

Q1. The values of systolic blood pressure measured in mmHg for a sample of 10 patients are as follows: 120, 100, 110, 120, 130, 160, 130, 120, 140, and 160. The arithmetic mean is equal to:

- a) 110
- b) 130
- c) 129
- d) 135
- e) 120

Q2. A sample of 15 cervical cancer-cases and 12 controls, aged between 35 and 45 years old was investigated. 11 of the cervical cancer-cases and 5 of the controls had at least one *Chlamydia* infection (considered as risk factor for cervical cancer). What are the values of TP(True Positive)-FP(False Positive)-FN(False Negative)-TN(True Negative) in the theoretical table:

- a) 11-5-4-7
- b) 7-4-5-11
- c) 9-7-6-5
- d) 9-6-5-7
- e) 5-4-11-7

**Solution**

Observed	CC+	CC-	Total
Chlamydia+	11	5	16
Chlamydia-	4	7	11
	15	12	27

Theoretical	CC+	CC-	Total
Chlamydia+	$=16 \cdot 15 / 27 = 9$	$=16 \cdot 12 / 27 = 7$	16
Chlamydia-	$=11 \cdot 15 / 27 = 6$	$=11 \cdot 12 / 27 = 5$	11
	15	12	27

Q3. A sample of 15 cervical cancer-cases and 12 controls, aged between 35 and 45 years old was investigated. 12 of the cervical cancer-cases and 10 of the controls had at least one *Chlamydia* infection (considered as risk factor for cervical cancer). To test the association between the *Chlamydia* infection and cervical cancer we will use:

- a) t-test two samples assuming equal variances
- b) t-test two samples assuming unequal variances
- c) Fisher exact test
- d) ANOVA test
- e) Chi-square test

Q4. A sample of 15 cervical cancer-cases and 12 controls, aged between 35 and 45 years old was investigated. 12 of the cervical cancer-cases and 10 of the controls had at least one *Chlamydia* infection (considered as risk factor for cervical cancer). The frequency of cervical cancer is equal to:

- a) 12/15
- b) 10/12
- c) 12/27
- d) 15/27
- e) 10/27

Q5. A new anesthetic has been developed and tested on 10 patients. The time from administration of the anesthetic until induction of anesthesia (expressed in minutes) was recorded (19, 30, 16, 12, 13, 25, 24, 18, 26, 24) using the effective dosage rate according to the patient (expressed in  $\mu\text{g}/\text{kg}$ ) (1.30, 0.60, 0.80, 1.00, 0.90, 0.70, 0.60, 1.90, 1.50, and 1.60). To test the relationship between induction time and dosage rate it can be use:

- a) Student t-test
- b) Z test
- c) Kolmogorov-Smirnov test
- d) Regression analysis
- e) ANOVA test

Q6. Blood cholesterol level of patients between 21 and 40 years with insulin-dependent diabetes is normally distributed with a mean of 140 mg/dl and a standard deviation of 36 mg/dl. A mean of 168 mg/dl with a standard deviation of 36 mg/dl was obtained on a normally distributed sample of 81 patients aged between 21 and 40 years with insulin-dependent diabetes. The value of the applied statistical test is equal to:

- a) 14
- b) 7
- c) 0.09
- d) 167.57
- e) 0.7

Solution:

$$m=140$$

$$s=36$$

$$m=168$$

$$s=36$$

$$n=81$$

$$Z \text{ TEST FOR COMPARING OF A SAMPLE MEAN WITH A POPULATION MEAN (equal variances)}$$

$$Z = (168-140)/(36/\sqrt{81}) = 7$$

Q7. A pharmaceutical company wishes to evaluate the effectiveness of a novel antihypertensive agent. A sample of 200 patients has been study at a significance level of 1%. The conclusion of the study was "the new drug significantly lowers systolic blood pressure compared to the standard drug ( $p < 0.01$ )". This p-value indicates which of the following? \*

- a)  $H_0$  is fail to be rejected
- b)  $H_0$  is rejected at a significance level of 1%
- c)  $H_1$  is accepted
- d) The observed difference in sample means is likely to be due to random chance (sampling error)
- e)  $H_0$  is rejected at a significance level of 5%

Q8. Two therapeutic schemas (A and B) are widely used to treat a certain type of bacterial disease. To compare the success rates of the two procedures, a random sample from each type of schema was obtained (A with a sample size of 160 and B with a sample size of 120), and the number of patients with no reoccurrence of the disease after 1 year was recorded (106 for A schema and 104 for schema B). The failure rate when the B therapeutic schema was used is:

- a) 0.6625
- b) 0.1333
- c) 0.7514
- d) 0.8667
- e) 0.3375

Q9. We are interested in investigating the frequency of hepatitis C to medical staff in Cluj-Napoca. It is known from previous studies that the prevalence of hepatitis C in the general population of Transylvania is 6%. A sample of 120 medical staff in Cluj-Napoca has been investigated and a frequency of hepatitis C equal to 8% was obtained. The alternative hypothesis for a two-tailed test is:

