Math 10 Final Exam Review

The following problems are meant to help you review for the final exam. However, this review is not complete.

1. A 2000 Department of Health and Human Services survey found that 41percent of full-time college students aged 18 – 22 reported that, within a month of the survey, they had had five or more drinks on one occasion.

a. What is the population?

b. What parameter is being reported? (In words. Be complete)

c. What is the variable?

d. This particular study was done by taking previous survey results and existing data bases to reach their findings. What type of sampling is this?

e. The number of drinks a student has on one occasion is what kind of data? (qualitative, quantitative discrete, or quantitative continuous)

2. Describe at least one problem you might have in obtaining a representative sample if you were to do a mail-in survey. In this type of survey, you would mail the surveys to your sample and each person would have to mail back their completed survey to you.

3. **Sixty** randomly selected students were asked the number of telephone calls they received yesterday. The results are as follows:

# phone calls	frequency	rel. frequency	cumulative rel. frequency
1	6		
2	25		
3	12		
4			
6	9		

a. Fill in the blanks in the above table. Round decimals to 4 decimal places.

b. Find the sample mean, $\bar{x}$._____

c. Find the sample standard deviation, s . _____

d. Find the 70th percentile._____

e. Find the mode._____

f. Find the third quartile, Q3._____

g. What percent of the students received at least 4 phone calls?

4. Construct a boxplot of the data in problem #2. Use a ruler to scale your axis. . You may use your calculator and then copy the result neatly on paper.

5. At Whatsamatta University, students rate professors on a scale of 1 to 10 with 10 being the highest. Last fall semester the following ratings were collected for three different professors in three different departments:

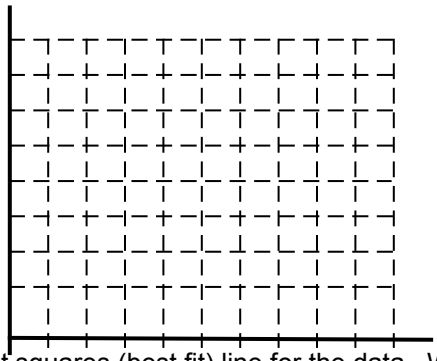
Professor	Rating	Department	Dept. Mean $\overline{x}$	St. Dev. s
A	10	History	8	4
B	7	Phys Ed	9	1
C	8	Math	4	2

Which of the three professors was the best professor compared to his or her department? Explain your reasons for your answer. Be complete in your answer.

6. Attached are per capita cigarette sales together with lung cancer death rates for 10 randomly chosen states in 1960.

State	# cigarettes sold (hundred cigarettes per person)	Lung Cancer Death Rate (per hundred thousand)
CT	31.10	22.83
OK	23.44	19.45
WV	22.86	15.53
IO	22.12	16.59
TX	22.57	20.74
DE	33.60	24.55
TE	20.08	17.60
SC	18.06	17.45
AK	30.34	25.88
UT	14.00	12.01

a. Enter the data into your calculator and graph a scatterplot for the data. Copy your scatterplot on the axes below. (3 pts) Do this accurately. Scale your axes.



b. Calculate the least squares (best fit) line for the data. Write your equation below.

c. What is the correlation coefficient? Corr = _____ (to 4 dec. places)

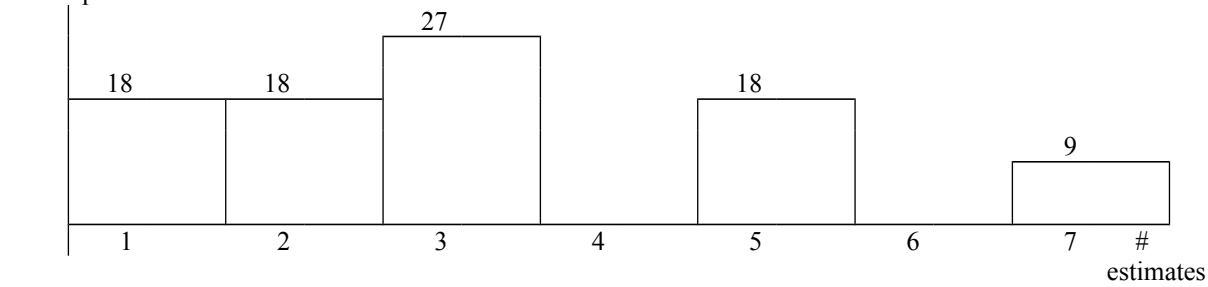
d. Is the correlation significant? Show your work in how you determined this.

e. Predict the lung cancer death rate if the number of cigarette sold per capita is 20 hundred. If the number sold per capita is 40 hundred.

f. Carefully draw your regression line on the graph.

g. Are there any outliers in your data? If so list them. Explain how you determined if there were outliers.

