

ACTM – Statistics

Questions 1 – 25 are multiple-choice items. Record your answer on the answer sheet provided. When you have completed the multiple choice items, then answer each of the three tie-breaker items in order. Record your answer and your work on the tie-breaker pages provided as part of the test booklet. When you finish, detach the tie breaker items from the booklet, be sure your name is on each page. When time is called, turn in the answer sheet and the tie-breaker items. You may keep the question part of the test booklet.

1. Given IQ scores are approximately normally distributed with a mean of 100 and standard deviation of 15, the proportion of people with IQs above 130 is:
 - a. 95%
 - b. 68%
 - c. 5%
 - d. 2.5%

2. Randomly assigning treatment to experimental units allows:
 - a. population inference
 - b. causal inference
 - c. both types of inference
 - d. neither type of inference

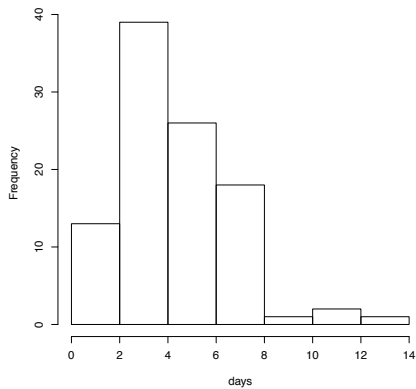
3. Failing to reject the null hypothesis when it is false is:
 - a. alpha
 - b. Type I error
 - c. beta
 - d. Type II error

4. A parameter is:
 - a. a sample characteristic
 - b. a population characteristic
 - c. unknown
 - d. normal normally distributed

5. A statistic is:
 - a. a sample characteristic
 - b. a population characteristic
 - c. unknown
 - d. normally distributed

6. Observational studies allow:
 - a. population inference
 - b. causal inference
 - c. both types of inference
 - d. neither type of inference

7. A national random sample of 20 ACT scores from 2010 is listed below. Calculate the sample mean and standard deviation.
- 29, 26, 13, 23, 23, 25, 17, 22, 17, 19, 12, 26, 30, 30, 18, 14, 12, 26, 17, 18
- 20.50, 5.79
 - 20.50, 5.94
 - 20.85, 5.79
 - 20.85, 5.94
8. Provided that the ACT is reasonably normally distributed with a mean of 18 and standard deviation of 6, determine the proportion of students with a 33 or higher.
- 0.0062
 - 0.0109
 - 0.0124
 - 0.0217
9. Using the data in question 7, calculate the 95% confidence interval for the mean ACT score based on the t -distribution.
- $-\infty$ to 23.05
 - $-\infty$ to 23.15
 - 18.07 to 23.63
 - 18.22 to 23.48
10. Using the data in question 7, calculate number of observations that are two or more sample standard deviations from the sample mean.
- 0
 - 1
 - 2
 - 3
11. The data in question 7 appears to be reasonably symmetric.
- True
 - False
12. When asked questions concerning personal hygiene, people commonly lie. This is an example of:
- sampling bias
 - confounding
 - non-response bias
 - response bias
13. Select the order of sampling schemes from best to worst.
- simple random, stratified, convenience
 - simple random, convenience, stratified
 - stratified, simple random, convenience
 - stratified, convenience, simple random



14. The histogram above represents the lifespan of a random sample of a particular type of insect. Determine the relationship between the mean and median.

- mean = median
- mean \approx median
- mean < median
- mean > median

15. When the correlation coefficient, r , is close to one:

- there is no relationship between the two variables
- there is a strong linear relationship between the two variables
- it is impossible to tell if there is a relationship between the two variables
- the slope of the regression line will be close to one

16. Given the following data pairs (x, y) , find the regression equation.

$(1, 1.24), (2, 5.23), (3, 7.24), (4, 7.60), (5, 9.97), (6, 14.31), (7, 13.99), (8, 14.88), (9, 18.04), (10, 20.70)$

- $y = 0.490x - 0.053$
- $y = 2.04x$
- $y = 1.98x + 0.436$
- $y = 0.49x$

17. Using the data from 16, calculate the correlation coefficient.

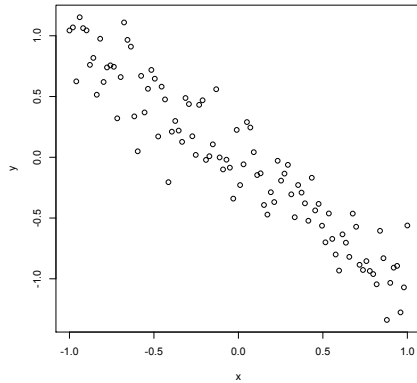
- $r = 0.490$
- $r = 0.985$
- $r = 0.971$
- $r = 0.240$

18. The coefficient of determination for 16 is strong.

- true
- false

19. Using the data from 16, obtain a prediction for $x = 4.5$.

- a. 2.15
- b. 2.21
- c. 9.18
- d. 9.34



20. The data in the scatterplot above would have a correlation coefficient that is close to:

- a. -1.0
- b. -0.5
- c. +1.0
- d. +0.5

21. The intercept in linear regression represents:

- a. the strength of the relationship between x and y
- b. the expected x value when y is zero
- c. the expected y value when x is zero
- d. a population parameter

22. Calculate the mean number of children per family for the sample from the following table.

Number of children	Number of families
0	8
1	16
2	22
3	14
4	6
5	4
6	2

- a. 1.91
- b. 2.47
- c. 3.14
- d. 2.19

23. Using the table from 22, calculate the standard deviation.
- a. 1.46
 - b. 1.45
 - c. 2.10
 - d. 2.17
24. In 1923, Babe Ruth had 522 at bats with 205 hits. Assuming that the binomial distribution can be appropriately applied, find the expected number of hits in 529 at bats.
- a. 321
 - b. 186
 - c. 230
 - d. 208
25. The distribution of heights of American women aged 18 to 24 is approximately normally distributed with a mean of 65.5 inches and standard deviation of 2.5 inches. Calculate the z -score for a woman six feet tall.
- a. 2.60
 - b. 4.11
 - c. 1.04
 - d. 1.33

Name: _____

Constructed Response

1. Use the following table on bowel cancer testing to calculate the sensitivity.

Blood test	Bowel cancer	
	Y	N
+	2	18
-	1	182

2. Use the table from 1 to calculate the false positive rate.
3. Use the table from 1 to calculate the probability of having bowel cancer given a positive blood test.

Statistics Answers
ACTM State Contest
April 2014

1. d
2. b
3. d
4. b
5. a
6. d
7. d
8. a
9. c
10. a
11. a
12. d
13. a
14. d
15. b
16. c
17. b
18. a
19. d
20. a
21. c
22. d
23. a
24. d
25. a

Tie Breaker Items

1. $P[+, \text{test}/\text{cancer} = Y] = 2/3$ or approximately 0.7
2. $P[+ \text{test}/\text{cancer} = N] = 18/200$ or approximately 0.90
3. $P[\text{cancer} = Y/+ \text{test}] = 2/20$ or $1/10$ or 0.1