

Statistics ~ Business Statistics

SAMPLE TEST 2: Measures of Position, Probability & the Normal Curve

(Revised Spring 2019)

1. What is the difference between **theoretical** and **empirical** (or experimental) probability?

2. What is the **LAW OF LARGE NUMBERS** in probability?

_____ 3. If an event is **impossible**, what is its probability?

_____ 4. If an event is **certain**, what is its probability?

_____ 5. Suppose there is a $\frac{4}{5}$ probability that an event will happen. What is the probability that the event will **not** happen?

YES or NO: Can these numbers be the probability of something?

_____ 6. $\frac{4}{3}$

_____ 9. 47%

_____ 7. .15

_____ 10. $-\frac{1}{4}$

_____ 8. $\frac{17}{24}$

_____ 11. 2.45

Use this information for the following problems: A couch potato has 2 bags of Cheetos, 4 bags of Fritos, 3 bags of Ruffles, and 1 bag of Mr. Salty pretzels.

_____ 12. If he reaches for a snack at random, what is the probability he will pick Ruffles?

_____ 13. If he reaches for a snack at random, what is the probability he will pick Cheetos?

_____ 14. If he reaches for a snack at random, what is the probability he will pick either Fritos or Ruffles?

_____ 15. Suppose he picks a snack, puts it back because he doesn't like it, and then picks at random again. What is the probability he will get Mr. Salty pretzels both times?

_____ 16. Suppose he picks a snack, eats it, and then picks another snack. What is the probability he will get Fritos the first time and Cheetos the second time?

USE THIS INFORMATION FOR THE PROBLEMS BELOW:

When Algona's Brad Nelson (who took this class at ILCC in Spring, 2001) played professional baseball for the Class A Beloit Snappers in 2002, the team roster had 2 men from the Midwest (both of whom were from Iowa), 2 men from the Northeast, 12 men from the Southeast, 4 men from the Southwest, and 8 men from other countries.

Before each minor league game, a player from each team is randomly chosen to take a drug test.

- _____ 17. What is the probability that the player selected at a Snappers game was from the Southeast?
- _____ 18. What is the probability the player selected at a Snappers game was **not** from another country?
- _____ 19. Suppose the team plays a double-header. If the same players could be randomly selected before each game, what is the probability the player selected for both the first and the second games was from the Midwest.

Use this information for the following problems: A new drug has some bad side effects. It causes diarrhea in 12% of the people who take it, it causes vomiting in 6% of the people who take it. BOTH diarrhea and vomiting occur in 3% of the people who take the drug.

- _____ 20. What percent of people who take the drug will experience either diarrhea or vomiting?
- _____ 21. What percent of people who take the drug will have no side effects—neither diarrhea nor vomiting?

Use the fundamental counting principal to find the number of possible outcomes.

- _____ 22. There are 100 U.S. Senators and 438 members of the House of Representatives. ABC randomly chooses one senator **and** one representative to interview on *World News Tonight*. How many ways could they make their selection?
- _____ 23. In some states motorcycle license plates have the format with two letters followed by three numbers, such as *AB 123*. How many possible license plates are there in this format?
- _____ 24. You take a 10-question true/false quiz. How many ways could you fill out your test form?
- _____ 25. If you draw a card from a standard deck of 52 cards, what is the probability the card is an ace?
- _____ 26. If you draw a card from a standard deck of 52 cards, what is the probability the card is a spade (♠)?
- _____ 27. If you draw a card from a standard deck of 52 cards, what is the probability it is the ace of spades?

- _____ 28. If you draw a card from a standard deck of 52 cards, what is the probability the card is an ace **or** a spade?
- _____ 29. If you draw two cards from a standard deck of 52 cards (**without** replacement), what is the probability both cards are clubs (♣)?
- _____ 30. If you draw a card from a standard deck of 52 cards, replace the card and re-shuffle, and then draw another card, what is the probability the first card is a spade (♠) and the second card is a king?

Would each of these problems involve **combinations** or **permutations**?

Write “**C**” or “**P**”. Do **not** actually solve the problems.

- _____ 31. A company has plants in eight different cities. The C.E.O. wants to take a business trip to inspect four of those facilities. In how many different orders could he plan his trip?
- _____ 32. A hotel is hiring housekeepers. Nine people apply for the job, and five of them will be hired. How many ways can they hire these employees?
- _____ 33. A waitress has seven tables. She must select three of these to take a special survey. How many ways could she do this?
- _____ 34. There are 100 people entered in a raffle. Three names will be drawn—one to win \$1000, one to win \$500, and one to win \$100. How many ways could the names be selected?

Use either combinations or permutations to compute.

Your answers should be numbers.

- _____ 35. There are 27 women entered in the Miss Iowa pageant. Seven finalists will be selected, but the names will not be read in any particular order. How many ways could the finalists be chosen?
- _____ 36. Suppose that a cable system carried 60 different commercial channels. Advertisers agree to pay a premium rate for the five top-rated cable channels. In how many different orders could those top five channels be listed?

