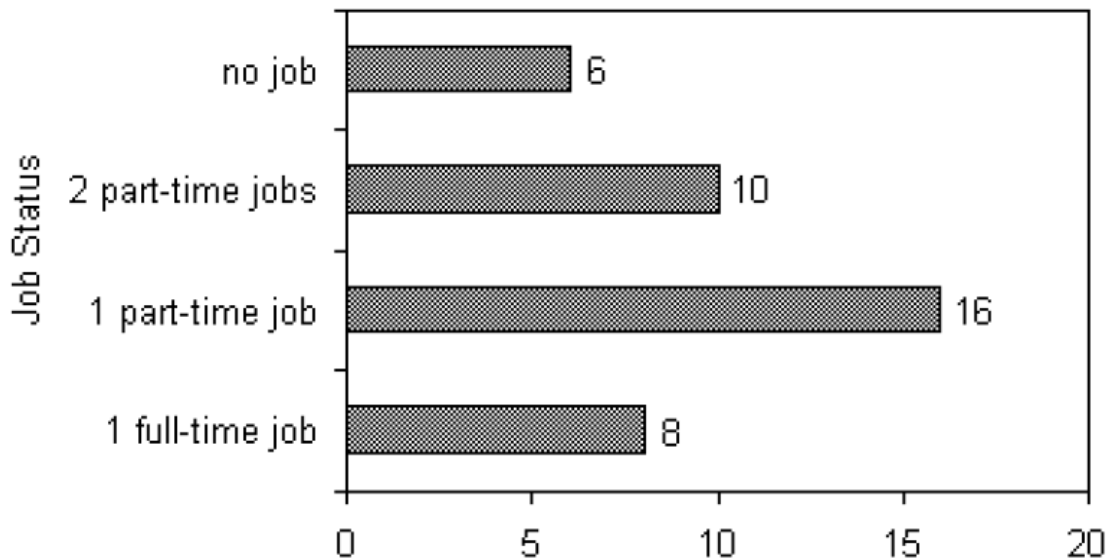


## ACTM Regional – Statistics Multiple Choice Questions

This exam includes 25 multiple-choice items and three constructed-response items that may be used as tie-breakers. Record your answer to each of the multiple-choice items on the answer grid in the appropriate location. Once you have completed the multiple-choice section then answer the three constructed-response questions. Be sure your name is on each page of the constructed-response items. When time is called you will be asked to turn in the answer sheet with the written items. You may keep the question part of the exam.

1. A variable that interferes with other variables in the study is called
  - a. an explanatory variable
  - b. an outcome variable
  - c. a confounding variable
  - d. an interfering variable
2. A research divided subjects into two groups according to gender and then selected members from each group for her sample. What sampling method was the researcher using?
  - a. Cluster
  - b. Stratified
  - c. Random
  - d. Systematic
3. The frequency bar graph below describes the employment status of a random sample of U.S. adults. What is the percentage of those having no job?

Frequency Bar Graph



- a. 15%
- b. 20%
- c. 40%
- d. cannot determine.

4. The mean GPA for all students at a community college in the fall 2005 semester was 2.77. A student with a GPA of 2.0 wants to know her relative standing relation to the mean GPA. A numerical summary that would be useful for this purpose is the
- standard deviation
  - median
  - interquartile range
  - number of students at the community college
5. The following grades are given for a student for a particular term.

Grade	Credit Hours
C	3
F	1
D	2
F	2
F	3

Find the grade point average. The point values of grades are given below.

A : 4,      B : 3,      C : 2,      D : 1,      F : 0

- 0.73
  - 2.2
  - 0.6
  - 1.8
6. For  $n \geq 0$ , what is  ${}_nC_n$  ?
- 0
  - 1
  - $n$
  - It cannot be determined.
7. A local country club has a membership of 600 and operates facilities that include an 18-hole championship golf course and 12 tennis courts. Before deciding whether to accept new members, the club president would like to know how many members regularly use each facility. A survey of the membership indicates that 61% regularly use the golf course, 45% regularly use the tennis courts, and 3% use neither of these facilities regularly. What percentage of the 600 uses at least one of the golf or tennis facilities?
- 97%
  - 3%
  - 103%
  - 9%

8. The random variable  $X$  represents the number of girls in a family of three children. Assuming that boys and girls are equally likely, find the mean and standard deviation for the random variable  $X$ .
- Mean: 1.50; standard deviation: 0.87
  - Mean: 1.50; standard deviation: 0.76
  - Mean: 2.25; standard deviation: 0.87
  - Mean: 2.25; standard deviation: 0.76
9. In a large city, 50% of the people choose a movie, 30% choose dinner and a play, and 20% choose shopping as a leisure activity. If a sample of 5 people is randomly selected, find the probability that 3 are planning to go to a movie, 1 to a play, and 1 to a shopping mall.
- 0.04
  - 0.15
  - 0.01
  - None of the above
10. Among the contestants in a competition are 35 women and 20 men. If 5 winners are randomly selected, what is the probability that they are all men?
- 0.04776
  - 0.10436
  - 0.06093
  - 0.00446
11. Find the sum of the areas under the standard normal curve to the left of  $z = -1.25$  and to the right of  $z = 1.25$ .
- 0.7888
  - 0.2113
  - 0.1056
  - 0.3944
12. The board of examiners that administers the real estate broker's examination in a certain state found that the mean score on the test was 493 and the standard deviation was 72. If the board wants to set the passing score so that only the best 10% of all applicants pass, what is the passing score? Assume that the scores are normally distributed.
- 400.73
  - 585.27
  - 550.75
  - 425.12

