Name Key Date _____ Pd ____

Statistics Exam Review

55 multiple choice questions: *Ch. 1 – 12, Ch. 2 – 4, Ch. 3 – 13, Ch. 4 – 9, Ch. 5 – 6, Ch. 7 – 8. No partial credit. No shown work required! You will receive tables and a formula chart.*

Vocabulary: *Be sure to know the definition for each of these terms. It could be a standalone multiple choice question or it could be needed to answer a mathematical question.*

Chapter 1

Sample
Random Sampling
Stratified Sampling
Statistics
Experiment
Control Group
Double-blind Experiment
Population
Systematic Sampling
Qualitative Variables
Randomized Experiment
Placebo Effect
Quantitative Variables
Undercoverage
Block
Lurking Variables
Individuals
Variables
Confounding Variables
Explanatory Variable
Response Variable
Parameter
Statistics

Chapter 2

Frequency table
Relative frequency
Histogram
Mound-shaped symmetrical distribution
Uniform distribution
Skewed left
Skewed right
Bimodal distribution
Outlier
Circle graph/pie chart

Chapter 3

Average
Mode
Median
Mean
Sample mean
Population mean
Range
Variance
Standard deviation
Sum of squares
Sample variance
Sample standard deviation
Population variance
Population standard deviation
Population size
Coefficient of variation
Outlier
Quartiles
Interquartile range
Five-number summary
Box-and-whisker plot

Chapter 4

Explanatory variable
Response variable
No linear correlation
Perfect linear correlation
Positive correlation
Negative correlation
Sample correlation coefficient, r
Causation
Lurking variable
Least-squares regression line
Slope b
Intercept a

Chapter 5

Probability of an Event A
Equally likely outcomes
Law of Large Numbers
Sample space
Complement of Event A^c
Independent events
Dependent events
Probability of A and B
P(A|B)
Multiplication Rules of probability
    Independent
    Dependent
Probability of A or B
Mutually exclusive events
Addition rules
    Mutually exclusive
    General events
Multiplication rule of counting
Tree diagram
Permutations rule
Combinations rule
Venn diagram

Chapter 6

Random variable
    Discrete
    Continuous
Probability distribution
Mean of a probability distribution
Standard deviation of a probability distribution
Expected value
Binomial experiment
Number of trials
Independent trials
Successes and failures in a binomial experiment
Probability of success
Probability of failure

Chapter 7

Normal distribution
Normal curve
Normal density function
Empirical rule
Z value, zscore
Standard score
Raw score
Standard normal distribution
Area under the standard normal curve
$\mu_{\bar{x}}$
$\sigma_{\bar{x}}$
Central limit theorem

Free Response: *Be able to answer the following questions. Work is not necessary for the final exam.*

1. Chocolate candies per bag of trail mix:

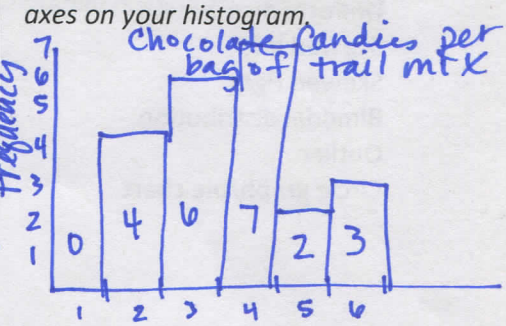
50 42 119 45 68 32 67 111 61 31 75
39 62 64 49 55 51 33 117 96 64 82

Fill in the chart below and then create a frequency histogram below the chart.

	Class Interval	Tally	Frequency	Relative Frequency
1	1 – 20		0	0%
2	21 – 40	||||	4	18.2%
3	41 – 60	||||	6	27.3%
4	61 – 80	|||| ||	7	31.8%
5	81 – 100	||	2	9.1%
6	101 - 120	|||	3	13.6%

Total 22 Total 100%

Include a title and labeled axes on your histogram.



2. If event A is certain to occur, what is the P(A)? $P(A^c)$?

100% $P(A) = 100\%$ $P(A^c) = 0\%$

3. You roll a die twice, what is the probability of rolling a 2, and then a number greater than 2? (Hint: draw your sample space or tree diagram for a visual.) independent

$P(2) + P(n>2)$ $P(2) = \{2\}$

$\frac{1}{6} + \frac{4}{6} = \boxed{\frac{5}{6}}$ $P(n>2) = \{3,4,5,6\}$

4. If two events are independent, what does this mean and which formulas would you use?

it means the two events do not influence each other.

