Stats Final Exam Review Guide

Unit 1 – Getting Started

- Population vs. Sample
- Parameter vs. Statistic
- Qualitative vs. Quantitative Data
- Descriptive vs. Inferential Statistics
- Data Collection Methods
  - Census, Experiment, Sampling, Simulation
- Biased Studies
  - Voluntary Response, Convenience, Response,
  - Under-coverage, Non-Response, Wording of Question
- Levels of Measurement
  - Nominal, Ordinal, Interval, Ratio

Unit 2 – Organizing (& Displaying) Data

- Frequency Distributions
- Displaying Data
  - Histograms, Stem-Leaf Plots, Dot Plots, Pie Charts
  - Bar Graphs, Pareto Graphs, Scatter Plots

Unit 3 – Measures of Center/Spread

- Measures of Center
  - Mean ($\bar{x}, \mu$), Median, Mode, Weighted Average, Trimmed Mean
- Measures of Variation
  - Range, Standard Deviation (σ), Coefficient of Variation
- Measures of Position
  - Box-and-Whiskers Plots, Outliers

$\bar{x}$ = sample mean
μ = population mean
Drop the High + Low, then re-run your stats
Standard Deviation / Mean
σ_x = Population St. Dev.
S_x = Sample St. Dev.

Unit 4 – Linear Regression

- Line of Best Fit
- Correlation
  - Positive vs. Negative
  - Strong vs. Moderate vs. Weak vs. None
- Interpolation vs. Extrapolation

0.8-1
0.5-0.8
0.2-0.5
$r < 0.2$

Unit 5 – Probability

- Types of Probability
  - Theoretical, Experimental, Subjective
- Probability
  - Addition Rule, Multiplication Rule
- Dependent vs. Independent Events
- Mutually Exclusive Events
- Counting Principles
  - Counting Principles, Combinations, Permutations, Distinguishable Permutations
- Expected Value (EV)

Unit 6 – Discrete Probability Distributions

- Probability Distributions
  - Discrete vs. Continuous
- Binomial Distributions
- Geometric Distributions
- Poisson Distributions

$P(x) = {}_nC_x (p)^x (q)^{n-x}$
$P(x) = (q)^{x-1}(p)$
$P(x) = \frac{\mu^x \cdot e^{-\mu}}{x!}$

Unit 1 – Getting Started

1. A tooth-whitening gel is to be tested for effectiveness. A group of 85 adults have volunteered to participate in the study. Of these, 43 are to be given a gel that contains the tooth-whitening chemicals, while the other 42 are to be given a similar-looking package of gel that does not contain the tooth-whitening chemicals.

   a. Identify the sampling technique used to test the tooth-whitening gel. Experiment

   b. Identify the sample. 85 Adults

   c. Identify the population. All Adults

2. The tooth-whitening gel study showed an 82% increase in tooth-whitening for the test group compared to the control group.

   a. Is the 82% a statistic or a parameter? Briefly explain.

   It comes from the sample

   b. Is this an example of descriptive statistics or inferential statistics? Briefly explain.

   It describes what they found (in the past).

3. It turns out, these 85 adults filled out a survey while they were in the waiting room at their dentists.

   a. Could there be any potential bias? Yes

   b. What type of bias? Briefly explain.

   Many Possibilities →
   Response Bias - Surveys can be lied on.
   Undercoverage - Not all people have a dentist.
   Convenience - Surveys were collected at a few offices.
   Voluntary Response - Only people who can admit they need teeth whitening will participate.

4. The company that ran this "test" is trying to mass produce this tooth-whitening gel and aggressively market it. The head of the marketing division claims that the tooth-whitening gel will whiten all teeth by more than 75%.

   a. Is the 75% a statistic or a parameter? Briefly explain.

   It describes the population.

   b. Is this an example of descriptive statistics or inferential statistics? Briefly explain.

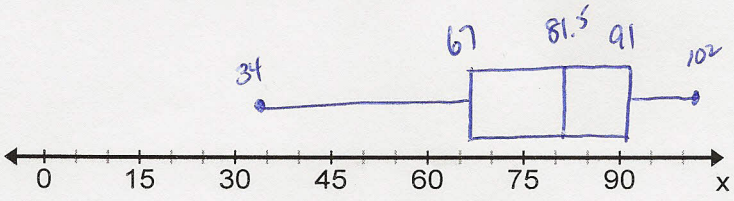
   It makes a prediction (in the future)

Unit 2 – Displaying Data

1. Create a box-and-whiskers to show the following data.

An Entire Class' Test Grades

72	74	77	79	84	84	91
34	51	59	59	64	66	68
84	88	89	90	91	96	102
98	99	100	100	71	75	60



