Name: Key Math 210 Test #2

1) A professor claims that people under the age of 30 watch more T.V, then people over the age of 30. One of their students decides to collect data and test that hypothesis. This is what they found. 80 randomly selected people under the age of 30 were asked how much T.V they watch a day, and they found out the average number of hours a day was 2.35 with a standard deviation of 0.72 hours. They then asked 90 randomly selected people over the age of 30 and found out that their average number of hours watched was 2.09 with a standard deviation of 0.92 hours. Is there enough evidence to support the professor's claim? (Conduct a complete hypothesis test) (15 pts)

1. Population_U: All people under the age of 30
   Population_O: All people over the age of 30
2. Parameters: (μ_U & μ_O) Avg. hours of T.V watched
3. Type of Test: 2 - Sample t - test
4. Conditions: Random Sample_U & Random Sample_O $n_U \geq 30$
   $10n_U < \text{Pop. Size}_U$ & $10n_O < \text{Pop. Size}_O$ $n_O \geq 30$
5. Hypotheses: $H_o: \mu_U = \mu_O$
   $H_a: \mu_U > \mu_O$
6. Calculation/Formula: $\bar{X}_U = 2.35$ $S_U = 0.72$ $n_U = 80$
   $\bar{X}_O = 2.09$ $S_O = 0.92$ $n_O = 90$

   p-value ≈ 0.020 $t = \dfrac{(\bar{X}_U - \bar{X}_O) - 0}{\sqrt{\dfrac{S_U^2}{n_U} + \dfrac{S_O^2}{n_O}}} \approx 2.06$ D.F = 165
7. Conclusion: Since the p-value is under 5% we reject the H_o, which means the evidence suggests that people under the age of 30 watch more T.V than people over the age of 30.

2) A statistician says that they can win 60% of games of "Rock, Paper, Scissors". You think that number is <u>too high</u>, so you decide to take 50 random games of RPS and the statistician won 28 out of 50 games. Is there enough evidence to suggest that the stated win percentage is too high? (Conduct a complete hypothesis test) (15 pts)

1. Population: All games of RPS played by the statistician
2. Parameter: (p) The proportion of RPS games won by the statistician
3. Type of Test: 1-Proportion (z) test
4. Conditions: Random Sample, $10n < \text{Pop. Size}$, $n\hat{p}_0 \geq 10$ & $n(1-\hat{p}_0) \geq 10$
5. Hypothesis: $H_0: p = 0.60$
   $H_a: p < 0.60$
6. Calculations/Formulas: $\hat{p} = \frac{28}{50}$ $n = 50$ $z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}}$
   p-value ≈ 0.330
7. Conclusion: Since our p-value is greater than 5%. we fail to reject the H_0, which means we do not have enough evidence to suggest the statistician wins less than 60% of the RPS games they play.

3) Explain what a Type I error and a Type II error would be in the context of the problem and state which one you think would be worse and why?

Ho: You will make money by starting a business.

Ha: You will NOT make money by starting a business.

Scenario: You are thinking of opening your own store/business, if you believe you will make money you take out a loan and open the store. If you believe you will not make money, then you do not take out a loan and do not open the store. (5 pts)

Type I: We do not think we will make money so we do not start the business, but it would have made money.

Type II: We think we will make money so we start the business, but we do not make money.

Type II probably worse because you are actually losing money and wasted all the time with the business.

4) What is the probability of flipping a coin and getting heads and then getting a red marble from a bag that contains 10 red, 7 green, 8 blue and 5 orange marbles? (4 pts)

$$P(\text{Heads and Red}) = \left(\frac{1}{2}\right)\left(\frac{10}{30}\right) = \frac{10}{60} = \frac{1}{6} \approx .167$$

5) Read the sentences below and then identify each **underlined (bold)** number by labeling it with the proper statistical symbol. (4 pts)

Jordan wanted to figure out the average number of people living in each house in Maryland. He randomly selected **100** houses from the phone book and called each one to ask how many people live in the house. The average number he calculated for the people that answered the phone was **4.8.** He knows based off a previous study the standard deviation for the number of people per household in Maryland is **1.7**. In another study he asked those same 100 people if they enjoyed living in their neighborhood and **73%** said that they did.

$n = 100$ $\quad \sigma = 1.7$

$\bar{x} = 4.8$ $\quad \hat{p} = .73$

6) A simple random sample of 200 college students were asked whether they have a subscription for NETFLIX. It is known that 45% of all college students have a NETFLIX subscription. What is the probability that the sample proportion for the 200 students is between 44% and 46%? **ASSUME Conditions are met** (7 pts)

$n = 200$

$p = .45$

$$\sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}} = \sqrt{\frac{(.45)(.55)}{200}} \approx .0352$$

$$Z = \frac{.46 - .45}{.0352}$$

$Z \approx .28$ $(.6103)$

$$Z = \frac{.44 - .45}{.0352}$$

$Z \approx -.28$ $(.3897)$

$.6103 - .3897 \approx .2206$

7) The actual time it takes to cook a turkey is a normally distributed random variable with a **mean of 4.6** hours and a **standard deviation of 0.4 hours**. (**Assume conditions are met**)