13. If the population size is 24,000 and the sample size is 400, and  $p = 0.7$ , what is the sampling distribution of the sample proportion  $\hat{p}$  .
- Exactly normal with  $\mu_{\hat{p}} = 0.7$ ,  $\sigma_{\hat{p}} = 0.023$
  - Approximately normal with  $\mu_{\hat{p}} = 0.7$ ,  $\sigma_{\hat{p}} = 0.0935$
  - Approximately normal with  $\mu_{\hat{p}} = 0.7$ ,  $\sigma_{\hat{p}} = 0.023$
  - Exactly binomial with  $\mu_{\hat{p}} = 289$ ,  $\sigma_{\hat{p}} = 9.17$
14. Suppose that on average 20 cars arrive at Burger King's drive-through between 12:00 noon and 1:00 PM with variance 20 cars. What is the approximate probability that a simple random sample of 40 12:00 noon–1:00 PM time periods results in a mean of at least 22.1 cars?
- 0.319
  - 0.032
  - 0.0015
  - 0.015
15. A marketing research company needs to estimate which of two medical plans its employees prefer. A random sample of  $n$  employees produced the following 98% confidence interval for the proportion of employees who prefer plan A: (0.241,0.561). Find a good point estimate for estimating the true proportion of employees who prefer that plan.
- 0.16
  - 0.241
  - 0.401
  - 0.561
16. A sociologist wishes to conduct a poll to estimate the percentage of Americans who favor affirmative action programs for women and minorities for admission to colleges and universities. What sample size should be obtained if she wishes the estimate to be within 4 percentage points with 90% confidence?
- 400
  - 423
  - 81
  - 123
17. When the level of significance of a hypothesis test is increased, the probability of committing a Type I error
- is decreased
  - remains the same
  - is increased
  - becomes zero

18. A Type II error is an error that
- rejects  $H_0$ , given that  $H_1$  is false
  - fails to reject  $H_0$ , given that  $H_1$  is true
  - fails to reject  $H_0$ , given that  $H_1$  is false
  - rejects  $H_0$ , given that  $H_1$  is true
19. To perform a hypothesis test of two population proportions, the pooled estimate of  $p$  must be determined. The pooled estimate,  $\hat{p}$ , is .
- $\hat{p} = \frac{x_1 + x_2}{n_1 + n_2}$
  - $\hat{p} = \frac{x_1}{n_1} + \frac{x_2}{n_2}$
  - $\hat{p} = \frac{n_2 x_1 + n_1 x_2}{n_1 + n_2}$
  - $\hat{p} = \frac{x_1 + x_2}{n_1 n_2}$
20. Two samples are randomly selected from each population. The sample statistics are given below. Use  $\alpha = 0.05$ .
- $$n_1 = 50, \bar{x}_1 = 21, s_1 = 1.5$$
- and*
- $$n_2 = 60, \bar{x}_2 = 19, s_2 = 1.9$$
- Find the standardized test statistic to test the hypothesis that  $\mu_1 = \mu_2$ .
- 8.1
  - 4.2
  - 6.2
  - 3.8
21. In a recent survey of drinking laws, a random sample of 1000 women showed that 65% were in favor of increasing the legal drinking age. In a random sample of 1000 men, 60% favored increasing the legal drinking age. Construct a 95% confidence interval for  $p_1 - p_2$ , where  $p_1$  is the population proportion of women who are in favor of increasing the legal drinking age and  $p_2$  is the population proportion of men who are in favor of increasing the legal drinking age.
- (0.587, 0.912)
  - (-1.423, 1.432)
  - (-2.153, 1.679)
  - (0.008, 0.092)

22. A company wants to determine if its employees have any preference among 5 different health plans, which it offers to them. A sample of 200 employees provided the data below.

Plan	1	2	3	4	5
Employees	65	32	18	55	30

Find the test statistic  $\chi^2$  to test the claim that the probabilities show no preference. Use  $\alpha = 0.01$ .

- a. 45.91
  - b. 37.45
  - c. 48.91
  - d. 55.63
23. Four different types of insecticides are used on strawberry plants. The number of strawberries on each randomly selected plan is given below.