Mean = 78.75

Median = 81.5

Mode = 84 (3)

Range = 102-34 = 68

Standard Deviation = 16.66

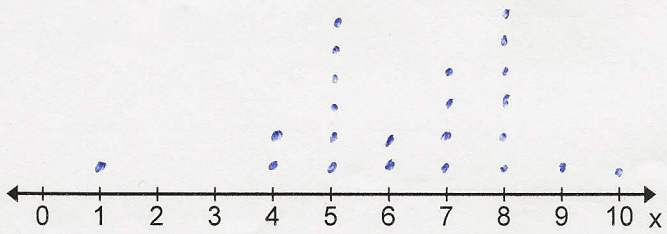
Coefficient of Variation = 21%

Trimmed Mean = 79.58

2. Display the following data as a Dot-Plot.

The number of siblings of students in a class

5	8	7	4	5	9	7	8	10	1	5	8	6
7	8	5	8	6	4	5	7	5	8			



3. Display the following data in a frequency distribution and Histogram with 5 classes.

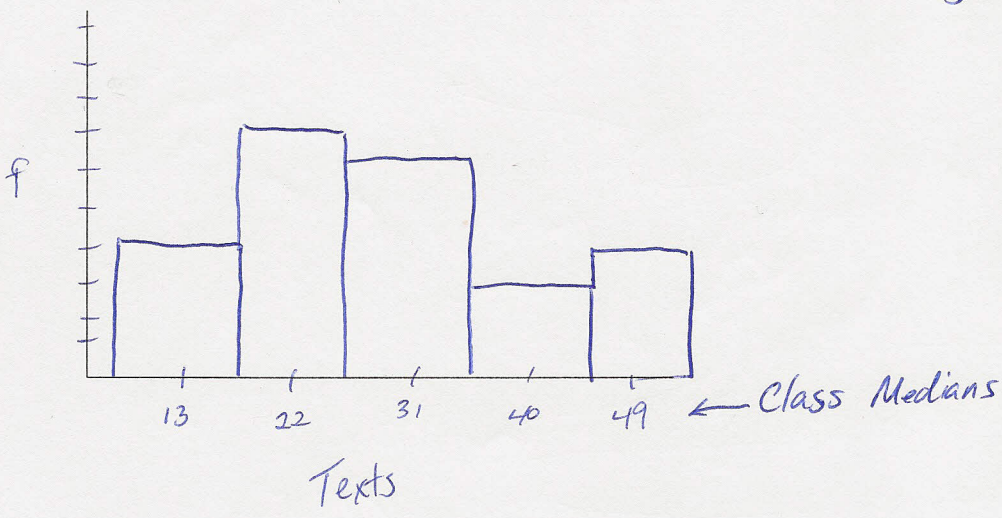
Phone Text Messages Received During the School Day

25	29	32	22	9	13
37	11	46	18	28	27
24	15	49	38	32	49
52	24	39	20	30	23

Class Width = $\left\lceil \frac{\text{Max} - \text{Min}}{\#\text{ of Classes}} \right\rceil$ — Round up

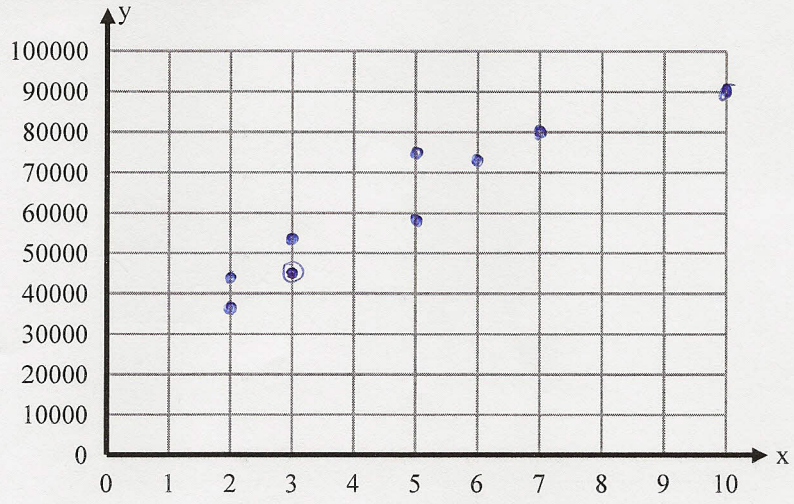
$C.W = 52 - 9 = \frac{43}{5} = 9$

Class	f
9 - 17	4
18 - 26	7
27 - 35	6
36 - 44	3
45 - 53	4



4. Display the following data as a Scatter-Plot. Perform a Linear Regression.
The length of employment and salaries at a sales firm.