- What is the probability that the average cooking time of a single (n = 1) turkey will take less than 4.8 hours to cook? (4 pts)

$$Z = \frac{4.8 - 4.6}{.4} = \frac{.2}{.4} = 0.50 \quad (.6915)$$

- What is the probability of the mean cooking time for a sample of 25 turkeys would be greater than 4.55 hours? (6 pts)

$$\sigma_{\bar{x}} = \frac{.4}{\sqrt{25}} = \frac{.4}{5} = .08$$

$$Z = \frac{4.55 - 4.6}{.08} = \frac{-.05}{.08} = -.63$$

$(.2643)$

$1 - .2643$

$= .7357$

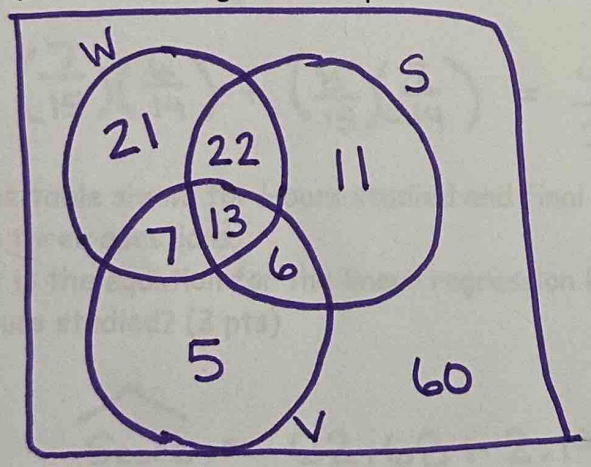
8) Given you have a bag that contains 50 number tiles numbered 1 - 50:
What would be the probability of selecting one number tile at random that is either odd or <u>*less than*</u> 33? (5 pts)

$$P(\text{ODD}) + P(\#<33) - P(\text{ODD and } \#<33)$$

$$\frac{25}{50} + \frac{32}{50} - \frac{16}{50} = \frac{41}{50}$$

9) At a school there are 145 students in the Senior Class and:
- 63 Students Work
- 52 Students play Sports
- 31 Students Volunteer in the Community
- 35 Students Work and play Sports
- 20 Students Work and Volunteer in the Community
- 19 Students Volunteer and play Sports
- 13 Students do ALL three of these Activities

- Draw a complete Venn diagram to represent this scenario. (6 pts)



- What is the probability that you randomly select one student and they **<u>do not</u>** participate in any of these activities? (3 pts)

$$\frac{60}{145}$$

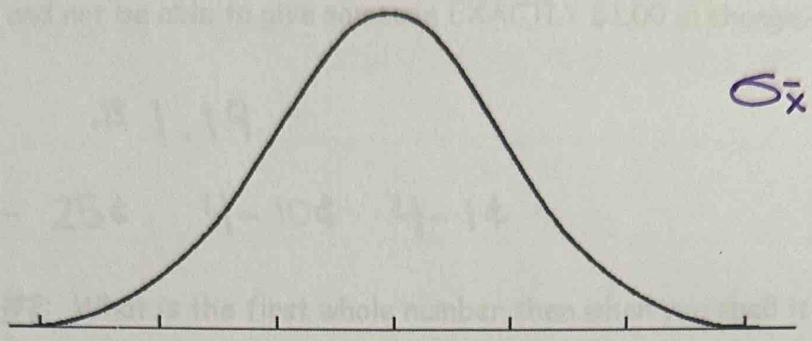
- What is the probability of selecting one student at random that **<u>ONLY</u>** plays a sport? (3 pts)

$$\frac{11}{145}$$

- What is the probability that if you select two students, they will do **<u>EXACTLY ONE</u>** of these activities? (4 pts)

$$\frac{37}{145} \cdot \frac{36}{144} = \frac{1332}{20880}$$

10) If the mean of a population that is normally distributed is 20 and the standard deviation of the population is 4. Sketch the sampling distribution of sample means for a sample size of 25. (4 pts)



$\sigma_{\bar{x}} = \frac{4}{\sqrt{25}} = \frac{4}{5} = 0.8$

11) If there is a committee that has 7 Republicans and 8 Democrats on it, what is the probability that two randomly selected members would be from the same political party? (5 pts)

$P(R\&R \text{ or } D\&D)$

$$\left(\frac{7}{15}\right)\left(\frac{6}{14}\right) + \left(\frac{8}{15}\right)\left(\frac{7}{14}\right) = \frac{42}{210} + \frac{56}{210} = \frac{98}{210} = \frac{7}{15} \approx .4\overline{66}$$

12) Using the table shown for Hours studied and final exam score in a biology class, answer the following three questions.

a) What is the equation for the linear regression line to predict exam score based on the number of hours studied? (3 pts)

$\widehat{Score} \approx 62.68 + 2.194(Hours)$

b) Calculate the residual for someone who studied 10 hours. (4 pts)

$resid = obs - pre$

$= 79 - 84.62$

$= -5.62$

Hours Studied	Final Exam Score
0	63
4	72
8	81
10	79
12	93

c) Put the correlation coefficients in order from weakest to strongest correlations. (3 pts)
{r = 0.78, r = -0.84, r = -1, r = 0.56, r = 0.09}

0.09, 0.56, 0.78, −0.84, −1

W S

Bonus Question: What is the most amount of money you can have in change (pennies, nickels, dimes, quarters) and not be able to give someone EXACTLY $1.00 in change?

$1.19

3- 25¢ 4-10¢ 4-1¢

Bonus Question #2: What is the first whole number then when you spell it out you would need to use the letter "A" to spell it?

One Thousand