For its grand opening, a store is running a contest. Each customer gets a card, and each card gets a certain percentage discount off the regular price:

Probability	Discount (%)
$\frac{1}{2500}$	100
$\frac{5}{2500}$	75
$\frac{25}{2500}$	50
$\frac{50}{2500}$	25
$\frac{2419}{2500}$	10

- _____ 37. Use the idea of **expected value** to find the average percentage discount each customer can expect to receive at the grand opening described above.

Now do this expected value problems.

- _____38. 1,000 tickets are sold for a raffle. One tickets will win a trip to Las Vegas worth \$1600, 3 will win TV sets worth \$275 each, and 20 will each win a gift certificate for \$25. What is the **expected value** of the raffle? (Assume that all 1000 tickets are eligible for every prize.)

Here are the test scores for several students in a class:

Student	Score	Student	Score
Allison	87	Kevin	39
Bart	84	LaNorra	38
Cyndi	84	Manuel	36
Danielle	70	Nancy	28
Edward	63	Ophelia	23
Frieda	62	Pauline	21
Gerald	58	Quenton	20
Hesperia	55	Rex	9
Ivan	55	Sonny	7
Janette	42	Therese	4

The mean of this data is 44.25, and the standard deviation is 26.13.

Use this information to find the following:

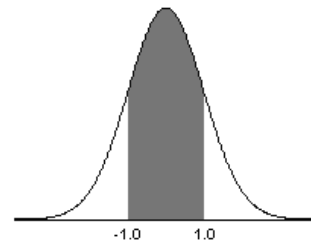
- _____39. Is Janette's z-score positive or negative?
- _____40. Is Bart's z-score positive or negative?
- _____41. What is Rex's z-score?
- _____42. What is Danielle's z-score?
- _____43. A student has a z-score of approximately -0.928 . Which student is this?
- _____44. A student has a z-score of approximately 1.636 . Which student is this?

According to Accor Economy Lodging, the average nightly cost of room at a Motel 6 in the United States is \$49.52. The standard deviation is \$12.14.

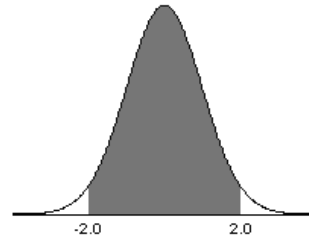
- _____45. One of the cheapest Motel 6 locations is in Cedar Rapids, Iowa. It costs just \$37.95 a night. What is the z-score for the Cedar Rapids Motel 6?
- _____46. The most expensive Motel 6 in the country is the chain's original location on the beach in Santa Barbara, California. It has a z-score of $z = 3.82$. How much does the Motel 6 in Santa Barbara cost per night?

47. The **EMPIRICAL RULE** says that

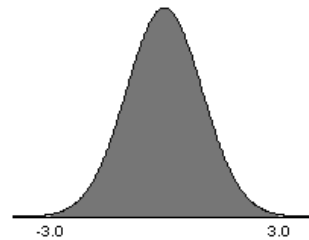
_____ % of all data are between $z = -1$ and $z = 1$,



_____ % of all data are between $z = -2$ and $z = 2$,

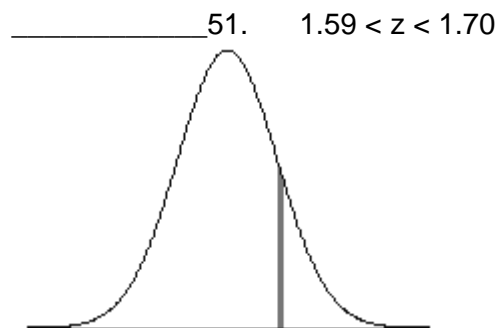
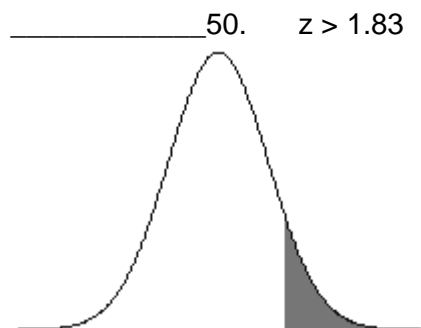


and _____ % of all data are between $z = -3$ and $z = 3$



- _____ 48. If you found out that your z-score on this test was -1.23 , how would you have scored on this test?
A. above average B. average B. below average
- _____ 49 If you selected an NBA star at random and compared his height to the height of all American men. Which of these would the NBA player's z-score be?
A. positive B. negative C. zero

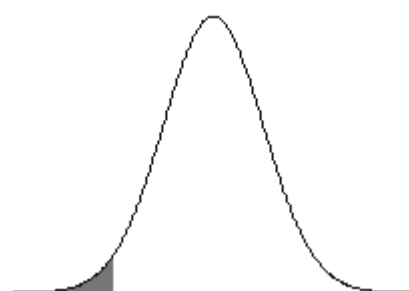
What is the probability that a score is in each of these areas under the normal curve?