Length (in years)	Salary
3	$45,000
5	59,000
2	38,000
3	45,000
5	74,000
6	72,000
7	80,000
2	43,000
10	90,000
3	52,000



a. Identify the equation of the line that best fits the data. $y = 6750x + 28750$

b. Identify the Correlation Coefficient $(r) =$ 0.953

c. In words, classify the correlation of the scatterplot. Strong, Positive

d. Identify the Explained variation $(r^2) =$ 0.908 91%

e. Identify the Unexplained variation $(1 - r^2) =$ 9%

f. What salary would you expect from someone who has been at this sales firm for 5 years?

$62,500

Plug years in for x and solve for y.

g. What salary would you expect from someone who has been at this sales firm for 15 years?

$130,000

h. If someone was getting paid $75,000, how many years have they been with this sales firm?

6.85 (or 7)

Plug salary in for y, and solve for x.

i. If someone was getting paid $135,000, how many years have they been with this sales firm?

15.7 (or 16)

j. What is the residual for (7, $80,000)?

$6750(7) + 28750 = 82750$

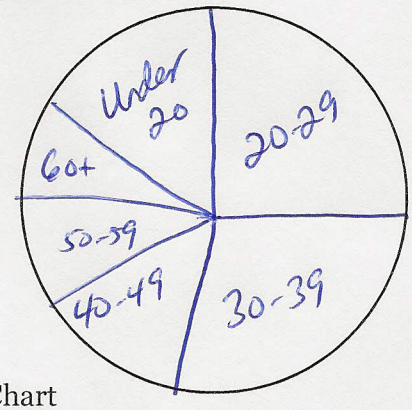
-80000

$2,750$

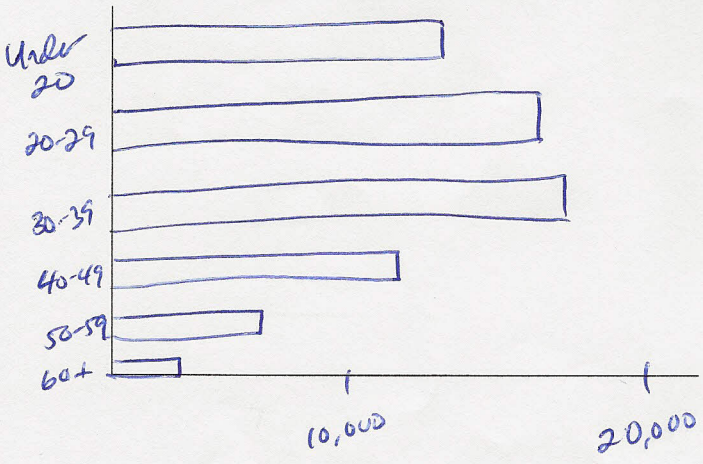
4. Display the following data as: Drunk Driving Accidents (in thousands).

Driver's Age	#	
Under 20	12,400	18.2%
20-29	17,200	25.1%
30-39	18,800	27.5%
40-49	11,200	16.4%
50-59	5,400	8%
60+	3,200	4.7%
total	68,200	

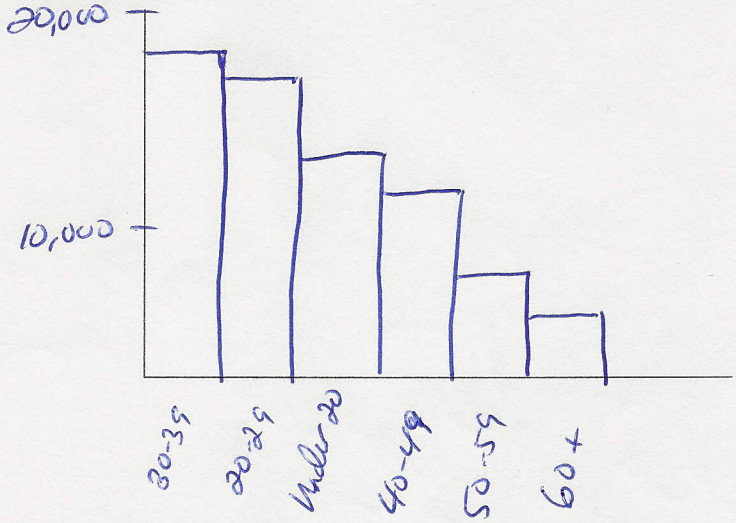
a. A Pie Chart



b. A Bar Graph.



