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| **كلية العلوم****قسم الإحصاء وبحوث العمليات** | **http://ksu.edu.sa/sites/KSUArabic/Students/FemaleStds/AlmalazCenter/AboutCenter/logo/ksu%20logo.png**  | **College of Science****Department of Statistics & Operations Research** |

**Final Exam Academic Year 1442-1443 Hijri- First Semester**

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| **معلومات الامتحان Exam Information**  |
| **اسم المقرر**  | **Biostatistics**  | **Course name**  |
| **رمز المقرر**  | **Stat 109** | **Course Code**  |
| **تاريخ الامتحان**  | **1443-05-22** | **2021-12-26** | **Exam Date**  |
| **وقت الامتحان**  | **01: 00 PM** | **Exam Time**  |
| **مدة الامتحان**  | **ساعتان** | **2 hours** | **Exam Duration** |
| **رقم قاعة الاختبار**  |  | **Classroom No.** |
| **اسم استاذ المقرر**  |  | **Instructor Name**  |
|  |
| **معلومات الطالب Student Information** |
| **اسم الطالب** |  | **Student’s Name** |
| **الرقم الجامعي** |  | **ID number** |
| **رقم الشعبة** |  | **Section No.** |
| **الرقم التسلسلي** |  | **Serial Number** |
| **تعليمات عامة:**  | **General Instructions:** |
| * عدد صفحات الامتحان  صفحة. (بإستثناء هذه الورقة)
* يجب إبقاء الهواتف والساعات الذكية خارج قاعة الامتحان.
* سيتم التصحيح من الورقة الخارجية فقط ولن ينظر لورقة الاختبار من الداخل .
 | * Your Exam consists of  PAGES (except this paper)
* Keep your mobile and smart watch out of the classroom.
* Only the front page will be corrected.
 |

**هذا الجزء خاص بأستاذ المادة *This section is ONLY for instructor***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **#** | **Course Learning Outcomes (CLOs)** | **Related Question (s)** | **Points** | **Final Score** |
| 1 | Chapter 6 | Q1—Q23, Q30—Q31 |  |  |
| 2 | Chapter 7 | Q1—Q40 |  |
| 3 |  |  |  |
| 4 |  |  |  | 40 |
| 5 |  |  |  |

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| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |
| **D** | **C** | **A** | **B** | **A** | **B** | **C** | **B** | **D** | **A** |
|  |  |  |  |  |  |  |  |  |  |
| **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** |
| **B** | **A** | **B** | **D** | **A** | **D** | **A** | **B** | **B** | **B** |
|  |  |  |  |  |  |  |  |  |  |
| **21** | **22** | **23** | **24** | **25** | **26** | **27** | **28** | **29** | **30** |
| **C** | **D** | **B** | **A** | **A** | **A** | **C** | **B** | **C** | **B** |
|  |  |  |  |  |  |  |  |  |  |
| **31** | **32** | **33** | **34** | **35** | **36** | **37** | **38** | **39** | **40** |
| **D** | **A** | **B** | **C** | **B** | **D** | **B** | **A** | **A** | **A** |

**Question(1 – 6):** Suppose that the weight of women at a large university in a certain population are normally distributed with a standard deviation of $20 pound$. A simple random sample of $25$ women was drawn with mean $150 $ *pound*.

* **We want to find a 95% confidence interval for population mean score µ.**
1. The standard error of $\overbar{X}$ is :

|  |  |  |  |
| --- | --- | --- | --- |
| 1. 150
 | 1. 20
 | 1. 0.8
 | 1. 4
 |

1. The margin of error is ( at 95% confident level ):

|  |  |  |  |
| --- | --- | --- | --- |
| 1. 1.96
 | 1. 1.57
 | 1. 7.84
 | 1. 6.58
 |

1. The 95% confidence interval for µ is:

|  |  |  |  |
| --- | --- | --- | --- |
| 1. (142.16,157.84)
 | 1. (148.04,151.96)
 | 1. (144.03,153.98)
 | 1. (143.4,156.6)
 |

* **On the basis of the data given above can we conclude that the mean weight of women in the population is not 140 bound? Let** $ α=0.1$**.**
1. The value of the test statistic is:

|  |  |  |  |
| --- | --- | --- | --- |
| (A) 12.5 |  (B) 2.5 |  (C) 0.5 |  (D) 0.625 |

1. The rejection region is :

|  |  |
| --- | --- |
| 1. ($-\infty ,-1.645) ⋃ (1.645,\infty ) $
 | 1. ($-1.645, 1.645)$
 |
| 1. ($-1.285, 1.285)$
 | 1. ($-\infty ,-1.285) ⋃ (1.285,\infty )$
 |

