper & lower limits w out Z limits~~

17) cum fr
2
5
25
40
45

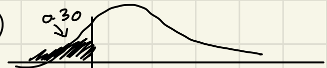
n = 45
index = 36.8

$\tilde{x} = L + \frac{j}{F} C$
j → percentile index
L → Lower boundar
F → Frequency
C → Class interval

$\tilde{x} = 39.5 + \frac{11.8}{15}(10)$
$\tilde{x} = 47.4$

18) $x_{inv} = 42.92$
2
∴ for 43 months?

Term Test Fall 2014

5)


area = 0.3, Standard Normal Distribution Means $\sigma = 1, \mu = 0$

$Z = -0.52$ 2

1) $\bar{x} = 146.38$
$S = 145.23$
index $= 0.72(9)$
$= 6.48$
$= 190 + (0.48)(105)$ 4
72nd Percentile $= 240.4$

2) 96.8 2

3) Binomial PD: 2
a) $P = 0.1844$
b) $P(x_b > 10) \simeq P(x_c > 10.5)$ Normal CD
$\mu = 7 \quad \sigma = 2.133$ Lower
$P = 0.9496$ $P = 0.0504$ 1

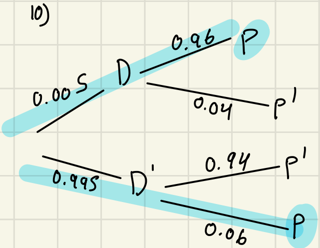
4) c) 2

6) a) $4.4 = 1hr$
$\lambda = 2.2,\ x = 2$, Psn PD
$P = 0.268$ 2
b) $P(x \leq 1) = ?$, $\lambda = 1.1$
$P = 0.699$ 2
c) $x = 4$, in Each hour means squared
$P = 0.19173^2 \rightarrow P = 0.0367$ 2

7) b) 2

8) $x = 19.61$ 2

9) a) $28P4 = 491400$ 2
b) $28C1 = 28$
$27C4 = 20475 \Rightarrow$ 1
$= 573300 = 28 \times 27C4$
$= 491400$

10)


$$\frac{0.005 \times 0.96}{(0.005 \times 0.96) + (0.995 \times 0.06)}$$

$$\frac{0.0048}{0.0645} = 0.0744$$

$P = 0.0744$ 2

11) a) $\frac{4C2\ 8C3}{12C5} = \frac{336}{792}$ 2
$P = 0.424$

× b) $\left(\frac{2}{4}\right)^2 \left(\frac{2}{8}\right)^2$ $P(2) = 4C2\left(\frac{1}{3}\right)^2\left(\frac{2}{3}\right)^2$ 2
$0.25 \times 0.0625 = 0.3125$ $= 0.296$
$= 0.015625$

× c) $\left(\frac{2}{4}\right)\left(\frac{2}{8}\right) + \left(\frac{2}{4}\right)\left(\frac{2}{8}\right)$ $\frac{4C2\ 8C0}{12C2} + \frac{4C0\ 8C2}{12C2}$
$P = 0.25$ $= 0.515$

12)

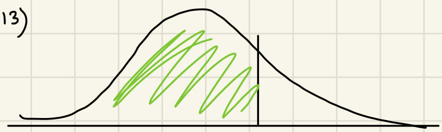
	Freq	cum fr
50-64	6	6
65-79	22	28
80-94	15	43
95-109	7	50
	50	50

$\tilde{x} = L + \frac{j}{F}C$ (j: index − last cum fr finished; L: Lower boundar; F: Frequency; C: class interval)

index $= 0.5 \times 51$
$= 25.5$
$J = 25.5 - 6$
$J = 19.5$
$L = 64.5$
$C = 15$
$F = 22$ 2

$\tilde{x} = 64.5 + \frac{19.5}{22}(15)$
$\tilde{x} = 77.795$

$\bar{x} = 78.9$
$Sx = 13.282$

13)


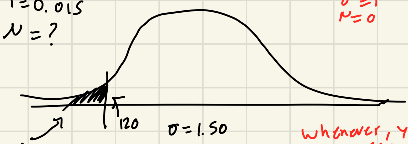
$\sigma = 15.7$
$\mu = 222.3$

x inv = 234.423 2

14) $P = 0.1708$ 2

15) mean = ✓
SD = ✓
median = ×
Range = ✓
a b c
(e) 2

16) $\sigma = 1.50$ $P(x \leq 120)$
$P = 0.015$
$\mu = ?$



$\sigma = 1.50$

x inv = −2.17
$\sigma = 1$
$\mu = 0$
$Z = -2.17$

$$-2.17 = \frac{120 - \mu}{1.50}$$

$= 123.26$

whenever you find Z, use $\sigma = 1, \mu = 0$

17) a) $= P(x \leq 15) - P(x \leq 3)$ 2
b) $= P(x \leq 19) - P(x \leq 11)$ 2

18) a) $= P(x_c < 11.5)$
b) $= P(x_c > 13.5)$ 3
c) $= P(x_c < 19.5)$

Term Test Winter 2015

1) $\bar{x} = 65.88$
$s_x = 42.52$
index $= 0.8 \times 9$
$= (0.2)(13) + 108$
$80^{th}\% = 110.6$ 4

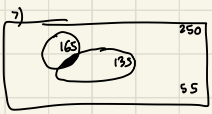
2) variance = 117.58

3) a) $p = 0.127$
b) $P(x \geq 1) = 1 - P(x \leq 0)$
$= 1 - 0.47744$
$= 0.523$ 6

4.) 18

5.) a) mean, median, mode, negative skew 4

6.) 3.6 F = 1 square m 2
a) $\lambda = 1.8$ $x = 2$
$P = 0.268$
b) $\lambda = 7.2$, $x = 4$
$P = 0.0836$ ×

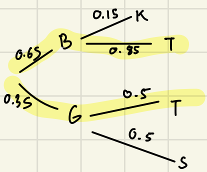
7)


$250 - 55 = 195$

300 = amt of ppl in organic chem/ stats
∴ 300 − 195
= 105 students are in both

$\frac{105}{250}$
$P = 0.420$

$\frac{250}{355}$
$P = 0.704$

8)


$\frac{0.35 \times 0.5}{0.35 \times 0.5 + 0.65(0.85)}$
$= \frac{0.175}{0.7275}$ 2
$P = 0.241$

9) a) $\frac{16C2}{20C2} = \frac{120}{190}$
$P = 0.632$ 2

b) ~~$\frac{16C4 \; 4C1}{20C5} = \frac{7280}{15504}$~~
$P = 0.4695$

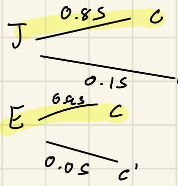
10) ? ×

11) index $= 51 \times 0.65$
$= 33.15$

$\tilde{x} = L + \frac{j}{F} C$ → class interval
(j: index − last cum fr finished)
(L: Lower boundar; F: Frequency)

$\tilde{x} = 29.95 + \frac{10.15}{18}(5)$
$\tilde{x} =$ 2

12) $\sigma_x = 99.8$ 2

13)


$1 - P(\text{both go})$
$= 1 - 0.8075$
$= 0.1925$

2 cases:
$= 0.0425$
$= 0.1425$
$P = 0.185$ 2

14) a) 17.495
b) 1.25

15)


Inv normal
$= 62.58$ 2

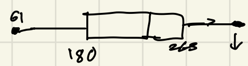
16) $P = 0.237$ 2

17) $n = 55$
$p = 0.25$
$P(x > 15) = P(x_c > 15.5)$ ← Lower
Normal CD
$\sigma = \sqrt{np(1-p)}$
$\sigma = \sqrt{13.75 \times 0.75}$
$\sigma = 10.3125$
$\sigma = 3.211$
$\mu = 13.75$
$= 0.293$ 2

18) a) Step = 1.5 IQR
$= 85 \times 1.5$
Step $= 127.5$

a) 61 — 180

← 52.5 → 61 √
~~50~~ 2



392.5

b) 265 ⟶ 385

19) a) $= P(x \leq 18) - P(x \leq 7)$ 3
b) $= P(x \leq 10) - P(x \leq 3)$
c) $= P(x \leq 12) - P(x \leq 6)$

20) a) $= P(x_c < 36.5)$
b) $= P(x_c > 10.5)$ 3
c) $= P(x_c > 13.5)$

Non Assignment 1

2.23) 365 − 231 = 134
134 ÷ 8 = 17

∴ I would use intervals of 17 for 125 data values

2.24) 5.9 − 3.2 = 2.7
2.7 ÷ 6 = 0.45

Non-Homework 1

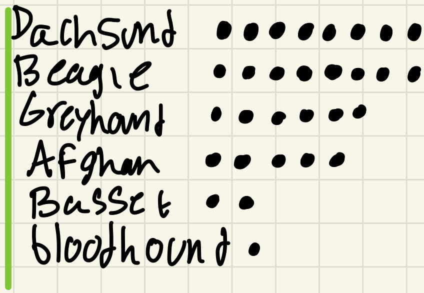
2)

Experimental		Standard
	2	7 2
	2	8 3
18	3	1 6
39 26	3	21 29
	3	45 49 50 56 56
75 61	3	60 66
93 92	3	80 84 99
10 07 06 03 01	4	02 10
34 30 27 26 20	4	31
47	4	55
77 67	4	6 2

Stem value: 100's
leaf: ones

Conclusions: Experimental has higher data values, less variability.

3) 2.5)

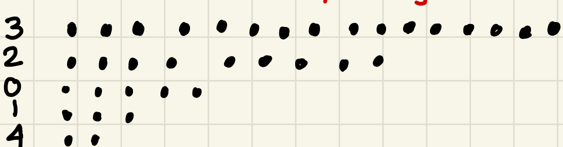


4) 2.23) 365 − 231 = 17

2.25)
class limits mean → a) 184.66 − 37.65 = 147.01
147.01 ÷ 4 = 36.75
0 - 49.99
50 - 99.99
b) 147.01 ÷ 6 = 24.5
c) 147.01 ÷ 8 = 18.37

2.27) 133 Total
a) 5.0 grams, 20.0, 35.0
b) 94.9 grams, 79.9, 65.0
c) 5.0 − 94.9 grams
d) 14.99 grams

3) 2.9) Note: Pareto diagrams have a lot of real world application, by using codes 0, 1, 2, 3, 4.



Non-Hw1

5) 2.28) May be difficult for people to interpret data that use different bin intervals and create bias. Can create bias and adjust skewness of the data.

2.29) The intervals are consistent, however they can't group any invoice from $50, -60. Not proper to skip values.

2.31) these categories are not very comparable fruits is way healthier and may be considered an outlier. Also does not include all deserts, Not fair comparison, all different in own way..

2.32) a) 54.5, 60.5, 66.5, 72.5, 78.5 - unaccounted for?
b) class marks = halfway through your intervals
57.5, 63.5, 69.5, 75.5, 81.5

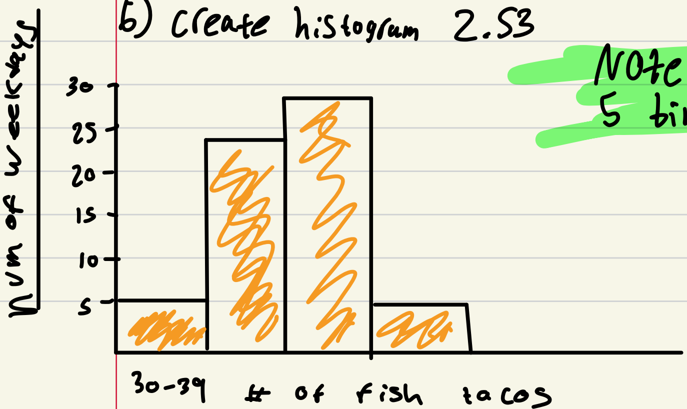
2.36) Frequencies are 1, 2, 4, 2, 15, 16

2.37) Total = 40   2.5%, 5%, 5%, 10%, 37.5%, 40%

2.38) 2.5%, 7.5%, 12.5%, 22.5%, 60%, 100%

6) create histogram 2.53

Note: Always use atleast 5 bins instead of 4



Non-HW1

7)

x (columns), y (rows)

Frequency	10-14	15-19	20-24	25-29
15-19	||	|||	||	
20-24	|	||||	~~||||~~ |	|
25-29		||	~~||||~~	||||

x (columns), y (rows)

Frequency	10-14	15-19	20-24	25-29	
15-19	2	3	2		7
20-24	1	4	6	1	12
25-29		2	5	4	11
	3	9	13	5	30

Non Assignment 2

Non-Assignment 2: Chapter 3

1) 3.6) $\bar{x} = 30$

2) 3.21)

382 - Humanities, \$33373
450 - Social Sciences, \$31684
113 - CS, \$40329

$\bar{x} = \$35\,129$

∴ The avg salary for all 945 graduates is \$35 129

3) a) $= \frac{n+1}{2}$

$= \frac{33+1}{2}$

$= 17$

b) $\frac{45+1}{2}$

$= 23$

4) 3.27) ~~40~~, ~~40~~, ~~50~~, ~~53~~, ~~53~~, 57, 59, ~~63~~, ~~65~~, ~~65~~, ~~68~~

Median = 58

5) $Q1 = 0.25(48+1)$

$Q1 = 12.25$ ↖ what bin ur in

$J = 12.25 - 5$

$J = 7.25$ more values to travel.

median position ↓

$Q1 = 24.95 + \left(\frac{7.25}{13}\right) 25$

$Q1 = 38.9$

$Q3 = 0.75(48+1)$

$Q3 = 36.75$

$J = 36.75 - 34$

$J = 2.75$

$Q3 = L + \frac{J}{f} c$

$Q3 = 74.95 + \frac{2.75}{8}(25)$

$Q3 = 83.5$

6) For someone in the 83^{rd} percentile of hieght, I can infer they are a relatively tall person for their age. They would not be tall enough to be considered an outlier.

For the 54^{th} percentile, in general the boy is average weight and is in the vast majority of kids his age.

7)

a) $\bar{x} = 1.804$

b) median = 1.725

c) mode = 1.92

d) range = max − min

range = 2.67 − 1.04

range = 1.63

Calculation for median

Index = $\frac{(n+1)}{2}$

Index = $\frac{(20+1)}{2}$

= 10.5

1.04	2.27
1.04	2.29
1.15	2.55
1.35	2.59
1.48	2.67
1.52	
1.59	
1.65	
1.67	
1.70	
1.75	
1.92	
1.92	
1.93	
1.95	

e) 40^{th} percentile :

index : (0.40) (20+1)

= 8.4^{th} value

40^{th} Percentile : 1.65 + (0.40)(1.67−1.65)

= 1.658

h) IQR : Q3 − Q1

IQR : 2.19 − 1.49

IQR = 0.70

Standard box plot: includes outliers

Simple box plot: has no outliers

f) Q1 = 0.25(20+1)

Index = 5.25

Q1 = 1.48 + (0.25)(1.52−1.48)

Q1 = 1.49

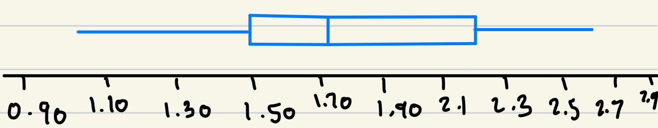
g) Q3 = 0.75(20+1)

Index = 15.75 index

Q3 = 1.95 + (0.75)(2.27−1.95)

Q3 = 2.19

Box Plot :



8) **Trimmed mean** = deleting portion of data from each side. Better for understanding location.

If n = 200, to find the 10% trimmed mean, you would get rid of 20 values from high side and low side. Then use remaining 160 values to get the mean.

In Q7 n = 20
5% of 20 = 1
∴ we get rid of
2.67 and 1.04
(highest and lowest)

If we found 10% trimmed mean you do: n = 16
$\bar{x} = 1.793$

Then: $\bar{x} = 1.798$

Q9)
Data: 24, 24, 27, 29, 36, 36, 36, 36, 44, 44, 44, 120
n = 12

a) mean = 41.67

b) median index = $\left(\frac{n+1}{2}\right)$ = 6.5 → $\frac{(36+36)}{2}$ = 36

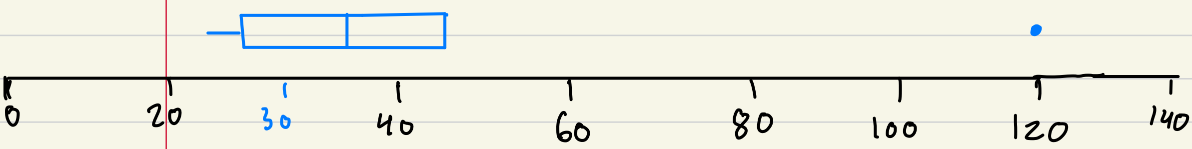
c) mode = 36

d) range = 96

e) $Q_1 = 0.25(n+1)$
$= 0.25(13)$
$= 3.25$
$Q_1 = 27 + (29-27)(0.25)$
$Q_1 = 27.5$

f) $Q_3 = 0.75(n+1)$
$Q_3 = 9.75$
$Q_3 = 44 + 0.75(44-44)$
$= 44$

g) IQR = 44 - 27.5
IQR = 16.5



q) whisker goes to largest or smallest value in the data that is not an outlier.

