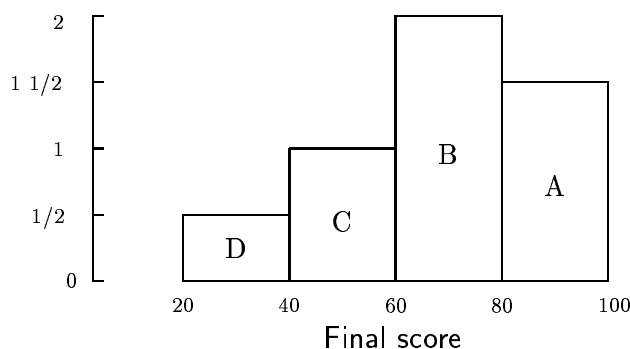


Sample Final Examination

Math 125, Exam Time: December 20, 2013 from 3 to 6 p.m.

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. The histogram below shows the distribution of final scores in a certain class. (Assume that the distribution is uniform on each class interval.)
 - (a) Which block represents the people who scored between 60 and 80?
 - (b) Ten percent scored between 20 and 40. About what percentage scored between 40 and 60?
 - (c) About what percentage scored over 60?
 - (d) About what score is the median score?
 - (e) About what score is at the 50th percentile?
 - (f) Estimate the 80th percentile score.
 - (g) Approximately how many points separate the 25th and 75th percentile scores?



2.
 - (a) Find the average and SD of the list 1, 3, 4, 5, 7.
 - (b) Take the list in part (a), multiply each entry by 3 and then add 7, to get the list 10, 16, 19, 22, 28. Find the average and SD of this new list.
3. In a study of the stability of IQ scores, a large group of individuals is tested once at age 18 and again at age 35. The following results are obtained.

age 18: average score ≈ 100 , SD ≈ 15

age 35: average score ≈ 100 , SD ≈ 15 , $r \approx 0.80$

 - (a) Predict the score at age 35 of an individual who scored 175 at age 18.
 - (b) Predict the score at age 35 of an individual who scored 80 at age 18.
 - (c) Predict the score at age 35 of an individual who scored 100 at age 18.
 - (d) Predict the score at age 35 of an individual whose score at age 18 is unknown.

4. For each question (a–e) below, choose one of the answers (i–viii); explain your choice.

Questions

A deck of cards is shuffled. What is the chance that—

- (a) the top card is the king of spades and the bottom card is the queen of spades.
- (b) the top card is the king of spades and the bottom card is the king of spades.
- (c) the top card is the king of spades or the bottom card is the king of spades.
- (d) the top card is the king of spades or the bottom card is the queen of spades.
- (e) of the top and bottom cards, one is the king of spades and the other is the queen of spades.

Answers

- (i) $1/52 \times 1/51$
- (ii) $1/52 + 1/51$
- (iii) $1/52 \times 1/52$
- (iv) $1/52 + 1/52$
- (v) $1 - (1/52 \times 1/51)$
- (vi) $1 - (1/52 \times 1/52)$
- (vii) $2/52 \times 1/51$
- (viii) None of the above

5. True or false, and explain:

- (a) If a die is rolled twice, the chance of getting at least one ace is $1/6 + 1/6 = 1/3$.
- (b) If a coin is tossed twice, the chance of getting at least one head is 100%.

6. (a) A die is rolled 3 times, What is the chance of getting at least one ace?
 (b) A pair of dice is rolled 36 times. What is the chance of getting at least one double-ace?

7. A box contains four tickets, one marked with a star and the other three blank.

$\boxed{\begin{array}{|c|c|c|c|} \hline \star & & & \\ \hline \end{array}}.$

Two draws are made at random with replacement from this box.

- (a) What is the chance of getting:
 - i. a blank ticket on the first draw.
 - ii. a blank ticket on the second draw.
 - iii. a blank ticket on the first draw and a blank ticket on the second draw.
- (b) What is the chance of not getting the star in the two draws?
- (c) What is the chance of getting the star at least once in the two draws?

8. A coin is tossed 10,000 times. Estimate the chance of getting 4,900 to 5,050 heads.

9. True or false, and explain:

- (a) With a well-designed sample survey, the sample percentage is very likely to equal the population percentage.
- (b) The sample percentage is extremely likely to be within two standard errors of the the population percentage. Provided the survey was done correctly, there will be no error in the observed result and the correctness of the estimate is a sure thing.

10. Which gives a more reliable sample: sampling with replacement or sampling without replacement?

When is it easier to calculate the probabilities and the standard errors: when the sample is drawn with replacement or without replacement?

In real-world applications, why is this distinction usually not of great concern to the statistician?

11. 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?

12. 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) 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?

13. Five hundred draws are made at random with replacement from a box of numbered tickets; 276 are positive. Someone tells you that 50% of the tickets in the box show positive numbers. Do you believe it? Answer yes or no, and explain. (The conclusion must be justified using the statistical methodology of this course.)