1. The decision is:

|  |  |
| --- | --- |
| 1. Accept $H\_{0}$
 | 1. Reject $H\_{0}$
 |

**Question (7 – 12):** The tear strengths are measured in a sample of 14 sheets of silicone rubber. The mean and standard deviation of tear strength of this sample are 33.712 and 0.798 respectively. Assuming a normal population, then,

1. The point estimate of $μ$ is

|  |  |  |  |
| --- | --- | --- | --- |
| 1. 0.213
 | 1. 14
 | (C) 33.712 | (D) 0.798 |

* **To find the 90% confident interval of** $μ$**,**
1. The reliability coefficient is

|  |  |  |  |
| --- | --- | --- | --- |
| 1. 1.350
 | 1. 1.771
 | 1. 1.645
 | 1. 1.761
 |

1. The lower limit of $90\%$ CI of $μ$ is

|  |  |  |  |
| --- | --- | --- | --- |
| 1. 34.09
 | 1. 33.42
 | (C) 32.30 | (D) 33.33 |

* **Test whether the mean tear strength exceeds 33 at level of significance** $α=0.05$**.**
1. The hypotheses are

|  |  |  |  |
| --- | --- | --- | --- |
| 1. $\begin{matrix}\begin{matrix}H\_{0}:&μ\leq 33\end{matrix}\\\begin{matrix}H\_{A}:&μ>33\end{matrix}\end{matrix}$
 | 1. $\begin{matrix}\begin{matrix}H\_{0}:&μ<33\end{matrix}\\\begin{matrix}H\_{A}:&μ>33\end{matrix}\end{matrix}$
 | 1. $\begin{matrix}\begin{matrix}H\_{0}:&μ=33\end{matrix}\\\begin{matrix}H\_{A}:&μ<33\end{matrix}\end{matrix}$
 | 1. $\begin{matrix}\begin{matrix}H\_{0}:&μ=33\end{matrix}\\\begin{matrix}H\_{A}:&μ\geq 33\end{matrix}\end{matrix}$
 |

1. The test statistic is

|  |  |  |  |
| --- | --- | --- | --- |
| 1. 0.89
 | 1. 3.34
 | 1. 15.82
 | 1. - 3.34
 |

1. The decision is

|  |  |
| --- | --- |
| 1. Reject $H\_{0}$
 | 1. Accept $H\_{0}$
 |

**Question (13 – 17 ):** Suppose a random sample of high school students is selected to determine how long male and female students sleep at night. Both populations have a normal distribution

|  |  |  |  |
| --- | --- | --- | --- |
| **Group** | ***n*** | **Sample mean hours of sleep** | $$σ^{2}$$ |
| **Males** | 13 | 6 | 2.3 |
| **Females**  | 10 | 7.5 | 3.9 |

1. The standard error of $\overbar{X}\_{male}-\overbar{X}\_{female}$ is

|  |  |  |  |
| --- | --- | --- | --- |
| 1. 1.3885
 | 1. 0.7529
 | 1. -1.5
 | 1. 1.4757
 |

1. The upper limit of the 95% confidence interval for $μ\_{male}-μ\_{female}$ is :

|  |  |  |  |
| --- | --- | --- | --- |
| 1. - 2.9757
 | 1. 2.9757
 | 1. 0.0243
 | 1. - 0.0243
 |

* **Test the average sleep hours for males less than the average sleep hours for females? α = 0.05**
1. The value of the test statistic is

|  |  |  |  |
| --- | --- | --- | --- |
| 1. -1.992
 | 1. -1.0803
 | 1. 1.0803
 | 1. 1.992
 |

1. The Acceptance Region of $H\_{0}$ (A.R. of $H\_{0}$) is:

|  |  |  |  |
| --- | --- | --- | --- |
| 1. (-∞ , -1.645)
 | 1. (-1.96, ∞)
 | 1. (-1.96,1.96)
 | 1. (-1.645, ∞)
 |

1. The decision is to:

|  |  |
| --- | --- |
| 1. Reject $H\_{0}$
 | 1. Accept $H\_{0}$
 |

**Question (18 – 23 ):** The data in table was collected from a sample of **47** infants in Providence, Rhode Island, at 1 month of age. In this study a research nurse visited the home of each child and took their blood pressure using a special apparatus for measuring infant (**BP**). She also noted whether the infant was sleep or awake and whether or not the child was agitated when the **BP** was taken. The two populations distributed normally with equal variances.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Sleep status** | **Mean BP** | **Sample Standard deviation** | **n** |
| **1** | **Quiet sleep** | 81.9 | 9.8 | 20 |
| **2** | **Awake and quiet** | 86.1 | 10.3 | 27 |