14) 65^{th} percentile

index = 0.65 (8+1)
= 5.85

∴

= 230 + (0.85) (5)

65^{th} percentile = 234.25

13). Data: 12, 17, 19, 26, 31, 52, 60, 69, 77, 104, 210, 260

Data B: 8, 22, 25, 31, 33, 38, 43, 55, 60, 61, 85

5 Summary for A:

Range = 248

median = 56

Q1 = 0.25 (13)

index = 3.25

= 19 + (0.25) (7)

Q1 = 20.75

Q3 = 0.75(13)

= 9.75

= 77 + (0.75)(27)

Q3 = 97.25

5 Summary for B:

Range = 77

median = 38

Q1 = (0.25) (12)

Q1 = 3

Q1 = 25

Q3 = 9

Q3 = 60

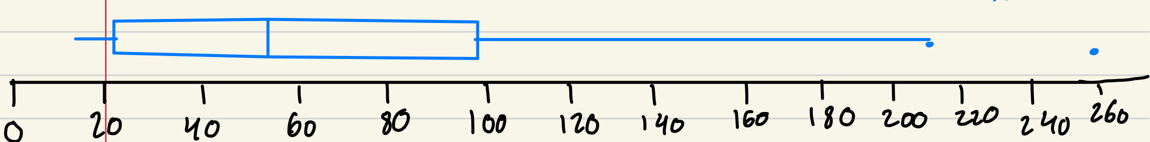
IQR = 76.5

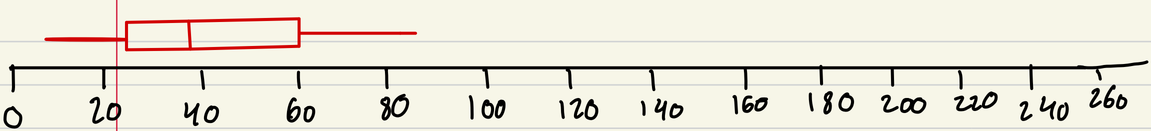
IQR = 35

Step = 114.75

step = 52.5

Could go up to 212, before an outlier.





Conclusions: data set 1 has more variability, 1 outlier and is mound shape.

data set 2 has less variability, no outliers and is Positively skewed.

Non Assignment 3

Non-Assignments 3: Chapter 4-5

1.) 4.12) $s = 0.207$ $\times 100 =$

after all data values are multiplied by 100 : $s = 20.68$

∴ If all data is affected by the same scalar multiple, the standard deviation also changes by a factor of that multiple.

4.20) $\bar{x} = 111.6$ min

$\bar{s} = 2.8$ min

Chebyshevs: $1 - \frac{1}{K^2}$] used to see how much data falls within a range.

a) 106 to 117.2 = 111.6 ± K(2.8)

∴ K = 2 ∴ $1 - \frac{1}{2^2} = 0.75$

∴ at least 75% of the data falls in between 106 - 117.2 minutes.

4.20) b)

97.6 to 125.6 = 111.6 ± K(2.8)

125.6 = 111.6 + K(2.8)

14 = K(2.8)

K = 5

∴ $1 - \frac{1}{K^2} \Rightarrow \frac{24}{25}$ or 96%

∴ atleast 96% of data falls tween 97.6 mins and 125.6 mins.

4.22) $\bar{x} = 47.7$

$\bar{s} = 2.46$

Chebyshevs Rule:

60 = 47.7 + 2.46K

K = 5

∴ $1 - \frac{1}{K^2}$ = 96% This is the amt of time she will be on time.

∴ At most she will be less than 4% of the time

Non-Assignments 3: Chapter ~~4~~ 5

4.26) Golfer 1:
$\bar{x} = 76.2$
$\bar{s} = 2.4$

Golfer 2:
$\bar{x} = 84.9$
$\bar{s} = 3.5$

∴ golfer 1 is relatively more consistent as he has a smaller standart deviation

4.32) $\bar{s} = 9.89$
$\bar{s}^2 = 97.81$

Pearsonian coefficient of skewness: 0

$L + \frac{J}{f} C$

$J = 25.5 - 17$
$J = 8.5$
$19.5 + \frac{8.5}{17}(10)$
$= 24.5$

Pearsonian coeffecients: $SK = \frac{3(\bar{x} - \tilde{x})}{s}$ (mean, median, standard deviation)

If you get a positive its a positive skew, negative means negative skew.

R8:

less than or equal to	cumulative frequency
4	34
9	64
14	69
19	78
24	80

4.28) $\bar{x} = 118.2$ $x = 109.7$
$s = 4.8$ $s = 4.7$

∴ person 1 has a relitively more variable blood glucose level.

R4) 3.9, 4.6, 4.9, 5.3, 5.8, 6.3, 6.3, 6.5, 6.8, 7.3, 7.5, 7.8, 8.2, 8.5, 9.0, 9.7, 10.1, 10.4, 11.3

a) $n = 0.5(21)$
$n = 10.5$
$m = 7.3 + (0.2)(0.5)$
$m = 7.4$

b) Q1 $= (0.25)(21)$
$= 5.25$
$m = 5.8 + (0.5)(0.25)$
$m = 5.93$

Q3 $= (0.75)(21)$
$= 15.75$
$m = 8.5 + (0.75)(0.5)$
$m = 8.88$

R7) a) $\bar{x} = 7.31$

c) $s = 5.7$

b) $\tilde{x} = L + \frac{J}{f}(c)$
$J = 40.5 - 34$ $f = 20$
$J = 6.5$ $L = 4.5$
$c = 5$
$\tilde{x} = 4.5 + \frac{6.5}{20}(5)$
$\tilde{x} = 6.125$

d) $SK = \frac{3(7.31 - 6.13)}{5.7}$

$SK = 0.62$

∴ The data is skewed positively, tail goes left.

Non-Assignments 3: Chapter 4-5

R32.) a) $x = 65$ $\bar{x} = 45$, $s = 8$

$z = \frac{x - \bar{x}}{s}$

$z = \frac{65 - 45}{8}$

$z = 2.5$

b.) $x = 39$

$z = \frac{39 - 45}{8}$

$z = -0.75$

c.) $x = 55$

$z = \frac{55 - 45}{8}$

$z = 1.25$

R34)

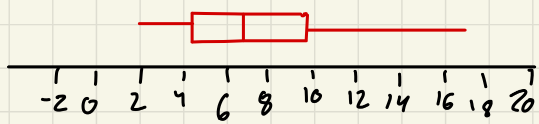
Raw data: 2, 3, 3, 4, 4, 5, 5, 5, 6, 6, 7, 8, 8, 9, 9, 10, 12, 12, 15, 17

Median = 6.5
Q1 = 4.25
Q3 = 9.75
Max = 17
Min = 2

$m_i = (0.5)(21)$
$m_i = 10.5$
$\tilde{m} = 6 + (0.5)(7-6)$
$\tilde{m} = 6.5$

$Q1 = (0.25)(21)$
$Q1 = 5.25$
$Q1 = (0.25)(1) + 4$
$= 4.25$

$Q3 = (0.75)(21)$
$Q3 = 15.75$
$Q3 = (0.75)(1) + 9$
$Q3 = 9.75$



Slightly positevly skewed

R.42)

a) Raw data: 417, 432, 462, 480, 1455

$\tilde{m} = (0.5)(6)$
$\tilde{m} = 3$
$\tilde{m} = 462$
$\bar{x} = 649.2$

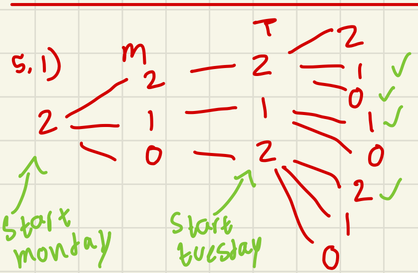
b) Corrected:
$\bar{x} = 449.2$
$\tilde{x} = 455$

417, 432, (455), 460, 480

∴ we know extreme outliers change the mean.

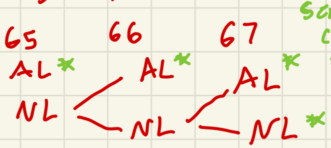
Chapter 5 - Questions

5.1)



4 ways

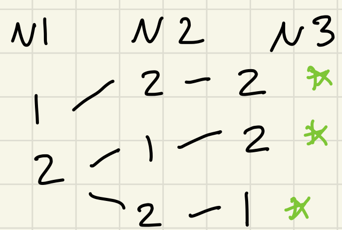
5.3) AL vs NL
3 - 1



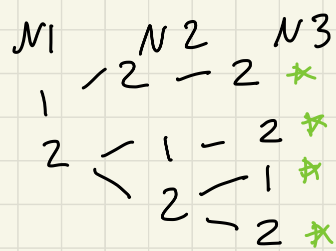
4 ways series can end

5.4) a) $_{10}C_2 = 45$

5.4)

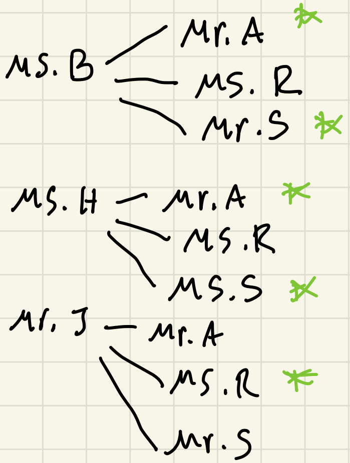


∴ There are 3 ways



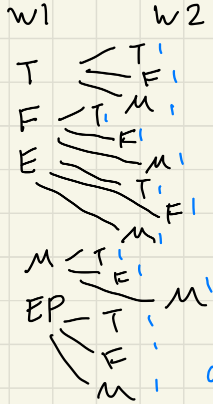
∴ There are 4 outcomes

5.14)



5 ways are possibility

5.18)



15 Total ways

m x n = 15

5x3 = 15

m ways of doing first step

n ways of doing second step.

5.21)

5 CL
5 CL
2 P
3 M

5x5x2x3 = 150

No matter what u choose first the rest, dont get affected

5.23) a) $3^{10} = 59049$ ← Exponential growth

b) $2^{10} = 1024$ ← 2 ways to get each question wrong.

c) $1^{10} = 1$ ← ways to get perfect.

5.29) $32C5 = 201376$

5.31) $8P5 = 6720$

5.44) a) $\left(\frac{4}{52}\right)$ $\left(\frac{3}{51}\right)$

P of 1   P of 2

$\frac{4 \times 3}{2652} = 0.00452$

$= 0.45\%$

5.44)

b) $\left(\frac{13}{52}\right) \times \left(\frac{12}{51}\right)$

$= \frac{156}{2652} = 0.0588$

or 5.8%

c) $\left(\frac{26}{52}\right) \left(\frac{26}{51}\right) = 0.510$

$= \frac{676}{2652}$ x2

5.46) a) $\frac{1}{6}$

b) $\frac{1}{2}$

c) $\frac{1}{3}$

5.48) $P(0) = \frac{1}{16}$

$P(1) = \frac{1}{4}$

$P(2) = \frac{3}{8}$

$P(3) = \frac{1}{4}$

$P(4) = \frac{1}{16}$

5.50) 24, 2000
14, 1999
10, 2002

a) $\frac{1}{2}$

b) $\frac{7}{24} + \frac{5}{12}$

$= \frac{17}{24} = 70.8$

7) 2^{10} ways to get all questions wrong but, Total is

$P(w)\frac{1024}{59049} = 0.01734$

6.33) odds is the probability that it will occur to the probability that it wont occur.

a) $\frac{a}{b} = \frac{p}{1-p}$ ← will occur ← Not occur

odds ↗

$\frac{a}{b} = \frac{\frac{11}{16}}{1-\frac{11}{16}} = \frac{11}{5}$ ← odds

b) odds $= \frac{34}{21}$

$\frac{\frac{K}{21}}{1-\frac{K}{21}} = \frac{34}{21}$

→ Note $34+21 = 55$

$\frac{34}{21} = \frac{\frac{34}{55}}{\frac{21}{55}}$ ← P(a) ← P'(a)

$= \frac{34}{21}$ ∴ probability is $\frac{34}{55}$

8) ABCD

a) $4C3 = 4$

ABC
BCD
ABD
ACD

} If order doesnt matter

b) $4P3 = 24$

ABC	BAC	CAB	DAB
ABD	BCD	CAD	DAC
ACB	BDA	CBD	DBC
ACD	BDC	CBA	DCB
ADC	BCA	CDA	DCA
ADB	BAD	CDB	DBA

c) $\frac{5}{24}$ $a = \frac{\frac{5}{24}}{\frac{19}{24}} = \frac{5}{19}$

∴ The odds are $\frac{5}{19}$. The odds it will not happen is 19 to 5.

d) $\frac{719}{1} = \frac{\frac{719}{720}}{\frac{1}{720}}$

P(a) all envelops end up in right places $= 0.999\%$

Non
Assignment 4

Non Assignment – 4

6.10) B': {8} this means everything but B — Fav color is not listed

$A \cap B$: {3,4} the things in common between A and B. — Fav color is red or blue

$B \cap C'$ {1,2,3,4,5} B intersects everything But C — red, yellow, blue, green, brown

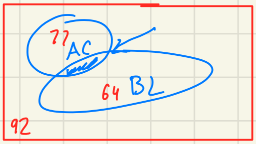
$A \cup B'$ {3,4,8} In A and not B — Blue, green, or other

6.16) 77 – accounting, 64 – Business, 92 – neither

Total = 233

233 − 200 = 33

1 of 200



233 = 77 + 64 + 92
33 students

6.54) P(M) means married, P(E) means experience

a) P(M) is the probability the first selected person is married

b) $P(M \cap E)$ is the people experienced and married

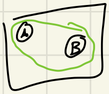
c) $P(E|M)$ is married people who have experience

a) P(M) = 0.6 b) $P(M \cup E) = 0.2$

c) P(M) = 0.33

6.26) a) P(S) = 0.73
P'(S) = 0.33
$P(S) + P'(S) \neq 0$

b)



Two mutually exclusive events can't Both occur.

c) $P(V) \neq 1.09$ can't be more than 1

d) P(S) and P'(S) / Can't happen and not happen

6.55) $P(E|M) = \frac{P(M \cap E)}{P(M)}$

$0.33 = \frac{0.2}{0.6}$

✓ $\frac{1}{3} = \frac{1}{3}$ ✓

6.32) $P(x \leq 3) = 0.64$
$P(4 \leq x \leq 6) = 0.21$

a) P(m) = 1 − 0.64
P(m) = 0.36

b) P(m) = 0.85

c) P(1) = 1
1 − 0.64 − 0.21
0.15 = P(m)
P(m) = 0.15

6.56) $P'(E) = 0.7$ ppl with no exp

$P(M' \cap E') = 0.3$ ppl are single and no exp

$P(M'|E') = 0.143$ ppl who have no exp who are single

6.40) P(Firestone) = 0.19
P(gy) = 0.26
P(mic) = 0.25
P(gr) = 0.20
P(P) = 0.07
P(other) = 0.03

a) P = 0.46
b) P = 0.44
c) P = 0.58

6.62) Probability of 2 hearts if:

a) sampling replacement $\frac{13}{52} \times \frac{13}{52} = \frac{1}{16} = 0.0625$

b) Sampling without replacement $\frac{13}{52} \times \frac{12}{51} = \frac{1}{17} = 0.058$

↳ Ends up being hypergeometric

6.42) $\frac{6}{36} + \frac{2}{36}$

a) $= \frac{2}{9}$

b) $= \frac{1}{36} + \frac{2}{36} + \frac{1}{36}$
$= \frac{1}{9}$

c) $\frac{2}{36} + \frac{4}{36} + \frac{6}{36} + \frac{4}{36} + \frac{2}{36} = \frac{1}{2}$

6.46) $P(NJ) = 0.68$
$P(LR) = 0.51$
$P(B) = 0.22$

$P(NJ) \cup P(LR)$

NJ + LR − B
0.68 + 0.51 − 0.22
= 0.97

6.63) P(A) = 0.8
P(C) = 0.95
$P(A \cap C) = 0.76$

A and C can occur together

(0.8)(0.95) = 0.76

∴ The events are independent.

6.64) $P(M) = 0.15$
$P(N) = 0.82$
$P(M \cap N) = 0.12$

$(0.15)(0.82) = 0.120$
$0.123 \neq 0.120$

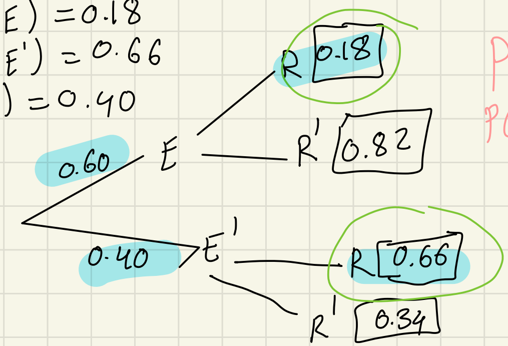
∴ They are not indepentent

When its in Stages in a tree diagram multiply the probability on each step.