- a) The frequency of hepatitis C in the studied sample is significantly higher compared to the frequency of

hepatitis C in general population

- b) The frequency of hepatitis C in the studied sample is significantly lower than the frequency of hepatitis C in general population
- c) There is a significant difference between the frequency of hepatitis C in the studied sample compared to general population
- d) There is no significant difference in frequency of hepatitis C in the studied sample compared to general population
- e) The alternative hypothesis could not be stated based on available information

Q10. The stress is suspected to be associated with apparition of hypertension. A sample of 500 persons was studied: 220 presented hypertension and from these 100 reported to be stressed. A number of 210 patients without hypertension and stress were identified. The alternative hypothesis of the test could be:

- a) There is an association between hypertension and stress
- b) Hypertension and stress are not associated
- c) There is a significant correlation between stress and hypertension
- d) There is not a significant correlation between stress and hypertension
- e) The mean of stress is significantly different on subjects with hypertension compared with the subject without hypertension

Q11. A study was conducted to measure the effect of mother alcohol consumption upon the birth weight of a baby. The following variables were measured for each woman included in the study: alcohol consumption status (yes/no), baby birth weight (g), and APGAR score. The scales of these variables are:

- a) ordinal, ratio, interval
- b) nominal, ratio, nominal
- c) nominal, ratio, ratio
- d) nominal, ratio, ordinal
- e) nominal, interval, ordinal

Q12. As a general rule, researchers tend to use \_\_\_\_ percent confidence intervals.

- a) 2%
- b) 5%
- c) 98%
- d) 50%
- e) 95%

Q13. Which of the following statements sounds like a null hypothesis?

- a) Lung cancer is dependent by sex
- b) There is no difference between male and female blood cholesterol level in the population
- c) The defendant is guilty
- d) There is a correlation in the population
- e) The coin is not fair

Q14. The following data represents the period of hospitalization in days for a random sample from a source of epidemic infectious mononucleosis (acute contagious infectious disease caused by Epstein Barr virus): 17, 13, 8, 7, 2, 3, 2, 14, 8, 4, 7, 12, 3, 7, 5, and 10. The sample size is equal to:

- a) 15
- b) 8
- c) 2
- d) 16
- e) Can not be determine based on provided data

Q15. The arithmetic mean of total of decayed, missing and filled teeth on a sample of children who attended to community dental surgery was of 1.71 with a standard deviation of 1.64 (sample size of 34). The 95% confidence interval ( $Z_{\alpha} = 1.96$ ) associated to mean is:

- a) 0.2813
- b) 1.4287 - 1.9913
- c) 1.1587 - 2.2613
- d) 0.0700 - 3.3500
- e) Could not be calculated based on provided data

Q16. When we reject  $H_0$  in an ANOVA we can conclude that:

- a) At least one of the mean is different from at least one other mean
- b) Only one mean is different from one other mean
- c) All of the means are the same
- d) All of the means are different
- e) None

Q17. A correlation of 0.56 was found between alcohol consumption and systolic blood pressure in men. This correlation is significant at the 0.001 level. From this information we conclude that:

- a) There is a significant association between alcohol consumption and systolic blood pressure
- b) Men who consume less alcohol are at lower risk for increasing systolic blood pressure
- c) Men who consume less alcohol are at higher risk for increasing systolic blood pressure
- d) High alcohol consumption can cause increased systolic blood pressure in men
- e) High systolic blood pressure can cause increased alcohol consumption in men

Q18. In a study examining the relationship between developmental disorders and prenatal exposure to cocaine, the hospital records of 1000 infants diagnosed with a developmental disorder and 1000 control infants were inspected to prove maternal cocaine abuse. Of the 1000 children with developmental disorder, 800 were born to mothers known to have abused cocaine during their pregnancy compared to 300 of the control group. The sample size of this study was equal to:

- a) 900
- b) 2000
- c) 2100
- d) 1000
- e) 1100

Q19. We want to study whether there is a significant difference between the amount of blood uric acid in women from urban and rural. In a sample of 16 women aged between 30 and 50 years in urban areas, average uric acid was 5 mg/100 ml, with a variance of 2 mg/100 ml. An average equal to 4 mg/100 ml with a variance of 2 mg/100 ml was obtained on a sample of 16 women aged 30 to 50 years in rural areas. The t-test for comparing two means (unknown and equal variances) was applied at a significance level of 5% and a value of \_\_\_\_\_ was obtained.

