Unit 3 Test review

Ch. 5 Review

Part 1: Multiple Choice. *Circle the letter corresponding to the best answer.*

1. A fair coin is tossed four times, and each time the coin lands heads up. If the coin is then tossed 1996 more times, how many heads are most likely to appear in these 1996 additional tosses?

(a) 996 (b) 998 (c) 1000 (d) 1002 (e) 1996

2. Dwayne has collected data on the number of occupants of cars travelling on the road past his house for the past week. Based on his data, he has constructed a probability model for the number of occupants of a randomly-selected car on his street. Which of the following could be his model?

(a)

No.	Prob.
1	.6
2	.2
3	.2
4	.1
≥5	.05

(b)

No.	Prob.
1	.5
2	.25
3	.15
4	.06
≥5	.04

(c)

No.	Prob.
1	2
2	1
3	.1
4	.1
≥5	.4

(d)

No.	Prob
1	1/2
2	1/4
3	1/4
4	1/8
≥5	1/8

(e)

No.	Prob.
1	.5
2	.2
3	.1
4	.05
≥5	.05

Use the following for questions 3 – 5.

The two-way table below gives information on the performers in the New York Philharmonic Orchestra, categorized by section (type of instrument) and gender.

	Strings	Woodwinds	Brass	Totals
Male	24	8	12	44
Female	37	6	1	44
Totals	61	14	13	88

3. You select one musician from this group at random. What is the probability that this person plays a woodwind?

(a) 0.091 (b) 0.136 (c) 0.159 (d) 0.182 (e) 0.571

4. You select one musician from this group at random. If the person is a male, what is the probability that he plays a woodwind?

(a) 0.091 (b) 0.136 (c) 0.159 (d) 0.182 (e) 0.571

5. You select one musician from this group at random. Which of the following statement is true about the events "Plays a woodwind" and "Male?"

(a) The events are mutually exclusive and independent.
(b) The events are not mutually exclusive but they are independent.
(c) The events are mutually exclusive, but they are not independent.
(d) The events are not mutually exclusive, nor are they independent.
(e) The events are independent, but we do not have enough information to determine if they are mutually exclusive.

6. A die is loaded so that the number 6 comes up three times as often as any other number. What is the probability of rolling a 1 or a 6?

(a) $\frac{2}{3}$ (b) $\frac{1}{2}$ (c) $\frac{3}{8}$ (d) $\frac{1}{3}$ (e) $\frac{1}{4}$

7. You draw two marbles at random from a jar that has 20 red marbles and 30 black marbles without replacement. What is the probability that both marbles are red?

(a) 0.1551 (b) 0.1600 (c) 0.2222 (d) 0.4444 (e) 0.8000

Use the following for questions 8 and 9:

An event A will occur with probability 0.5. An event B will occur with probability 0.6. The probability that both A and B will occur is 0.1.

8. The conditional probability of A, given B

(a) is 1/2.
(b) is 3/10.
(c) is 1/5.
(d) is 1/6.
(e) cannot be determined from the information given.

9. We may conclude that

(a) events A and B are independent.
(b) events A and B are mutually exclusive.
(c) either A or B always occurs.
(d) events A and B are complementary.
(e) none of the above is correct.

10. If you buy one ticket in the Provincial Lottery, then the probability that you will win a prize is 0.11. Given the nature of lotteries, the probability of winning is independent from month to month. If you buy one ticket each month for five months, what is the probability that you will win at least one prize?

(a) 0.55
(b) 0.50
(c) 0.44
(d) 0.45
(e) 0.56

Part 2: Free Response

Show all your work. Indicate clearly the methods you use, because you will be graded on the correctness of your methods as well as on the accuracy and completeness of your results and explanations.

11. An airline estimates that the probability that a random call to their reservation phone line result in a reservation being made is 0.31. This can be expressed as P(call results in reservation) = 0.31. Assume each call is independent of other calls.

(a) Describe what the Law of Large Numbers says in the context of this probability.

Even if 100 calls in a row don't result in a sale, the 101st needn't "make up" and results in a sale.

However in a large number of calls, approx. 31% will result in a sale.

(b) What is the probability that none of the next four calls results in a reservation?

$(1-0.31)^4 = (0.69)^4 = 0.2267$

(c) You want to estimate the probability that exactly one of the next four calls result in a reservation being made. Describe the design of a simulation to estimate this probability. Explain clearly how you will use the partial table of random digits below to carry out your simulation.

#s 00-30 = reservation, 31-99 = no reservation.
For 4 cycles, iterate over each pair of digits, determining if the pair represents a reservation. Repeat this 5 times.
Then, determine the fraction (probability) of the 5 trials that resulted in exactly 1 reservation.

