

Exam 1 for Math 146

May 5, 2024

Name: Grading Key

This exam is meant to take 45 minutes. This exam has 9 questions, for a total of 100 points. You are meant to complete the exam on your own without help. You are allowed to have a calculator (not a smart device or computer) with you. You are not allowed to use any other electronics for this test, and you are not allowed scratch paper. If you need more room to answer a question, continue on the back side of the paper. You are also allowed to have one sheet of notes, either typed or hand written, on the front and back.

You are not required to show a solution to multiple choice problems. For free response questions, you are encouraged to show your work so that partial credit may be awarded for progress toward a correct answer. If a question is unclear or if you are not sure how to answer a question, take your best guess and write down your thoughts. No help or clarification will be given during the exam.

Page:	2	3	4	5	6	Total
Points:	18	20	16	24	22	100
Score:						

Circle the correct answer to each multiple choice question.

1. (6 points) Psychologists want to figure out how much sleep people in their city typically get per day. They ask 50 college students to estimate how much sleep they get, and they take the average. They are worried that their results might not be accurate, because college students have irregular sleep schedules. Which of these methods could they use to improve their accuracy?
 - A. Increase their sample size by sampling 1000 students instead of just 50.
 - B. Increase their precision by using sophisticated EEG machines to measure how much sleep each student gets.
 - ☒ C. Collect a more representative sample by handing out the survey at a market far from campus.
 - D. Any of the above strategies would give more accurate results.

2. (6 points) A teacher brags that a majority of her students scored above the mean on her last exam. This means
 - A. the teacher is crazy because this is not possible
 - B. the distribution of scores was right-skewed
 - ☒ C. the distribution of scores was left-skewed
 - D. the distribution of scores was symmetric
 - E. the distribution of scores was uniform

3. (6 points) A professor gives a test to 140 students and determines the median score. After grading the test, she realizes that the 5 students with the highest scores did exceptionally well. She decides to award these 5 students a bonus of 10 more points. The median of the new score distribution will be _____ that of the original score distribution.
 - A. lower than
 - ☒ B. equal to
 - C. higher than
 - D. depending on skewness, higher or lower than
 - E. depending on modality, higher or lower than

4. (10 points) To estimate the mean number of days in the hospital for a motorcyclist involved in a crash without a helmet, a group of 40 such motorcyclists is studied. Fill in each blank with the correct word.

- (a) The 40 motorcyclists involved in a crash without a helmet, as a group, is a Sample.
- (b) The mean time spent in the hospital for 40 motorcyclists involved in a crash without a helmet is a Statistic.
- (c) The time spent in the hospital is a variable.
- (d) The mean time spent in the hospital for all motorcyclists involved in a crash without a helmet is a Parameter.
- (e) All motorcyclists involved in a crash without a helmet, as a group, is a Population.

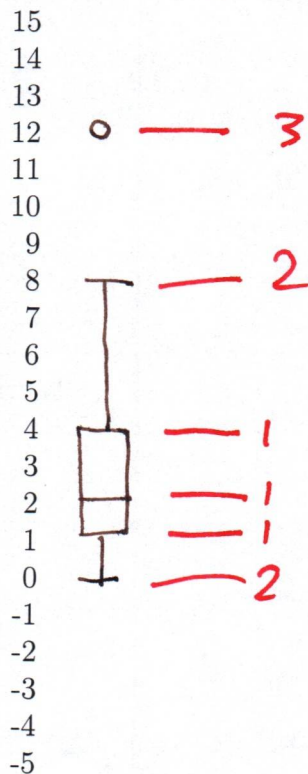
5. (10 points) The data below record the cups of coffee a person consumes in a day.

0,0,0,0,0,1,1,1,1,1,2,2,2,2,4,4,4,5,8,8,12

When the `summary` command in R is used, the following output is produced.

Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
0.000	1.000	2.000	2.762	4.000	12.000

Use the following scale to create a boxplot of the data.



$$IQR = 4 - 1 = 3$$

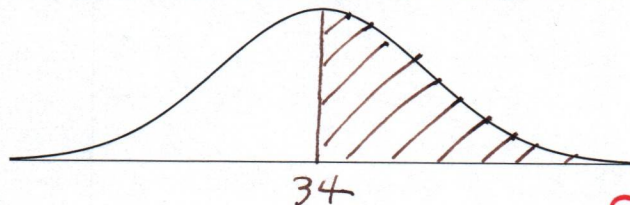
$$1.5 \times IQR = 4.5$$

$$4 + 4.5 = 8.5$$

$$1 - 4.5 = -3.5$$

6. The average gas mileage of a certain model of car, measured in miles per gallon, follows the distribution $N(\mu = 34, \sigma = 4)$. Answer the following questions, and shade in the region of the given normal curve corresponding to your answer.