6.70) Bays Theory: $P(A|B) = \dfrac{P(A \cap B)}{P(B)}$

$P(A|B) = \dfrac{P(B|A)\,P(A)}{P(B)}$

$P(E) = 0.60$
$P(R|E) = 0.18$
$P(R|E') = 0.66$
$P(E') = 0.40$



$P(R) = (0.60)(0.18) + (0.66)(0.40)$
$P(R) = 0.372$

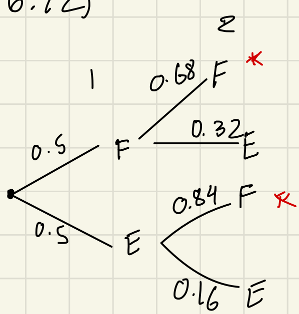
6.71) $P(E'|R) = \dfrac{(0.66)(0.40)}{(0.60)(0.18) + (0.40)(0.66)} = 0.710$

Him winning if E did not enter race

Total probability he wins again

6.73) $P(F) = 0.76$
$P(F|F) = 0.76 - (0.84)(0.5)$
$P(F|F) = 0.34$

6.72)

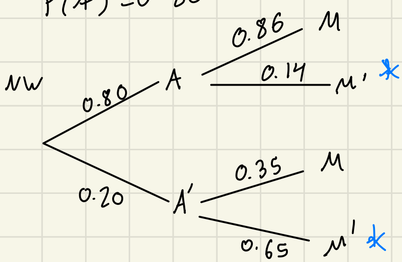


$P(F) = (0.5)(0.84) + (0.5)(0.68)$
$P(F) = 0.76$

6.74) $P(M) = 0.86$

$P(M'|A) = 0.35$

$P(A) = 0.80$



a) $P(M') = (0.20)(0.65) + (0.80)(0.14)$

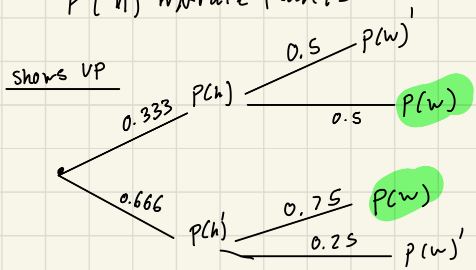
$= 0.242$

b) $P(A'|M') = \frac{(0.20)(0.65)}{0.242}$

$P(A'|M') = 0.537$

6.76) $P(w)$ Prob of withering

$P(h)$ hydrate plants



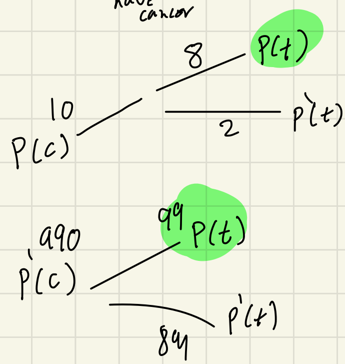
$P(h'|w) = \frac{(0.666)(0.75)}{(0.333)(0.5) + (0.666)(0.75)}$

$= \frac{0.4995}{0.666}$

$= \frac{3}{4}$ or 0.75

6) $P(c)$ = have cancer $P(t)$

$P'(c)$ = dont have cancer



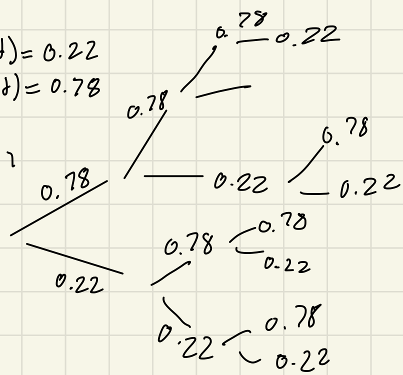
$P(t) = 0.107$

$P(c|t) = \frac{8}{107}$

$= 0.075$

5) $P(d) = 0.22$

$P'(d) = 0.78$



$P(d) = 0.2887 \Leftarrow$ All 5 are the same

$P(d') = 1 - 0.2887$

$= 0.7113$

b) $\frac{7}{3} \Rightarrow \frac{7}{10} = 0.7$

c) $P' = \frac{5}{2}$ $\quad \frac{5/7}{2/7}$ $\frac{B'}{B} = \frac{2}{7}$

$= 0.286$

d) $P(c) = 0.62$

$\frac{0.62}{0.38} = \frac{62}{38} = \frac{31}{19}$

$\therefore 31:19$

$\frac{c}{c'}$ = odds c will happen

Non Assignment 5

Non Assignment #5 - chapter 7, 8

7.7) average gross profit is: 1260

7.8) average amount of alarms are 3.82.

8.2) a) probability cant be expressed as a negative.
b) Yes, can serve
c) NO, values must sum to 1 ⇒ for probability Distribution of Random variable

8.6) Binomial PD & CD

$\frac{4}{6}$ $p = 0.30$ P = probability of success
x = # of success
n = # of total trials

$n = 6$
$x = 2$
$p = 0.30$

For plant to survive: $P(s) = 0.324$

b) $P(x \geq 1) = 1 - P(0)$ — Probability of 0 surviving
$= 1 - (0.117)$
$= 0.88$

Binomial CD - gives cumulative, 0, 1, 2

c) $P(x \leq 2) = 0.744$
$n = 6$
$x = 2$
$P = 0.3$

3.) $n = 10$ Binomial CD:
$P = 0.33$

b) $P(2 \leq X < 7) = P(x \leq 6) - P(x \leq 1)$
$= 0.981451 - 0.108001$
$= 0.873$

a) $P(3 < X \leq 8) = 0.99674 - 0.56836$
$= 0.43$

3) c) $P(x = 5) = P(x \leq 5) - P(x \leq 4)$
$= 0.9268 - 0.79364$
$= 0.133$

d) $P(x \geq 4) = P(x \leq 10) - (x \leq 3)$
$= (1) - 0.5683$
$= 0.4317 \rightarrow = 0.432$

e) $P(x \geq 1) = 1 - P(x \leq 0)$
$= 1 - 0.0182284$
$= 0.9817716 \rightarrow 0.982$

8.28) Rules: $n \geq 100$, $np < 10$
a) Yes
b) NO, $400 \times \frac{1}{50} > 10$
c) NO, $n < 100$

8.30) $n = 180$ $np = 5.4$
$P = 0.03$ $P(5) = 0.173$
$x = 5$ $\lambda = np$
$\lambda = 5.4$, $x = 5$

8.34) $\lambda = 3.2$ Poisson PD

a) $x = 2$

$P(2) = 0.209$

b) $P(x \leq 2) = ?$ Note any time you have $\leq$, chances are your using CD.

Poisson CD:

$\lambda = 3.2$

$x = 2$ $= 0.38$

c) $\lambda = 3.2$

$\times 2$

$\lambda = 6.4$

$x = 0$

But we must adjust lambda because it wants 2 days of stuff.

$P(0) = 0.00166$ or

$\lambda = 3.2$

$x = 0$

$P(0) = 0.0407$

$P(0) = (0.0407)^2$

$P = 0.00166$

d) $\lambda = 6.4$

$x = 3$

$P(3) = 0.07259$

8.40) $\bar{x} = 2$

$s = 1$

8.42) $\bar{x} = 1.4$

$\sigma = 1.2$

8.47) a) $\mu = np$

$\sigma^2 = np(1-p)$

$n = 484$

$p = 0.5$

$\mu = 242$

$\sigma^2 = 242(1-0.5)$

$\sigma^2 = 121$

b) $n = 720$

$p = 0.166$

$\mu = n(p)$

$\mu = 720(0.166)$

$\mu = 119.52$

$\sigma^2 = 119.52(1-0.166)$

$\sigma^2 = 99.687$

$\sigma = 10$

c) $n = 600$

$p = 0.30$

$\mu = 180$

$\sigma^2 = 126 \rightarrow \sigma = 11.2$

e) $n = 800$

$p = 0.65$

$\mu = 520$

$\sigma^2 = 182$ $\sigma = 13.5$

8.48) $np = \mu$

$\sigma^2 = np(1-p)$

$n = 48$ hrs

$p = 0.6$

$\mu = 28.8$

$\sigma^2 = 28.8(1-0.6)$

$\sigma = 3.347$

8.20) $T = 20$

$FP = 12$

$C = 8$

$$\frac{12c3 \times 8c3}{20c6}$$

$$= \frac{12320}{38760}$$

$= 0.3185$

8.22) $\frac{16c3}{16c5}$ (16c3 = amt of ways he checks; 16c5 = amt of ways shipments)

a) $\frac{5c0 \times 11c3}{16c3}$

$= 0.295$

b) $\frac{5c1 \times 11c2}{16c3}$

$= 0.491$

c) $\frac{5c2 \times 11c1}{16c3}$

$= 0.196$

$\frac{5c3 \times 11c0}{16c3}$

$= 0.018$

Calculator Questions

A) $\bar{x} = 12$

$S = 8.042$

$S^2 = 64.667$ ← standard deviation

B) $\bar{x} = 17.04$

$S = 4.08$

$S^2 = 16.65$

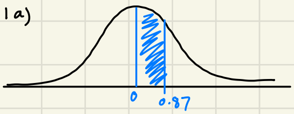
c) $\mu = 10.7$

$\sigma = 6.943$

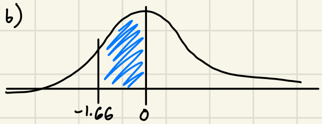
$\sigma^2 = 48.210$

Non Assignment 6

Non Assignment 6 - Chapters 9/10.

1 a)


NCD:
$P = 0.308$

b)


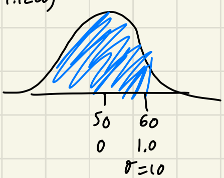
$P = 0.451$

c) $P = 0.315$

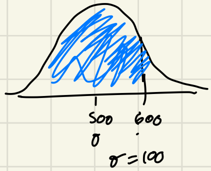
d) $P = 0.606$

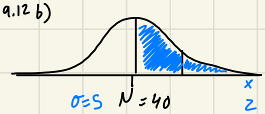
e) $P = 0.9032$

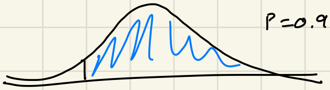
f) $P = 0.214$

9.12 a)


vs

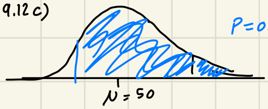


9.12 b)




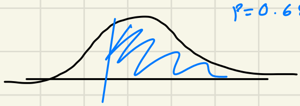
$\sigma = 5$
$\mu = 50$

$P = 0.977$

9.12 c)


$P = 0.841$

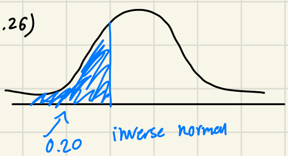
⟹ Probability is bigger



$P = 0.685$

9.18) $P = 0.399$

9.25) a) $P = 0.766$
b) $P = 0.130$

9.26)


inv $x = 15.65$

9.31) $\sigma = 0.08$
$\mu = 1.96$
a) Lower = 2

$P = 0.308$ ✓
$= 30.8\%$

b) 0.95
xinv = 2.0916
∴ The value one would find

9.43) $P = 0.8$
$n = 200$

$\mu = 160$
$\sigma = \sqrt{np(1-p)}$
$\sigma = \sqrt{32}$
$\sigma = 4\sqrt{2}$

L:

$P = 0.0397$
$P = 0.04$

9.39) $n = 20$
$p = 0.5$

$np = \mu$
$\mu = 10$

$\sigma = \sqrt{np(1-p)}$
$\sigma = 2.236$

$P(x_D \geq 12) = P(x_c \geq 11.5)$
$P = 0.2511$

Lower = 11.5
Upper = 20
$\mu = 10$
$\sigma = 2.236$

10.35) b) $\sigma_{\bar{x}} = \frac{\sigma_x}{\sqrt{n}}$

$$\frac{\frac{\sigma}{\sqrt{5}}}{\frac{\sigma}{\sqrt{245}}} = \frac{\sqrt{245}}{\sqrt{5}} = 7$$

∴ S.E mean is a multiplied by 7.

10.36) a) $\frac{\frac{\sigma}{\sqrt{10}}}{\frac{\sigma}{\sqrt{1000}}} \times \frac{\sqrt{1000}}{\sqrt{10}} = 10$

∴ S.E mean is multiplied by 10.

b) $\frac{\frac{\sigma}{\sqrt{80}}}{\frac{\sigma}{\sqrt{500}}} \times \frac{\sqrt{500}}{\sqrt{80}} = \frac{2}{5}$ SE is ÷ by 2.5

10.37) $\sigma_{\bar{x}} = [redacted] \sqrt{\frac{100-10}{100-1}}$

a) $\sigma_{\bar{x}} = 0.953$

b) $\sigma_{\bar{x}} = \sqrt{\frac{300-25}{300-1}}$
$\sigma_{\bar{x}} = 0.959$

c) $\frac{\sqrt{4900}}{\sqrt{4999}} = 0.990$

Find probabilities of error in the estimate

10.42) $n = 100$
$\sigma = 3.6$

$\sigma_{\bar{x}} = \frac{\sigma_x}{\sqrt{n}}$

$\sigma_{\bar{x}} = \frac{3.6}{\sqrt{100}}$

Error = |estimate − μ| $\sigma_x = 0.36$ answers

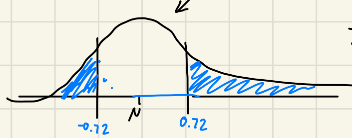
a) $P(x \geq 0.72) =$
$P(|\text{error}| \geq 0.72)$
$P(|z| \geq 0.72)$

$Z = \frac{\mu + 0.72 - \mu}{3.6/\sqrt{100}}$

$Z = \frac{0.72}{0.36}$

$Z = 2$

Convert:
$\bar{x} \to \mu = ?\ \sigma = 3.6$
$Z \to \mu = 0, \sigma = 1$



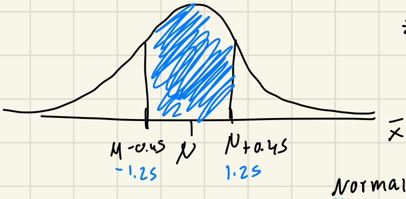
$P = 0.046$

10.35) when n is quadrupled
a) $\sigma_x = \frac{\sigma_x}{\sqrt{n}}$ $\quad \frac{\sigma}{\sqrt{120}} \times \frac{\sqrt{30}}{\sigma} = \frac{\sqrt{30}}{\sqrt{30}\sqrt{4}} = \frac{1}{2}$

∴ the S.E mean gets multiplied $\times \frac{1}{2}$

10.42 b) $P(\bar{x} \leq 0.45) =$

$P(|z| \leq 0.45) =$



$z = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}}$

$z = \frac{0.45}{3.6 / \sqrt{100}}$

$z = 1.25$

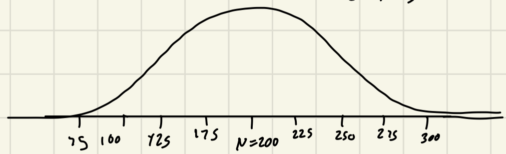
Normal CD: ← use standard $\mu = 0,\ \sigma = 1$

$P = 0.788$

More than = two tails

Less than = big belly

3) $x \sim N(200, 25)$



Non Assignment 7

Non Assignment 7: Ch 11 & 12.

11.2) $n=40$, $\bar{x}=1126$, $\sigma=135$

$\alpha = 0.01$

want 99% confidence interval for μ

$\mu = \bar{x} \pm Z_{\frac{\alpha}{2}} \frac{\sigma}{\sqrt{n}}$

$Z_{\frac{\alpha}{2}}$ = inverse normal ①

Area = $1 - \frac{0.01}{2}$ ②

$\sigma = 1$, $\mu = 0$ ③

$= 2.576$

$\mu = 1126 \pm 2.576 \frac{135}{\sqrt{40}}$

$\mu = 1126 \pm 55.0$

$1071 < \mu < 1181$ with 99%.

11.4) $n=40$, $\bar{x}=32.5$, $\sigma=3.2$

$\alpha = 0.02$

want 98% confidence interval for μ

$\mu = \bar{x} \pm Z_{\frac{\alpha}{2}} \frac{\sigma}{\sqrt{n}}$

$Z_{\frac{\alpha}{2}} = 2.326$

$\mu = 32.5 \pm 2.326 \frac{3.2}{\sqrt{40}}$

$\mu = 32.5 \pm 1.177$

$31.323 < \mu < 33.677$ with 98% confidence.

11.6) S.E 288 → 32

$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{288}}$ to $\frac{\sigma}{\sqrt{32}}$

$\frac{\sqrt{288}}{\sqrt{32}} = 3$

S.E is multiplied by $\sqrt{\frac{288}{32}} = 3$

11.8) $\alpha = 0.05$, $\sigma = 22$, $Z_{\frac{\alpha}{2}} = 1.96$

$n = \left[\frac{Z_{\frac{\alpha}{2}} \times \sigma}{E}\right]^2$

$n = \left[\frac{1.96 \times 22}{6}\right]^2$

$n = 7.186^2$

$n = 51.645$ ∴ A sample of n would be required.

11.10) $E = 0.25$, $\sigma = 0.77$, $Z_{\frac{\alpha}{2}} = 1.96$

$n = \left[\frac{Z_{\frac{\alpha}{2}} \times \sigma}{E}\right]^2$

$n = \left[\frac{1.96 \times 0.77}{0.25}\right]^2$

$n = 6.0368^2$

$n = 36.443$

∴ you need a sample of 37.

1.16) b) $\bar{x} = 75.53$, $\sigma = 2.63$, $\alpha = 0.05$, $Z_{\frac{\alpha}{2}} = 1.96$, $n = 12$

$\mu = \bar{x} \pm Z_{\frac{\alpha}{2}} \frac{\sigma}{\sqrt{n}}$

$\mu = 75.53 \pm 1.488$

∴ $74.042 < \mu < 77.018$

with 95% confidence.

1.20) $\bar{x} = 0.406$, $\sigma = 0.003$, $Z_{\frac{\alpha}{2}} = 2.576$, $n = 10$

a) $\mu = \bar{x} \pm Z_{\frac{\alpha}{2}} \frac{\sigma}{\sqrt{n}}$

$\mu = 0.406 \pm 0.002443$

$0.4036 < \mu < 0.40844$ with 99% confidence

b) $E = 0.001$, $n = ?$

$n = \left[\frac{Z_{\frac{\alpha}{2}} \times \sigma}{E}\right]^2$

$n = \left[\frac{2.576 \times 0.003}{0.001}\right]^2$

$n = 7.728^2$

$n = 59.7$

∴ a sample size of 60 would be required to get it within 0.001 with 99% confidence.

11.30) $n = 15$, $s = 2.155$

estimating for σ.

$Z_{\frac{\alpha}{2}} = 2.326$

$\alpha = 0.02$

$\frac{\alpha}{2} = 0.01$

d.f = 14

$\frac{(n-1)s^2}{\chi^2_{\frac{\alpha}{2}}} < \sigma^2 < \frac{(n-1)s^2}{\chi^2_{(1-\frac{\alpha}{2})}}$

$\frac{14(2.15)^2}{\chi_{0.01}} < \sigma^2 < \frac{14(2.15)^2}{\chi_{0.99}}$

$2.231 < \sigma^2 < 13.887$

$1.493 < \sigma < 3.72$ with 98% confidence.

