Statistics II

Quiz III

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Answers 1 - 9

	a	*b*	*c*	*d*	*e*
1	☐	☐	☐	☐	☐
2	☐	☐	☐	☐	☐
3	☐	☐	☐	☐	☐
4	☐	☐	☐	☐	☐
5	☐	☐	☐	☐	☐
6	☐	☐	☐	☐	☐
7	☐	☐	☐	☐	☐
8	☐	☐	☐	☐	☐
9	☐	☐	☐	☐	☐

1. *(2 points)* A parametric analysis of variance is a test to compare:
   (a) variances.
   (b) residuals.
   (c) standard deviations.
   (d) means. √
   (e) proportions.

2. *(3 points)* In a group of private hospitals, workers complain that the Board of Directors discriminates against workers, raising wages differently between different departments. The Workers' Commission carried out an inquiry to assess this situation. Given the following tables, indicate the correct answer [1] (consider $\alpha = 0,05$):

Tests of homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
Wage (m.u)	Based on Mean	92,553	2	1673	< 0,001
	Based on Median	49,503	2	1673	< 0,001
	Based on Median and with adjusted df	49,503	2	1563,915	< 0,001
	Based on trimmed mean	87,471	2	1673	< 0,001

ANOVA

Wage (m.u)

	Sum of Squares	df	Mean Square	*F*	Sig.
Between Groups	2307089611	2	1153544805	54,915	< 0,001
Within Groups	3,514E+10	1673	21006016,9		
Total	3.745E+10	1675			

Multiple Comparisons

Wage (m.u)

	Curso (i)	Curso (j)	Mean Difference ($i-j$)	Std. Error	Sig.
Dunnett'C	Cardiology	Maternity	1559,785*	256,805	< 0,001
		Neurology	−1419,087*	315,830	< 0,001
	Maternity	Cardiology	−1559,785*	256,805	< 0,001
		Neurology	−2978,872*	294,242	< 0,001
	Neurology	Cardiology	1419,087*	315,830	< 0,001
		Maternity	2978,872*	294,242	< 0,001

*. The mean difference is significant at the 0,05 level.

   (a) The average wages are the same for workers in the three Services.
   (b) The average wages are different for workers in the three Services. √
   (c) Workers in the Neurology Service have a higher average salary than Maternity workers and these, in turn, have a higher average salary than Cardiology workers.
   (d) Workers in the Cardiology Service have a higher average salary than Maternity workers and these, in turn, have a higher average salary than Neurology workers.
   (e) None of the other answers are correct.

[1] The Scheffé test is sensitive to variance heterogeneity while the Dunnett's test is robust, i.e., it can be used if we reject equality of variances.

3. *(2 points)* The nonparametric alternative to the test for the difference of the means from two independent populations, when these are not *Normal* and the random samples are small ($n_1 < 30$ e $n_2 < 30$):

   (a) Mann-Whitney. √

   (b) Chi-square.

   (c) Kruskal-Wallis.

   (d) Scheffé.

   (e) Wilcoxon.

4. *(2 points)* A group of private hospitals regularly conduct employee satisfaction surveys. A survey was conducted to compare the degree of satisfaction of workers depending on the shift they are most often in (workers work in 3 shifts). Based on the following tables, indicate the correct decision ($\alpha = 0.05$).

Rank

	Shift	N	Mean Rank
Satisfaction	1	684	476,98
	2	185	515,75
	3	99	478,10
	Total	968	

Test Statistics[a,b]

	Satisfation
Kruskal-Wallis H	3,085
df	2
Asymp. Sig.	0,214

a. Kruskal-Wallis Test

b. Grouping Variable: Turno

   (a) The distribution of the degree of satisfaction is equal in the various shifts. √

   (b) The distribution of the degree of satisfaction is different in the various shifts.

   (c) Shift 2 workers are significantly more satisfied.

   (d) The significantly more satisfied workers are those in shift 2 and the significantly less satisfied workers are those in shift 1.

   (e) None of the other answers are correct.

5. *(3 pontos)* In a group of private hospitals, workers complain that the Board of Directors discriminates against workers, raising wages differently between different departments. The Workers' Commission carried out an inquiry to assess this situation. Given the following tables, indicate the correct answer (consider $\alpha = 0,05$):

Tests of homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
Percentage of salary increase	Based on Mean	0,299	2	1673	0,741
	Based on Median	0,266	2	1673	0,767
	Based on Median and with adjusted df	0,266	2	1672,858	0,767
	Based on trimmed mean	0,272	2	1673	0,762

ANOVA

Percentage of salary increase

	Sum of Squares	df	Mean Square	*F*	Sig.
Between Groups	4,754	2	2,377	0,179	0,836
Within Groups	22268,270	1673	13,310		
Total	22273.0240	1675			

(a) The salary increase for Maternity workers was higher than for workers in the Cardiology and Neurology Services.

