Calculations

Chapter 2

Frequency Distributions

- Consider the following data representing the number of miles professors drive to work each day: 3.8, 2.7, 9.3, 6.5, 5.8, 7, 10.2, 1, 3.7, 9.1, 6.2, 11, 11.9, 5.5, 4.8, 7.3, 9.1, 1.4

Number of Miles Professors Drive to Work Each Day							
	Class	**Frequency**	**Class Boundaries**		**Midpoint**	**Relative Frequency**	**Cumulative Frequency**
			Lower	**Upper**			
Calculation	N/A	Count the numbers in the range	$\frac{upper\ limit\ (lower\ class) + lower\ limit\ (upper\ class)}{2}$		$\frac{upper\ limit + lower\ limit}{2}$	$\frac{frequency}{sample\ size}$	Add frequencies of previous classes
	1.0-2.9	2.7, 1, 1.4 (3)	$1 - 0.05 = 0.95$	$\frac{3.0 + 2.9}{2} = 2.95$	$\frac{1 + 2.9}{2} = 1.95$	$\frac{3}{18} = 0.1\bar{6} = 17\%$	3
	3.0-4.9	3.8, 3.7, 4.8 (3)	$\frac{3.0 + 2.9}{2} = 2.95$	$\frac{5.0 + 4.9}{2} = 4.95$	$\frac{3 + 4.9}{2} = 3.95$	$\frac{3}{18} = 0.1\bar{6} = 17\%$	3+3 = 6
	5.0-6.9	6.5, 5.8, 6.2, 5.5 (4)	$\frac{5.0 + 4.9}{2} = 4.95$	$\frac{7.0 + 6.9}{2} = 6.95$	$\frac{5 + 6.9}{2} = 5.95$	$\frac{4}{18} = 0.\bar{2} = 22\%$	6+4 =10
	7.0-8.9	7, 7.3 (2)	$\frac{7.0 + 6.9}{2} = 6.95$	$\frac{9.0 + 8.9}{2} = 8.95$	$\frac{7 + 8.9}{2} = 7.95$	$\frac{2}{18} = 0.\bar{1} = 11\%$	10+2=12
	9.0-10.9	9.3, 10.2, 9.1, 9.1 (4)	$\frac{9.0 + 8.9}{2} = 8.95$	$\frac{11.0 + 10.9}{2} = 10.95$	$\frac{9 + 10.9}{2} = 9.95$	$\frac{4}{18} = 0.\bar{2} = 22\%$	12+4=16
	11.0-12.9	11, 11.9 (2)	$\frac{11.0 + 10.9}{2} = 10.95$	$\frac{13.0 + 12.9}{2} = 12.95$	$\frac{11 + 12.9}{2} = 11.95$	$\frac{2}{18} = 0.\bar{1} = 11\%$	16+2=18

Chapter 3

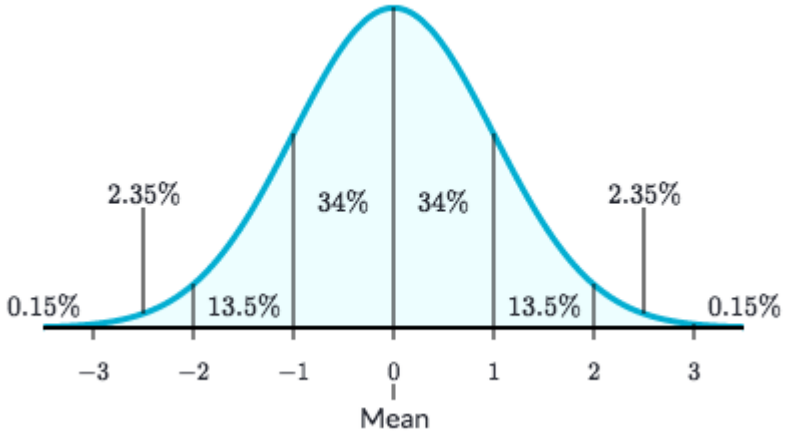
	Center				Dispersion			
	Mean	**Weighted Mean**	**Median**	**Mode**	**Standard Deviation**	**Variance**	**Range**	**IQR**
Good For	Symmetrical	Symmetrical With Weights	Skewed & Outliers	Qualitative	Symmetrical	Symmetrical	Easy Calculations	Skewed & Outliers
Sample	$\bar{x}$	$\bar{x}$	Med	N/A	s	s^2	N/A	N/A
Population	μ	μ			σ	σ^2		
Calculation	• Stat > Edit • 1: Edit… • Input Data • Stat > Calc • 1: 1-Var Stats • List: Input List • $\bar{x}$	• Stat > Edit • 1: Edit… • Input Data • Stat > Calc • 1: 1-Var Stats • List: Input List • FreqList: Weight List • $\bar{x}$	• See "Mean" • Value: Med	• Stat > Edit • 1: Edit… • Input Data • Stat > Edit •2: SortA() •2nd > List # • Mode = Most Often	• See "Mean" • Value: Sx or σx $\sqrt{variance}$	• See "Mean" • Vars >Vars • 5:Statistics… • 3:Sx or 4:σx • SD^2 SD^2	$max - min$	• See "Mean" • Values: Q_1 and Q_3 • $Q_3 - Q_1$

