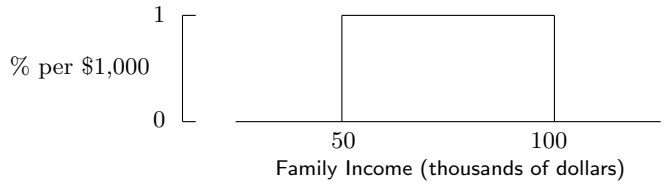
Common Final Examination

Math 125: December 17, 2021

No notes of any kind are allowed to be brought into this exam; only tables provided may be used.
To get full credit you **must show your work**. No work, no credit.
Each regular question is worth 10 points, and the bonus problem is worth 5 points.

1. Someone has sketched one block of a family-income histogram for a wealthy suburb. About what percentage of the families in this suburb had incomes between \$90,000 and \$100,000 a year?



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. Find the correlation coefficient for each of the two data sets shown below.

x	y
1	5
1	3
1	5
1	7
2	3
2	3
2	1
3	1
3	1
4	1

x	y
1	2
1	2
1	2
1	2
2	4
2	4
2	4
3	6
3	6
4	8

4. A die is rolled 10 times. Find the chance of—
   (a) getting 10 sixes.
   (b) not getting 10 sixes.
   (c) all the rolls showing 5 spots or less.

5. A coin will be tossed 10 times. Find the chance that there will be exactly 2 heads among the first 5 tosses, and exactly 4 heads among the last 5 tosses.

6. Fifty draws are made at random with replacement from the box
   $\boxed{\boxed{1}\ \boxed{2}\ \boxed{3}\ \boxed{4}\ \boxed{5}}$;
   the sum of the draws turns out to be 157. The expected value for the sum is _____, the observed value is _____, the chance error is _____, and the standard error is _____.
   Fill in the blanks, and explain briefly.

7. True or false: with a well-designed sample survey, the sample percentage is very likely to equal the population percentage. Explain.

8. A university has 30,000 registered students. As part of a survey, 900 of these students were chosen at random. The average age of the sample students turns out to be 22.3 and the SD is 4.5 years.
   (a) The average age of all 30,000 students is estimated as _____. This estimate is likely to be off by _____ or so.
   (b) Find a 95%-confidence interval for the average age of all 30,000 registered students.

9. To test for ESP, a subject is asked to guess the value of one of 10 randomly selected targets. Suppose that in 1,000 trials, a subject scores 143 correct guesses.
   (A subject who has ESP will guess correctly more often than expected from a person who is guessing randomly.)
   (a) Set up the null hypothesis as a box model.
   (b) The SD of the box is _____ . Fill in the blank, using one of the options below, and explain briefly.
   $$\sqrt{0.1 \times 0.9} \qquad\qquad \sqrt{0.143 \times 0.857}$$
   (c) Make the z-test.
   (d) What do you conclude?

10. True or false, and explain:
    (a) The P-value of a test equals its observed significance level.
    (b) The alternative hypothesis is another way of explaining the results; it says the difference is due to chance.

Bonus problem. (worth 5 points)

A. The average SAT verbal test score in 2002 was precisely the same as it was in 1981. Yet each of the six major ethnic categories used by the College Board shows an increase in scores over that period of time: whites, 8 points; blacks, 19; Asians, 27; Mexicans, 8; Puerto Ricans, 18; and American Indians, 8. How can it be, then, that all groups that make up the national average have gained but the national average score has not budged in 21 years?