STA205 Exam 2 (Spring 2017): Packets 6-9

Name:

Directions: Show your work! Your written work also allows me the option of giving you partial credit in the event of an incorrect final answer (but good reasoning). Indicate clearly your answer to each problem (e.g., put it in the box provided). **Good luck!**

Problem 1: (14 pts) A random sample of current professional basketball players in the NBA was

taken, and the salary of each player was recorded in millions of dollars. The salaries are summarized in the StatCrunch output. Use the output to fill in the description of the distribution below.

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The distribution of ______ has a shape that is ______. The average salary was ______, and 50% of the ______ players had a yearly salary of _______ or more. The lowest paid player had a salary of ______, while the highest paid player had a salary of _______. The middle ______% of players had salaries falling between _______ and \$7.244 million. According to ______ Rule, we expect _____% of NBA players to have salaries between _______ and _____ (three standard deviations from the mean). There is one player whose salary is greater than ______ that would likely be classified as an unusual observation.



Column	n	Mean	Std. dev.	Min Q1		Median	edian Q3	
Salary (millions)	100	5.1231359	4.9913451	0.049709	1.28964	3.106518	7.243906	25

Problem 2: (8 pts) One measure of interest for a state is the percentage of its residents living below the poverty level. As part of the 2010 census, this information was recorded for each state, as well as the state's geographical location (Midwest, Northeast, South, West). The poverty rates for the states were then compared by geographical region using side-side boxplots. Use this information to answer the following:



A. _____ According to the range, which region has the most variability in poverty rates?

a. Midwest b. Northeast c. South d. West

B. _____ The distribution of poverty rates in the West most likely has what shape?

a.	Approximately symmetric	b.	Right skewed
c.	Left skewed	d.	cannot be determined

C. _____ Which region is responsible for the overall smallest poverty rate?

a. Midwest b. Northeast

c. South d. West

D. _____According to the boxplots, 75% of Southern states had a poverty rate greater than 16.3. Based on the boxplots, what percentage of Midwest states has a poverty rate less than 16.3?

a.	25%	b.	75%
c.	50%	d.	100%

Problem 3: (30 pts) According to the Kentucky Transportation Cabinet, an average of 167,000 vehicles crossed the Brent Spence Bridge into Ohio in 2009. Given the bridge's state of disrepair, a journalist would like to know if the mean traffic count has increased over the past five years. Assume the population of all traffic counts at this station is bimodal with a standard deviation of 15,691 vehicles.

A. What conjecture has been made by the journalist? (3 pts)

B. A random sample of 75 days is taken and the traffic counts are recorded. Completely describe the sampling distribution of the sample mean number of vehicles crossing the Brent Spence Bridge. (6 pts)

C. The sample of 75 days had an average of 172,095.937 vehicles crossing the bridge. What is the probability of observing a sample mean of 172,095.937 vehicles or larger? Include a normal curve, and shading to indicated the probability. (7 pts)

D. Based on the probability computed in part c, what can be concluded about the mean number of vehicles crossing the Brent Spence Bridge in 2014? (5 pts)

E. If the number of sampled days was changed to 25, which characteristics of the sampling distribution of the sample mean traffic counts would be affected? Circle your response(s) below, and explain your answers below for each one – whether circled or not. (9 pts)

Shape Mean $\mu_{\overline{y}}$ Standard deviation, $\sigma_{\overline{y}}$

Problem 4: (20 pts) A survey of 490 undergraduate students at a state university in the southwestern US was administered. Each student in the sample was classified according to class (freshmen, junior, senior) and body art (body only, only, both tattoos piercings, no art).

Statistic	DE Value	D-value			
Chi-Square	test:				
Total	145	44	54	247	4
Senior	21 (34.03) (4.99)	17 (10.33) (4.31)	23 (12.67) (8.41)	54 (57.97) (0.27)	1
Junior	20 (23.38) (0.49)	9 (7.09) (0.51)	7 (8.71) (0.33)	43 (39.82) (0.25)	
Sophomore	43 (37.88) (0.69)	11 (11.49) (0.02)	10 (14.11) (1.2)	64 (64.52) (0)	1
Freshmen	61 (49.71) (2.56)	7 (15.09) (4.33)	14 (18.51) (1.1)	86 (0.02)	1
	Body piercings	Tattoos	Body piercings & Tattos	None	То

0.0005

A. (4 pts) Compute the number of freshmen with no body art we would expect if there is no relationship between these variables.

- B. Determine if there is a significant relationship between class standing and body art using a significance level of 0.01.
 - 1. (2 pts) Determine the appropriate hypotheses for your test:
 - a. Ho: there is no relationship between class standing and body art; Ha: there is a relationship between class standing and body art;
 - b. Ho: there is a relationship between class standing and body art; Ha: : there is no relationship between class standing and body art.
 - 2. (2 pts) $\alpha =$; reject Ho if the probability is
 - a. > 0.01

Chi-square 9

- b. $\neq 0.01$
- c. < 0.01

3. (4 pts) TS: $\chi^2 =$ (show at least part of your calculation...)

- 4. (2 pts) probability =
- 5. (2 pts) Decision:
 - a. reject Ho
 - b. fail to reject Ho
- 6. (2 pts) Interpretation:
 - a. At the 0.01 level, there is not significant evidence to conclude there is a relationship between class standing and body art.
 - b. At the 0.01 level, there is significant evidence to conclude there is not a relationship between class standing and body art.
 - c. At the 0.01 level, there is not significant evidence to conclude there is not a relationship between class standing and body art.
 - d. At the 0.01 level, there is significant evidence to conclude there is a relationship between class standing and body art.
- 7. (2 pts) Characterize what we can learn about the relationship between class rank and body art, based on the discrepencies shown in the table.

Problem 5: (20 pts) The owner of a garage believes that, with improved technology, oil changes are down (even as the number of customers has stayed the same over time). If the number of oil changes gets low enough, she will get out of the oil-change business, and just do repairs. She notes that they have historically done 5.2 oil changes a day. A random sample of 36 work days over the last year shows an average of 4.7 oil changes per day, with a standard deviation of 4.16.

1. (12 pts) Do a complete test of hypothesis for the owner's conjection, at a significance level of .05. Use the table provided to find the critical value of t you need.

Two-tail probability One-tail probability		0.20 0.10	0.10 0.05	0.05 0.025	0.02 0.01	0.01 0.005	
Table T	df						df
	30	1.310	1.697	2.042	2.457	2.750	30
	32	1.309	1.694	2.037	2.449	2.738	32
	35	1.306	1.690	2.030	2.438	2.725	35
	40	1.303	1.684	2.021	2.423	2.704	40
	45	1.301	1.679	2.014	2.412	2.690	45

2. (6 pts) What type of error is possible, given your conclusion, and what are the practical consequences to the owner of that error, if it should occur?

3. (2 pts) What evidence allows us to conclude that the distribution of oil changes is skewed, and in what direction is the skew?

Problem 6: (15 pts) Short answer.

1. Draw a typical chi-square distribution. What is its most prominent feature?

2. Compare a t distribution to a normal distribution by drawing both together on the same axis. What controls the shape of the t distribution?

3. Define interquartile range.

4. How are median and mean affected by skew?

5. How might you explain the fact that test scores (0 to 100) are frequently **bimodal**?