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

5. **Using the formulas provided first decide if the scenario would involve a permutation or a combination. Then determine the number of possibilities possible.**

$$P_{n,r} = \frac{n!}{(n-r)!} \qquad C_{n,r} = \frac{n!}{r!\,(n-r)!}$$

a) 5 runners race. 1 person gets gold, 1 gets silver, and 1 gets bronze.

$n=5$, $r=3$ $P_{5,3} = \frac{5!}{(5-3)!} = \frac{5\cdot4\cdot3\cdot2\cdot1}{2\cdot1} = 5\cdot4\cdot3 = \boxed{60}$

b) Google has an opening for 4 new interns, and they interviewed 8 applicants.

$n=8$, $r=4$ $C_{8,4} = \frac{8!}{4!\,(8-4)!} = \frac{8\cdot7\cdot6\cdot5\cdot4\cdot3\cdot2\cdot1}{(4\cdot3\cdot2\cdot1)(4\cdot3\cdot2\cdot1)} = \frac{1680}{24} = \boxed{70}$

6. In a binomial experiment,
   a. How many different outcomes are there? 2; success or failure
   b. n = fixed number of trials
   c. r = random variable representing the number of successes expected
   d. p = probability of success
   e. q = probability of failure

7. **Use the formula for a binomial probability distribution to find the probability of the given situation.** $P(r) = \frac{n!}{r!(n-r)!} p^r q^{n-r}$

You flip a coin 17 times, what is the probability of flipping 15 heads. Notice p and q were not given to you so you first need to figure out the probability of a success and probability of a failure in regards to flipping a coin.

$n=17$, $r=15$, $p=0.5$, $q=0.5$

$P(15) = \frac{17!}{15!(17-15)!}(.5)^{15}(.5)^{17-15}$

$= 136(.5)^{15}(.5)^2$

$\boxed{P(15) = 0.001}$

8. Use the table in the appendix in the back of the book to answer the following question.

You are trying to finish your Psychology test. You have 3 multiple choice questions left, and each question has 4 answer choices. Assuming that you randomly guess on all 3 questions...

$n = 3$
$r = ?$
$p = .25$
$q = .75$

a) What is the probability that you do not get any questions correct?

$r = 0 \quad P(0) = \frac{3!}{0!(3)!}(.25)^0(.75)^3 = 1(1)(.75)^3 = \boxed{0.422}$

b) What is the probability that you get only 1 question correct?

$r = 1 \quad P(1) = \frac{3!}{1!(2)!}(.25)^1(.75)^2 = 3(.25)(.75)^2 = \boxed{0.422}$

c) What is the probability that you get at least 2 questions correct?

table $\quad (r \geq 2) \quad 1 - [P(0) + P(1)] \quad$ OR $\quad P(2) + P(3)$

$P(2) = 0.141 \qquad P(3) = 0.016$

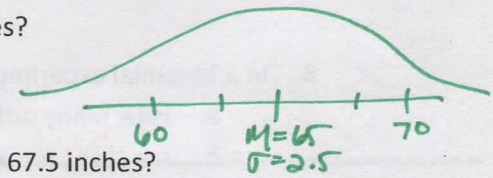
$P(r \geq 2) = 0.141 + 0.016 = \boxed{0.157}$

9 – 12: Given data that has a normal distribution, use the Empirical Rule to answer the questions below. 68-95-99.7

9. What percent of the data lies above the mean? 50%
10. What percent of the data lies within one standard deviation from the mean in both directions? 68%
11. What percent of the data lies within two standard deviations from the mean in both directions? 95%
12. Assuming that heights of college women are normally distributed with a mean of 65 inches and standard deviation of 2.5 inches... $\mu = 65 \quad \sigma = 2.5$

    a. What percent of college women are shorter than 65 inches?

    50%



    b. What percent of the women are between 62.5 inches and 67.5 inches?

    68%

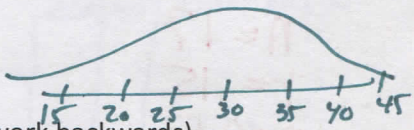
    c. What percent of the women are between 60 inches and 70 inches?

    95%

13. A normal distribution has a $\mu = 30$ and $\sigma = 5$. (HINT: sketch a normal curve for a visual.) $\mu = 30 \quad \sigma = 5$

    a. Find the z-score corresponding to $x = 42$.