11.34) a) $n = 40$, d.f = 39, $s = 135$, $\alpha = 0.05$, $\frac{\alpha}{2} = 0.025$, $Z_{\frac{\alpha}{2}} = 1.96$

$\frac{s}{1 + \frac{z_{\alpha/2}}{\sqrt{2n}}} < \sigma < \frac{s}{1 - \frac{z_{\alpha/2}}{\sqrt{2n}}}$

$\frac{135}{1.21913} < \sigma < \frac{135}{0.7808}$

$111 < \sigma < 173$ with 95% confidence.

2.)

11.41) $\hat{p}$ = True population

$n = 400$
$x = 56$
$p = \frac{x}{n}$

$p = 0.14$ $\quad Z_{\frac{\alpha}{2}} = 2.576$

$p - Z_{\frac{\alpha}{2}}\sqrt{\frac{p(1-p)}{n}} < p < \hat{p} + Z_{\frac{\alpha}{2}}\sqrt{\frac{p(1-p)}{n}}$

$p = \hat{p} \pm Z_{\frac{\alpha}{2}}\sqrt{\frac{p(1-p)}{n}}$

$p = 0.14 \pm 2.576\,(0.01735)$

$p = 0.14 \pm 0.0447$

$0.0953 < p < 0.1847$

$0.095 < p < 0.185$ with 99% Confidence.

11.42)

$E = Z_{\frac{\alpha}{2}}\sqrt{\frac{p(1-p)}{n}}$

$E = 1.96\sqrt{\frac{0.14(0.86)}{400}}$

$E = 0.034$

11.44) $p = 0.78$ $\quad Z_{\frac{\alpha}{2}} = 2.326$

$x = 234$
$n = 300$
$p = p \pm Z_{\frac{\alpha}{2}}\sqrt{\frac{p(1-p)}{n}}$

$p = 0.78 \pm 0.0556$

$0.72 < p < 0.836$ with 98% Confidence.

11.52) a) Assume $p = 0.5$

$E = Z_{\frac{\alpha}{2}}\sqrt{\frac{p(1-p)}{n}}$

$0.025 = 2.326\sqrt{\frac{0.5 \times 0.5}{n}}$

$0.01075^2 = \left(\sqrt{\frac{0.5 \times 0.5}{n}}\right)^2$

$\frac{1.15 \times 10^{-4}}{1} = \frac{0.5 \times 0.5}{n}$

$n = 2173.9$

$\therefore$ 2174 sample size is required.

b) $p = 0.3$

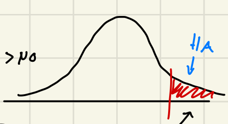
$0.025 = 2.326\sqrt{\frac{0.3 \times 0.7}{n}}$

$n = 1818$

12.2) $H_0: \mu = \mu_0$

a) she should use $H_A: \mu > \mu_0$

$\therefore$ one tail test



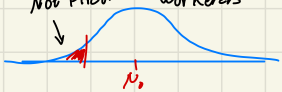
$\bar{x}$ # of mistakes will be in rejection region.

b) $H_0: \mu = \mu_0$

$H_A: \mu < \mu_0$

$\bar{x}$ unless is less than other workers

Not Fired.



12.8) $\sigma = 12$ $\quad H_0: \mu = 75$

$n = 100$

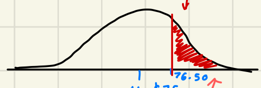
a) Type I error: Reject H_0, shouldn't have

$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$

$\sigma_{\bar{x}} = \frac{12}{10}$

$\sigma_{\bar{x}} = 1.2$

Rejection Region



Find Area using normal CD.

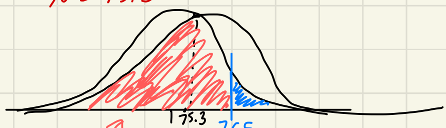
P=0.105

12.8 b) $\sigma = 12$ $\quad H_0: \mu = 75$

$n = 100$

Type 2 Error: Should have rejected HA, but did not.

$\mu = 75.3$



Find Area using Normal CD:

$p = 0.841$

c) Same as part b, use 77.22 as μ.

$p = 0.28$

3) 12.21) $H_0: \mu = 12.3$ $\alpha = 0.05$
$H_A: \mu \neq 12.3$
$n = 35$ $\sigma = 3.8$
$\bar{x} = 11.5$

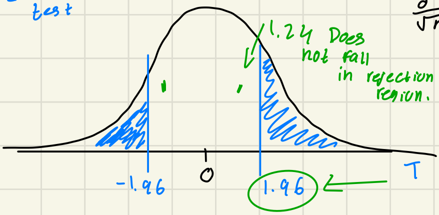
Note: Because $n > 30$: the central limit theorem has kicked in.

2 tail test

① $z = \dfrac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}}$

② $z = \dfrac{11.5 - 12.3}{\frac{3.8}{\sqrt{35}}}$

$z = -1.245$

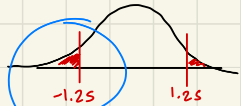


T Table is used z values

∴ We do not have evidence at the 5% level of significance to conclude the avg time spent in jail is 12.3 months

12.22) P value : Normal CD

Note: The P value is driven by the observed value.

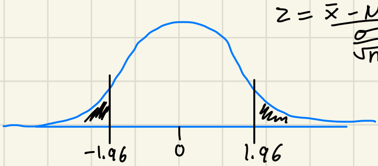


calculate
$P = 0.105$
$P \times 2 = 0.21$
$\therefore P = 0.21$

12.23) $H_0: \mu = 3.52$ $\sigma = 0.07$ CLT
$H_A: \mu \neq 3.52$ $n = 32$
$\bar{x} = 3.55$ $\alpha = 0.05$

$z = \dfrac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}}$ $z = \dfrac{3.55 - 3.52}{\frac{0.07}{\sqrt{32}}}$

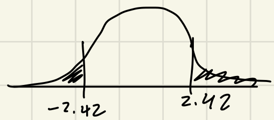
$z = 2.42$



∴ It falls in the rejection region

∴ We have evidence at the 5% level of significance the average ounces of KPC is not equal to 3.52.

2.24) P value:



$P = 0.0155$

Reassess the hypothesis

Because its less than 5% we come to the same conclusion.

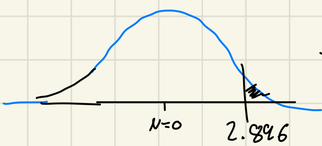
12.28) $n = 9$, $\bar{x} = 6.2$, $\sigma = 0.15$
$H_0: \mu = 6$ $\alpha = 0.01$
$H_A: \mu > 6$

One tail test:

$z = \dfrac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}}$

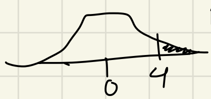
$z = \dfrac{6.2 - 6}{\frac{0.15}{\sqrt{9}}}$

$z = 4$



∴ We have evidence to suggest at the 1% level of significance the $\mu \neq 6$ ounces.

P value:

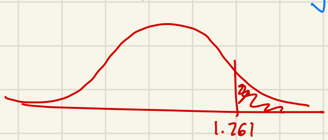


$P = 0.000032 < 0.005$

12.3) $H_0: \mu = 65.4$ $\bar{x} = 68$ $s = 10.06$
$\mu > 65.4$ $n = 15$ $\alpha = 0.05$

One Sided Test

$t_0 = \dfrac{\bar{x} - \mu_0}{\frac{s}{\sqrt{n}}}$ $t_0 = \dfrac{68 - 65.4}{\frac{10.06}{\sqrt{15}}}$ $t_0 = 1.00$



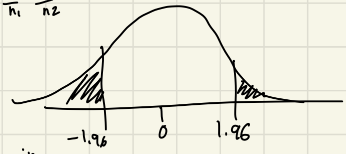
∴ We do not have evidence at 5% level of significance that the average a is increased.

4) 12.36) $n=40$ $n=50$ $\alpha=0.05$ $H_0: \mu_1=\mu_2$
$\bar{x}=9.4$ $\bar{x}=7.9$ $H_A: \mu_1 \neq \mu_2$
$\sigma_1=\sigma_2=3$

$$z = \frac{\bar{x}-\mu}{\sqrt{\frac{\sigma_1^2}{n_1}+\frac{\sigma_2^2}{n_2}}}$$

① $$z = \frac{9.4-7.9}{\sqrt{\frac{3^2}{\sqrt{40}}+\frac{3^2}{\sqrt{50}}}}$$

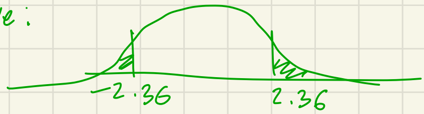
$z = 2.36$



∴ It falls in rejection region.

∴ we have evidence to suggest that the average buisness lunches is not equal in both sections at the 5% level of significance.

P value:



$P = 0.00914$

$P = 0.018$

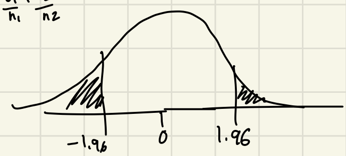
t values number gets bigger, Area gets smaller

12.37) 12.36) $n=40$ $n=50$ $\alpha=0.05$ $H_0: \mu_1=\mu_2$
$\bar{x}=9.4$ $\bar{x}=7.9$ $H_A: \mu_1 \neq \mu_2$
$\sigma_1=3.3$ $\sigma=2.9$

$$z = \frac{\bar{x}-\mu}{\sqrt{\frac{\sigma_1^2}{n_1}+\frac{\sigma_2^2}{n_2}}}$$

① $$z = \frac{9.4-7.9}{\sqrt{0.4405}}$$

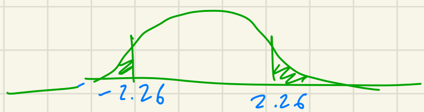
$z = 2.26$



∴ It falls in rejection region.

∴ we have evidence to suggest that the average buisness lunches is not equal in both sections at the 5% level of significance.

P value:

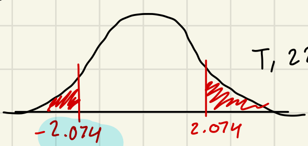


$P = 0.024$

∴ very small, reject H_0

12.40) $n_1=12$ $n_2=12$ $\bar{x}_1=41.2$ $\bar{x}_2=45.8$ $s_1=5.12$ $s_2=6.7$ $\alpha=0.05$ $\sigma=?$ ← split two tail test?

$H_0: \mu_1=\mu_2$
$H_A: \mu_1 \neq \mu_2$
Two tail test



Pooled variance T Test.

① $$sp = \sqrt{\frac{(11)\,26.2 + 11 \times 44.9}{22}}$$

$sp = 5.96$

② $$t = \frac{\bar{x}_1-\bar{x}_2}{5.96\sqrt{\frac{1}{11}+\frac{1}{11}}}$$

$$t = \frac{-4.6}{2.54}$$

$t = -1.81$

③ ∴ It does not fall in the lower rejection region

④ ∴ we do not have evidence at the 5% level of significance that they are not equal.

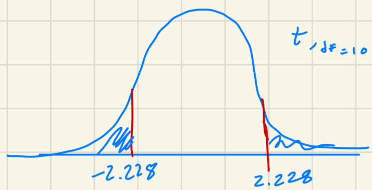
⑤ P value falls between: 0.5 and 0.10

12.44) $n_1=6$ $n_2=6$ $\bar{x}_1=15.4$ $\bar{x}_2=10.6$ $s_1=2.2$ $s_2=2.6$ $\alpha=0.05$
$H_0: \mu_1-\mu_2=2.0$
$H_A: \mu_1-\mu_2 \neq 2.0$

① $$sp = \sqrt{\frac{\frac{5}{4}+11.25}{10}}$$

$$sp = \sqrt{\frac{12.5}{10}}$$

$sp = 2.403$



② $$t = \frac{\bar{x}_1-\bar{x}_2-\sigma}{sp\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}}$$

$$t = \frac{15.4-10.6-2}{2.403\sqrt{\frac{1}{6}+\frac{1}{6}}} \rightarrow t = 2.01$$

σ = delta which is the difference

③ we do not have evidence to suggest at the 5% level of significance that the average time taken to fall asleep by something other than 2

Z - can be about proportions, σ, S

T - only used μ_1, μ_2, μ,

12.48) $n_1 = 9$ $\bar{x}_1 = 156.7$ $s_1 = 13.67$ $\alpha = 0.05$ $H_0: \mu_1 = \mu_2$

$n_2 = 9$ $\bar{x}_2 = 151.7$ $s_2 = 13.79$ $H_A: \mu_1 \neq \mu_2$

Z test means a P value can be Found

t, df = 16

P value

$P > 0.10$

$$SP = \sqrt{\frac{(n-1)s_1^2 + (n_2-1)s_2^2}{n_1+n_2-2}}$$

$$t = \frac{156.7 - 151.7}{13.73 \times 0.4714}$$

$$SP = \sqrt{\frac{8 \times 186.87 + 8 \times 190.1641}{16}}$$

$t = 0.77$

$$SP = \sqrt{\frac{3016}{16}}$$

∴ we do not have evidence at the 5% level of significance that the difference of means is significant.

$SP = \sqrt{188.5}$

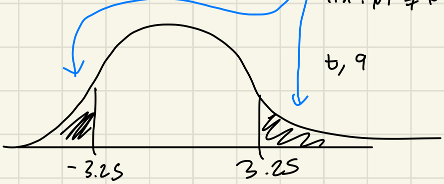
$SP = 13.73$

12.49) $n = 10$ $\bar{x} = -0.2$ $\alpha = 0.01$ $s = 0.0286$

$H_0: \mu_1 = \mu_2$

$H_A: \mu_1 \neq \mu_2$

∴ We do not have evidence at the 1% level of significance to suggest a systematic difference in scale performance.



$(5\% < P \text{ value} < 10\%)$

$$t_0 = \frac{\bar{x}}{\frac{s}{\sqrt{n}}} \qquad t_0 = \frac{-0.02}{\frac{0.2867}{\sqrt{10}}} \qquad t_0 = -2.21$$

$t_0 =$

Chapter 12 Notes

Hypothesis - a statement about the parameters of a population.

H_0 is the null hypothesis

- The null hypothesis is what you assume to be true, before the analysis.
- Null hypothesis is hypothesis of no change, no difference

The Alternative hypothesis is H_A or H_1

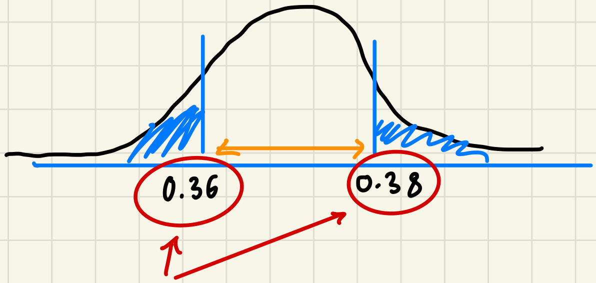
The alternative hypothesis is accepted if the null hypothesis is rejected.

$H_A: \mu \neq \mu_0$

$H_A: \mu > \mu_0$

$H_A: \mu < \mu_0$

The conclusion is always a statement about the Alternative hypothesis.



Critical values are the values where you begin to reject the null hypo.

Either:

Fail to reject H_0

or

Reject H_0

Type 1 error - Reject H_0, but wrong to do so.

Type 2 error - Don't Rejectt H_0, but should have.

α - the probability of a Type 1 error.
β - the probability of a Type 2 error

Sensitivity = $1-\beta$
Specificity = $1-\alpha$

Level of Significance
- Probability of making a type 1 error which is acceptable.

Keywords:

Change/Difference - 2 tail test
Increase/Decrease - 1 tail test
$H_A: \mu \neq 1.5$, Two tail test

* Finding β always on the exam.

The P value - lowest level of significange where H_0 would have been rejected. / where your desicion would have changed.

Calculated value of Z
Observed value for Z

t, chi square: we do the best we can
Z, we can use the P value.

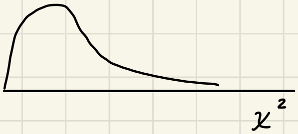
Statistically significant - Fall in the rejection region.

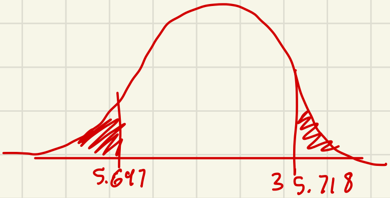
σ is 0 when comparing $\mu_1 = \mu_2$

Non Assignment 8

Non Assignment 8: Ch 13 & Ch 14

13.2) $n = 18$ Ho: $\sigma = 2.7$ $\alpha = 0.01$
$S = 3.8$ HA: $\sigma \neq 2.7$ two tail test





P value:

$0.01 < P < 0.02$

.995 0.005

d.f = 17

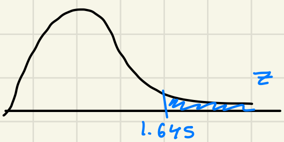
$$\chi^2_{n-1} = \frac{(n-1)s^2}{\sigma^2}$$

$$= \frac{17(3.8)^2}{2.17^2}$$

$$= 33.7$$

∴ we do not have evidence at 1% level of significance to suggest the standard deviation is equal to 2.7 mins.

13.4) $n = 35$ Ho: $\sigma = 0.065$ 1 tail test
$S = 0.082$ HA: $\sigma > 0.065$ $\alpha = 0.05$



$$z = \frac{s - \sigma_0}{\frac{\sigma_0}{2\sqrt{n}}}$$

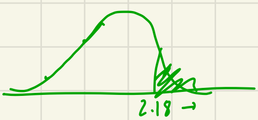
$$z = \frac{0.082 - 0.065}{\frac{0.065}{\sqrt{2n}}}$$

$z = 2.18$

∴ we have evidence to suggest at the 5% level of significance that the standard dev. in her sample is greater then 0.065.

P value:

$P = 0.0146$



13.7) $n1 = 12$ Indep random samples normal pop.
$S1 = 2.6$
$n2 = 16$ $\alpha = 0.05$
$S2 = 4.4$ Ho: $\sigma_1 = \sigma_2$
HA: $\sigma_1 < \sigma_2$

$$F = \frac{s_2^2}{s_1^2}$$

$$F = \frac{4.4^2}{2.6^2}$$

$F = 2.86$

Crit value: 2.22

$F > 2.72$

∴ we have evidence at 5% level of significance σ_2 is greater.