* **Do these data provide sufficient evidence to indicate a difference among the population means at** $α=0.05$**?**
1. The alternative hypothesis is:

|  |  |  |  |
| --- | --- | --- | --- |
| 1. $H\_{A}: μ\_{1}=μ\_{2}$
 | 1. $H\_{A}: μ\_{1}\ne μ\_{2}$
 | 1. $H\_{A}: μ\_{1}>μ\_{2}$
 | 1. $H\_{A}: μ\_{1}\leq μ\_{2}$
 |

1. The point estimate of $μ\_{1}-μ\_{2}$ is:

|  |  |  |  |
| --- | --- | --- | --- |
| 1. -1.5
 | 1. - 4.2
 | 1. 0.5
 | 1. 4.2
 |

1. The pooled estimate of the commend variance $\left(S\_{p}^{2}\right) $is:

|  |  |  |  |
| --- | --- | --- | --- |
| 1. 106.338
 | 1. 101.847
 | 1. 9.659
 | 1. 10.089
 |

1. The appropriate test statistic is:

|  |  |  |  |
| --- | --- | --- | --- |
| $T=\frac{\overbar{X}\_{1}-\overbar{X}\_{2} }{\sqrt{\frac{S\_{1}}{n\_{1}}+\frac{S\_{2}}{n\_{2}} }}$  | $Z=\frac{\overbar{X}\_{1}-\overbar{X}\_{2} }{\sqrt{\frac{σ\_{1}^{2}}{n\_{1}}+\frac{σ\_{2}^{2}}{n\_{2}} }}$  |  $T=\frac{\overbar{X}\_{1}-\overbar{X}\_{2} }{\sqrt{\frac{S\_{P}^{2}}{n\_{1}}+\frac{S\_{P}^{2}}{n\_{2}} }}$  |  $Z=\frac{\overbar{X}\_{1}-\overbar{X}\_{2} }{\sqrt{\frac{S\_{P}^{2}}{n\_{1}}+\frac{S\_{P}^{2}}{n\_{2}} }}$ |

1. The 95% C.I for the difference between the mean of BP for quiet sleep infants and mean of BP

 for awake infants is:

|  |  |  |  |
| --- | --- | --- | --- |
| 1. (-10.03, 1.64)
 | 1. (-6.08, 2.31)
 | 1. (10.29,12.89)
 | 1. (-10.197,1.797)
 |

1. Based on the 95% C.I in the above question, it can be concluded that

|  |  |  |  |
| --- | --- | --- | --- |
| 1. $\overbar{ X}\_{1}=\overbar{X}\_{2}$
 | 1. $ μ\_{1}=μ\_{2}$
 | 1. $ μ\_{1}\ne μ\_{2}$
 | 1. None of these
 |

**Question (24 - 25):**

1. Type II error is

|  |  |
| --- | --- |
| 1. Accepting H0 when H0 is false
 | 1. *P*( Accepting H0 | H0 is false)
 |
| 1. Rejecting H0 when H0 is true
 | 1. *P*( Rejecting H0 | H0 is true)
 |

1. Suppose the P-value for a hypothesis test is 0.0304. Using α = 0.05, what is your decision?

|  |  |
| --- | --- |
| 1. Reject $H\_{0}$
 | 1. Accept $H\_{0}$
 |

**Question (26 - 29):** The cholesterol levels of 11 people before (X) and after (Y) using a certain medicine are given in the following table.

|  |  |  |  |
| --- | --- | --- | --- |
| **People** |  **Xi** | **Yi** | **Di = Xi -Yi** |
| 1 | 318 | 296 | 22 |
| 2 | 287 | 268 | 19 |
| 3 | 275 | 270 | 5 |
| 4 | 275 | 265 | 10 |
| 5 | 285 | 276 | 9 |
| 6 | 284 | 269 | 15 |
| 7 | 307 | 291 | 16 |
| 8 | 291 | 277 | 14 |
| 9 | 283 | 263 | 20 |
| 10 | 285 | 262 | 23 |
| 11 | 307 | 292 | 15 |