7. Ninety homeowners were asked the number of estimates they obtained before having their homes fumigated for termites. The results are given in the following graph:



a. Calculate the relative frequency for each bar in the histogram.
b. Calculate the mean of the data.
c. What is the 1st quartile?
d. Find the 60th percentile.
e. Find the 90th percentile.
f. What percent of homeowners obtained at least 3 estimates?

8. The table shows the performance of the students of three classes taught by a certain Math instructor on the second test.

	Math 105	Statistics	Finite Math	**TOTAL**
A	7	12	10	**29**
B	15	11	16	**42**
C	12	8	11	**31**
D	5	9	4	**18**
TOTAL	**39**	**40**	**41**	**120**

Suppose a student is randomly selected.

a. Find P(the student got a C)
b. Find P(the student is in Finite Math)
c. Find P(the student got an A OR the student is in the Statistics class)
d. Find P(the student got a B AND the student is in the Math 105 class)
e. Find P(the student got a C | the student is in the Finite Math class)
f. Find P(the student is in the Finite Math class | the student got a C)
g. Are the event that the student got a B and the event that the student is in Math 105 class mutually exclusive? How do you know? Use numbers to show this.
h. Are the event that the student got a B and the event that the student is in Math 105 class independent? How do you know? Use numbers to show this.

9. Given that P(E) = 0.2, P(K) = 0.6, and P(E and K) = 0.15, find P(K | E).

10. If events R and S are mutually exclusive, find P(R and S)

11. If events R and S are independent and P(R) = 0.4 and P(S) = 0.6, find P(R and S)

12. From a deck with 5 Black and 4 Yellow cards, you first draw one card, and then another WITHOUT REPLACEMENT.

    a. Draw the tree diagram for this situation.
    b. Find the probability that you draw a Black card AND a Yellow card, in either order.
    c. Find the probability that you first draw a Yellow card and then draw a Black card.
    d. Find the probability that you draw a Black card, GIVEN that you drew a Yellow card on the first draw.
    e. Find the probability that you get a Black card on the second draw.

13. Assume the final exam in this course is a 40 question multiple choice exam, with each question having 4 choices, only one of which is correct. Also, assume the questions are answered by random guessing. We are interested in the number of questions answered correctly.

    a. Define the random variable in words, X = _____
    b. What values can the variable take on?
    c. What is the distribution of X: X ~_____
    d. How many questions could a student expect to get correct if they randomly guessed the answers?
    e. Find the probability of answering more than 11 questions correctly.
    f. Find the probability of answering at most 6 questions correctly.
    g. Find the probability of answering at least 8 questions correctly.
    h. Find the probability of answering between 5 and 9 questions, inclusive, correctly.
    i. Find the probability of answering exactly half of the questions correctly.

14. In 2000, as reported by the ACT Research Service, the mean ACT Math score was 20.7. Suppose the ACT Math scores are normally distributed with a standard deviation of 5. We are interested in the ACT math scores.

    a. Define the random variable in words. X = _____
    b. What is the probability that a randomly selected student has an ACT Math score of at least 25?
    c. What is the probability that a randomly selected students has an ACT Math score less than 18?
    d. What is the probability that a randomly selected students has an ACT Math score between 24 and 27?
    e. Find the 95^{th} percentile.

15. A cable TV company collected data on the number of emergency service calls it had to make in a given day. The results are shown in the table:

# of calls	Probability
0	0.10
1	0.20
2	0.25
3	
4	0.05
5	0.05

    a. Find P(X=3)
    b. Find P(X≥3)
    c. Find P(X>4)
    d. Find P(X≤3)
    e. Find the expected number of calls made per week.

16. Two different Math 10 classes took a quiz on the same topics. In section A, the distribution was N(15, 0.8). In Section B, the distribution was N(16.5, 1.2) One student in section A received a 16 on his quiz. One student in section B received an 18 on her quiz. In comparison to their respective classes, who did better on the quiz?

