

7. Which of the following statements is (are) true?
- The sampling distribution of \bar{x} has standard deviation σ/\sqrt{n} even if the population is not normally distributed.
 - The sampling distribution of \bar{x} is normal if the population has a normal distribution.
 - When n is large, the sampling distribution of \bar{x} is approximately normal even if the population is not normally distributed.
- I and II
 - I and III
 - II and III
 - I, II, and III
 - None of the above gives the correct set of responses.
8. The law of large numbers states that, as the number of observations drawn at random from a population with finite mean μ increases, the mean \bar{x} of the observed values
- Gets larger and larger.
 - Gets smaller and smaller.
 - Gets closer and closer to the population mean μ .
 - Fluctuates steadily between one standard deviation above and one standard deviation below the mean.
 - Varies randomly about μ .

Short Answer:

In items 9–10, classify each underlined number as a parameter or statistic. **ALSO**, give the appropriate notation for each. (That means, use the correct variables!!)

9. Voter registration records show that 68% of all voters in Indianapolis are registered as Republicans. To test whether the numbers dialed by a random digit dialing device really are random, you use the device to call 150 randomly chosen residential telephones in Indianapolis. Of the registered voters contacted, 73% are registered Republicans.
10. The Wechsler Adult Intelligence Scale (WAIS) is a common “IQ test” for adults. The distribution of WAIS scores for persons over 16 years of age is approximately normal with mean 100 and standard deviation 15. A sample of 100 persons was found to have an average of 102.5.

A study of the health of teenagers plans to measure the blood cholesterol level of an SRS of youth of ages 13 to 16 years. The researchers will report the mean \bar{x} from their sample as an estimate of the mean cholesterol level μ in this population.

11. Explain to someone who knows no statistics what it means to say that \bar{x} is an “unbiased” estimator of μ .
12. The sample result \bar{x} is an unbiased estimator of the population truth μ no matter what size SRS the study chooses. Explain to someone who knows no statistics why a large sample gives more trustworthy results than a small sample.

Free Response:

A survey asks a random sample of 1500 adults in Ohio if they support an increase in the state sales tax from 5% to 6%, with the additional revenue going to education. Suppose that 40% of all adults in Ohio support the increase. Make sure to check your rule of thumbs.

13. What are the mean and standard deviation of the proportion of adults in this sample that would support this increase?

14. What is the probability that at least 42% of the sample will support the increase.

Sheila's doctor is concerned that she may suffer from gestational diabetes (high blood glucose levels during pregnancy). There is variation both in the actual glucose level and in the blood test that measures the level. A patient is classified as having gestational diabetes if the glucose level is above 140 milligrams per deciliter (mg/dl) one hour after a sugary drink is ingested. Sheila's measured glucose level one hour after ingesting the sugary drink varies according to the normal distribution with $\mu = 125$ mg/dl and $\sigma = 10$ mg/dl.

15. If a single glucose measurement is made, what is the probability that Sheila is diagnosed as having gestational diabetes?

16. If measurements are made instead on four separate days and the mean result is computed, describe the center, shape and spread of the resulting sampling distribution.

17. If the sample mean of Sheila's four readings is compared with the criterion 140 mg/dl, what is the probability that Sheila is diagnosed as having gestational diabetes?

18. What is the level L such that there is probability only 0.05 that the mean glucose level of four test results falls above L for Sheila's glucose level distribution?

The IRS reports that 63% of the people filing tax returns have an error or unallowable deductions on their tax forms. Suppose that a sample of 45 tax returns are selected and tax audits performed and let p be the proportion of the sampled tax forms having an error or unallowable deduction on them.

19. What is the mean and standard deviation of the sampling distribution of \hat{p} , the proportion of returns with an error or unallowable deduction?

20. Explain why you can use the formula for the standard deviation of \hat{p} in this setting.

21. Check that you can use the normal approximation for the distribution of \hat{p} .

22. What is the probability that the random sample will be within 3 percentage points of the true value (p)?

Let x = The amount of soda pop in a 355 ml bottle. From past experience, the variable, x , is known to have a normal distribution with mean 355 ml and a standard deviation of 2 ml.