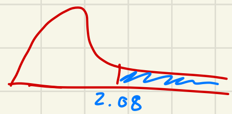
P value:

1% table $= 4.25$
5% table $= 2.72$
$0.01 < P < 0.05$

13.8) $n1 = 25$ $n2 = 21$ $\alpha = 0.05$ one tail
$S1 = 4.2$ $S2 = 3$
Ho: $\sigma_1 = \sigma_2$
HA: $\sigma_1 > \sigma_2$

$$F = \frac{S_1^2}{S_2^2}$$

$F = 1.96$



∴ we do not have evidence to suggest that their devs are not equal at the 5% level of significance

P value:

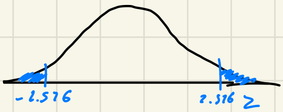
$P > 0.05$

2)

14.7) n = 500 $\alpha = 0.01$
x = 464

95% C.I means we expect to miss 5% of the time.

$H_0: p = 0.95$
$H_A: p \neq 0.95$



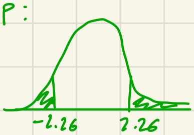
$$z = \frac{x - np_0}{\sqrt{np_0(1-p_0)}}$$

$$z = \frac{-11}{4.87}$$

$$z = -2.26$$

∴ we do not have evidence to suggest at the 1% level of significance that the yields 95% confidence interval.

P:



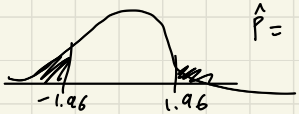
P = 0.0119 × 2
P = 0.238

14.12) $P_1 = 0.667$ $\alpha = 0.05$
$P_2 = 0.73$

$H_0: P1 = P2$
$H_A: P1 \neq P2$

$$\hat{p} = \frac{201}{288}$$

$\hat{p} = 0.698$



$$z = \frac{\frac{x_1}{n_1} - \frac{x_2}{n_2}}{\sqrt{\hat{p}(1-\hat{p})\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

$$z = \frac{\frac{96}{144} - \frac{105}{144}}{\sqrt{(0.698)0.302\left(\frac{1}{144} + \frac{1}{144}\right)}}$$

$z = -1.15$

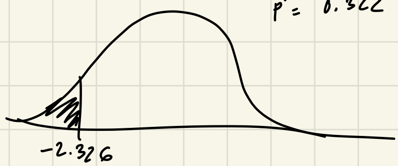
∴ we do not have evidence at 5% level

P × 2
P = 0.250

14.14) $x_1 = 62$ $x_2 = 99$
$n_1 = 200$ $n_2 = 300$
$\alpha = 0.01$

$H_0: P_1 = P_2$
$H_A: P1 > P2$

$\hat{p} = 0.322$



$$z = \frac{\frac{x_1}{n_1} - \frac{x_2}{n_2}}{\sqrt{\hat{p}(1-\hat{p})\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

$$z = \frac{\frac{62}{200} - \frac{99}{300}}{}$$

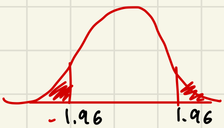
$z = -0.47$

∴ we do not have evidence

P value: P = 0.319

14.8) n = 600 $\alpha = 0.05$
a) x = 157 $p_0 = 30\%$
$p_0 = 0.3$

$$z = \frac{x - np_0}{\sqrt{np_0(1-p_0)}}$$

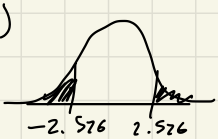


$$z = \frac{157 - 600 \times 0.3}{\sqrt{600 \times 0.3(1-0.3)}}$$

∴ we do have evidence

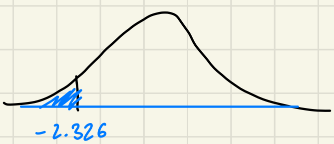
$$z = \frac{-23}{11.225}$$ $z = -2.05$

b)



∴ We do not have evidence to suggest.

14.10) $x_1 = 412$ $n_1 = 5000$ $H_0: P1 = P2$
$x_2 = 312$ $n_2 = 3000$ $H_A: P1 < P2$



$$\hat{p} = \frac{412 + 312}{8000}$$

$\hat{p} = 0.0905$

$$z = \frac{\frac{412}{5000} - \frac{312}{3000}}{\sqrt{0.0905(1-0.0905)\left(\frac{1}{5000} + \frac{1}{3000}\right)}}$$

$z = -3.26$

∴ we do have evidence at the 1% level of significance

Chapter 13 Notes

- Whenever you do hypothesis testing with σ, you use chi square test χ^2

- Chi square looks like this:

Ho: Equal frequencies
HA: Unequal frequencies

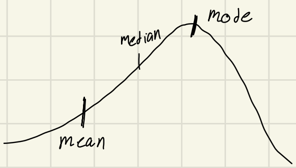
← Always positive skew

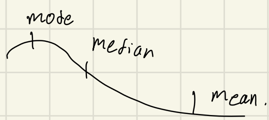
$Z = U_1 - U_2 = 0$ ← delta is always 0.

paired data is usefull as it reduces possible sources of variability.

For F-table : - df of numerator
- df of denominator.

Chapter 14 Notes





count data uses: goodness of fit test

Non Assignment 9

Chapter 15 - Non assignment #9

1) 15.2)

numerator = (4-1) = 3

Denominator = 20×4 - 4 = 76 $\quad k(n-1)$

b) Numerator = 7

Denominator = $N = 15 \times 8 \quad \therefore \quad 120 - 8 = 112$

$N = k \times n$

$D = N - k$

15.14) ANOVA $\alpha = 0.05$

$H_0: \mu_1 = \mu_2 = \mu_3 = \mu_4$

HA: They are not all equal

Source	Deg	Sum Squares	mean Sq	F
Treatment	3	12.95	4.32	0.68
Error	16	101.6	6.35	
Total	19	114.55		

55, 615

60, 754

64, 840

54, 610

$T.. = \sum\sum y$ = 233 $\quad$ 2829

$SST = 2829 - \frac{1}{20}(233)^2 = 114.55$

$SS(Tr) = \frac{55^2}{5} + \frac{60^2}{5} + \frac{64^2}{5} + \frac{54^2}{5} - \frac{1}{20}(233)^2 = 12.95$

$\alpha = 0.05$

∴ We do not have evidence to suggest.

15.38) $\alpha = 0.01$

$n_1 = 8,\ n_2 = 11,\ n_3 = 8,\ T_1 = 92,\ T_2 = 98,\ T_3 = 56,\ T_{..} = 246,\ \Sigma x_1^2 = 1036,\ \Sigma x_2^2 = 906,\ \Sigma x_3^2 = 420 \quad \Sigma\Sigma x^2 = 2412$

$H_0: \mu_1 = \mu_2 = \mu_3$

H_A: They are not all equal.

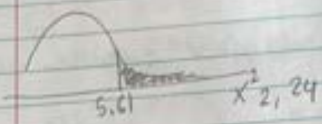
$SST = 2412 - \frac{1}{27}(246)^2$

$SST = 170.6$

$SS(Tr) = \left(\frac{92^2}{8} + \frac{98^2}{11} + \frac{56^2}{8}\right) - \frac{1}{27}(246)^2 = \frac{2698}{33} = 81.75$

$= \frac{6724}{3}$

$SS(Tr) = 81.75$



Source	DF	Sum Squares	mean square	F
Treatment	2	81.75	40.875	11.04
Error	24	88.85	3.7	
Total	26	170.6		

∴ There is evidence at 1% level of significance they are not all equal.

15.36) $\alpha = 0.05$

p values: 0.926 } Bigger than 0.05
0.237
0.071

Ho: Recipe } Doesn't matter
HA: Does matter

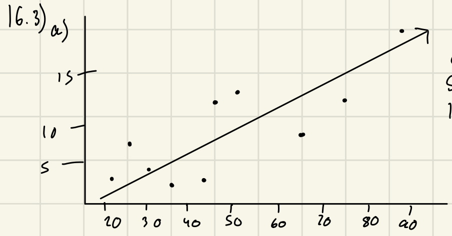
HO: mix doesn't matter
H_A: mix does matter

To conclude, nothing investigated gives us enough evidence.

Non Assignment 10

Non Assignment #10:

16.3) a)



Overall pattern suggests straight line is usefull.

c) when $x = 65$, we estimate $y \approx 12.6$

16.4) Claim: $\hat{y} = 1.5 + 0.16x$ $\hat{y} = a + bx$, $r = 0.7834$, $r^2 = 0.6137$

$A = 1.525$ ∴ This is true
$B = 0.161$

∴ 61% of the variability in y is accounted by variability in x.

Plug in $x = 65$,

$\hat{y} = 1.5 + 0.16 \times 65$

$\hat{y} = 11.2$

r tells you if its a positive relationship between your 2 variables or negative. - r = negative
r = positive
r = 0 means no relationship

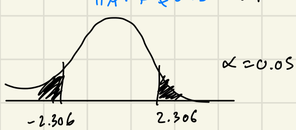
$H_0: \rho = 0$ $H_A: \rho \neq 0$
$n = 10$ $d.f = 8$ $r = 0.7834$

$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} = 3.57$

r^2 represents how strong the model fits the data.

∴ we have evidence that there is a relationship between x and y.

16.20) $H_0: B = 0.15$ $\alpha = 0.05$
$H_A: B \neq 0.15$ $d.f = 8$



∴ we do have evidence

P value = 0.568
P value = 0.007 which is less than 0.05

∴ Reject null hypothesis

∴ we do not have evidence to conclude the intercept is not zero.

If there is a linear relationship between x, y. The slope is not 0.

If P value > α. It did not fall in rejection region.

If P value < α. It did fall in rejection region.

Notes

(ρ) = Rho

When dealing with simple linear regression.

The T test about β, the test about ρ and the F Test in Anova table. Are All EQUAL

To test significance in x, y

T test = P test = F Test (Anova)

β - represents the slope of the line of best fit.

α - represents the intercept of the line of best fit.

16.31) $\alpha = 0.01$

a) $x = 60$

$b_{\frac{\alpha}{2}} = 3.355$

$S_{xy} = 5980 - \frac{1}{10}(523)(100)$

$S_{xy} = 730$

$S_{yy} = 1192 - \frac{1}{10}(100)^2$

$S_{yy} = 192$

$\mu_y = \hat{y}_0 + t_{\frac{\alpha}{2}, n-2} \cdot S_e \sqrt{\frac{1}{n} + \frac{(x_0 - \bar{x})^2}{S_{xx}}}$

$S_e = \sqrt{\frac{S_{yy} - bS_{xy}}{n-2}}$ $\quad S_e = \sqrt{\frac{192 - 0.16(730)}{8}}$

$S_e = 3.065$

$\mu_y = 11.2 + 3.385\,(3.065)\sqrt{\frac{1}{10} + \frac{(60-\bar{x})^2}{45522.5}}$

$\mu_y = 11.21 \pm 3.43$

$\therefore$ The 99% confidence interval is

7.78 to 14.64.

17.12) a) positive

b) positive

c) positive

d) No correlation

e) negative

17.16) $r = 0.32$. Taller ⇒ weigh more.

The independent variable x, is height

As their weight depends on it.

Correlation may exist, but neither causes the other.

Causality is directly saying one thing causes another thing.

Correlation ≠ Causality due to lurking variables

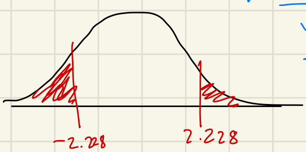
17.22) $H_0: \rho = 0$

$H_A: \rho \neq 0$

$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$

t_{n-2} $\quad \alpha = 0.05$

a) $n = 12$, $r = 0.77$



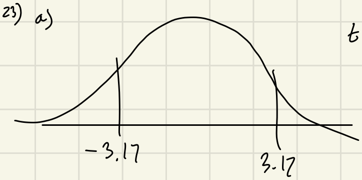
$t = \frac{0.77(\sqrt{10-2})}{\sqrt{1-0.77^2}}$

$t = \frac{2.1778}{0.6380}$

$t = 3.413$

$\therefore$ the value of r is significant.

17.23) a)



$t = 3.6$

$\therefore$ Still falls in rejection region.

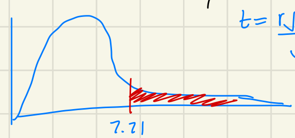
$\therefore$ Level of significance does not change anything.

17.1)

Source	Deg of freedom	Sum Squares	mean square	$F_{1,n-2}$
Regression	1	1.619	1.619	21.88
Error	4	0.296	0.0740	
Total	5	1.915		

F Test

$F_{\frac{1}{4}}$



$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$

$t = \frac{0.9195\sqrt{4}}{\sqrt{1-0.9195^2}}$

$t = 4.628$

$t^2 = F$

$4.6^2 = 21.88$

$SST = 20.29 - 0.06(10.5)^2$

$SST = 1.915$

$SSR = 0.84846 \times 1.915$

$SSR = 1.619$

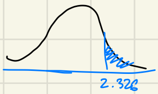
H_0: No relationship

H_A: there is a relationship

18.7) $n = 36$ $\alpha = 0.01$

HO: $\tilde{N} = 24.2$
HA: $\tilde{N} > 24.2$

$x_c = 25$
$x_t = 24.5$



$$z = \frac{x - 0.5n}{\sqrt{0.25n}}$$

$$z = \frac{24.5 - 0.5 \times 36}{\sqrt{0.25 \times 36}}$$

$$z = \frac{7}{3}$$

$$z = 2.17$$

∴ we do not have evidence at 1% level

P value ≈ 0.015

18.10) HO: $\tilde{N} = 0$
HA: $\tilde{N} > 0$

$\alpha = 0.05$
$x_c = 14$
$x_t = 13.5$

+	−
~~||||~~ ~~||||~~ I II	~~||||~~

$n = 19$
$+ = 14$
$- = 5$

$$z = \frac{13.5 - 0.5(19)}{\sqrt{0.25(19)}}$$

$$z = \frac{4}{2.18}$$

$$z = 1.83$$

∴ we do have evidence at 5% level of significance

The sign test

① Count the +'s and −'s and get rid of the equal, 0's.
② Correction for Continuity
③ Check condition, make decision.

18.30) Reject Ho, if $U2 \leq 21$ ← one tail, takes lower

reject Ho, if $U \leq 17$ ← Two tail test 5%

reject Ho, if n is ≤ 21. ← one tail, takes, lower

18.37) $\alpha = 0.05$
HO: $\tilde{N} = \tilde{N}$
HA: $\tilde{N} \neq \tilde{N}$

two tail test

$n1 = n2 = 12$

$$w1 + w2 = \frac{(24)(25)}{2}$$

$$w1 + w2 = 300$$

Critical value: 37

Lower U can't pass 37:

18, 25, 36, 39, 42, 49, 50 51, 53, 57, 59, 64, 65, 66, 67, 68, 73, 75, 76, 82, 86, 88, 89, 91

$W1 = 112$
$W2 = 188$

∴ The observed value is in the rejection region and we do have evidence.

$$U = 112 - \frac{12(12+1)}{2}$$

$$U = 34$$

Because $U \leq 37$

18.39) $n_1 = 15$
$n_2 = 12$

$$w1 + w2 = \frac{(15+12)(15+12+1)}{2}$$

$$w1 + w2 = 378$$

$W_m = 208$
$W_w = 170$

$$U2 = 170 - \frac{12(12+1)}{2}$$

$$U2 = 92$$

$U \leq 49.$

$$U1 = 208 - \frac{15(16)}{2}$$

$$U1 = 88$$

∴ $U = 88$, can't pass, 49 Crit value

∴ we do not have evidence

In the whitney U Test: you order data by indices and groups, get $w1 + w2$, get $w1$, $w1 + w2 - w1 = w2$
Then use w's to get $U1$, $U2$, then take lowest and compare with condition.

17.41) HO: A = B
HA: B > A

$n_1 = 6$
$n_2 = 8$

$\alpha = 0.05$
∴ $U \leq 10$

56, 58, 63, 63, 70, 72, 74, 75, 77, 80, 82, 85, 86
1 2 3.5 3.5 5

$$w1 + w2 = \frac{14 \times 15}{2}$$

$$w1 + w2 = 105$$

$W1 = 26.5$
$W2 = 78.5$

$$U1 = 26.5 - \frac{6(7)}{2}$$

$$U1 = 5.5$$

$$U2 = 78.5 - \frac{8 \times 9}{2}$$

$$U2 = 42.5$$

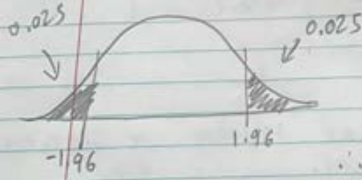
∴ we do fall in rejection region
So we do have evidence that B is larger than A.

Bonus hypothesis questions

evidence.