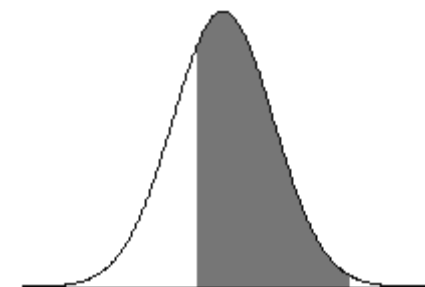
52. $z > -2.01$



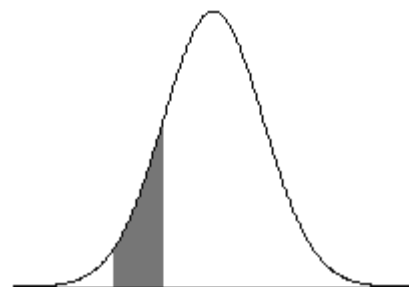
53. $z < -2.05$



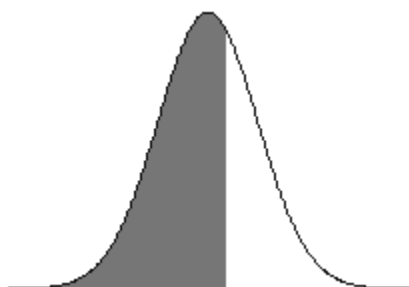
54. between -1.03 and 2.34



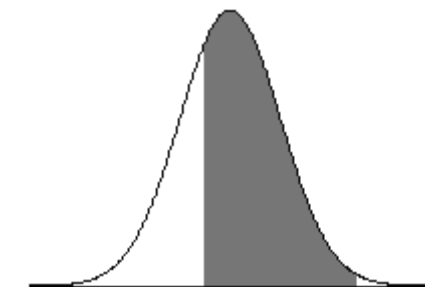
55. between -2.34 and -1.60



56. $z < 1.79$



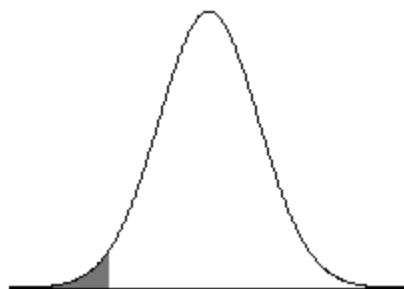
57. between -1.05 and 3.01



Use this information for the following problems: According to Hospitality Franchise Systems, the average Super 8 motel has 55 guest rooms. The standard deviation is 11 rooms.

_____ 58. Use the z-score formula $z = \frac{x - \bar{x}}{s}$ to find the z-score associated with 35 rooms at a Super 8 motel.

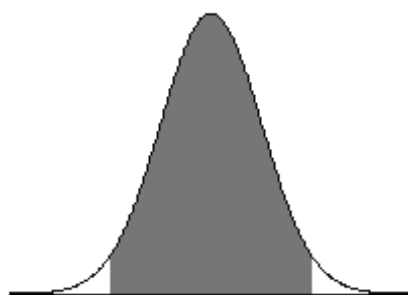
_____ 59. Use the z-table to find out what percent of Super 8 motels have less than 35 guest rooms.



_____ 60. Use the z-score formula to find the z-score associated with 40 rooms at a Super 8 motel.

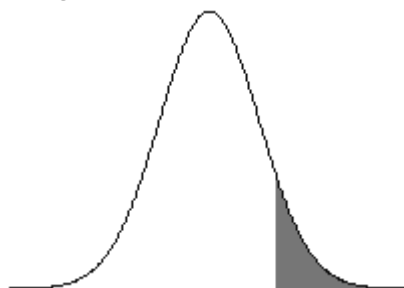
_____ 61. Use the z-score formula to find the z-score associated with 70 rooms at a Super 8 motel.

_____ 62. Use the z-table to find out what percent of Super 8 motels have between 40 and 70 guest rooms.

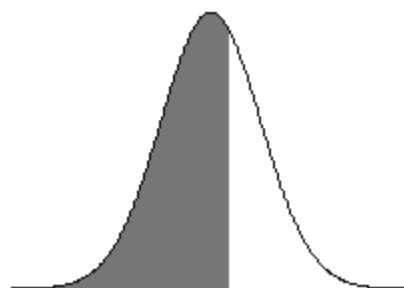


Find the z-score associated with these percentages of the normal curve.

_____ 63. Find z so that 15% of the normal curve is more than z.



_____ 64. Find z so that 67% of the normal curve is less than z.



Statistics—Business Statistics

FORMULAS

COMPOUND PROBABILITY

- $P(A') = 1 - P(A)$
- $P(A \text{ and } B) = P(A) * P(B | A)$
- $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

BINOMIAL DISTRIBUTION

- $P(r / n) = ({}_nC_r)(p^r)(q^{n-r})$
- $q = 1 - p$

STANDARD SCORES

- $z = \frac{x - \bar{x}}{s}$ or $z = \frac{x - \mu}{\sigma}$