23. What is the probability that a randomly chosen bottle will have less than 352 ml?

24. What are the mean and standard deviation of the average amount of soda pop for a sample of 25 bottles?

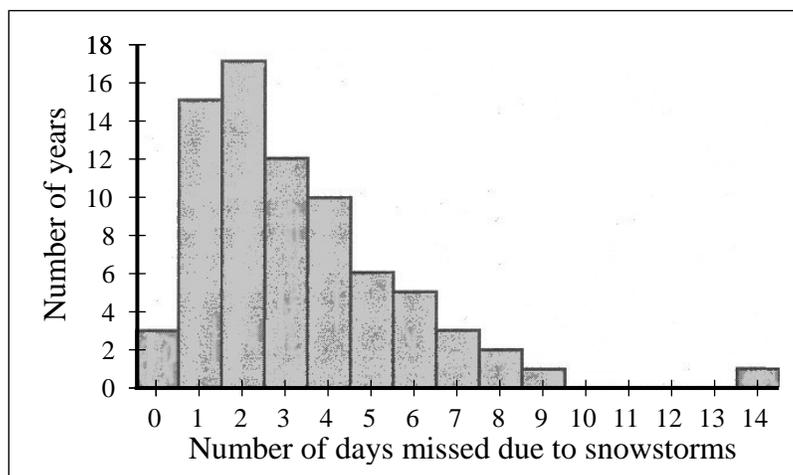
25. Is it reasonable to use a normal distribution to compute probabilities concerning \bar{x} here? Explain.

26. What is the probability that the average amount of soda of an SRS of 25 bottles is between 354 ml and 355.5 ml?

Review: Please circle the best answer.

27. A botanist is studying the killing of trees by pine beetles in a small square-shaped region of a national forest. Using an aerial photograph of the region, the botanist divides the area into a grid 20 units long by 20 units wide. Forty of the four hundred squares on the grid are selected at random, and all trees within those squares are sampled. What type of sampling procedure is this?
- (A) Cluster sample
 - (B) Convenience sample
 - (C) Simple random sample
 - (D) Stratified random sample
 - (E) Systematic sample

28. In the northern United States, schools are sometimes closed during winter due to severe snowstorms. At the end of the school year, schools have to make up for the days missed. The following graph shows the frequency distribution of the number of days missed due to snowstorms per year, using data collected from the past 75 years.



Which of the following should be used to describe the center of this distribution?

- (A) Mean, because it is an unbiased estimator.
 - (B) Median, because the distribution is skewed.
 - (C) IQR, because it excludes outliers and includes only the middle 50 percent of data.
 - (D) First quartile, because the distribution is right skewed.
 - (E) Standard deviation, because it is least affected by the outliers.
29. Pearls from a certain variety of oyster have diameters that are normally distributed with a mean of 7 mm and a standard deviation of 1 mm. Which of the following represents the approximate probability of sampling three oysters before one is found to contain a pearl between 5 mm and 9 mm in diameter?
- (A) $(0.05)^3$
 - (B) $(0.95)^3$
 - (C) $(0.05)^2(0.95)$
 - (D) $(0.05)(0.95)^2$
 - (E) $\binom{3}{1}(0.05)^2(0.95)$

30. The least squares regression equation of the relationship between sale price (in thousands of dollars) and size (in square feet) for a randomly selected group of homes in a certain city is $\widehat{price} = 0.118 \text{ size} + 42.0$. Which of the following statements is the correct interpretation of the slope?
- (A) For each increase of one square foot in home size, the price increases on average by \$118.
 - (B) For each increase of one square foot in home size, the price increases on average by \$42,000.
 - (C) For each increase of \$1000 in the price of a home, the size increases on average by 0.118 square feet.
 - (D) For each increase of \$1000 in the price of a home, the size increases on average by 42.000 square feet.
 - (E) None of the above is a correct interpretation.

31. Two independent random variables X and Y have standard deviations of $\sigma_X = 10$ and $\sigma_Y = 7$. Compute

$$\sigma_{X-Y}.$$

- (A) 3
- (B) 17
- (C) $\sqrt{51}$
- (D) $\sqrt{149}$
- (E) None of the above