Extra hypothesis questions:

1) $H_0: \mu = 30.0$ (two tail test)
$H_A: \mu \neq 30.0$ $\alpha = 0.05$



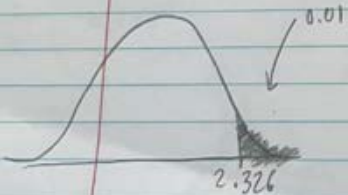
$z_0 = 2.09$

∴ we have evidence

P value: 0.0183×2
$= 0.0366$

∴ Decision was close

2) $H_0: \mu = 30.0$ (one tail test)
$H_A: \mu > 30.0$ $\alpha = 0.01$



$z_0 = 2.86$

∴ we do have evidence

P value: 0.0021

∴ Decision was not close

4.) Ho: $\mu = 30.0$
HA: $\mu \neq 30.0$, n=15

to= 2.49
α = 0.01

∴ we do not have evidence

P value: 0.02 < p < 0.05

∴ was close

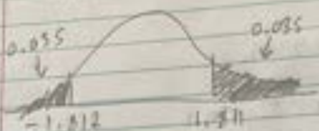
6.) Ho: $\mu = 30.0$
HA: $\mu \neq 30.0$

α = 0.07
zo = 2.29

∴ we do have evidence

P value: 0.011 × 2
= 0.022

∴ This was not close

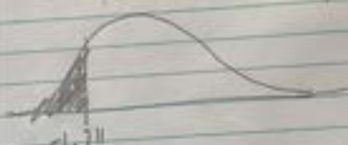


7) Ho: $\mu = 30.0$ n=25
HA: $\mu < 30.0$ α = 0.05

to = -1.61

∴ we do not have evidence

P value: 0.05 < p < 0.10
∴ The decision was close



9) Ho: $\mu = 30$ n=55
HA: $\mu < 30.0$ α = 0.08

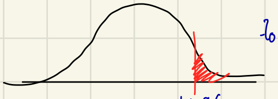
zo = -2.06

∴ we do have evidence
∴ was not close

P = 0.0197

Some Questions to Think About

1) $n=12$ Ho: $\mu=30$
$\bar{x}=28.5$ HA: $\mu<30$
$\sigma=6.40$
$\alpha=0.05$



$$t_0=\frac{\bar{x}-\mu_0}{\frac{s}{\sqrt{n}}}$$

$$t_0=\frac{28.4-30}{\frac{6.40}{\sqrt{12}}}$$

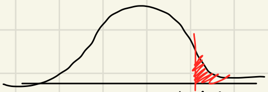
$t_0=-0.866$

∴ We do not have evidence at 5% level of significance to suggest the mean is less than 30.

2) $n=12$ Ho: $S=36$
$\bar{x}=28.5$ HA: $S>36$
$\sigma=6.40$
$\alpha=0.05$

$$\chi^2_{n-1}=\frac{(n-1)s^2}{\sigma_0}$$

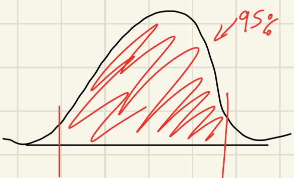
$$\chi^2_{n-1}=\frac{(11)(6.4)}{36}$$



∴ no evidence

∴ We do not have evidence at 5% level of significance to suggest the mean is less than 30.

3) $n=12$ $\alpha=0.05$
$\bar{x}=28.5$
$\sigma=6.40$



$\mu=\bar{x}\pm t_{n-1}$

$\frac{\alpha}{2}=0.025$

$28.5\pm\frac{6.40}{\sqrt{12}}(2.201)$

∴ The confidence interval is 95% between 24.43 and 32.566

5) $\bar{x}_1=17.2$ $\bar{x}_2=19.6$ $\alpha=0.01$
$\sigma_1=3.50$ $\sigma_2=3.20$
$n_1=38$ $n_2=32$

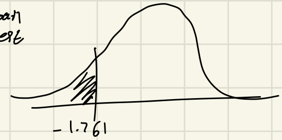
Ho: $\mu_2=\mu_1$
HA: $\mu_2>\mu_1$

$$z=\frac{\bar{x}_1-\bar{x}_2}{\frac{\sigma_1^2}{n_1}+\frac{\sigma_2^2}{n_2}}$$

$z=$

6.) $n=15$ $\alpha=0.05$
$\bar{x}=18.5$ HO: $\mu<20$
$\sigma=4.40$ HA: $\mu\geq 20$

one tail test



$$t_{n-1}=\frac{18.5-20}{\frac{4.40}{\sqrt{15}}}$$

$t_{n-1}=-1.32$

∴ There is not evidence

8) $n=25$ $\sigma=4.40$
$\bar{x}=13.5$ $\alpha=0.05$
$\sigma=?$

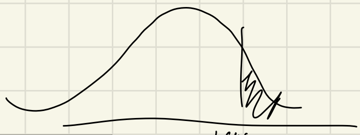
$$\frac{(n-1)s^2}{\chi^2_{\frac{\alpha}{2}}}<\sigma^2<\frac{(n-1)s^2}{\chi^2_{(1-\frac{\alpha}{2})}}$$

$$\frac{24(4.40)^2}{39.364}<\sigma^2<\frac{24(4.40)^2}{12.401}$$

$3.44<\sigma<6.12$ with 95% confidence

10) $n=160$ HO. $P=0.50$
$P_0=0.594$ HA: $P>0.50$

$$z=\frac{95-160\times0.594}{\sqrt{160\times0.594(1-0.594)}}$$



12) $Z_{\frac{\alpha}{2}}\sqrt{\frac{P(1-P)}{n}}=0.03$

$$1.96\,\frac{\sqrt{(0.5)(0.5)}}{\sqrt{n}}=0.03$$

$$\sqrt{n}=\frac{1.96\times0.5}{0.03}$$

$\sqrt{n}=32.6$
$n=1067.11$

∴ Sample size of 1068.

Notes For Exam

Notes for Test 5:

Count Data:

- If data can be reperesented in more than 1 way - Contingency table
- Data represented in only 1 way - Goodness of fit

Correction for continuity:

$P(x_D < 12) \approx P(x_c < 11.5)$ — $<$ -0.5

$P(x_D > 20) \approx P(x_c > 20.5)$ — $>$ $+0.5$

$P(x_D \geq 12) \approx P(x_c \geq 11.5)$ — $\geq$ -0.5

$P(x_D \leq 16) \approx P(x_c \leq 16.5)$ — $\leq$ $+0.5$

Note:

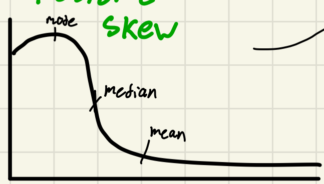
P values can only be calculated for z test

You can use inverse normal to find z values

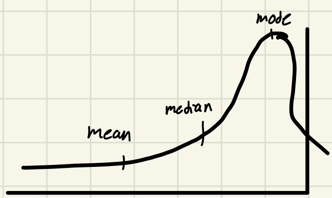
Formula that transforms x values into z values

$$z = \frac{\bar{x} - \mu_{\bar{x}}}{\sigma_{\bar{x}}}$$

Positive skew



negative skew



Questions with $\bar{x}$ is less than 3.5 units from μ. Steps:

1. Convert to z using $\frac{\mu + 3.5 - \mu}{\frac{\sigma}{\sqrt{n}}}$
2. Normal CD

Notes for Probability

A ∨ B - means A or B

Chapter 6 - Some Rules of Probability

Replacement Probability - Binomial

Binomially Distributed:

$$_{20}C_7 (0.35)^7 (1-p)^{13}$$

Total chances → 20; success → 7; not success → (1-p)

Not replaced - hypergeometric

- n - # taken out
- A - # of successes in whole
- b - # of failures
- x - # of successes in n trials

A ∩ C means intersection A and C.

A ∪ C means union A and/or C.

Mutually exclusive - Cant Both happen

How to find β questions:

① Draw a z scale, using α, one tail / two tail

② $z = \frac{\bar{x} - \mu_0}{\sigma / \sqrt{n}}$, Draw a second curve, centered at the calculated z value.

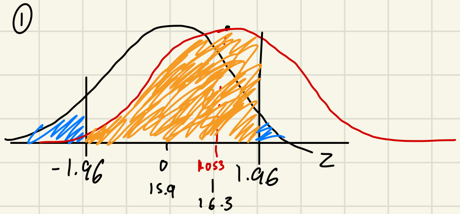
③ calculate from crit values of z curve #1 then use ↑ for normal CD.

The Central Limit theorem –
No matter the shape of the distribution. As the size of the sample increases. $\bar{x}$ gets closer and closer to being normally distributed. ∴ σ get closer to 1.

Ex1
Ho: $\mu = 15.9$
HA: $\mu \neq 15.9$
$n = 37$
$\sigma = 2.31$
$\alpha = 0.05$

$\mu_2 = 16.3$

①



② $z = \frac{\bar{x} - \mu_0}{\frac{\sigma}{\sqrt{n}}}$

$z = \frac{16.3 - 15.9}{\frac{2.31}{\sqrt{37}}} \rightarrow z = 1.053$

③ Normal CD: $L = -1.96$
$U = 1.96$
$\sigma = 1$
$\mu = 1.055$

$\beta = 0.81$

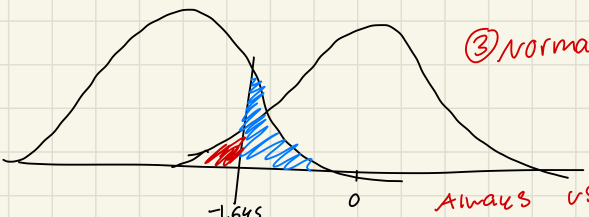
Example 2
Ho: $\mu = 105.9$
HA: $\mu < 105.9$
$n = 35$
$\sigma = 15.31$
$\alpha = 0.05$

new = 100

② $z = \frac{\bar{x} - \mu_0}{\frac{\sigma}{\sqrt{35}}}$

$z = -2.28$

①



③ Normal CD
$p = 0.263$

Always use critical value as lower/upper

To find p values

Use normal CD for z and use $\sigma = 1$, $\mu = 0$, L/U can be z observed.

20)

$H_0: \mu = 20.9$ $n = 32$ $\alpha = 0.05$
$H_A: \mu \neq 20.9$ $\sigma = 5.65$ two tail

$$z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}}$$

$$z = \frac{18.6 - 20.9}{\frac{5.65}{\sqrt{32}}}$$

$z = -2.3$

Use this as μ for normal CD. P=0.367

---

x^2 table

Regression Anova table

Least squares line: $y = a + bx$

Residuals for a data value:

Ex: $y = 19 - 2.85x$ @ (1.2, 17)
$y = 19 - 2.85 \times 1.2$
$y^1 = 15.58$
$e_i = 17 - 15.58$
$e_i = 1.41$

$e_i = y - x\hat{y}$

r^2 - is the percentenge of variability in y explained by x.

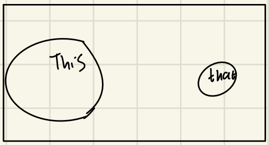
Null hypothesis is always that there is no linear relationship.

r close to 0, means straight line across the page

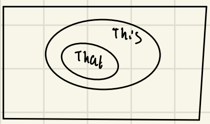
Review

Conditional Probability

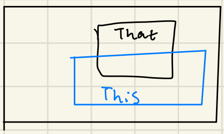
a) $Q(\text{This}|\text{That}) = 0$ Type 2 error could be worse than type 1 error.



b) $Q\ P(\text{This}|\text{That}) = 1$



c) $Q(\text{this}|\text{that}) = 0.5$



Quiz #11

6) 76.2, 79.3, 80.5, 80.9, 83.0, 83.4, 83.7, 84.2, 84.8, 85.1, 85.6, 86.3, 88.3, 88.7
(above values: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9)

P value: ?

$H_0: \tilde{N} = 83.0$

$H_A: \tilde{N} > 83.0$

$z = \frac{x - 0.5n}{\sqrt{0.25n}}$

9 +'s   4 -'s

n = 13

$P(x_0 > 12.5) \approx P(x_c > 13.0)$

$x = 8.5$, $n = 13$

$z = \frac{8.5 - 0.5 \times 13}{\sqrt{0.25 \times 13}}$

$z = 1.109$

P = 0.134

7) one tail

z = 8

z = 7.5   n = 12

8'+s   4 - s

$z = \frac{x - 0.5n}{\sqrt{0.25n}}$

z = 0.866

P = 0.192

w1   w2

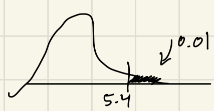
5.5 5.5 8 8 8

6, 7, 9, 11, 12, 12, 20, 20, 20, 21, 25

w1 = 2+3+5.5+8+10

w1 =

P value represents the area of the rejection region.



z = 6.4 means $p < 0.01$

practise beta questions.

3 groups of data
- $\sigma = \sigma_2 = \sigma_3$ - Bartlett's Test
- $\mu_1 = \mu_2 = \mu_3$ - Anova table

Pooled variance T test:
- normal distribution
- Equal variances.

U Test: - Population not normal

Sign test - median $\tilde{\mu}$

1 Sample
- $\sigma^2 = \sigma_0^2$: χ^2 test or Z test if $n \geq 30$ C, I
- $n \geq 30 \rightarrow \mu = \mu_0$: Z-test A
- $n < 30 \rightarrow \mu = \mu_0$: Z-test B
- $p = p_0$: Z test L
- $\tilde{\mu} = \tilde{\mu}_0$: sign test R

Regression
- No significant relationship - F test (Anova) O
- Slope of is given: - t test for β P
- correlation coeffecient ρ - t test abt ρ (rho) G

Contingency table - data is being compared in many different ways S

Goodness of fit - H0: model fits the data (one tail test) M

Anova table - Easy Translations

Source	Deg of freedom	sum of squares	mean square	F Test
Treatment	$K-1$	$SS(Tr)$	$\frac{SS(Tr)}{K-1}$	divide by
Error	$N-K$	SSE	$\frac{SSE}{N-K}$	
Total	$N-1$	SST		

K is the # of Samples

n is # of data pieces

$$SST = \Sigma\Sigma x^2 - \frac{1}{N}(\Sigma\Sigma x)^2$$

$$SS(Tr) = \frac{\Sigma x_1^2}{n_1} + \frac{\Sigma x_2^2}{n_2} + \frac{\Sigma x_3^2}{n_3} \dots - \frac{\Sigma\Sigma x^2}{N}$$

$\Sigma x = 31.4 \quad \Sigma x^2 = 205.4 \quad n = 5$

$\Sigma\Sigma x = 173.2 \quad \Sigma\Sigma x^2 = 1402.06$

$SST = 1402.06 - \frac{1}{23}(173.2)^2 = 97.78$

d.f	ss	mean square	F
3	47.5	15.83	5.996
19	50.28	2.64	
22	97.78		

$$SS(Tr) = \frac{\Sigma x^2}{n_1} + \frac{\Sigma x_2^2}{n_2} + \frac{\Sigma x_3^2}{n_3} + \frac{\Sigma x_4^2}{n_4} - \frac{\Sigma x^2}{N}$$

Source	d.f	Sum Square	mean square	F
Treatment	3	235.57	78.52	2.464
Error	22	701.08	31.87	
Total	25	936.65		

gives you critical point:

$$SS(Tr) = \frac{193^2}{7} + \frac{162^2}{7} + \frac{137^2}{7} + \frac{109^2}{5} - \frac{1}{26}(601)^2$$

$= 235.57$

$\Sigma x = 109$ $\quad \Sigma x^2 = 2433$

$\Sigma\Sigma x = 601$ $\quad \Sigma\Sigma x^2 = 14829$

$SST = 14829 - \frac{1}{26}(601)^2$

$SST = 936.65$

If A and B are independent they are not mutually exclusive.

If A and B are mutually exclusive they are not independent

$e_i = y - \hat{y}$

Hypergeometric - without replacement

Type 1 error - You rejected null hypothesis, but you shouldn't have

Said he is guilty when hes innocent

Type 2 error - You did not reject null hypothesis, but should have.

Said he is innocent but hes guilty

Type 2 error's are worse.

Practise Exams

Fall 2016 Exam

① $\bar{x} = 317.5$ ✓
$Sx = 180.83$ ✓

$0.83(n+1)$
$= 5.81$

$412 + 0.81(177)$
$= 560.37$ ✓

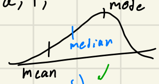
why negative?

⑤ 1.796

② Ho: person is innocent
HA: person is guilty

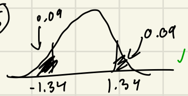
c) ✓

③ a, f, ✓

④


∴ d) ✓

⑦ a ?

⑥


8) e, ?

a) c)

P value is the smallest level of significance at which Ho would be rejected.

10) $\lambda = 2.5$

a) $P(x \geq 1) = 1 - P(0) = 1 - 0.286 = 0.713$ ✓

b) $P = 0.2565$ ← 1 hour
$P = 0.0658$ ← $0.2565^2 = P = 0.0658$ ✓

12) $n = 32$
$\bar{x} = 9.10$
$s = 0.720$

$H_0: \mu = 8.90$
$H_A: \mu \neq 8.90$

two tail

$$z = \frac{\bar{x} - \mu_0}{\frac{s}{\sqrt{n}}}$$

$$z = \frac{9.10 - 8.90}{\frac{0.720}{\sqrt{32}}} \qquad z = 1.57$$

P value: 0.0582×2
$= 0.116$

13) ~~$\sigma = 15$~~
$\sigma \bar{x} = 1$
$n = ?$

~~$n = \left[\frac{z_{\alpha/2} \cdot \sigma}{E}\right]^2$~~

~~we would need E.~~

$$\sigma_{\bar{x}} = \frac{\sigma_x}{\sqrt{n}} \qquad 1 = \frac{15}{\sqrt{n}}$$

$\sqrt{n}^2 = 15^2$
$n = 225$

14) If given a stem/leaf plot

① you must make a fr and cum fr column.