c. A Pareto Graph



Probability Review

1. Use a 24-sided die (showing numbers 1 through 24) to calculate the probability of:
   a. Rolling a 9. $\frac{1}{24}$
   b. Rolling a number divisible by 5. 5, 10, 15, 20 $\frac{4}{24} = \frac{1}{6}$
   c. Rolling a prime number (recall 1 is not prime). 2, 3, 5, 7, 11, 13, 17, 19, 23 $= \frac{9}{24} = \frac{3}{8}$
   d. Rolling either an even number or a number divisible by 3. 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24 / 3, 6, 9, 12, 15, 18, 21, 24 $= \frac{16}{24} = \frac{2}{3}$
   e. Rolling a number that's greater than 8 and divisible by 7. 14, 21 $= \frac{2}{24}$ or $\frac{1}{12}$

2. Tell whether the event is simple or compound.
   a. Flipping tails. S
   b. Rolling an even number. C
   c. Drawing the 10 of clubs. S
   d. Drawing any diamond. C

3. Tell whether the probability is Theoretical, Experimental, or Subjective.
   a. The probability that Courtney will get the highest score on a test is .17. S
   b. Since an even came up 3 out of 4 times, the probability of rolling even is 0.75. E
   c. The probability of rolling two dice and getting a 7 is 0.167. T

4. Tell whether the events are dependent or independent of each other.
   a. Rolling a die twice and getting the same numbers. I
   b. Drawing a heart, NOT replacing it, and not drawing a heart. D
   c. Passing a Prob-Stats' test and failing the next Prob-Stats' test. I

5. Tell whether the events are mutually exclusive or not.
   a. Rolling an odd and rolling an even number. M.E.
   b. Rolling a 2 and rolling an even number. Not M.E.
   c. Being a vegetarian and eating a steak. M.E.

Use the Multiplication Rule when you are looking for two events to occur simultaneously or consecutively.

6. Calculate the probability of rolling a 3, then rolling an even number.

$$\frac{1}{6} \cdot \frac{1}{2} = \frac{1}{12} = 0.083$$

7. Calculate the probability of selecting an Ace, then selecting a face card (no replacement).

$$\frac{4}{52} \cdot \frac{12}{51} = \frac{48}{2652} = 0.018$$

↑ King, Queen, Jack

8. Calculate the probability of selecting a heart, replacing it, then selecting a spade.

$$\frac{1}{4} \cdot \frac{1}{4} = \frac{1}{16} = 0.0625$$

9. The probability that a dog will bark on command is 0.45. The probability that a dog will sit on command is 0.70. Calculate the probability a dog can do both.

$$(0.45)(0.70) = 0.315$$

Use the Addition Rule when you are looking for the Union of two events to occur.

10. The probability that a person can speak Spanish is 0.31. The probability that a person can do a pirouette is 0.13. The probability a person can do both is 0.03. Calculate the probability a person can either speak Spanish or do a pirouette.

$$0.31 + 0.13 - 0.03 = 0.41$$

11. The probability a hockey player is missing teeth is 0.67. The probability that a hockey player is bilingual is 0.56. The probability that a hockey player whistles in two languages is 0.35. Calculate the probability that a randomly selected hockey player is bilingual and/or missing teeth.

$$0.67 + 0.56 - 0.35 = 0.88$$

Basic Counting Principles

12. David Bell, when he played for the Mets, claimed that he had enough pants, shirts, shoes, belts, and jackets to wear a different outfit for each of the Mets 162 games. He had 5 shirts, 3 pants, 3 belts, 2 shoes, and 3 jackets. Was he right?

$5 \times 3 \times 3 \times 2 \times 3 = 270 > 162$

Yes

13. How many Pick 3 numbers can be selected from the Virginia State Lotto if any digit from 0 – 9 can be selected for each of the 3 numbers?

$10 \times 10 \times 10 = 1{,}000$

Use Permutations when you Pick a few things from a larger set (when order matters).

14. How many ways can you rank the top 2 football teams in the top 12?

${}_{12}P_2 = 132$

15. How many ways can the top 3 swimmers finish if there are 6 in the race?

${}_6P_3 = 120$

Use the Distinguishable Permutations formula when you have a permutation with repeats.

16. How many ways can you arrange your 15 shirts if you have 6 white, 4 blue, 3 green, and 2 black shirts.

$$\frac{15!}{6!4!3!2!} = 6{,}306{,}300$$

Use Combinations when you choose a few things from a larger set (when order doesn't matter).

17. How many ways can you select 4 person groups from a class of 16?

${}_{16}C_4 = 1820$

18. How many ways can you take out 3 books from a set of 15?

${}_{15}C_3 = 455$

Probability Distributions

1. What's the difference between discrete and continuous random variables?

Countable/Finite Uncountable/Infinite

2. What are the two criteria that make up a Probability Distribution?

① All probabilities are between 0 and 1.

② Sum of all probabilities is 1.