Box Plots

- **Five Number Summary** (1-Var Stats)
  - Minimum, Q_1, Median, Q_3, Maximum
  - **Potential Outliers**
    - Lower Limit: $Q_1 - (1.5 * IQR)$
    - Upper Limit: $Q_3 + (1.5 * IQR)$

z-scores	
Sample	**Population**
$z = \frac{x - \bar{x}}{s}$	$z = \frac{x - \mu}{\sigma}$

Percentiles

	Location	Percentile in a List	Empirical Rule
Equation	$l = n * \frac{P}{100}$	$P = \frac{l}{n} * 100$	• 68% in 1 SD • 95% in 2 SD • 99.7% in 3 SD
Decimal Rules	If the answer is a decimal, round up. If the answer is a whole number, find the mean of the number in that location and the number in the next location up.	N/A	N/A
Example: 6.8, 9.1, 8.7, 7.5, 8.2, 5.4, 6.5, 8.5, 7.3, 6.6, 5.9, 7.3, 9.3, 7.4	• 12^{th} percentile • Order the numbers from least to greatest. • $l = 14 * \frac{12}{100} = 1.68 = 2$ • Find the second number in the list: 5.9	• What percentile is 8.2? • Order the numbers from least to greatest. • Find where 8.2 is in the list. • $P = \frac{10}{14} * 100 = 71^{st}$	N/A
Graph	N/A	N/A	

Chapter 4

Experimental Probability

$$P(E) = \frac{f}{n} = \frac{frequency}{sample\ size}$$

Classical Probability

- $P(E) = \frac{n(E)}{n(S)} = \frac{number\ of\ outcomes\ in\ the\ event}{number\ of\ total\ outcomes}$
- $0 \leq P(E) \leq 1$
- **Complement**
  - $P(E^c) = 1 - P(E)$ $\quad P(E^c) + P(E) = 1$ $\quad P(E) = 1 - P(E^c)$
- **Addition (OR)**
  - Mutually Exclusive Events
    (a) $P(E\ or\ F) = P(E) + P(F)$ OR $P(E \cup F) = P(E) + P(F)$
  - Not Mutually Exclusive Events
    (a) $P(E\ or\ F) = P(E) + P(F) - P(E\ and\ F)$ OR $P(E \cup F) = P(E) + P(F) - P(E \cap F)$
- **Multiplication (AND)**
  - Independent Events
    (a) $P(E\ and\ F) = P(E) * P(F)$ OR $P(E \cap F) = P(E) * P(F)$
  - Not Independent Events
    (a) $P(E\ and\ F) = P(E) * P(F|E) = P(F) * P(E|F)$ OR $P(E \cap F) = P(E) * P(F|E) = P(F) * P(E|F)$
- **Conditional (Given That/If)**
  - $P(F|E) = \frac{P(E\ and\ F)}{P(E)}$ OR $P(F|E) = \frac{P(E \cap F)}{P(E)}$

Fundamental Counting Principle

- $k_1 * k_2 * k_3 \ldots k_n$ multiply the outcomes of a multistage event to find the total possible outcomes.

Chapter 5

Discrete Probability Distributions

- Key Phrases and Graphs
  - Expected value
  - Expected

x	P(x)

- Calculator: See "Weighted Means"
  - P(x) will be the FreqList
  - P(x) will add to 1
  - Expected Value: $\bar{x}$
  - Standard Deviation: σ
  - Variance: σ^2

Binomial Probability

Conditions	Probability	Calculator Input			Key Phrases	Equations
• Simple Random Sample • Independent Trials • Probability of Success = p • Number of Trials = n	$P(X = x)$	• 2nd > Vars • A: binompdf	binpdf	n,p,x	• Exactly x	• $\mu = np$ • $\sigma^2 = np(1-p)$ • $\sigma = \sqrt{np(1-p)}$
	$P(X \leq x)$	• 2nd > Vars • B: binomcdf	bincdf	n,p,x	• At most x • x or fewer • x or less	
	$P(X < x)$		bincdf	n,p,(x-1)	• Less than x • Fewer than x	
	$P(X > x)$		1-bincdf	n,p,x	• Greater than x • More than x	
	$P(X \geq x)$		1-bincdf	n,p,(x-1)	• At least x • x or more	