(b) The variance of salary increase is similar in the Cardiology and Maternity Services and lower than the variance of salary increase of Neurology workers.

(c) The salary increase was, on average, the same in the workers of the three Services, although its value is not known. √

(d) The workers of the three Services all had an average wage increase of 15.2%.

(e) None of the other answers are correct.

6. *(2 points)* In a study on self-perceived employability, one of the objectives was to characterize the participants. Consider the following results:

Employee seniority	Observed N	Expected N	Residual
less than 2 years	14	33	-19
between 2 and 5 years	52	33	19
more than 5 years	33	33	0

Test Statistics

	Employee seniority
Chi-Square	$21,879^a$
df	2
Asymp. Sig.	$< 0,001$

a. 0 cells (0,0%) have expected frequencies less then 5. The minimum expected cell frequency is 33.

Identify the hypothesis test performed and the null hypothesis.

(a) Chi-square goodness-of-fit test. $H_0 : X$ follows an uniforme distribution. √

(b) Chi-square independence test. H_0: Seniority ranks are independent in the population.

(c) Chi-square goodness-of-fit test. $H_0 : X$ follows an unknown distribution.

(d) Chi-square goodness-of-fit test. $H_0 : X$ follows a $\chi^2_{(2)}$ distribution.

(e) Chi-square independence test. H_0: Seniority ranks are not independent in the population.

7. *(2 points)* In a study on self-perceived employability, one of the objectives was to characterize the participants. Consider the following results:

			Type of organization	
			Non-profit	For profit
Gender	Man	Count (Expected)	14 (18,5)	28 (23,5)
	Woman	Count (Expected)	30 (25,5)	28 (32,5)

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	$3,344^a$	1	0,067
N of Valid Cases	100		

a. 0 cells (0,0%) have expected count less then 5. The minimum expected count is 18,48.

What is intended with the test carried out?

(a) Test whether there is a significant relation between the variables, gender and type of organization. √

(b) Test whether the population proportion of participants by type of organization and gender are equal.

(c) Test the equality of type of organization distributions for men and women.

(d) Test the equality of gender distributions for both types of organizations.

(e) Test whether the population proportion of participants by type of organization and by gender follows a uniform distribution.

8. *(2 points)* An IT company intends to build an explanatory model of its quarterly sales according to the investment, in the previous quarter, in research and development (R&D). Based on a sample of 15 quarters, the following results were obtained:

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	*t*	Sig.
(Constant)	51,548	3,448		14,949	$< 0,001$
Investment in R&D in previous quarter (m.u.)	4,201	0,317	0,965	13,242	$< 0,001$

a. Dependent Variable: Volume de vendas no trimestre (em u.m.)

ANOVA[a]

Model	Sum of Squares	df	Mean Square	*F*	Sig.
Regression	1901,424	1	1901,424	175,339	$< 0,001^b$
Residual	140,976	13	10,844		
Total	2042,400	14			

a. Dependent Variable: Sales volume in the quarter (m.u.)

b. Preditors: (Constant) Investment in R&D in previous quarter (m.u.)

According to the estimated model, the slope of the line is?

(a) 14,494.

(b) 13,242.

(c) 0,965.

(d) 51,548.

(e) None of the other answers are correct. √

9. *(2 points)* In a study on satisfaction with public transport in the Lisbon Metropolitan Area, a sample of 480 users (in equal number for each type of transport - metro, train and bus) was asked about the quality of service (continuous satisfaction scale from *1=not at all satisfied* to *10=completely satisfied*). If you wanted to test, using *SPSS software*, whether the distribution of satisfaction is the same for users who use only the metro or only the train or only the bus, which of the procedures should choose:

   (a) Analyze → Compare means and proportions → Independent-Samples T-test.

   (b) Analyze → Compare means and proportions → One-way ANOVA. √

   (c) Analyze → Descriptive Statistics → Crosstabs → Statistics: Chi-square.

   (d) Analyze → Nonparametric Tests → 2 Independent Samples → Test Type: Mann-Whitney U.

   (e) Analyze → Nonparametric Tests → *k* Independent Samples → Test Type: Kruskal-Wallis H.