Common Final Examination

Math 125: May 24, 2019

To get full credit you **must show your work**. No work, no credit. Each question is worth about 9 points, the bonus essay 5 points. Do all 11 questions and the essay.

- 1. True or false, and explain briefly—
 - (a) If you add 7 to each entry on a list, that adds 7 to the average.
 - (b) If you add 7 to each entry on a list, that adds 7 to the SD.
 - (c) If you double each entry on a list, that doubles the average.
 - (d) If you double each entry on a list, that doubles the SD.
 - (e) If you change the sign of each entry on a list, that changes the sign of the average.
 - (f) If you change the sign of each entry on a list, that changes the sign of the SD.
- 2. In a law school class, the entering students averaged about 160 in the LSAT; the SD was about 8. The histogram of LSAT scores followed the normal curve reasonably well. (LSAT scores range from 120 to 180; among all test-takers, the average is around 150 and the SD is around 9.)
 - (a) About what percentage of the class scored below 166?
 - (b) One student was 0.5 SDs above the class average on the LSAT. About what percentage of the students in the class had lower scores than he did?
- 3. In a certain class, midterm scores average out to 60 with an SD of 15, as do scores on the final. The correlation between midterm scores and final scores is about 0.50. Estimate the average final score for the students whose midterm scores were

(a) 75 (b) 30 (c) 60

Plot your regression estimates.

4. Find the regression equation for predicting final score from midterm score, based on the following information:

average midterm score ≈ 70 , SD ≈ 10 average final score ≈ 55 , SD ≈ 20 , $r \approx 0.60$

- 5. Two coins are tossed and the number of heads is observed. Will the data be qualitative or quantitative, discrete or continuous?
 - (a) This was repeated 60 times and it resulted in 0 heads 18 times, 1 head 33 times, and 2 heads 9 times. Draw the histogram for this data.
 - (b) Draw the probability histogram for the number of heads occurring when two coins are tossed.
 - (c) Are the two histograms precisely the same? If they differ, explain why that was to be expected.
 - (d) True or false: if one were to toss these two coins thousands and thousands of times, the data histogram for these three categories would more closely resemble the probability histogram.
 - (e) True or false: if one were to toss these two coins thousands and thousands of times, the data histogram for these three categories would more closely resemble the normal curve.
- 6. Every week you buy a ticket in a lottery that offers one chance in a million of winning. What is the chance that you never win, even if you keep this up for ten years? Find a numeric answer rounded to the nearest hundredth of one percent (nearest 0.01%).

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- 7. A deck of cards will be shuffled and then the top two cards will be placed face down on a table. True or false, and explain:
 - (a) There is 1 chance in 52 for the first card to be the ace of clubs.
 - (b) Initially—before the shuffle—there is 1 chance in 52 for the second card to be the ace of diamonds.
 - (c) The chance of getting the ace of clubs and then the ace of diamonds is $1/52 \times 1/52$.
- 8. A coin is tossed 10,000 times. Estimate the chance of getting—
 - (a) 4,900 to 5,050 heads
 - (b) 4,900 heads or fewer
 - (c) 5,050 heads or more
- 9. Six hundred and twenty-five draws will be made at random with replacement from the box $\begin{vmatrix} 80,000 & 0 \end{vmatrix}$'s $20,000 & 1 \end{vmatrix}$'s.

True or false, and explain:

- (a) The expected value for the percentage of 1's among the draws is exactly 20%.
- (b) The expected value for the percentage of 1's among the draws is around 20%, give or take 1.6% or so.
- (c) The percentage of 1's among the draws will be around 20%, give or take 1.6% or so.
- (d) The percentage of 1's among the draws will be exactly 20%.
- (e) The percentage of 1's in the box is exactly 20%.
- (f) The percentage of 1's in the box is around 20%, give or take 1.6% or so.
- 10. One hundred draws are made at random with replacement from a box. The average of the draws is 22.7, and their SD is 10. Someone claims that the average of the box equals 20. Is this plausible?
- 11. A gambler is accused of using a loaded die, but he pleads innocent. A record has been kept of the last 60 throws. There is disagreement about how to interpret the data and a statistician is called in. The observed frequencies for the six numbers on the die are summarized in this table.

	Observed	
Value	frequency	
1	5	Compute the value of χ^2 ,
2	7	the degrees of freedom,
3	17	and P .
4	16	What can be informed?
5	8	what can be interreu:
6	7	

Bonus Essay. (worth 5 points)

A researcher wanted to estimate the percentage of citizens who supported the new constituion in the Arab Republic of Egypt. He took a simple random sample of 625 citizens and surveyed them. This led to an estimate and a confidence interval for the support in the whole country.

A crotchety old man took issue with the whole process, saying: "How can you tell me anything about the whole country? You have only *one* sample of size 625. For me that is not enough. You are engaged in mathematical trickery and sophistry. We know nothing about the country as a whole."

Write a very short essay, responding to the statements of the old man, using the principles of the course and the ideas of the text. A correct response could have as little as two sentences. Be brief.