Chapter 6

Normal Probability

- Find
  - Area under the curve, probability, percentile, percent
- Standard Normal Distribution
  - Mean = 0 SD = 1

Conditions	Probability	Calculator Input		Key Phrases
• Continuous Data • Symmetrical • Mean in Middle • Data Separated by Standard Deviation • Area Adds to 1	•$P(X < x)$ • $P(X \leq x)$	• 2^{nd} > Vars • 2: normalcdf	• Lower: -1E99 • Upper: X • Mean: μ • SD: σ	• Less Than • At Most • Fewer Than • X or Less
	• $P(X > x)$ • $P(X \geq x)$		• Lower: X • Upper: 1E99 • Mean: μ • SD: σ	• Greater Than • At Least • More Than • X or More
	• $P(X \leq x \leq Y)$ • $P(X < x < Y)$		• Lower: X • Upper: Y • Mean: μ • SD: σ	• Between
	• $P(x < X \; or \; x > Y)$ • $P(x \leq X \; or \; x \geq Y)$		1 – "Between"	• Tails • Less than X or Greater than Y
	Differs by Less		• Lower: $\mu - X$ • Upper: $\mu + X$ • Mean: μ • SD: σ	• Differs by Less Than X • Differs by Fewer Than X
	Differs by More		• 1 – "Differs by Less" • 2 * normalcdf a tail	• Differs by Greater Than X • Differs by More Than X

invNorm

- Find
  - z-score
  - Measurements

Conditions	Direction	Calculator Input			Key Phrases
			Ti-83	**Ti-84**	
• Continuous Data • Symmetrical • Mean in Middle • Data Separated by Standard Deviation • Area Adds to 1	Left	•2^{nd} > Vars •3: invNorm	p, μ, σ	• Area: p • Mean: μ • SD: σ • Left	• To the Left • Bottom % • Percentile • Less Than
	Right		(1-p), μ, σ	• Area: p • Mean: μ • SD: σ • Right	• To the Right • Top % • More Than
	Between -z and z		• $\left(\frac{1-p}{2}\right), 0, 1$ Gives -z • z = -z * -1	• Area: p • Mean: 0 • SD: 1 • Center	• Between • This is ONLY z-scores
	Left -z and Right z		• $(\frac{p}{2}, 0, 1)$ Gives -z • z = -z * -1	• Area: 1-p • Mean: 0 • SD: 1 • Center	• Left of -z Plus Right of z • This is ONLY z-scores

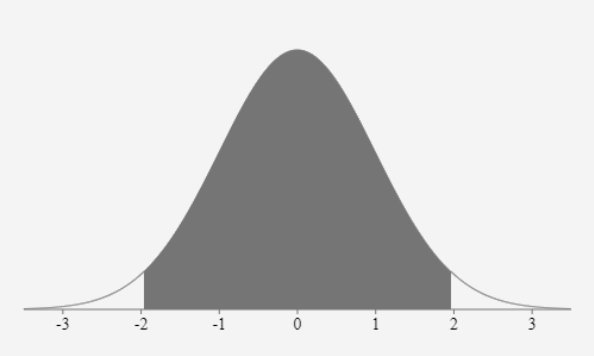
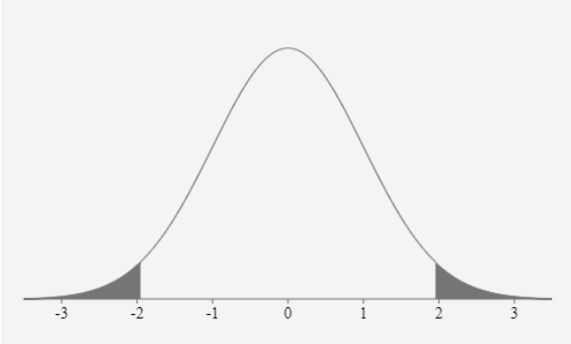
Chapter 7

Central Limit Theorem: Probability

- ALL CLT probability questions follow the normal distribution.
- What are you being asked about?