- a) 2.04
- b) -2.04
- c) 1.41
- d) 2.38
- e) -1.68

Solution:

$$s = \sqrt{\frac{(15 \cdot 2 + 15 \cdot 2)}{(16 + 16 - 2)}} = 1.41$$

$$t = \frac{(5 - 4)}{(1.41 \cdot \sqrt{1/16 + 1/16})} = 2.00 \rightarrow \text{the closest to 2.04}$$

Q20. The stress is suspected to be associated with apparition of hypertension. A sample of 500 persons was studied: 220 presented hypertension and from these 100 reported to be stressed. A number of 210 patients without hypertension and stress were identified. The value of chi-square test is equal to:

- a) 22.60
- b) 2.26
- c) 226

- d) 21.60  
 e) No answer is correct

Solution:

Observed	HTA+	HTA-	Total
Stress+	100	70	170
Stress -	120	210	330
	220	280	500

Theoretical	HTA+	HTA-	Total
Stress+	75	95	170
Stress -	145	185	330
	220	280	500

$$\text{Chi} = (100-75)^2/75 + (70-95)^2/95 + (120-145)^2/145 + (210-185)^2/185 = 22.60$$

Q21. It is known that the frequency of anorexia nervosa in the general population is 2%. In a sample of 356 military persons has identified a number of five anorexic people. Anorexia in the military is different from that of the general population? The parameter of the proper statistical test is:

- a) 0.80  
 b) 0.81  
 c) -0.80  
 d) -0.81  
 e) No answer is correct

Solution:

$$f=0.02$$

$$n=356$$

$$p=5/356 = 0.014$$

$$z = (0.02-0.014)/\text{sqrt}((0.014*(1-0.014))/356) = 0.96$$

Q22. A pharmaceutical company has developed a new test for identifying pregnancy. The company tested the new product on 150 pregnant women; in 130 of these cases the tests were positive. The same test was applied on 150 women who were not pregnant; 145 of them had negative test. The positive predictive value is equal to:

- a) 0.97  
 b) 0.96  
 c) 0.92  
 d) 0.91  
 e) None is correct

Solution:

Observed	Pregnancy+	Pregnancy -	Total
Test+	130	5	135
Test -	20	145	165
	150	150	300

$$\text{PPV} = \text{AP}/(\text{AP}+\text{FP}) = 130/135 = 0.96$$

Q23. A physician wants to know if the number of male oesophageal cancer patients diagnosed with multiple primary tumours differs from the proportion of female oesophageal cancer patients with the same diagnosis. A random sample of 60 male and 40 female oesophageal cancer patients was selected and the

numbers with multiple primary tumours in each sample were recorded. Forty men and ten women with multiple primary tumours were identified. What is H0 for the study?

- a) The proportion of male oesophageal cancer patients diagnosed with multiple primary tumours does not differ from that of female oesophageal cancer patients diagnosed with multiple primary tumours
- b) None is correct
- c) An association exists between gender and the presence of multiple primary tumours
- d) The proportion of male oesophageal cancer patients with multiple primary tumours is greater than of female oesophageal cancer patients with such tumours
- e) The proportion of men with oesophageal cancer differ from that of female with oesophageal cancer

Q24. It seeks to estimate the prevalence of smoking among students from "Iuliu Hațieganu" University of Medicine and Pharmacy Cluj-Napoca. A random sample of students was selected and each student was asking to complete an anonymous questionnaire. Students selected for this study are:

- a) Sample
- b) Parameter
- c) Available population
- d) Statistic
- e) Target population

Q25. A Collaborative Depression study examined several factors impacting the detection and treatment of depression. One primary focus was to develop a biochemical test for diagnosing depression. For this research, a subpopulation of 300 persons were selected and subjected to the Dexamethasone Suppression Test (DST). The results of the study are as follow: 189 patients proved to be with positive DST results, 150 patients had a positive diagnosis of depression, 87 patients with positive diagnosis of depression had also a positive DTS result. The specificity is:

- a) 87/150
- b) 48/150
- c) 102/150
- d) 63/111
- e) 102/189

Solution:

Observed	Depression+	Depression -	Total
DST+	87	102	189
DST -	63	48	
	150	150	300

$$Sp = 48/150$$

Q26. The 99% confidence interval ( $Z_{\alpha} = 2.579$ ) associated to systolic blood pressure for a sample of 169 persons with an arithmetic mean of 135 mg/dl and a standard deviation of 20 mg/dl is:

- a) [132 - 138]
- b) [83 - 187]
- c) [132 - 138]
- d) Could not be determined based on provided data
- e) [131 - 139]

Solution:

$$135 \pm 2.579 * 20 / \sqrt{169} = 135 \pm 3.97 = [131 - 139]$$

Q27. In a study examining the relationship between developmental disorders and prenatal exposure to cocaine, the hospital records of 1000 infants diagnosed with a developmental disorder and 1000 control infants were inspected to prove maternal cocaine abuse. Of the 1000 children with developmental disorder, 800 were born to mothers known to have abused cocaine during their pregnancy compared to

300 of the control group. The total number of maternal cocaine use was equal to:

- a) 1100
- b) 300
- c) 900
- d) 700
- e) 800

Q28. The following are examples of continuous random variables, EXCEPT:

- a) The mean of depression score obtained by application of a test on a sample of patients with terminal diseases
- b) Mean of systolic blood pressure on 24h
- c) Mean of body weight of children
- d) Mean of pulmonary capacity of physicians
- e) Number of students who pass the exam

Q29. A correlation of 0.28 was found between smoking (as number of cigarettes smoked per day) and lung cancer. Which of the following sound like a null hypothesis?

