

### Final Review

**Chapters:** 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 21, 23, 26

**Topics:** histograms, mean, median, variance, standard deviation, the normal approximation for data, finding areas under the normal curve, correlation coefficients (p. 132 shows how to compute these), regression lines, the multiplication rule, independence and dependence, mutually exclusive, not mutually exclusive, the “at least once” rule, the addition rule, counting arrangements, combinations (binomial coefficients), binomial probabilities, box models, the expected value and standard error, counting successes using box models, the normal approximation for probability histograms, the Central Limit Theorem, simple random sampling, the bootstrap, confidence intervals for percents and averages, tests of significance (hypothesis testing)

#### Suggested Problems:

- Find the mean, median, variance, standard deviation of the following list of numbers:

6	7	10	12	13	14	15
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- SAT scores are approximately normal with a mean of 500 and a standard deviation of 100.
  - Scores of 800 or higher are reported as 800, so a perfect paper is not required to score 800 on the SAT. What percent of students who take the SAT score 800?
  - What percent of students taking the exam scored between 450 and 600?
  - How high must a student score on the SAT in order to be in the 90<sup>th</sup> percentile?
- Compute the correlation coefficient  $r$  for the following data set:

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

- A statistical analysis was made of the midterm and final scores in a large course, with the following results:
 

Average midterm score  $\approx 50$ ,  $SD \approx 25$   
 Average final score  $\approx 55$ ,  $SD \approx 15$ ,  $r = 0.60$

  - The scatter diagram was football-shaped. Find the regression line to predict the final score from the midterm score.
  - Predict the final score for a student whose midterm score was 80.

5. A deck is shuffled and three cards are dealt.
- Find the chance that the first card is a king.
  - Find the chance that the first card is a king, the second is a queen, and the third is a jack.
  - Repeat part (b) with replacement.
  - In part (b), the draws are \_\_\_\_\_. In part (c) the draws are \_\_\_\_\_.
6. You draw one card from a well-shuffled deck of cards. What is the probability of drawing:
- A queen?
  - A heart?
  - The Queen of Hearts?
  - A queen or a heart?
  - Are the events in part (d) mutually exclusive?
7. A pair of dice is rolled 10 times. What is the chance of getting at least one double-ace (i.e., two sixes)?
8. How many different 5-card poker hands are there that consist entirely of hearts? What is the probability of getting a poker hand that consists entirely of hearts?
9. You draw cards from a standard deck with replacement. What is the probability that when you draw 5 cards,
- exactly two of them are hearts?
  - at least two of them are hearts?
  - no more than two of them are hearts?
10. Suppose 25 draws are made at random from the following box:
- |   |   |   |   |   |
|---|---|---|---|---|
| 0 | 2 | 3 | 4 | 6 |
|---|---|---|---|---|
- Find the expected value and standard error for the
- sum of draws.
  - average of draws.
11. A box contains 4 red marbles and 6 blue marbles. You draw a marble from the box with replacement 100 times. Each time the color of the marble is noted. What is the chance of drawing between 40 and 50 red marbles?
12. In a certain town, there are 25,000 people aged 18 and over. To estimate the percentage of them who watched a certain TV show, a statistician chooses a simple random sample of size 1,000. It turns out that 308 of the 1,000 sampled saw the show. Construct an 80% confidence interval for the percentage of all persons age 18 and over who saw the show.
13. A simple random sample of 400 persons age 25 and older is taken as a part of an opinion survey in a certain town. The total years of collective schooling completed by the people in the sample was 4,635. So their average educational

level was  $4,635/400 \approx 11.6$  years, and the SD of the sample is 4.1 years. Find a 95% confidence interval for the average educational level of all persons age 25 and over in this town.

- 14.** A die is rolled 2,400 times, and it lands on an ace 450 times. Do you think this die is fair or are there too many aces? Use a hypothesis test to check if the die is fair. Find the  $z$ -statistic and  $P$ -value. What do you conclude?

Solutions:

- 1) mean=11, median=12, variance=10.29, sd = 3.21  
 2a) 0.135%; 2b) 53.28%; 2c) 630  
 3)  $r = 0.82$   
 4a)  $y = 0.36x + 37$ ; 4b) 65.8  
 5a)  $4/52 = 1/13$ ; 5b)  $(4/52)*(4/51)*(4/50)$ ; 5c)  $(4/52)*(4/52)*(4/52)$ ;  
 5d) independent; dependent  
 6a)  $4/52$ ; 6b)  $13/52$ ; 6c)  $1/52$ ; 6d)  $16/52$ ; 6e) no; you can draw the queen of hearts  
 7) 0.245  
 8) 1287; 0.000495  
 9a) 0.264; 9b) 0.367; 9c) 0.896  
 10a) 75; 10; 10b) 3; 0.4  
 11) 48%  
 12)  $30.8\% \pm (1.3)(1.45\%)$   
 13)  $11.6 \pm 0.4$  years  
 14)  $z = 2.75$ ;  $P$ -value = 0.3%; Reject the null hypothesis (that the die is fair) in favor of the alternative hypothesis.