

Math 153 - Final Exam
May 17, 2018

Name _____
Score _____

Show all work to receive full credit. Supply explanations where necessary.

1. (12 points) 125 Illinois hospitals were recently rated on a 1–10 scale according to the incidence of "hospital-acquired conditions," such as secondary infections. The higher the rating, the worse the score. The results are summarized below.

Rating	Frequency
1–1.9	3
2–2.9	12
3–3.9	16
4–4.9	23
5–5.9	23
6–6.9	21
7–7.9	17
8–8.9	5
9–9.9	5

- (a) What are the class boundaries associated with the last class listed above?
- (b) What is the class width?
- (c) What are the class midpoints?
- (d) Use class midpoints to estimate the (weighted) mean hospital rating.
- (e) Use class midpoints to estimate the (weighted) median.

2. (12 points) Survey participants were asked how much time they spend on morning hygiene and grooming. The numbers below are their responses, in minutes, listed in numerical order. Determine the quartiles, the interquartile range, and the boundary values for outliers. Then sketch the modified boxplot.

4, 6, 7, 9, 14, 15, 15, 16, 18, 18, 25, 26, 30, 32, 41, 45, 55, 63

3. (8 points) Over the 25-year period from 1980 through 2004, the annual snowfall recorded at O'Hare Airport averaged 10.9 inches with a standard deviation of 7.5 inches. Over the same time period, Illinois averaged 41.0 tornadoes per year with a standard deviation of 28.3. Compute the CV's and determine whether inches of snowfall or numbers of tornadoes have greater relative spread.

4. (6 points) Heights of men are normally distributed with mean 69 in and standard deviation 2.8 in. A contractor wishes to determine the height of a basement ceiling that allows 99.5% of all men to stand without crouching. What would that height be?

5. (16 points) A jar contains 4 quarters, 3 dimes, and 1 nickel. Two coins are selected at random (without replacement).

(a) Sketch the complete tree diagram for this experiment. **Include the probabilities of each path.**

(b) Let x be the total value of the two-coin sample in cents. List all possible values of x .

(c) Use your tree diagram to determine the probability distribution for x . Give your answer in the form of a table.

(d) Find the mean value of x .

(e) Based on your probability distribution, are there any unusual values of x ? Explain how you know.

6. (12 points) Suppose A and B are events such that $P(\bar{A}) = 0.62$, $P(B) = 0.67$, and $P(A \cap B) = 0.22$.
- (a) Compute $P(A)$.
 - (b) Compute $P(A \cap \bar{A})$.
 - (c) Compute $P(A \cup B)$.
 - (d) Compute $P(B|A)$.
 - (e) Are A and B independent? Explain.
 - (f) What are the odds in favor of B ?
7. (16 points) In a certain area, weekly SNAP benefits (per recipient) are normally distributed with mean \$115 and standard deviation \$22.
- (a) A SNAP recipient is randomly selected. What is the probability that his weekly benefit exceeds \$120?
 - (b) If 26 SNAP recipients are randomly selected, find the probability that the mean benefit exceeds \$118.
 - (c) In samples of size 26, what would be an unusually large mean benefit?
 - (d) Suppose SNAP benefits were not normally distributed. Would have this changed your approach to solving (b)? Briefly explain.

8. (12 points) 89% of U.S. adults use the internet. A random sample of 575 U.S. adults is obtained.

(a) In samples of size 575, what is an unusually large number of adults who use the internet?

(b) What is the probability that at most 540 people in the sample use the internet?

(c) In the sample of 575 adults, what is the probability that exactly 511 or 512 adults use the internet?

9. (12 points) Vehicles pass through a junction on a busy road at the rate of 300 per hour.

(a) In any given hour, what is the probability that exactly 320 vehicles pass through the junction?

(b) Terrible traffic back-ups occur if the rate exceeds 340 vehicles per hour. In any given hour, what is the probability that more than 340 vehicles pass through the junction?

(c) In any given hour, what would be an unusually small number of vehicles passing through the junction?

10. (12 points) The Pew Research Center recently conducted a survey of 2541 randomly selected American adults. They found that 67% of survey respondents believe that the government is doing too little to reduce the effects of climate change.

(a) Compute a 95% confidence interval estimate for the true proportion of American adults who believe the government is doing too little to reduce climate change. State your conclusion in a complete sentence.

(b) What is the margin of error in your confidence interval estimate?

(c) Suppose the Pew Research Center is going to conduct the survey again, and they would like to predict the proportion with a margin of error no greater than 1%. What sample size should they use?

11. (16 points) In a certain occupation, men earn a mean salary of \$40,668. The following data are the salaries (in \$1000s) of a random sample of women in the same occupation.

28.3, 30.5, 35.0, 37.2, 39.0, 30.4, 31.0, 29.8, 41.2, 28.9

You believe that, on average, women's salaries are less than men's, and you intend to test your hypothesis.

- (a) State the null and alternative hypotheses.
- (b) In order to test the claim, will you use a t -test or a z -test? Why?
- (c) In order to trust the conclusion of your hypothesis test, what assumption must be made?
- (d) Compute the test statistic.
- (e) Find the P -value and draw a conclusion about your original claim at the level $\alpha = 0.05$. Write your conclusion in a complete sentence.

12. (16 points) Data from a random sample of used Porsche sports cars were obtained from Autotrader.com.

Mileage (in thousands), x	Price (in \$1000s), y
16.7	95.8
18.2	91.7
32.7	45.7
26.2	72.0
23.4	79.5
41.9	65.0
54.1	41.0
73.2	30.1

- (a) Compute the linear correlation coefficient, r , and use it to draw a conclusion about the strength (and direction) of the linear relationship between x and y .

- (b) Find the regression equation.

- (c) Use your regression equation to predict the cost of a used Porsche with 60,000 miles.

- (d) If a used Porsche was selling for \$55,000, about how many miles would you predict are on it?