

Name _____

Solve the problem.

- 1) In a study comparing the effects of four energy drinks on running speed, eight runners were timed (in seconds) running four miles. On each day, they were given a single energy drink. The data are listed below. Is there evidence of a difference in the probability distributions of the running times among the four drinks? Use $\alpha = .025$. 1) _____

Runner	Drink			
	1	2	3	4
1	1233	1234	1281	1252
2	1137	1043	1159	1167
3	1237	1365	1299	1311
4	1264	1225	1280	1275
5	1167	1129	1223	1228
6	1326	1303	1356	1352
7	1228	1269	1265	1251
8	1251	1142	1279	1256

- 2) Specify the rejection region for the Wilcoxon rank sum test in the following situation. 2) _____

$$n_1 = 6, n_2 = 8, \alpha = .10$$

H_0 : Two probability distributions, 1 and 2, are identical

H_a : Probability distribution of population 1 is shifted to the right or left of the probability distribution for population 2

- 3) A coffeehouse wishes to see if customers have any preference among 5 different brands of coffee. A sample of 200 customers provided the data below. Find the rejection region used to test the claim that the probabilities show no preference. Use $\alpha = 0.01$. 3) _____

Brand	1	2	3	4	5
Customers	18	55	30	32	65

A) $\chi^2 > 13.277$

B) $\chi^2 > 14.860$

C) $\chi^2 > 11.143$

D) $\chi^2 > 9.488$

- 4) A researcher wants to know if the time spent in prison for a particular type of crime is the same for men and women. A random sample of men and women were each asked to give the length of sentence received. The data, in years, are listed below. Use the Wilcoxon rank sum procedure to test the claim that there is no difference in the sentence received by each gender. Use $\alpha = .05$. 4) _____

Men	18	30	24	26	27	34
Women	17	20	17	22	34	20

Men	22	30	20	27	31	32
Women	42	16	18	21	25	35

- 5) Find the rejection region for a test of independence of two classifications where the contingency table contains $r = 2$ rows and $c = 4$ columns and $\alpha = .10$. 5) _____
- A) $\chi^2 > 15.507$ B) $\chi^2 > 6.251$ C) $\chi^2 > 13.362$ D) $\chi^2 > 22.307$

- 6) A researcher wishes to determine whether there is a difference in the average age of elementary school, high school, and community college teachers. Teachers are randomly selected. Their ages are recorded below. Use the Kruskal-Wallis H -test to test the claim that there is no difference in the distribution of the populations. Use $\alpha = .05$. 6) _____

Elementary School Teachers	High School Teachers	Community College Teachers
3	42	45
34	47	51
33	44	42
58	53	67
43	48	51
31	37	41

- 7) A convenience store owner believes that the median number of lottery tickets sold per day is 64. A random sample of 20 days yields the data below. Test the owner's claim. Use $\alpha = .05$. 7) _____

47 63 74 79 46 70 85 42 48 53
 62 69 69 59 59 64 64 74 69 53

- 8) The contingency table below shows the results of a random sample of 200 state representatives that was conducted to see whether their opinions on a bill are related to their party affiliations. Use $\alpha = 0.05$. 8) _____

Party	Opinion		
	Approve	Disapprove	No Opinion
Republican	42	20	14
Democrat	50	24	18
Independent	10	16	6

Find the rejection region used to test the claim of independence.

- A) $\chi^2 > 13.277$ B) $\chi^2 > 9.488$ C) $\chi^2 > 11.143$ D) $\chi^2 > 7.779$

- 9) Nine students took the SAT test. Their scores are listed below. Later, they took a test preparator course and retook the SAT. Their new scores are listed below. Use the Wilcoxon signed rank test to test the claim that the test preparation had no effect on their scores. Use $\alpha = .05$. 9) _____

Student	1	2	3	4	5	6	7	8	9
Before Score	1110	1020	830	970	1180	1040	1140	1050	810
After Score	1130	1020	820	1010	1210	1050	1130	1090	830

- A) critical value 3; test statistic $T = 4$; Do not reject H_0 ; There is not sufficient evidence to reject claim. The evidence is not strong enough to say the course had an effect.
 B)

- 10) A coffeehouse wishes to see if customers have any preference among 5 different brands of coffee. A sample of 200 customers provided the data below. Calculate the chi-square test statistic χ^2 used to test the claim that the probabilities show no preference. 10) _____

Brand	1	2	3	4	5
Customers	18	30	65	32	55

- A) 45.91 B) 55.63 C) 48.91 D) 37.45

- 11) The contingency table below shows the results of a random sample of 300 state representatives that was conducted to see whether their opinions on a bill are related to their party affiliations. Assuming the row and column classifications are independent, find an estimate for the expected cell count E_{22} . 11) _____

Party	Opinion		
	Approve	Disapprove	No Opinion
Republican	63	30	21
Democrat	75	36	27
Independent	15	24	9

- A) 41.4 B) 26.22 C) 34.2 D) 70.38

- 12) A sports researcher is interested in determining if there is a relationship between the number of home team and visiting team wins and different sports. A random sample of 526 games is selected and the results are given below. Calculate the chi-square test statistic χ^2 used to test the claim that the number of home team and visiting team wins is independent of the sport. Use $\alpha = 0.01$. 12) _____

	Football	Basketball	Soccer	Baseball
Home team wins	39	156	25	83
Visiting team wins	31	98	19	75

- A) 5.391 B) 4.192 C) 3.290 D) 2.919

Answer the question True or False.

- 13) The sign test provides inferences about the population median rather than the population mean. 13) _____
 A) True B) False

- 14) For a sign test to be valid, a large sample must be selected from a population which is approximately normal. 14) _____
 A) True B) False

Use the sign test to test the indicated claim.

- 15) A researcher wishes to study whether music has any effect on the ability to memorize information. 87 randomly selected adults are given a memory test in a quiet room. They are then given a second memory test while listening to classical music. 62 people received a higher score on the second test, 24 a lower score, and 1 received the same score. At the 0.05 significance level, test the claim that the music has no effect on memorization skills. 15) _____

Answer Key

Testname: SAMPLEEXAME4_3123

- 1) critical value 9.348; $F_r = 11.1$; reject H_0 ; There is enough evidence to conclude that there is a difference in the probability distributions of the running times among the four drinks.
- 2) The test statistic is $T = T_1$ since population 1 has the smaller sample. The rejection region is $T \leq 32$ or $T \geq 58$.
- 3) A
- 4) critical values ± 1.96 ;

$$\text{test statistic } z = \frac{T_1 - \frac{n_1(n_1+n_2+1)}{2}}{\sqrt{\frac{n_1n_2(n_1+n_2+1)}{12}}} = \frac{174.5 - \frac{12(25)}{2}}{\sqrt{\frac{12 \cdot 12(25)}{12}}} \approx 1.415;$$

fail to reject H_0 ; There is not sufficient evidence to reject the claim.

- 5) B
- 6) critical value 5.991; test statistic $H \approx 4.056$; fail to reject H_0 ; There is not enough evidence to conclude that there is difference in the distribution of the populations.
- 7) critical value 1.96; test statistic $z = -.22$; fail to reject H_0 ; There is not sufficient evidence to reject the claim.
- 8) B
- 9) A
- 10) D
- 11) A
- 12) C
- 13) A
- 14) B
- 15) H_0 : the music has no effect on memorization skills.

H_1 : the music has an effect on memorization skills.

Convert $x = 24$ to the test statistic $z = -3.99$. Critical values: $z = \pm 1.96$.

Reject the null hypothesis. There is sufficient evidence to warrant rejection of the claim that music has no effect on memorization skills.