    $z = \frac{42 - 30}{5} = \frac{12}{5} = \boxed{2.4}$

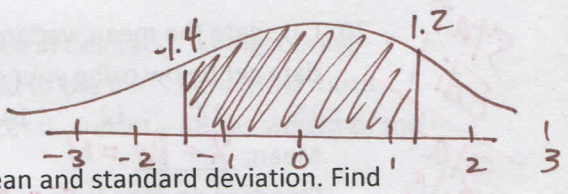


    b. Find the raw score that corresponds to $z = 1.3$. (Hint: raw score = x, work backwards)

    $X = 1.3(5) + 30 = \boxed{36.5}$

table

14. What percent of the data will lie between z = -1.4 and z = 1.2?



0.8849
−0.0808 0.8041 → **80.41%**

15. Assume that x has a normal distribution with the specified mean and standard deviation. Find the indicated probabilities. P(x ≥ 120) when μ = 100 and σ = 15.

$P(x \geq 120) = \frac{x-M}{\sigma} = \frac{120-100}{15} = \frac{20}{15} = 1.33$

$P(z \geq 1.33) = 1 - 0.9082 =$ **0.0918**

16. Find the z-value described and sketch the area described. Find the z score such that 13% of the normal curve lies to the **RIGHT** of z.

$1 - .13 = .87$

$z = 1.13$

17. How large of a sample size is needed to apply the Central Limit Theorem, making a non-normal distribution approximately normal?

$n \geq 30$

18. Using the formulas provided below, suppose x has a distribution with a mean of 8 and standard deviation of 16. Random samples of size 64 are drawn.

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

$M = 8$
$\sigma = 16$
$n = 64$

a. Find the mean and standard deviation of the sample described.

$M_{\bar{x}} = 8 \qquad \sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{16}{\sqrt{64}} = \frac{16}{8} = 2$

b. Find the z-score corresponding to $\bar{x} = 9$.

$z = \frac{\bar{x} - M}{\frac{\sigma}{\sqrt{n}}} = \frac{9-8}{2} = \frac{1}{2} =$ **0.5**

c. Find $P(\bar{x} \geq 9)$.

$P(\bar{x} \geq 9) = \frac{9-8}{2} = \frac{1}{2} = 0.5 \qquad P(z \geq 0.5) = 1 - 0.6915 =$ **0.3085**

19. The following data shows the number of injuries per landing point for commercial boats on trips down the Colorado River.

8	1	1	0	6	7	2
14	3	0	1	13	2	1

Calculate the

a) Mean

$\bar{X} = \frac{\Sigma x}{n} = \frac{59}{14} \approx$ **4.214**

b) Median

0 0 1 1 1 2 2
3 6 7 8 13 14

$\frac{2+2}{2} = \frac{4}{2}$

2

c) Mode

1

Stat, Edit / Stat, Calc, 1-Var

20. Calculate the mean, variance, standard deviation, and coefficient of variation of the **population** data set below using your calculator. (*Hint: make sure you know the notation for each term*)

15 18 12 14 21

Mean: $\bar{X} = 16 = M$ Variance: $\sigma^2 = 9.998$

Standard deviation: $\sigma_x = 3.162$ Coefficient of variation: $CV = \frac{\sigma}{M} \cdot 100 = \frac{3.162}{16}(100) = (.198)(100)$

19.8%

21. In your closet you have 12 t-shirts: 4 blue, 3 red, 3 green, and 2 white.

a. What is the probability of randomly selecting a red t-shirt from the closet?

$P(R) = \frac{\text{red}}{\text{total}} = \frac{3}{12} = \frac{1}{4}$ 25%

b. If you **DO NOT REPLACE** the t-shirts after drawing them, what is the probability of selecting a white t-shirt and then selecting a blue t-shirt? Dependent

$P(W \cap B) = \left(\frac{2}{12}\right)\left(\frac{4}{11}\right) = \frac{8}{132} = \frac{2}{33} \approx .061$

22. Tell whether the following variables are continuous or discrete.

a. The number of students at Lancaster high school on a specific day. discrete, 1 #

b. The time of travel from home to work from day to day. interval, continuous

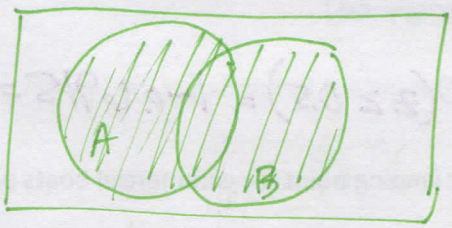
c. The age of a teacher chosen at random from a specific school. interval, continuous

d. The number of textbooks at the bookstore at 2pm on this Friday. exact #, discrete