17. Suppose that a sample of 15 randomly chosen people are put on a special weight loss diet. The amount of weight lost, in pounds, follows an unknown distribution with sample mean equal to 12 pounds and sample standard deviation equal to 3 pounds.
    a. X =
    b. X~
    c. $\bar{X}$ =
    d. $\bar{X}$ ~
    e. Find the probability that the average weight lost by the 15 people is at most 14 pounds.
    f. Find the 90th percentile for the average amount of weight lost by 15 people.

18. A recent news article reported that, in a sample of 200 cities, there was an average of 17 pregnancy-related deaths among women who are under 20. The sample standard deviation was 3. We wish to calculate a 90% confidence interval for the true mean number of pregnancy-related deaths.

    a. Find the 90% confidence interval for this problem. Label a diagram with all needed numbers.
       The confidence interval is: _____

    b. What distribution did you use to construct the confidence interval. Explain why you used this distribution.

    c. What would happen to the 90% confidence interval if we increase the sample size to 500 cities but the sample mean and standard deviation stay the same? Explain why this happens.

19. A recent article in the San Jose Mercury News reported that, in a survey of 800 Silicon Valley children ages 10 to 17, 15% go online less than once a month. We wish to construct a 95% confidence interval for the true proportion of Silicon Valley children ages 10 to 17 who go online less than once a month.
    a. P'=
    b. P'~
    c. Draw and label a diagram
    d. Find the desired confidence interval.
    e. Interpret your interval

For all hypothesis tests, you should be able to state the null and alternate hypotheses, the distribution to use for the test, find the p-value, sketch a graph of the situation, make the correct decision, write a conclusion and state the Type I and Type II errors.

20. Suppose the null hypothesis is "The brakes work". You are in a car at the top of a steep, winding road with a cliff to one side. Which has the worse consequence: a Type I error or a Type II error. Explain your answer.

21. An article in *La Voz* in May 2001 stated that approximately 62% of De Anza students were expected to NOT vote in the DASB elections that year. Suppose that you believe that this year, the percent is actually higher than the 62% reported. You conduct a survey. Of the 212 students you survey, 141 did not vote.
    a. Conduct a hypothesis test at a 5% significance level

    b. **Multiple Choice:** The Type I error for this problem is:
        A. We claim the proportion is 0.62 when, in fact, it is higher that 0.62.
        B. We claim the proportion is 0.62 when, in fact, it is not 0.62.
        C. We claim the proportion is higher than 0.62 when, in fact, it is 0.62.
        D. We claim the proportion is not 0.62 when, in fact, it is not 0.62.

22. A recent article in the San Jose Mercury News reported that dieters who follow the Atkins diet lost an average of 13 pounds. Suppose a consumer watchdog agency feels that the average is lower than that reported. They conduct a study of 25 dieters and find that these 25 dieters lost an average of 11.5 pounds with a sample standard deviation of 3 pounds. Conduct a hypothesis test at a 1% significance level.

23. An insect repellant manufacturing company wants to determine if adding a new chemical to the formula decreases the number of insect bites. 43 volunteers have one arm treated with the old formula and the other arm treated with the new formula. After exposing their arms to mosquitoes, the number of bites on each arm is recorded. For each person, the difference in the number of bites (new formula – old formula) is computed as x_d.

    The statistics are: $\bar{x}_d = -3.5$ $s_d = 4.1$ $n = 43$

    a. **Multiple Choice**: What type of hypothesis test is this?
        A. Test of two proportions
        B. Test of a single mean
        C. Paired samples
        D. Test of two independent groups: means

    b. Conduct a hypothesis test to see if adding the new chemical decreases the number of insect bites. Use a significance level of 1%.

24. A product design firm in Silicon Valley wants to determine if the average number of user errors in a product built using new standards is less than the same product built to older standards. Two samples are taken with the results summarized below: Conduct a hypothesis test using a 5% significance level.

	New Standards	**Old Standards**
Sample Size	76	58
Sample Mean	13,224	23,509
Sample St. Dev.	5920	8294

25. A researcher conducts a study to investigate whether the proportion of college students who drink alcohol decreased between 1991 and 2001. In a national study conducted in 1991, 3820 students out of a sample of 4845 college students said that they drank alcohol. In 2001, a similar study reported that 4105 college students said they drank alcohol out of 5265 students asked. Conduct a hypothesis test using a 5% significance level.

26. An urban economist wishes to determine whether the distribution of residents in the United States is the same today as it was in 1999. The percent distribution is given in the first column of the table below. (Info obtained from the Census Bureau) The economist randomly selects 2000 households in the US. The data is summarized in the table below. Conduct a Goodness of Fit test to see if the distribution of households has changed from 1999.