Then use $\tilde{x} = L + \frac{J}{f} C$

15) $K = 4$, $m = 0$ ← no values estimated

a) d.f. $= 4 - 1 - 0$
$= 3$

∴ $\chi^2_{0.05}$ df=3

critical value: 7.815

b) Binomial CD
$P(2) = 0.334125$

Expected freq
200×0.334125
$= 66.8$

In goodness of fit theres observed and expected values ADD UP to the same total

16) $Tm = 747$
$Tw = 434$

$\frac{276}{747} = p(m)$

$\frac{195}{434} = p(w)$

a) $z = 1.645$

b) $\hat{p} = \frac{475}{1181}$

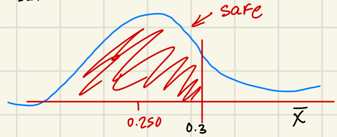
$\hat{p} = 0.402$

$$z = \frac{\frac{276}{747} - \frac{195}{434}}{\sqrt{0.402(1 - 0.402)\left(\frac{1}{747} + \frac{1}{434}\right)}}$$

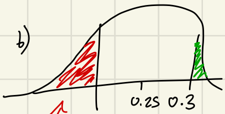
$z = -2.69$

17) $\bar{x} = 0.3$
$\mu = 0.250$
$\sigma = 0.080$
safe to eat: < 0.300

Proportion?
Normal distribution - Z Test



P=0.734

b)


Area = 0.182

∴ I estimate 0.182 is the distribution of mercury for 20th percentile

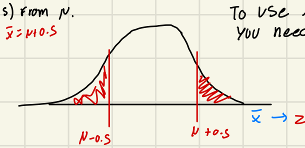
18) Ho: $\mu_1 = \mu_2 = \mu_3$ ✗
HA: Not all pop are equal ✓

c, e

19) $P(\bar{x} > 0.5)$ from μ.
$n = 33$ $\bar{x} = \mu \pm 0.5$
$\sigma = 6.39$

To use Normal CD, you need Z scale.

$$z = \frac{\bar{x} - \mu_0}{\frac{\sigma}{\sqrt{n}}}$$



$$z = \frac{\mu + 0.5 - \mu}{\frac{6.39}{\sqrt{33}}}$$

$z = 0.4495$

Normal CD: Lower = 0.45
Upper = 100
$\sigma = 1$
$\mu = 0$

$P = 0.326 \times 2$

P = 0.652

21) 24.7, 25.1, 25.2, 25.2, 25.2, 25.5, 25.5, 25.6, 26.2
(1, 2, 4, 4, 4, 6.5, 6.5, 8, 9)

$W1 + W2 = 55$
$W1 = 13.5$
$W2 = 41.5$

$U_1 = 13. - \frac{(4)(5)}{2}$

$U_1 = 3.5$ ∴ $U = 3.5$

22) $n = ?$ μ estimation to within 0.5
$\alpha = 0.01$
$\sigma = 6$

$0.5 = \bar{x} + z_{\alpha/2} \frac{\sigma}{\sqrt{n}}$

$0.5 = 2.576 \frac{6}{\sqrt{n}}$

$\sqrt{n} \, 0.5 = \frac{2.576 \times 6}{0.5}$

$\bar{x}$ doesn't matter why?

$n = 955.55$ ∴ Sample size of 956 needed.

23) $n_1 = 14$
$S_1 = 13.6$
$\bar{x}_1 = 41.7$

$n_2 = 12$
$S_2 = 15.2$
$\bar{x}_2 = 45.1$

a) $\frac{14^2}{12^2}$ $\frac{13}{11}$ would need F value of numerator 11.

$F_{11,13} = 2.67$ (use 10)

b) $F = \frac{S_2^2}{S_1^2}$ $F = 1.25$

c) Critical val: 2.064

$$T_{24} = \frac{41.7 - 45.1}{14.35\sqrt{\frac{1}{14} + \frac{1}{12}}}$$

$= -0.602$

d) $$Sp = \frac{13 \times 13.6^2 + 11 \times 15.2^2}{24}$$

~~4943.4~~ $\frac{4943.92}{24} = 4.5867$

$Sp = 14.355$

24) S4: Σx 180 Σx^2 4768

K = # of Samples

$SS_{TR} = \frac{\Sigma x}{n} + \frac{\Sigma x_2}{n_2} + \frac{\Sigma x_3}{n_3} - \frac{\Sigma x\ Total}{n\ total}$

Dumb Formulas

$SST = \Sigma\Sigma x^2 - \frac{\Sigma x}{N}^2$

$SST = 16072 - \frac{642^2}{27}$

SST = 866.6

Source	d.f	Sum Squares	mean Sq	F
Treatment	3	265.68	88.56	3.765
Error	23	540.99	23.521	
Total	26	806.67		

$F_{.10},\ \frac{3}{23}$ ∴ 3.03

b) = F = 3.77

SST = 302.65
SSR = 191.16

Source	d.f	Sum Squares	mean sq	F
Treatment	1	191.16	191.16	6.857
error	4	111.5	27.875	
Total	5	302.55		

Plug in x

a) $\hat{y} = a + bx$
$\hat{y} = -18.25 + 1.5x$

b) $e_i = y_i - \hat{y}_i$ = 11.5 − 7.25 = 4.25

c) $\hat{y}_0$ = 17.95

d) There is a linear relationship between x and y

e) 7.71

f) 6.86

29) M, HA: $O_1 \neq O_2$, Is there a difference in the
a) level nitric oxide

Independent samples U Test,

b) L, $\hat{P}$= HA: $P_e > P_0$
$P_e > 0.0125$?

Count Data,

c) N, $N_1 = U_2 = U_3$ means 3 samples
HA: There is a difference in mean amounts of coffee.

d) C, HA: $\sigma > 0.15$

f) 2 groups, H

h) B, HA: $N_A < N_B$

Exam winter 2016

Last page

a) H, ✓ HA: $P_A > P_B$ ✓

b) K, ✓ HA: ~~$\mu_A > \mu_B$~~ $\mu_D > 0$

c) D, HA: $\mu_1 > \mu_2$ → F, $\sigma_1 = \sigma_2$

* d) A, HA: P > 0.019 ✓ → L

e) B ✓ HA: $\mu < 0.3$ ✓

f) S, ✓ HA: Methods are not equal ✓

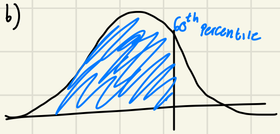
g) Q ✓, $\tilde{\mu}_D > 0$ ✓

h) H, Filters to reduce CO levels. ✓, D

17) $\mu = 3364$ a)
$\sigma = 495$

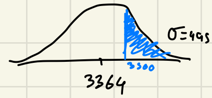
P=0.86

b)



60th percentile – 3489.4

c) n=15
$\mu_0 = 3500$



$P(\bar{x} > 3500)$

$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$

$\sigma_{\bar{x}} = \frac{495}{\sqrt{15}}$

$\sigma_{\bar{x}} = 127.808$

P = 0.1436

d) n=4
p=0.5 → because μ is centered at 0.5

$P(x \geq 1) = 1 - P(0)$

1 − 0.0625

= 0.938

1) mean: $\bar{x} = 79.33$
deviation: $S_x = 67.99$

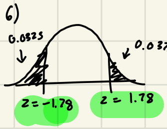
(0.3)(7) = 2.1 ← index

29 + (0.1)(12)

30th percentile = 30.2

2) a)
3) A)
4) ?
5) d, f

6)



7) $70P_3 = 328440$

8) 8C1 × 6C1 × 9C2 × 5C1
= 8640

9) 0.935 G

0.065 DF

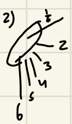
Binomial PD
a) x=2
N=30
P=0.28

b) N=10 x=0
P(DF ≥ 1) = 1 − P(DF=0)
= 1 − 0.5106
= 0.489

10) $\pi = 4.5$
$\lambda = 2.25$ x=0
P=0.105

11) P(A)=0.4 × A (c)
P(B)=0.5 × E

12)



~~$\frac{1}{6} \times \frac{1}{6} = \frac{1}{12}$~~ $\frac{1}{6} + \frac{1}{6}$

~~P=0.083~~ = 0.167

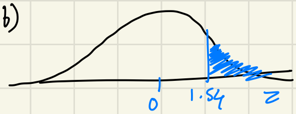
18) n=259
$\bar{x} = 70.4$
mode = 75
range = 45
s = 10.8
z score = 1.54

Formula that transforms x values into z values

$z = \frac{\bar{x} - \mu_{\bar{x}}}{\sigma_{\bar{x}}}$

a) $1.54 = \frac{\mu - 70.4}{10.8} = 87.032$

b)



P=0.062

Probability of one student doing better

z is always centered at 0

0.062 × 259
= 16.001

∴ 16 students did better.

correction for continuity

13) $\sigma = 1.50$ χ^2 $\alpha = 0.05$
S = 1.97
n=21
HA: $\sigma > 1.5$

a) = 30.144 → 10.85

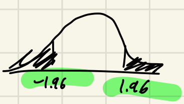
b) $\chi^2_{n-1} = \frac{(n-1)s^2}{\sigma_0^2} = \frac{20(1.97)^2}{1.50^2}$

= 3.45

14) 11 + Sign test – Differences
5 −
20
HA: $\tilde{\mu}_D \neq 0$ two tail test
$\alpha = 0.05$

x = 11
n = 16

a)

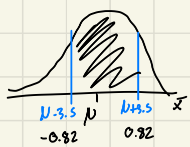


b) $z = \frac{11 - 0.5 \times 16}{\sqrt{0.25 \times 16}}$

z = 1.5

19) p=? means inverse normal

σ=26.3
n=38



$z = \frac{\bar{x} - \mu_0}{\frac{26.3}{\sqrt{38}}}$

$z = \frac{\mu + 3.5 - \mu_0}{\frac{26.3}{\sqrt{38}}}$

z = 0.82

Can only use normal CD in Z land

P=0.588

15) $\chi^2_{k-m-1} = \sum \frac{(o-e)^2}{e} = \sum \frac{o^2}{e} - n$ $\alpha = 0.05$

χ^2 K=6
m=0

a) χ^2_5 → 1.635 / 12.592

b) ?

16) Z test one tail
$\alpha = 0.05$
$\chi = 1.645$

b) $z = \frac{\frac{x_1}{n_1} - \frac{x_2}{n_2}}{\sqrt{\hat{p}(1-\hat{p})\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$ $\hat{p} = 0.317$

z = −5.527

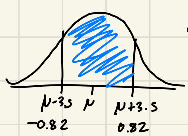
19) Again?

① convert to z land

$\bar{x} = \mu \pm 3.5$
σ=26.3
n=38

$z = \frac{\mu + 3.5 - \mu}{\frac{\sigma}{\sqrt{38}}}$

z = 0.82



Normal CD → P=0.588

Exam Fall 2015

22) $n = ?$
$\alpha = 0.10$
$E = 0.02$

$E = z_{\frac{\alpha}{2}} \sqrt{\frac{p(1-p)}{n}}$

$E = 1.645 \sqrt{\frac{0.5 \times 0.5}{n}}$

$\sqrt{n} = \frac{1.645\,(0.5)}{0.02}$

$41.125^2 = n$

$n = 1692$

23) a) $\frac{t}{2}$ $10,7$ $= 3.64$

b) $F = 1.91$

c) 2.11

d) 12.64

1) $\bar{x} = 115.43$
$s_x = 95.163$
$0.66(8) = 5.3$
$117 + 0.3(77)$
$= 140.1$

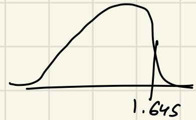
2) F
3) B
4)
5) e)

7) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
$= 0.5 + 0.4 - 0.2$
$= 0.70$

8) $z = \frac{\bar{x} - \mu_0}{\frac{\sigma}{\sqrt{n}}}$

$1.645 = \frac{\bar{x} - 22.5}{\frac{3.86}{\sqrt{35}}}$

$\bar{x} = 23.57$



9) $E = 0.02$ $P = 0.5$ (assume worst case)
$n = ?$

$n = 0.5\,(0.5)\left[\frac{1.96}{0.02}\right]^2$

$z_{\frac{\alpha}{2}} = 1.96$

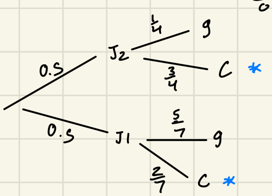
$n = 2401$
$\therefore$ 2401 people.

10) $P(x < 4 \mid x \geq 2) = \frac{P(x \geq 2 \cap x < 4)}{P(x \geq 2)}$
This given that

$P(x \geq 2) = 1 - P(x < 2) = 0.2 + 0.3$
$= 0.5$

$P(x \geq 2 \cap x < 4) = P(3) + P(2)$
$= 0.15 + 0.20$
$= \frac{0.35}{0.5} = 0.7$

11)



$0.5 \times 0.25 + 0.5 \times \frac{2}{7}$
$= 0.518$

12) $z = \frac{x - 0.5n}{\sqrt{0.25n}}$ two tail tes
g Response

+ − − + + + 0 − 0 + + 0 − − − + − −

$n = 15$

$(x_d \geq 7) \approx 6.5$

$z = \frac{6.5 - 0.5 \times 15}{\sqrt{0.25 \times 15}}$

$z = -1.96$

$z = -1.03$

14) $n = 43$
$\sigma = 18.8$
$\bar{x} = \mu + 2$

$z = \frac{\mu + 2 - \mu}{\frac{18.8}{\sqrt{43}}}$

$z = 0.6976$

Normal CD:

$P = 0.485$

15) If $H_A: \mu \neq 1.65$ $\alpha = 0.05$
The null hypothesis would be rejected if the 95% confidence interval does NOT include 1.65
$\therefore$ b) d)

16) $\mu = 271$
$\sigma = 22$

a) $P = 0.036$

b) convert to z

$z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}}$ $z = \frac{269 - 271}{\frac{22}{\sqrt{35}}}$

$z = -0.5378$

normal CD
$P = 0.705$

c)

$-0.84 = \frac{x - 271}{22.0}$

$x = 271 - 0.84 \times 22$

$x = 252.5$

4) We know that $\hat{p} > 0.25$
One proportion test:

$H_0: p = 0.25$ ×
$H_A: p > 0.25$

$\hat{p}$ has to be greater than 0.25.

want $\hat{p}$ in top $\frac{1}{2}$ of confidence interval.

If $p \neq 0.25$, then $P = 0.08$

Directly relate 95% confidence interval − $H_A: p \neq 0.25$

17) t_{n-2} two tail

T_8

$= 3.355$

$$t_{n-2} = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$$

$= 5.462$

18) $n_1 = 80$ c) a) ← Lower population size means less accurate.

$n_2 = 200$

Two random samples are equally non bias

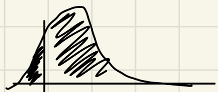
19) Reject H0 if P is low

$P < \alpha$ e), c)

$P > \alpha$

23) $\chi^2_{(3)(1)}$

$\chi^2_3 = 7.815$



21) a) $t_{6,} = \frac{\bar{x} - \mu_0}{\frac{s}{\sqrt{n}}}$ $\bar{x} = 1.91$ $S = 1.01$

not ↗

$t_7 = \frac{1.91}{\frac{1.01}{\sqrt{7}}} = 4.61$

Expected Freq: $\frac{60 \times 578}{1384} = 25.1$

Expected Freq $= \frac{\text{row sum} \times \text{coloumn sum}}{\text{Tota Data sum}}$

22) $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{40}} = \sigma = \sqrt{5.82} \times \sqrt{40} = 15.26$

↑ $\sqrt{5.82}$

0.05 to 0.025 x2 = $< P < 10\%$ 5%

a) $0.02 < P < 0.05$ ✓

b)

c) $0.025 < P < 0.05$ ✓

d) $P = 0.035$ ✓

25)

source	d.f	SS	mean sq	F
regression	1	64	64	11.17
error	3	17.2	5.73	
Total	4	81.2		

SST = 81.2
SSR = 64

a) $Y = a + bx$
$Y = 19.013 - 2.85x$

d) There is a linear relationship between y and x

b) $e_i = y_i - \hat{y}_i$ @ (1.2, 17)
$y_i =$
$\hat{y}_i = 17 - 15.593$
$\hat{y}_i = 1.4$

$r^2 = 0.287$
∴ 28%

∴ $e_i = 17 - 14$
$e_i = 15.6$

f) 11.17

e) $F_{13} = 10.1$

Last Page

a) M, ✓ The claimed mix ratio is invalid. ✓

b) L ✓, HA: Proportion of adults favouring capital punishment has increased. ✓

c) A ✓ HA: The mean is lower than the stated value ✓

d) T HA: The mean time of all 5 tablets are not Equal. ✓ Bartletts Test is about mean time $\sigma_1^2 = \sigma_2^2$

e) D ✓ HA: The treatment increases the lifetime of mice. ✓ → Pooled Variance T test has equal variances.

f) S ✓ HA: The crime rates in the cities are not all equal. ✓

g) V HA: There is a difference in mean blood plasma levels. ✓ → Welch's T test, $\mu_1 = \mu_2$

h) H. ✓ HA: The rate of breast cancer is higher in one area than another. ✓

Exam winter 2015

19) a) e)

20) $t_{n-1} = \dfrac{\bar{x} - \mu_0}{\frac{s}{\sqrt{n}}}$

$t_{,6}$

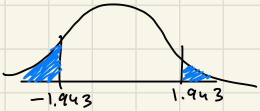
+ + + + + + +
2 1 3 7 3 1 3

$\bar{x} = 2.85$

$s\bar{x} = 2.035$

$\mu_0 = 0$

$t = 3.7$



∴ we reject the null hypothesis

21) $n = 170$ $H_0: S_r = 65\%$ $x = 116$

$P = \frac{116}{170}$ $H_A: S_r > 65\%$

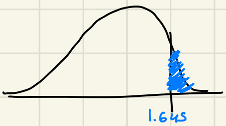
$P = 0.68 \rightarrow$ Proportion

$P_0 = 0.65 \rightarrow$ Prob of successes

$z = \dfrac{x - np_0}{\sqrt{np_0(1-p_0)}}$

$z = \dfrac{116 - 170 \times 0.65}{\sqrt{170(0.65)(1-0.65)}}$

$z = 0.0884$



22) b) $\dfrac{TR \times TC}{TD}$

$= \dfrac{1491 \times 325}{2201}$

$= 220.16$

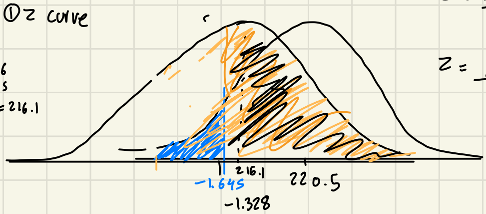
a) $\alpha = 0.05$

$\chi^2_{(4-1)(1)}$

$\chi^2_3 = 7.815$

23) ① z curve

$n = 33$
$\sigma = 19.6$
$\alpha = 0.05$
new $\mu = 216.1$



$z = \dfrac{\bar{x} - \mu_0}{\frac{\sigma}{\sqrt{n}}}$

$z = \dfrac{216.1 - 220.5}{\frac{19.6}{\sqrt{35}}}$

$z = -1.328$

Type 2: You accept the null hyp but shouldnt have

$B = 0.624$

Type 1 – reject sh

– did not reject sh should have

$\Sigma\Sigma x = 601$

$\Sigma x = 109$ $\Sigma x^2 = 2433$

Source	d.f	sum sq	mean sq	$F_{1,n-2}$
Treatment	1	353.715	353.715	14.133
noise	3	75.085	25.0283	
Total	4	428.8		

$a = -5.38$ $\hat{y} = -5.38 + 5.126x$ $e_i = -0.897$

$b = 5.126$

∴ There is a relationship between x and y.