	Individual	Mean	Proportion
Mean	μ	μ	p
Standard Deviation	σ	$\frac{\sigma}{\sqrt{n}}$	$\sqrt{\frac{p(1-p)}{n}}$
Conditions	• Normal	• $n \geq 30$ • Normal	• $np \geq 10$ • $n(1-p) \geq 10$ • Normal
z-score	$z = \frac{x-\mu}{\sigma}$	$z = \frac{\bar{x}-\mu}{(\frac{\sigma}{\sqrt{n}})}$	$z = \frac{\hat{p}-p}{\sqrt{\frac{p(1-p)}{n}}}$
Other Equations	N/A	N/A	• $\hat{p} = \frac{x}{n}$ • $x = \hat{p} * n$
Key Phrases: Probability	• Individual • Random ____ Chosen	• Mean	• Proportion • Percent • x of n

- Does it say, “differs by”?

	No	Differs By Less			Differs By More
		Individual	Mean	Proportion	
Calculator Functions	Follow normalcdf Rules	• $\mu - x$ • $\mu + x$ • Mean: μ • SD: σ	• $\mu - x$ • $\mu + x$ • Mean: μ • $\frac{\sigma}{\sqrt{n}}$	• $p - \%$ • $p + \%$ • Mean: p • $\sqrt{\frac{p(1-p)}{n}}$	• 1 – “Differs by Less” • 2 * normalcdf (one of the sides)
Diagram	N/A				

Chapters 8 and 9

Confidence Intervals

	Mean		Proportion	Two Means
	σ Known	σ Unknown		
Formula	$(\bar{x} - E, \bar{x} + E)$	$(\bar{x} - E, \bar{x} + E)$	$(\hat{p} - E, \hat{p} + E)$	$((\overline{x_1} - \overline{x_2}) - E, (\overline{x_1} - \overline{x_2}) + E)$
Calculator Function	Z Interval	T Interval	1-PropZInt	2-SampZInt
Margin of Error	$E = z_{\frac{\alpha}{2}}(\frac{\sigma}{\sqrt{n}})$	$E = t_{\frac{\alpha}{2}}(\frac{s}{\sqrt{n}})$	$E = z_{\alpha/2}\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$	$E = z_{\alpha/2}\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$
Sample Size	$n = (\frac{z_{\alpha/2} * \sigma}{E})^2$	N/A	$n = p(1-p)(\frac{z_{\alpha/2}}{E})^2$	N/A
Critical Value	$z_{\alpha/2}$	$t_{\alpha/2}$	$z_{\alpha/2}$	$z_{\alpha/2}$
Requirements	• n ≥ 30 • Approximately Normal	• n ≥ 30 • Approximately Normal	• np ≥ 10 • n(1-p)≥10 • Approximately Normal	• $n_1 \geq 30$ and $n_2 \geq 30$ • Both Populations Approximately Normal
Key Phrases	• Interval • Endpoints • Mean • Population Standard Deviation Known	• Interval • Endpoints • Mean • Population Standard Deviation Unknown • Sample Standard Deviation	• Interval • Endpoints • Proportion	• Interval • Endpoints • Difference Between Two Means • Population Standard Deviation Known
Extra Equations	• $E = \frac{upper\ endpoint - lower\ endpoint}{2}$ • $\mu = \frac{upper\ end\ point + lower\ endpoint}{2}$		• $E = \frac{upper - lower}{2}$ • $p = \frac{upper + lower}{2}$ • $x = \hat{p} * n$	• $E = \frac{upper - lower}{2}$ • $\mu_1 - \mu_2 = \frac{upper + lower}{2}$

Critical Value Calculations

	Z Interval	T Interval		Proportion Interval	2 Sample Z Interval
Symbol	$z_{\frac{\alpha}{2}}$	$t_{\frac{\alpha}{2}}$		$z_{\frac{\alpha}{2}}$	$z_{\frac{\alpha}{2}}$
General	• 2nd > Vars • invNorm	• Stat > Tests • 8: T Interval • Stat	• 2nd > Vars • invT	Same as Z Interval	Same as Z Interval
Ti-83	$\left(\frac{1-c}{2}\right), 0, 1$	• $\bar{x}$: 0 • Sx: $\sqrt{n}$ • n: Sample Size • C-Level: c	N/A		
Ti-84	• Area: $\frac{1-c}{2}$ • Mean: 0 • SD: 1		• Area: $\frac{1-c}{2}$ • DF: n – 1		

Endpoint Calculations

	Z Interval	T Interval	Proportion Interval	2 Sample Z Interval
General	• Stat > Tests • 7: Z Interval • Stat if Numbers • Data if List (Stat > Edit)	• Stat > Tests • 8: T Interval • Stat if Numbers • Data if List (Stat > Edit)	• Stat > Tests • A: 1-PropZInt	• Stat > Tests • 9: 2-SampZInt • Stat if Numbers • Data if Lists (Stat > Edit)
Calculator Input	• σ: Population SD • $\bar{x}$: Sample Mean • n: Sample Size • C-Level: c	• $\bar{x}$: Sample Mean • Sx: Sample SD • n: Sample Size • C-Level: c	• x: Number of Successes • n: Sample Size • C-Level: c	• σ1: Population SD Group 1 • σ2: Population SD Group 2 • $\bar{x}1$: Sample Mean Group 1 • n1: Sample Size Group 1 • $\bar{x}2$: Sample Mean Group 2 • n2: Sample Size Group 2 • C-Level: c