	1999 Distribution (%)	Data from today (Observed)	Expected
Northeast	19.6%	355	
Midwest	23.0%	404	
South	35.4%	752	
West	22.0%	479	
		Total - 2000	

27. An obstetrician wants to know whether the number of children born each day of the week is the same. She randomly selects 500 birth records and obtains the following data. Conduct a hypothesis test to see if the number of children born each day of the week is the same.

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Observed	57	78	74	76	71	81	63
Expected							

28. Blood is classified as A, B, AB or O. In addition, blood can be classified as Rh^+ or Rh^-. In a survey of 500 randomly selected individuals, a researcher obtained the results shown in the table below. Test whether the blood type and Rh-level are independent.

	A	B	AB	O
Rh^+	176	28	22	198
Rh^-	30	12	4	30

29. The following data represent the smoking status by level of education for residents of the United States 18 years or older from a random sample of 1054 residents. Conduct a hypothesis test to see if smoking status and level of education are independent.

Number of Years Of Education	Smoking Status		
	Current	Former	Never
<12 years	178	88	208
12 years	137	69	143
13 – 15 years	44	25	44
16 or more years	34	33	51

30. In using the ANOVA test, which of the following is true?

A. The populations from which the samples are selected have different distributions
B. The sample sizes are large
C. The test is to determine if the different group averages are the same.
D. The standard deviations of the groups are different.

For Chapter 13, do the homework problems from the book that were assigned.

Selected Answers:

1. a. Full-time college students aged 18 – 22
   b. the percent of full-time college students aged 18 – 22 who reported that, within a month of the survey, they had had five or more drinks on one occasion.
   c. the number of full-time college students aged 18 – 22 who reported that, within a month of the survey, they had had five or more drinks on one occasion.
   d. convenience e. quantitative – discrete
2. people in the sample may not fill out or may not mail back the survey
3. b. 2.9667 c. 1.5290 d. 3 e. 2 f. 4 g. 28.33%
5. Professor C was the best professor compared to his or her department because his rating was a full 2 standard deviations above the mean, while Professor a was only ½ standard deviation above.
6. b. $\hat{y} = 4.2203 + .6316x$ c. .9031 d. yes e. 16.85; 29.48 g. no
7. a. 0.2; 0.2; 0.3; 0; 0.2; 0; 0.1 b. 3.2 c. 2 d. 3 e. 6 f. 60%

8a. 31/120 b. 41/120 c. 57/120 d. 15/120 e. 11/41 f. 11/31
g. No P(B and 105) $\neq$ 0 h. no , for example P(B) = 42/120 $\neq$ P(B| 105) = 15/39

9. .75 10. 0 11. .24
12b. (5/9)(4/8) + (4/9)(5/8) c. (4/9)(5/8) d. 5/8 e. (5/9)(4/8) + (4/9)(5/8)
13c. X~B(40, 0.25) d. 10 e. .2849 f. .0962 g. .8180 h. .4235
i. .0004

14. b. .1949 c. .2946 d. .1508 e. 28.92
15. a. .35 b. .45 c. .05 d. .90 e. 2.2
16. they both score the same

17.b. X~unknown d. $\overline{X}: N\left(12, \frac{3}{\sqrt{15}}\right)$ e. 0.9951 f. 12.99 pounds

18. a (16.65, 17.35) b. t_{199} c. the error bound would decrease

19. b. P'~ $N\left(0.15, \sqrt{\frac{0.15*0.85}{800}}\right)$ d. (0.1253, 0.1747)

20. the Type II error is worse.

21. a. p-val = .0881 Do not reject H_0 The percent who did not vote is about 62% b. C
22. Reject H_0 The average amount of weight lost is less than 13 pounds.
23. a. C b. t = -5.60 p-val = 0 Reject H_0 the new formula decreases the number of bites
24. t = -8.01 p-val = 0 Reject H_0 the errors are less with the new standards
25. z = 1.0696 p-val = .1424 Do not reject H_0 the percent has not decreased
26. χ^2 =14.87 pvalue=0.0019 today not the same as 1999
27. χ^2 =6.18 pvalue=0.4029 # of births same each day of week
28. χ^2 =7.60 pvalue=0.0550 blood type and Rh factor are independent
29. χ^2 =7.80 pvalue=0.2529 yrs of education and smoking status are independent

31. C