(d) Carry out 5 trials of your simulation. Mark on or above each line of the table so that someone can clearly follow your method.

reservation
no reservation

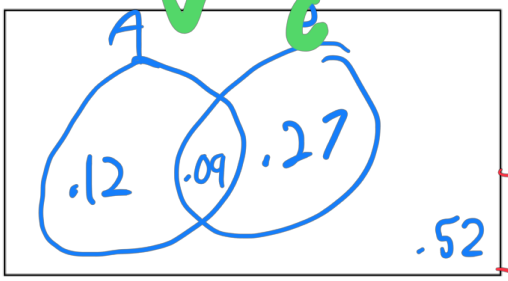
Trial 1 = 1 reservation; Trial 2 = 0 reservations; Trial 3 = 0 reservations; Trial 4 = 2 reservations; Trial 5 = 2 reservations

188	87370	88099	89695	87633	76987	85503	26257	51736
189	88296	95670	74932	65317	93848	43988	47597	83044
190	79485	92200	99401	54473	34336	82786	05457	60343
191	40830	24979	23333	37619	56227	95941	59494	86539
192	32006	76302	81221	00693	95197	75044	46596	11628

Only trial 1 had exactly 1 reservation. $\hat{p} = 0.2$

12. A grocery store examines its shoppers' product selection and calculates the following: The probability that a randomly-chosen shopper buys apples is 0.21, that the shopper buys potato chips is 0.36, and that the shopper buys both apples and potato chips is 0.09.

(a) Let A = Randomly-chosen shopper buys apples, and C = Randomly-chosen shopper buys potato chips. Sketch a Venn diagram or two-way table that summarizes the probabilities above.



	A	!A	T
C	.09	.27	.36
!C	.12	.52	.64
T	.21	.79	1

(b) Find each of the following:

i. The probability that a randomly-selected shopper buys apples or potato chips.

$P = 0.21 + 0.36 - 0.09 = 0.48$

ii. The probability that a randomly-selected shopper buys potato chips or doesn't buy apples.

$P = 0.36 + 0.79 - 0.27 = 0.88$

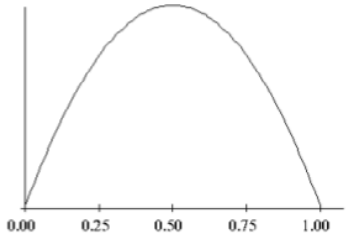
iii. The probability that a randomly-selected shopper doesn't buy apples and doesn't buy potato chips.

$P = 0.52$

CH. 2 Review

Part 1: Multiple Choice. *Circle the letter corresponding to the best answer.*

1. For the density curve shown, which statement is true?



(a) The density curve is Normal.
(b) The density curve is skewed right.
(c) The density curve is skewed left.
(d) The density curve is symmetric
(e) None of the above is correct.

2. For the density curve shown in Question 1, which statement is true?

(a) The mean is greater than the median.
(b) The mean is less than the median.
(c) The mean and median are equal.
(d) The mean could be either greater than or less than the median.
(e) None of the above is correct.

3. Suppose that 16-ounce bags of chocolate chip cookies are produced with weights that follow a Normal distribution with mean weight 16.1 ounces and standard deviation 0.1 ounce. The percent of bags that will contain between 16.0 and 16.1 ounces is about

(a) 10
(b) 16
(c) 34
(d) 68
(e) None of the above is correct.

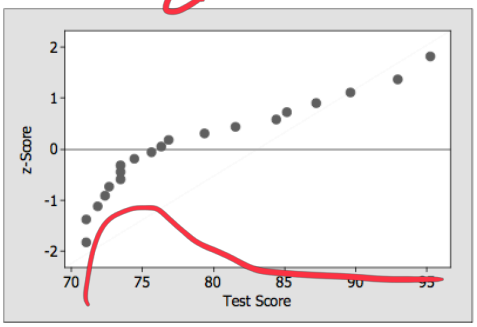
4. For the distribution of cookie bags described in Question 3, approximately what percent of the bags will likely be underweight (that is, less than 16 ounces)?

(a) 10
(b) 16
(c) 32
(d) 64
(e) none of the above

$100\% - 50\% - \frac{66\%}{2} = 17\%$

5. The plot shown at the right is a Normal probability plot for a set of test scores. Which statement is true for these data?

(a) The data are clearly Normally distributed.
(b) The data are approximately Normally distributed.
(c) The data are clearly skewed to the left.
(d) The data are clearly skewed to the right.
(e) There is insufficient information to determine the shape of the distribution.



6. Which of the following statements are true?

I. The area under a Normal curve is always 1, regardless of the mean and standard deviation.
II. The mean is always equal to the median for any Normal distribution.
III. The interquartile range for any Normal curve extends from $\mu - \sigma$ to $\mu + \sigma$.

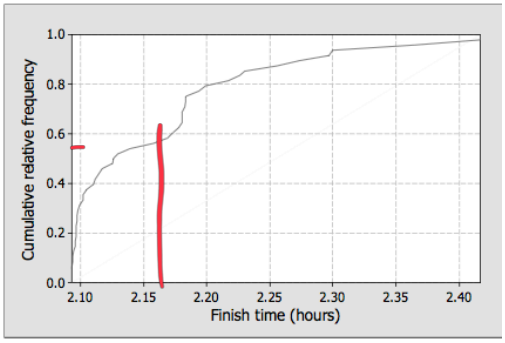
(a) I and II
(b) I and III
(c) II and III
(d) I, II, and III
(e) None of the above gives the correct set of true statements.