- a) The smokers have lung cancer
- b) The smokers do not have lung cancer
- c) No significant differences exist between persons with and without lung cancer
- d) There is a linear relationship between smoking and lung cancer
- e) The correlation coefficient between smoking and lung cancer is not significantly different by zero

Q30. A researcher wishing to demonstrate the efficacy of a new treatment for hypertension. He compares the effect of the new treatment versus a placebo. This study provides a test of the null hypothesis that the new treatment has no effect on hypertension. In this case, the null hypothesis should be considered as:

- a) Positive proof that the stated premise is correct
- b) The assertion of a statistical significant relationship
- c) The assumption that the study design is adequate
- d) The probability that the relationship being studied is the result of random factors
- e) Fail to be rejected, there are no proofs that the identify effect is not given by chance

Q31. Which of the following is a conclusion of carrying out a given statistical test of hypothesis at a 5% significance level?

- a) The probability of accepting  $H_0$  when it is false is 0.01.
- b)  $H_0$  is more likely to be rejected than if the investigator had chosen a level of significance of 5%
- c) The probability of observing a statistically significant result is 0.1
- d) The probability of rejecting  $H_0$  when it is true is 0.01
- e) The probability of accepting  $H_0$  when it is false is 0.05

Correct: D

Q32. A physician wants to know if the number of male oesophageal cancer patients diagnosed with multiple primary tumours differs from the proportion of female oesophageal cancer patients with the same diagnosis. A random sample of 60 male and 40 female oesophageal cancer patients was selected and the numbers with multiple primary tumours in each sample were recorded. Forty men and ten women with multiple primary tumours were identified. The calculated value of test statistic is:

- a) 0.65
- b) 16.67
- c) 14.04
- d) 0.72
- e) None is correct

Solution:

$$nM=60, p1=40/60 = 0.67$$

$$n_F=40, p_2=10/40 = 0.25$$

$$p=(0.67*60+0.25*40)/(60+40) = 0.502$$

$$z = (0.67-0.25)/\sqrt{0.502*(1-0.502)*(1/60+1/40)} = 4.11$$

Q33. A physician wants to know if the number of male oesophageal cancer patients diagnosed with multiple primary tumours differs from the proportion of female oesophageal cancer patients with the same diagnosis. A random sample of 60 male and 40 female oesophageal cancer patients was selected and the numbers with multiple primary tumours in each sample were recorded. Forty men and ten women with multiple primary tumours were identified. How many degrees of freedom are associated with the test statistic:

- a) 1
- b) 2
- c) 3
- d) 4
- e) Cannot be determined based on provided data

Q34. In a study examining the relationship between developmental disorders and prenatal exposure to cocaine, the hospital records of 1000 infants diagnosed with a developmental disorder and 1000 control infants were inspected to prove maternal cocaine abuse. Of the 1000 children with developmental disorder, 800 were born to mothers known to have abused cocaine during their pregnancy compared to 300 of the control group. What is the odd ratio of a developmental disorder given exposure to cocaine?

- a) 9.33
- b) 3.27
- c) 0.73
- d) 0.80
- e) It cannot be calculated based on provided data

Solution:

Observed	Develop disorder+	Develop disorder -	Total
cocaine+	800	300	1100
cocaine -	200	700	900
	1000	1000	2000

$$= (AP*AN)/(FN*FP) = (800*700)/(300*200) = 9.33$$

Q35. The arithmetic mean of haemoglobin calculated on a sample of 15 newborn babies in urban areas was 11.20 mg / dl with a variance of 0.60 mg / dl. To test the hypothesis that the arithmetic mean of haemoglobin urban infants is not significantly different from that of infants in rural areas, a sample of 10 newborn babies from was investigated. In the second sample the arithmetic mean of haemoglobin was of 11.40 mg / dl with a variation of 0.65 mg / dl. The variations of the two samples were found to be equal when variances were tested. To test the hypothesis the following statistical test will be use:

- a) Student test for paired samples
- b) Student test for independent samples, equal variances
- c) Student test for independent samples, unequal variances
- d) Z test for comparing a sample mean with a population mean
- e) Z test for comparing two proportions