* **Assume normal distribution for the differences. The value of standard deviation of the difference** $S\_{D}=5.623 .$ **Test the effectiveness of the medicine at α =0.05 as a level of significance** $H\_{0}$**:** $μ\_{d}\geq 0$ **versus** $H\_{A}$**:** $μ\_{d}$$< $ **.**
1. The sample mean of the differences *D*  is:

|  |  |  |  |
| --- | --- | --- | --- |
| $\left(A\right) \overbar{ D}$= 15.273 | $\left(B\right) \overbar{D}$= 16.8 | $$\left(C\right) \overbar{D}=5.361$$ | $\left(D\right) \overbar{D }$= $5.623$ |

1. The value of the test statistic is:

|  |  |  |  |
| --- | --- | --- | --- |
| (A) *Z* = 8.59 |  (B) *T* = 8.59 | (C) *T* = 9.01 | (D) *Z* = 9.01 |

1. The decision is:

|  |  |
| --- | --- |
| 1. Accept $H\_{0}$
 | 1. Reject $H\_{0}$
 |

1. The lower limit of 90 % confident interval for µD is:

|  |  |  |  |
| --- | --- | --- | --- |
| (A) 12.33 |  (B) 18.345 | (C) 12.201 | (D) 11.075 |

**Question (30 – 35 ):** In order to study the smokes in a primary school, it was found that the number of students who smokes is 25 out of 300.

1. A point estimate of population proportion *p* is :

|  |  |  |  |
| --- | --- | --- | --- |
| 1. 0.061
 | 1. 0.083
 | 1. 0.25
 | 1. 0.05
 |

1. The 95% confidence interval of *p* is :

|  |  |  |  |
| --- | --- | --- | --- |
| 1. (0.01 , 0.82)
 | 1. (0.057 , 0.109)
 | 1. (0.012 , 0.31)
 | 1. (0.052 , 0.114)
 |

* **We want to test** $H\_{0}:p\leq 0.07 $**against**$ H\_{A}:p>0.07$**, using the 0.05 level of significance.**
1. The critical value is

|  |  |  |  |
| --- | --- | --- | --- |
| 1. 1.645
 | 1. 1.96
 | 1. 1.711
 | 1. -1.645
 |

1. The value of the test statistic is :

|  |  |  |  |
| --- | --- | --- | --- |
| 1. 2.252
 | 1. 0.882
 | 1. 0.816
 | 1. 5.634
 |

1. Reject $H\_{0}$ if :

|  |  |  |  |
| --- | --- | --- | --- |
| 1. $ Z<- Z\_{1-\frac{α}{2}}$
 | 1. $ Z>Z\_{1-\frac{α}{2}}$
 | 1. $ Z>Z\_{1-α}$
 | 1. $ Z>- Z\_{1-α}$
 |

1. The Decision is :

|  |  |
| --- | --- |
| 1. Reject $H\_{0}$
 | 1. Accept $H\_{0}$
 |

**Question (36 – 40 ):** In a study on the prevalence of asthma (مرض الربو) among Saudi school children age from 7 to 12, two independent samples were taken from wheezy children and non- wheezy children. It was determined whether or not the child’s father has/had asthma. The results shown in the following table

|  |  |
| --- | --- |
| **Population** | **Father with asthma** |
| Yes | No | Total |
| 1  | **wheezy children** | 130 | 189 | 319 |
| 2 | **non-wheezy children** | 234 | 2488 | 2722 |

* **Can we conclude that the proportion of wheezy children whose father has/had asthma (Yes) is more than this proportion for non-wheezy children with α =0.01 as a level of significance?** Assume equal proportion.
1. The point estimate of $ p\_{1}-p\_{2} $for children whose father has/had asthma is

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. 0.086
 | 1. 0.156
 | 1. 0.408
 | 1. 0.322
 | 1. - 0.322
 |

1. The null hypothesis is

|  |  |  |  |
| --- | --- | --- | --- |
| (A) $H\_{0}: p\_{1}-p\_{2}= 0$ | $$(B) H\_{0}: p\_{1}-p\_{2} \leq 0$$ | $$\left(C\right) H\_{0}: p\_{1}-p\_{2} >0$$ | $$\left(D\right) H\_{0}:p\_{1}-p\_{2} \ne 0$$ |

1. The pooled estimate of the common proportion ($\overbar{p}$) is:

|  |  |  |  |
| --- | --- | --- | --- |
| 1. 0.119
 | 1. 0.085
 | 1. 0.880
 | 1. 0.322
 |

1. The value of the test statistic is

|  |  |  |  |
| --- | --- | --- | --- |
| 1. 16.76
 | 1. 12.67
 | 1. 11.49
 | 1. 15.21
 |

1. The decision is to

|  |  |
| --- | --- |
| (A) Reject $H\_{0}$ | (B) Accept $H\_{0}$ |





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