Chapters 10 & 11

Hypothesis Tests

	Mean		Proportion	Two Means
	σ Known	σ Unknown		
Calculator Function	Z-Test	T-Test	1-PropZTest	2-SampZTest
Alternative Hypotheses	• $u \neq u$ • $u < \mu$ • $\mu > \mu$	• $u \neq u$ • $u < \mu$ • $\mu > \mu$	• $p \neq p$ • $p < p$ • $p > p$	• $\mu_1 \neq \mu_2$ • $\mu_1 < \mu_2$ • $\mu_1 > \mu_2$
Test Statistic	$z = \frac{\bar{x} - \mu}{(\frac{\sigma}{\sqrt{n}})}$	$t = \frac{\bar{x} - \mu}{(\frac{s}{\sqrt{n}})}$	$z = \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}}$	$z = \frac{(\overline{x_1} - \overline{x_2}) - (\mu_1 - \mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}$
Requirements	• n ≥ 30 • Approximately Normal	• n ≥ 30 • Approximately Normal	• np ≥ 10 • n(1-p)≥10 • Approximately Normal	• $n_1 \geq 30 \; and \; n_2 \geq 30$ • Both Populations Approximately Normal
Key Phrases	• Test • Claim • Sufficient Evidence • Mean • Population Standard Deviation Known	• Test • Claim • Sufficient Evidence • Mean • Population Standard Deviation Unknown • Sample Standard Deviation	• Test • Claim • Sufficient Evidence • Proportion	• Test • Claim • Sufficient Evidence • Difference Between Two Means • Population Standard Deviation Known
Conclusions	$p - value \leq \alpha$	Reject the null hypothesis. There is sufficient evidence to support the alternative hypothesis.		
	$p - value > \alpha$	Do not reject the null hypothesis. There is not sufficient evidence to support the alternative hypothesis.		

Test Calculations				
	Z Test	T Test	Proportion Test	2 Sample Z Test
General	• Stat > Tests • 1: Z-Test • Stat if Numbers • Data if List (Stat > Edit)	• Stat > Tests • 2: T-Test • Stat if Numbers • Data if List (Stat > Edit)	• Stat > Tests • 5: 1-PropZTest	• Stat > Tests • 3: 2-SampZTest • Stat if Numbers • Data if Lists (Stat > Edit)
Calculator Input	• μ_0: Null Hypothesis • σ: Population SD • $\bar{x}$: Sample Mean • n: Sample Size • μ: $\neq \mu_0 < \mu_0 > \mu_0$ Alternative Hypothesis	• μ_0: Null Hypothesis • $\bar{x}$: Sample Mean • Sx: Sample SD • n: Sample Size • μ: $\neq \mu_0 < \mu_0 > \mu_0$ Alternative Hypothesis	• p_0: Null Hypothesis • x: Number of Successes • n: Sample Size • $prop$: $\neq p_0 < p_0 > p_0$ Alternative Hypothesis	• σ1: Population SD Group 1 • σ2: Population SD Group 2 • $\bar{x}1$: Sample Mean Group 1 • n1: Sample Size Group 1 • $\bar{x}2$: Sample Mean Group 2 • n2: Sample Size Group 2 • $\mu 1$: $\neq \mu 2 < \mu 2 > \mu 2$ Alternative Hypothesis

Chapter 12

Linear Regression						
	Explanatory Variable	Response Variable	Slope	y-intercept	Correlation Coefficient	Coefficient of Determination
Symbol	x	y	a	b	r	r^2
Purpose	Predict changes in y	Respond to changes in x	For every one x, y changes by b	If x = 0, y = a	• Close to -1 or 1: Strong Relationship • Close to 0: Weak Relationship • Sign Matches Correlation (+ or -)	Tells how much of y is predicted by x
AKA	• Independent • Predictor	• Dependent • Predicted	• Rate of Change	• Starting Value	• Strength and Direction of Relationship	• Accuracy of Data
Calculator Function	• Stat > Edit • Input Data • Stat > Calc • 4: LinReg(ax+b)			• Xlist: List With x Data • Ylist: List With y Data • FreqList: Blank		