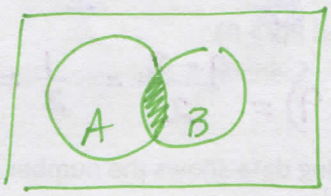
e. The speed of an airplane during one direct flight from gate to gate. interval, continuous

23. Draw a Venn diagram that would represent each of the following scenarios.

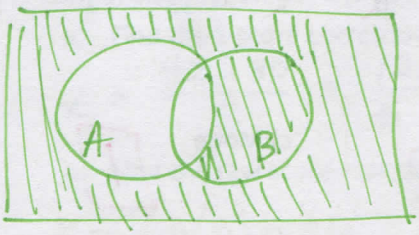
a. A or B



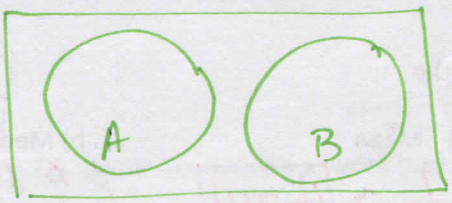
b. A and B



c. A^c



d. A and B are mutually exclusive / Disjoint



Stat Edit $L_1=X$ $L_2=Y$

Stat calc 8)

24. **Ranching: Cattle.** You are the foreman of the Bar-S cattle ranch in Colorado. A neighboring ranch has calves for sale, and you are going to buy some to add to the Bar-S herd. How much should a healthy calf weigh? Let x be the age of the calf (in weeks), and let y be the weight of the calf (in kilograms).

x	1	3	10	16	26	36
y	42	50	75	100	150	200

a) Find the y-intercept and slope of the data above.

$a = 33.696$ y-int $\quad b = 4.509$ slope

correlation: $r = .998$ very positive strong

b) Write the least-square regression line using your answers in (a).

$\hat{y} = 33.696 + 4.509x$

Coefficient of determination $r^2 = .995$ 99.5% explained

c) Use your equation to predict a healthy weight for calves that are 12 weeks old.

When $x = 12$, what is $\hat{y}$? $\quad \hat{y} = 33.696 + 4.509(12) = 87.804 \approx 88$ kilograms

Stat Edit 4

Stat Calc 1-Var Stats

25. **Consider the following data:**

2 5 5 6 7 8 8 9 10 12

a. Find the first quartile using your calculator.

$Q_1 = 5$ $\quad 25\%$

b. Find the Median or the second quartile using your calculator.

$Med = 7.5$ $\quad 50\%$

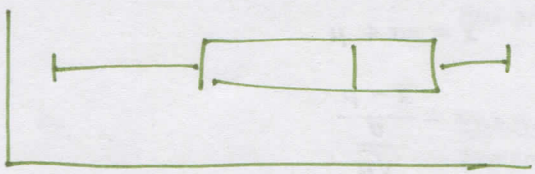
c. Find the third quartile using your calculator.

$Q_3 = 9$ $\quad 75\%$

d. Find the IQR using your answers from (a) and (c).

$IQR = Q_3 - Q_1 = 9 - 5 = \boxed{4}$

e. Sketch a modified box-and-whisker plot using your calculator.



f. Determine if there are outliers. How do you know this?

no outliers; no * on graph

g. Is your graph skewed left, skewed right, or approximately normal?

skewed left (look at the box in e)

26. Given the least-square regression equation of $\hat{y} = 5 - 2x$, what interpretation of slope would you give and would you expect your correlation, r, to be positive or negative?

slope is -2 so down 2 units for every unit right.

Correlation would be negative b/c slope is neg.

Final Exam Formula Chart for Statistics

$$\hat{y} = a + bx$$

$$q = 1 - p$$

$$P(r) = C_{n,r}\, p^r q^{n-r}$$

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

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

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

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

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

$$P(A^c) = 1 - P(A)$$

$$P_{n,r} = \frac{n!}{(n-r)!}$$

$$C_{n,r} = \frac{n!}{r!(n-r)!}$$

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

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

$$z = \frac{x - \mu}{\sigma}$$

$$x = z\sigma + \mu$$

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

Also know how to use the tables in the Appendix: random number table, binomial probability distribution and z-score table!