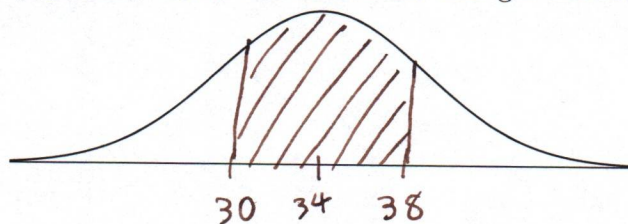
(a) (4 points) What fraction of the cars get more than 34 miles per gallon?



2

(a) 50% 2

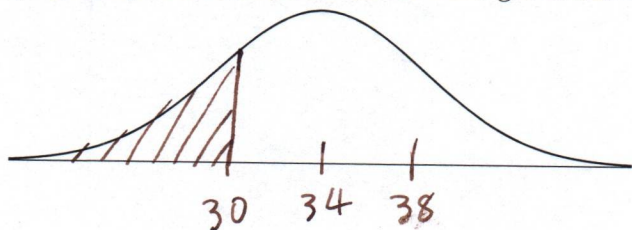
(b) (4 points) What fraction of the cars get between 30 and 38 miles per gallon?



2

(b) 68% 2

(c) (4 points) What fraction of the cars get fewer than 30 miles per gallon?



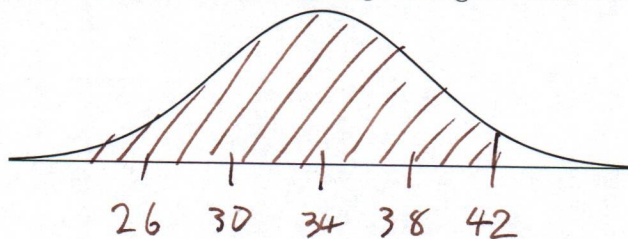
2

$$100 - 68 = 32$$

$$\frac{32}{2} = 16$$

(c) 16% 2

(d) (4 points) What gas mileage is higher than 97.5% of the cars?



1

95% between 26 and 42
 → 5% above 42 or below 26
 → 2.5% above 42
 → 97.5% below 42 3

(d) 42 mpg

7. I roll two six-sided dice at the same time. Find the probability of each of the following events. Give your answer as a reduced fraction.

(a) (4 points) The sum is exactly 4

$(1, 3)$
 $(2, 2)$
 $(3, 1)$

2

$$\frac{3}{36} = \frac{1}{12}$$

(a) $\frac{1}{12}$ 1

(b) (4 points) Both dice show the same number

$(1, 1)$
 $(2, 2)$
 $(3, 3)$
 $(4, 4)$
 $(5, 5)$
 $(6, 6)$

6

$$\frac{6}{36} = \frac{1}{6}$$

(b) $\frac{1}{6}$ 1

(c) (4 points) The sum is exactly 4 and both dice show the same number.

$(2, 2)$
1

(c) $\frac{1}{36}$ 2

(d) (4 points) The sum is exactly 4 or both dice show the same number.

$$\frac{3}{36} + \frac{6}{36} - \frac{1}{36} = \frac{8}{36}$$

2

$$= \frac{2}{9}$$

(d) $\frac{2}{9}$ 2

8. (8 points) I flip a coin 6 times. What is the probability that the coin lands on heads at least one time? Give your answer as a reduced fraction.

$$P(\text{at least 1}) = 1 - P(\text{none})$$

$$= 1 - \left(\frac{1}{2}\right)^6$$

$$= 1 - \frac{1}{64}$$

8. $\frac{63}{64}$ 2

9. Researchers designed a study to test the effects of antidepressants on the relapse rates of cocaine users. The following table summarizes the results. Use the table to estimate each probability indicated. Give your answer as a reduced fraction.

	relapse	no relapse	total
desipramine	10	14	24
lithium	18	6	24
placebo	20	4	24
total	48	24	72

- (a) (4 points) The probability that a participant received a placebo and did not relapse.

$$\frac{4}{72}$$

(a) $\frac{1}{18}$ 1

- (b) (6 points) The probability that a participant relapsed or received a placebo.

$$\frac{24 + 48 - 20}{72} = \frac{52}{72}$$

(b) $\frac{13}{18}$ 2

- (c) (6 points) The probability that a participant relapsed, given that they did not receive a placebo.

$$\frac{10 + 18}{24 + 24} = \frac{28}{48}$$

4

(c) $\frac{7}{12}$ 2

- (d) (6 points) The probability that a participant received a placebo, given that they did not relapse.

$$\frac{4}{24}$$

4

(d) $\frac{1}{6}$ 2