Insecticide 1	Insecticide 2	Insecticide 3	Insecticide 4
6	5	6	3
5	8	3	5
6	5	4	3
7	5	3	4
7	5	2	5
6	6	3	4

Find the test statistic  $F$  to test the hypothesis that the type of insecticide makes no difference in the mean number of strawberries per plan. Use  $\alpha = 0.01$ .

- a. 8.123
  - b. 7.123
  - c. 6.912
  - d. 8.357
24. In linear regression, a good estimator of  $\sigma$  is called the
- a. standard deviation
  - b. variance
  - c. standard error of the estimate
  - d. sample standard deviation

25. The data below are the temperatures on randomly chosen days during the summer and the number of employee absences at a local company on those days. Construct a 95% confidence interval about the slope of the true least-squares regression line, for the data given below.

Temperature, $x$	72	85	91	90	88	98	75	100	80
Number of absences, $y$	3	7	10	10	8	15	4	15	5

- a. (0.367, 0.530)
- b. (-1.760, 2.658)
- c. (0.385, 0.513)
- d. (0.371, 0.527)

\_\_\_\_\_ Name

### Tie Breakers

1. A Secchi disk is an 8-inch diameter weighted disk that is painted black and white and attached to a rope. The disk is lowered into water and the depth (in inches) at which is no longer visible is recorded. The measurement is an indication of water clarity. An environmental biologist is interested in determining whether the water clarity of the lake at Joliet Junior College is improving. She takes measurements at the same location on eight dates during the course of a year and repeats the measurements on the same days 5 year later. She obtains the following results:

Observation	1	2	3	4	5	6	7	8
Date	5/11	6/7	6/24	7/8	7/27	8/31	9/30	10/12
Initial depth	38	58	65	74	56	36	56	52
Depth 5 years later	52	60	72	72	54	48	58	60

Does the evidence suggest that the clarity of the lake is improving at the  $\alpha = 0.05$  level of significance? Conduct an hypothesis test to answer this equation. Write down the hypotheses, test statistics, P-value, decision, and conclusion.



\_\_\_\_\_ Name

2. In an area of Russia, records were kept on the relationship between the rainfall (in inches) and the yield of wheat (bushels per acre) as shown below.

Rainfall (in inches), $x$	10.5	8.8	13.4	12.5	18.8	10.3	7.0	15.6	16.0
Yield (bushels per acre), $y$	50.5	46.2	58.8	59.0	82.4	49.2	31.9	76.0	78.8

- Fit a linear regression model.
- Using the model, predict the rainfall if the yield is 60 bushels per acre.
- Construct a 99% confidence interval about the slope of the true least-squares regression line, for the data given below.
- Is the slope of the model significantly different from zero? Justify your answer by carrying out an appropriate hypothesis test.

\_\_\_\_\_ Name

3. Ten people apply for a job as assistant manager of a restaurant. Six have completed college and four have not. If the manager selects 3 applicants at random,
- find the probability that all 3 are college graduates.
  - find the probability that all 3 are not college graduates.
  - find the probability that at least 1 applicant is a college graduate.
  - find the probability that at least 1 applicant is not a college graduate.

### Answers to Multiple Choice

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

## Solutions of Tie Breaker Problems

1. The samples are dependent.

- a. Hypotheses:  $H_0: \mu_d = 0$   
 $H_1: \mu_d < 0$ , where  $\mu_d$  is the average of difference of the readings Initial depth – Depth after 5 years.
- b. Test statistic:  $t = -2.384$ .
- c. P-value: 0.024
- d. Decision: Reject  $H_0$ .
- e. Conclusion: Yes, the evidence suggests that the clarity of the lake is improving at the  $\alpha = 0.05$  level of significance.

2.

- a.  $\hat{y} = 4.379x + 4.267$
- b.  $x = \frac{60 - 4.267}{4.379} = 12.727$  inches of rainfall.
- c. 99% confidence interval = (3.228, 5.53)
- d.  $H_0: \beta = 0$ ;  $H_1: \beta \neq 0$ . P-value = 0.000003. Reject  $H_0$ . Yes, the slope of the model is significantly different from zero.

3.

- a.  $\frac{{}_6C_3 \cdot {}_4C_0}{{}_{10}C_3} = \frac{20}{120} = \frac{1}{6}$
- b.  $\frac{{}_6C_0 \cdot {}_4C_3}{{}_{10}C_3} = \frac{4}{120} = \frac{1}{30}$
- c.  $\frac{{}_6C_1 \cdot {}_4C_2}{{}_{10}C_3} + \frac{{}_6C_2 \cdot {}_4C_1}{{}_{10}C_3} + \frac{{}_6C_3 \cdot {}_4C_0}{{}_{10}C_3} = \frac{116}{120} = \frac{29}{30}$
- d.  $\frac{{}_6C_2 \cdot {}_4C_1}{{}_{10}C_3} + \frac{{}_6C_1 \cdot {}_4C_2}{{}_{10}C_3} + \frac{{}_6C_0 \cdot {}_4C_3}{{}_{10}C_3} = \frac{100}{120} = \frac{5}{6}$