7. The proportion of scores in a standard Normal distribution that are greater than 1.25 is closest to:

(a) .1056
(b) .1151
(c) .1600
(d) .8849
(e) .8944

8. At right is a cumulative relative frequency graph for the 48 racers who finished the grueling 50km cross-country ski race at the 2010 Vancouver Olympics. Approximately what proportion of the racers finished the race in *more* than 2.15 hours?

(a) 0.17
(b) 0.40
(c) 0.45
(d) 0.50
(e) 0.55



9. In the previous question, the mean finish time is 2.164 hours and the standard deviation is 0.85 hours. The distribution is skewed right. What are the mean, standard deviation, and shape of the distribution of *z*-scores of the same data?

(a) Mean = 2.164, Standard deviation = 0.85, skewed right
(b) Mean = 2.164, Standard deviation = 0.85, skewed left
(c) Mean = 2.164, Standard deviation = 0.85, approximately normal
(d) Mean = 0, Standard deviation = 1, skewed right
(e) Mean = 0, Standard deviation = 1, approximately normal

10. Kitchen appliances don't last forever. The lifespan of all microwave ovens sold in the United States is approximately Normally distributed with a mean of 9 years and a standard deviation of 2.5 years. What percentage of the ovens last more than 10 years?

(a) 11.5%
(b) 34.5%
(c) 65.5%
(d) 69%
(e) 84.5%

$z = \frac{1}{2.5} = 0.4$ → 34.46%

Part 2: Free Response

Show all your work. Indicate clearly the methods you use, because you will be graded on the correctness of your methods as well as on the accuracy and completeness of your results and explanations.

Lamar is shopping for a used car, and he's interested in determining the typical mileage on cars that are three or four years old. He looks at an online car-buying site and compares the number of miles on 30 cars that are three years old to 30 cars that are four years old. His results are summarized by Minitab below. *All values are in thousands of miles.*

Descriptive Statistics: Mileage on Four year old cars and Three year old cars

Variable	N	Mean	StDev	Minimum	Q1	Median	Q3	Maximum
Four year old cars	30	56.68	17.82	23.60	47.80	54.70	64.50	100.30
Three year old cars	30	33.33	12.70	14.10	22.33	32.10	39.23	66.40

Both distributions are approximately Normally distributed.

11. One car that Lamar is interested in is four years old and has been driven 40 thousand miles. Another one is three years old and has 30 thousand miles on it. How does the number of miles on these cars compare, relative to other cars of the same age? Provide appropriate statistical calculations to support your answer.

$z_{4yr} = \frac{40 - 56.68}{17.82} = -0.936$

$z_{3yr} = \frac{30 - 33.33}{12.70} = -0.262$

See next page for conclusion

The 4 year old car has a much lower mileage compared to other cars of its age than the 3 year old car.

12 Based on the information above, estimate the number of four year old cars Lamar looked at that had been driven more than 42 thousand miles.

$z = \frac{42 - 56.68}{17.82} = -0.8238$

$79.39 \cdot 7.30 = 24$ cars

13. Estimate the 39th percentile for mileage on the cars Lamar found that were four years old.

$z = -0.26 = \frac{x - 56.68}{17.82}$, $x = 61.31$ thousand miles.

14. A researcher wishes to calculate the average height of patients suffering from a particular disease. From patient records, the mean was computed to be 156 cm, with a standard deviation of 5 cm. Further investigation reveals that the scale was misaligned, and that all readings are 2 cm too large, for example, a patient whose height is really 180 cm was measured as 182 cm. Furthermore, the researcher would like to work with statistics based on meters (1 meter = 100 centimeters). What would be the revised values for the mean and standard deviation of the patients' heights?

$\text{mean} = (156\text{cm} - 2\text{cm}) \cdot \left(\frac{1\text{m}}{100\text{cm}}\right) = 1.54\text{m}$

$\text{stddev} = (5\text{cm}) \cdot \left(\frac{1\text{m}}{100\text{cm}}\right) = 0.05\text{m}$

During the 2009-2010 basketball season, the number of points scored in each game by the Boston Celtics was approximately Normally distributed with a mean of 99.2 points and a standard deviation of 10.5 points.

15. What is the 33rd percentile of points scored by the Celtics?

$z = -0.44$; $99.2 \text{ points} - 0.44 \cdot 10.5 \text{ points} = 94.58 \text{ points}$

16. The mean number of points scored by Los Angeles Lakers was 101.7. In what proportion of their games did the Celtics score more than the Lakers' mean score?

$z = \frac{101.7 - 99.2}{10.5} = 0.238 \rightarrow 0.24$

40.52%