Sample Final Examination

Math 125, December 17, 2021 from 3 to 6 p.m.

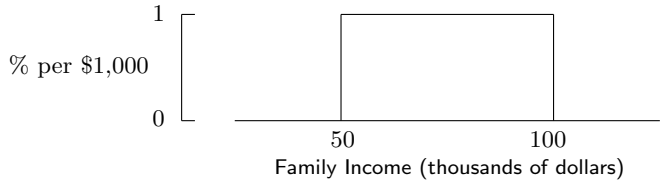
on Chaps. 2,3,5,8,13,15,17,19,20,23,26 emphasizing: 2.4, 15, 17.1–17.2, 19.8, 20.1–20.2, 26.2, 26.3, 26.5

Also see final review (with detailed solutions): problems 1,8,9a,19,20,22,23,26b,28,30,34,35a

To get full credit on the final examination you **must show your work**. No work, no credit.

Each question on the final exam will be worth 10 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 \$98,000 and \$100,000 a year?



2. Among applicants to one law school, the average LSAT score was about 169, the SD was about 9. The histogram of LSAT scores followed the normal curve reasonably well.

   About what percentage of the applicants scored below:

   (a) 182?
   (b) a student who scored at the 72nd percentile?
   (c) a student whose whose score was 1.15 SDs below the average of all the applicants?
   (d) the median score?
   (e) the two-thirds of all the applicants who scored the highest?

3. The heights of the men age 18 and over in HANESS averaged 69 inches; the SD was 3 inches. Use the normal curve to estimate the percentage of these men with heights:

   (a) below 76.5 inches (expressed as a percent with accuracy to 2 decimal places).
   (b) within 0.8 SDs of the average.
   (c) below +1.55, when expressed in standard units.
   (d) below the 11th percentile height.
   (e) that round off to the average, when expressed as the nearest whole number of inches.
   (f) below the top one-eighth of all the men.

4. For each of the data sets shown below, calculate r.

x	y
1	6
2	7
3	5
4	4
5	3
6	1
7	2

x	y
1	2
2	1
3	4
4	3
5	7
6	5
7	6

x	y
1	7
2	6
3	5
4	4
5	3
6	2
7	1

5. (a) A die is rolled ten times. What is the chance of never getting a six?

   (b) A coin is tossed 3 times.

   i. What is the chance of getting 3 heads?

   ii. What is the chance of not getting 3 heads?

   (c) Forty draws are made with replacement from a standard deck or playing cardss. Find the chance (to nearest 0.1%) of—

   i. getting all non-aces.

   ii. not getting all non-aces.

   iii. getting no red ace.

6. A red die is rolled six times; then a blue die is rolled four times.

   Find the chance of getting exactly one red 5 and exactly one blue 5 on the ten rolls.

7. One hundred draws are made at random with replacement from the box

   | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

   .

   The sum of the draws is 431. The expected value for the sum of the draws is _____, the observed value is _____, the chance error is _____, and the standard error is _____.

   Fill in the blanks, and explain briefly.

8. Five hundred draws will be made at random with replacement from the box

   | 60,000 | 0 | 's | 20,000 | 1 | 's |

   .

   True or false, and explain:

   (a) The percentage of 1's among the draws will almost certainly be exactly 25%.

   (b) If a very large sample (much larger than 500) is taken from this box, chance error in the result can be eliminated.

9. A real estate office wants to make a survey in a certain town, which has 50,000 households, to determine how far the head of household has to commute to work. A simple random sample of 1,000 households is chosen, the occupants are interviewed, and it it found that on average, the heads of the sample households commuted 8.7 miles to work; the SD of the distances was 9.0 miles. (All distances are one-way; if someone isn't working, the commute distance is defined to be 0.)

   (a) The average commute distance of all 50,000 heads of households in the the town is estimated as _____, and this estimate is likely to be off by _____ or so.

   (b) If possible, find a 95%-confidence interval for the average commute distance of all heads of households in the town. If this isn't possible, explain why not.

10. A person is to be tested for ESP or clairvoyance, the ability to see objects that are not visible to the normal senses. The subject is asked to guess which one of ten targets has been randomly selected by a computer. Suppose that in 1,000 trials, he guesses correctly 173 times.
    (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.

    $$\sqrt{0.1 \times 0.9} \qquad \sqrt{0.173 \times 0.827}$$

    (c) Make the z-test.

    (d) What do you conclude? How would you explain this result to a layman who never studied statistics?

11. In order to test a null hypothesis, you need
    (i) data
    (ii) box model for the data
    (iii) both of the above
    (iv) none of the above

12. The _____ hypothesis says that the difference is due to chance but the _____ hypothesis says that the difference is real. Fill in the blanks. *Options*: null, alternative.

13. True or false, and explain.

    (a) The observed significance level depends on the data.

    (b) If P is 43%, the null hypothesis looks plausible.

    (c) If P is 0.43 of 1%, the null hypotheis looks implausible.

    (d) If the observed significance level is 3.6%, then $P = 3.6\%$.

    (e) If $z = 2.3$, then the observed value is 2.3 SEs above what is expected on the null hypothesis.

The next question is a bonus; it covers material not explicitly in our course.

14. Suppose that in the first half of a certain season, Dustin Pedroia of the Boston Red Sox batted .300 while Mike Napoli batted only .275. And further suppose that in the seocnd half, Pedroia batted .250 while Napoli batted only .240.

    Someone claims that Napoli had a higher batting average for the entire season than Pedroia. Is that possible, or must the claim be rejected outright?