$SST = 428.8$

$SSR = 353715$

$r^2 = 6.825 \rightarrow 82.5\%$

Crit val = 10.1

---

29) a) μ, $n \geq 30$, z test – could be not normally distributed.

A. HA: The cookies contain less than 1000 chips on avg.

b) 2 samples, small n. $\sigma_1 = \sigma_2$

D. HA: Weekly income in County A is higher than in County B

c) H. HA: Crime rate is higher in City A, then in City B.

d) L. HA: Seeds have a lower rate than 0.93.

e) M P? $n \geq 30$, HA: is there a change in proportions

f) V $n \leq 30$ HA: Population means are not equal

g) G, HA: There is a linear relationship

h) J HA: Breast milk had a lower antioxidant level than fresh milk.

$n \leq 30$

Residuals SC: S regression

y val − x val * $\hat{y}$.

$SST = 14829 - \frac{1}{26}(601)^2$

$SST = 936.65$

$SS(Tr) = \frac{193^2}{7} + \frac{162^2}{7} + \frac{137^2}{7} + \frac{109^2}{5} - \frac{1}{26}(601)^2$

$SS(Tr) = 235.57$

24)

Source	d.f	Sum square	mean sq	F
Treatment	3	235.57	78.523	2.464
error	22	701.08	31.867	
Total	25	936.65		

b) = 2.464

a) = 3.05

27.) a) $P(x_D < 16) = P(x_c < 15.5)$

b) $P(x_D \geq 18) = P(x_c > 17.5)$

26) a) $P(16 < X < 24) = P(X \leq 23) - P(X \leq 16)$

15, 16, [17, 18, 19, 20, 21, 22, 23] 24, 25

b) $P(24 \leq X \leq 30) = P(X \leq 30) - P(X \leq 23)$

23 [24, 25, 26, 27, 28, 29, 30] 31

28.) a) $0.05 < p < 0.1$

b) $0.05 < p < 0.10$

c) $0.1 < P < 0.20$

d) $P = 0.119 \times 2$ $P = 0.238$ ✓

1-17)

1) $\bar{x} = 78.875$
$s_x = 60.35$

$63 + (0.23)(87-63)$
$= 68.52$

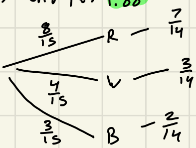
2) $IQR = Q3 - Q1$
$Q3 = 10$ $IQR = 9$
$Q1 = 1$

3) Crit pt: 1.88

4) a)

5) d)

6) a)



* $P = 0.266$

b) $1 - P(2R) - P(2W) - P(2B)$

$1 - \frac{8}{15} \times \frac{7}{14} - \frac{4}{15} \times \frac{3}{14} - \frac{3}{15} \times \frac{2}{14}$

$= 0.648$

7a) Binomial Situation
$n = 10$ $P = 0.246$
$P = 0.5$
$x = 5$

b) $n = 5$ $1 - P(0)$
$x = 1$ $1 - 0.03125$
$P = 0.5$ $= 0.969$

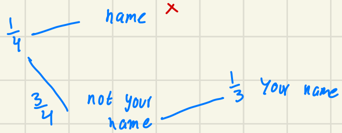
8) a) $n1 = 100$
$n2 = 400$

9) $n = 38$

10) If you use hypothesis testing and see an effect but is not practical

a) The effect is small but sample is too big.

11)

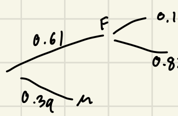


×

$= \frac{3}{4} \times \frac{1}{4} = \frac{1}{4}$

12) $P(A \cap B) = P(A) + P(B)$
$0.70 = 0.05 + P(B)$
$PB = 0.65$

13)



* 0.61×0.18
$P = 0.1098$

14) $z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}}$ $z = \frac{\mu + 0.75 - \mu}{\frac{\sqrt{\sigma^2}}{\sqrt{n}}}$

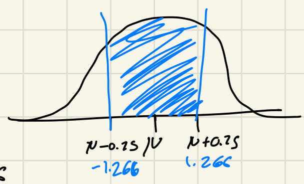
$\mu = ?$
$x = \mu \pm 0.75$
$\sigma^2 = 12.28$
$n = 35$

$z = \frac{0.75}{\frac{\sqrt{12.28}}{\sqrt{35}}}$

$z = 1.266$

Normal CD: Lower $= -1.266$
Upper $= 1.266$
$\sigma = 1$
$\mu = 0$

P means normal CD



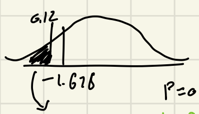
16) $\mu = 12.1$
$\sigma = 1.41$

a) $P = 0.089$ ✓

b) $z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}}$

$z = \frac{12.5 - 12.1}{\frac{1.41}{\sqrt{35}}}$

$z = 1.678$



$P = 0.0466$
$1 - 0.0466$
$= 0.953$

c) -1.175

$-1.175 = \frac{x - 12.1}{1.41}$

$x = -1.175 \times 1.41 + 12.1$

$x = 10.44$

17) a

Exam Fall 2014

Last Pg

a) G, HA: There is a linear relationship between sodium intake and blood. ✓
b) M, S HA: The proportions are not equal. ✓
c) E ✓ HA: There is a difference in Strength of truss joints ✓ in Southern Pine and Ponderosa pine
d) K ✓ HA: The paper airplanes with clips fly farther. ✓
e) N ✓ HA: There is a difference in effectiveness among 3 drugs. ✓
f) D HA: There is a difference in means ✓
g) H ✗ L HA: Dog chases toy more than other toy. ✓ → L, Because data comes from only one sample size, Z test alt P.
h) O ✗ T HA: Difference in the variability of marks ✓ → T, Bartletts T test deals with $\sigma_1^2 = \sigma_i^2$ means its a test about the standard deviation.

---

26)

Source	d.f	sum squares	mean square	F
reg	1	103.899	103.899	59.91
Error	4	6.931	1.734	
Total	5	110.83		

SST = 110.83

a) $\hat{y} = -0.389 + 3.014x$

b) $e_i = 0.0586$ $y - x\hat{y}$

c) 93.74%

d) There is a linear relationship

e) 7.71

$$y = \hat{y}_0 + t_{\frac{\alpha}{2}, n-2} \cdot S_e \sqrt{\frac{1}{n} + \frac{(x_0 - \bar{x})^2}{S_{xx}}}$$

$S_{xx} = 11.433$

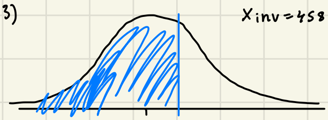
$$y = 14.681 + 2.776 \cdot 1.316 \sqrt{1 + \frac{1}{6} + \frac{(5 - 3.835)^2}{11.433}}$$

---

1) $\bar{x} = 89.067$
$S_x = 95.589$
(0.67)(7)
Index = 4.69
= 63 + (0.69)(81.7)
67^{th} percentile = 119.373

2) b) ~~Binomial~~ → without replacement means hypergeometric
a) ~~Bar chart~~
d) could increase/decrease

3)



$X_{inv} = 458.786$

4.) $\mu = 0.3$ /gram
$P(x \geq 1) = 1 - P(0)$
$= 1 - 0.2231$
$\lambda = 1.5$ $= 0.777$
$x = 0$

5) a), e)

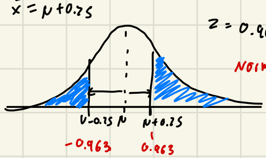
6) e) α, the prob of making a type I error

7) critical value: 7.962

8) $n = 31$
$\sigma^2 = 18.8$
$x = \mu + 0.25$

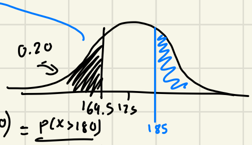
$$z = \frac{\mu + 0.25 - \mu}{\frac{\sqrt{18.8}}{\sqrt{31}}}$$

$z = 0.963$



Normal CD = L: 0.963
U: 100
σ = 1
μ = 0
= 0.1677
= 0.3354

9.) a) P = 0.062
b) x = 169.5



c) $P(x > 180 \mid x > 170) = \frac{P(x > 180)}{P(x > 170)}$
$= \frac{0.221}{0.779}$

10) f) c) If A and B are independent they can not be mutually exclusive

A and B are independent if A does not cause B.

A and B mutually exclusive means they can't be independent.

11) d) c) a) f) g)

b) e) ✓

12) b) e)

13) Chebyshev's theorem works for all distributions

14) a) $H_A: \mu_A \neq \mu_B$

b) $t_5 \quad \alpha = 0.05$
$= 2.571$

c) $= \frac{\bar{x} - 0}{}$ $\quad \bar{x} = 4.33$, $s_x = 5.24$

$= \frac{4.33}{\frac{5.24}{\sqrt{8}}} = 2.0241$

15) $P(x \geq 19) \approx P(x \geq 18.5)$
$n = 48$
$P = 0.45 \quad = P(x < 18.5)$

$\mu = np$
$\mu = 21.6$
$\sigma = \sqrt{48 \times 0.45(1-0.45)}$
$\sigma = 3.447$

Normal CD:
$= P = 0.815$

16) $t_{n-2} = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$

$H_0: \rho = 0$
$H_A: \rho \neq 0$
$n = 17$
$r = 0.688$
$\alpha = 0.05$

a) 2.131

$= \frac{0.688\sqrt{15}}{\sqrt{1-0.688^2}}$

$= 3.672$

17) $H_0: \mu = 5.25$
$H_A: \mu \neq 5.25$
$\alpha = 0.01$

∴ Approximatly 1% of the time that $\mu = 5.25$, we will wrongly conclude $\mu \neq 5.25$

This would show 1% of the time we will wrongfully choose HA.

which is the prob of type I error

Reject Ho but shouldnt have

18) Total = 605
$\chi^2_{(c-1)(r-1)}$
$\chi^2_{(3)(1)}$
$\chi^2_{3,0.05} = 7.815$

b) $\frac{303 \times 38}{605}$
$= 19.03$

19) critical value of $\bar{x}$?
$H_0: \mu = 20.5$
$H_A: \mu > 20.5$
$n = 31$
$\sigma = 5.66$
$\alpha = 0.05$

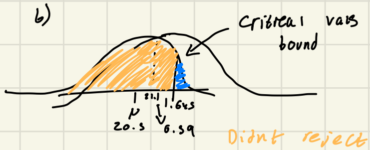
$z = \frac{\bar{x} - \mu_0}{\frac{\sigma}{\sqrt{n}}}$

$z = 1.645$

$1.645 = \frac{\bar{x} - 20.5}{\frac{5.66}{\sqrt{31}}}$

a) $\bar{x} = 22.17$

b)



$z = \frac{21.1 - 20.5}{\frac{5.66}{\sqrt{31}}}$ → Normal CD
L: any
V: 1.645
σ = 1
μ = 0.59

$z = 6.59$

Didnt reject Ho, should have

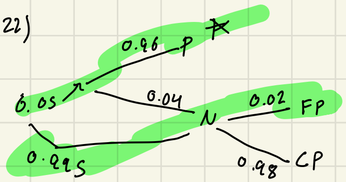
20) b)

21) 11.8, 11.8, 12.2, 13.6, 13.6, 13.6, 14.1, 14.4, 15.2
(1.5, 1.5, 3, 5, 5, 5, 7, 8, 9)

$w_1 + w_2 = 45$
$w_1 = 16.5$
$w_2 = 28.5$

$U_1 = 16.5 - \frac{4(5)}{2}$
$U_1 = 6.5$ ✓
$U = 6.5$

22)



$P = 0.96 \times 0.05 + 0.02 \times 0.995$
$P = 0.0247$

$P(D|T) = \frac{P(A \cap B)}{P(B)}$

$= \frac{0.005 \times 0.96}{0.0247}$

$= 0.194$

23) $P(A) = 0.2$
$P(B) = 0.4$

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$
$P(A \cap B) = 0.2 \times 0.4$
$P(A \cup B) = 0.52$

24) $\Sigma x = 166 \quad \Sigma x^2 = 5542 \quad n = 5$
$\Sigma\Sigma x = 450 \quad \Sigma\Sigma x^2 = 12074 \quad N = 18$

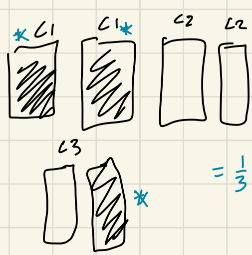
Source	d.f	S S	M.S	$F_{K-1,N-K}$
K-1	2	426.36	238.18	10.28
N-K	15	397.64	23.17	
Total	17	824		

$12074 - \frac{1}{18}(450)^2$
$SST = 824$

$SS(Tr) = \frac{137^2}{6} + \frac{147^2}{7} + \frac{166^2}{5} - \frac{1}{18}(450)^2$
$SS(Tr) = 11726.36 -$
$SS(Tr) = 426.36$

a) HA: The populations means are not all equal

b) $F_{2,15} = 3.68$

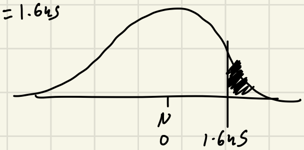


$= \frac{1}{3}$

27) a) $0.10 < P < 0.20$
b) $0.0125 < 0.05$

19) HO: $\mu = 20.5$
HA: $\mu > 20.5$
$n = 31$
$\sigma = 5.66$
$\alpha = 0.05$

$Z = 1.645$



Don't reject HO, should have

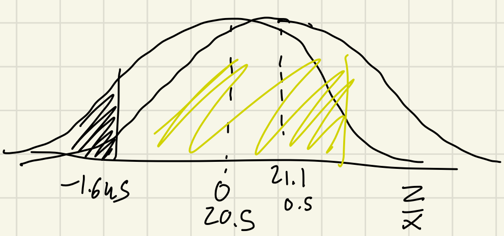
$$Z = \frac{\bar{x} - \mu_0}{\frac{\sigma}{\sqrt{n}}}$$

$$1.645 = \frac{\bar{x} - 20.5}{\frac{5.66}{\sqrt{31}}}$$

$$1.645 \times \frac{5.66}{\sqrt{31}} + 20.5 = \bar{x}$$

$\bar{x} = 22.17$

b)



$P = 0.854$

$$Z = \frac{\bar{x} - \mu_0}{\frac{\sigma}{\sqrt{31}}} \qquad Z = \frac{21.1 - 20.5}{\frac{5.66}{\sqrt{31}}}$$

2 samples / small samples / μ/normal dist

V, N

$Z = 0.590$

Exam Winter 2014
Last Pg.

a) A ✓ HA: Poor readers tes lower in IQ than Chidren who reat well. ✓

b) S, ✓ HA: The proportions differ in the 3 towns ✓

c) K ✗, V HA: Gobi berries reduce the weight of tumors. ✓

d) N ✗ HA: The population mean is different than expected value ✓

e) N HA: There is a difference in effectiveness among 3 drugs. ✓

f) T ✓ HA: There is variability in marks at the 4 schools. ✓

g) V, J ✗ HA: There is a difference in means.

h) U ✓ HA: women prefer hotter water than men when showing ✓

small sample / μ / normally distributed

~~V~~, ~~S~~, (B)

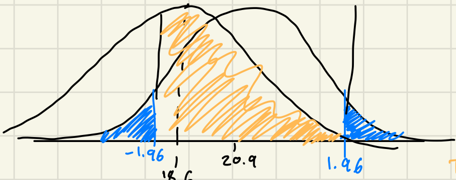
Measurement data / 2 samples / Big sample / Independent
- E

20) $H_0: \mu = 20.9$ $n = 32$ $\alpha = 0.05$

$H_A: \mu \neq 20.9$ $\sigma = 5.65$ $\mu_2 = 18.6$

$$z = \frac{20.9 - 18.6}{\frac{5.65}{\sqrt{32}}}$$

$z = 2.3$



Type 2 error: Did not reject null hypo, should have

Normal CD $-1.96 - 1.96$

$\sigma = 1$

$\mu = 2.3$

$P = 0.367$

23) $H_0: \mu = 14.5$

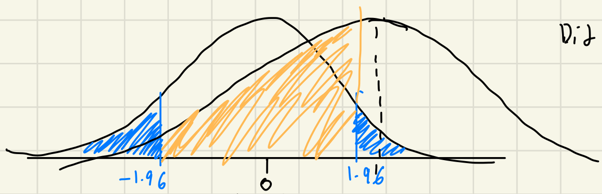
$H_A: \mu \neq 14.5$

$n = 33$

$\sigma = 3.17$

$\alpha = 0.05$

$\mu_2 = 17$



Did not reject null hypo should have

$$z = \frac{17 - 14.5}{\frac{\sigma}{\sqrt{n}}}$$

$$z = \frac{17 - 14.5}{\frac{3.17}{\sqrt{33}}}$$

$z = 4.53$

Normal CD =

$P = 5.085 \times 10^{-3}$

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a) L HA: Cell Phone users develop cancers at a higher rate than 0.0340%

large sample, 1 sample, μ

b) A large sample, μ

c) H

d) E

e) M

f) G

g) F