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Research

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قسم الإحصاء
وبحوث العمليات

جامعة الملك سعود
King Saud University

# Second Midterm Exam

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|---|---|---|
| Sunday November 22, 2018 | STAT 105 | Academic year 1439-40H |
| 7:00 – 8:30 pm | Statistical Methods | First Semester |

| | | |
|---|---|---|
| Student's Name | | اسم الطالب |
| ID number | | الرقم الجامعي |
| Section No. | | رقم الشعبة |
| Classroom No. | | رقم قاعة الاختبار |
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## Instructions

- Switch off your mobile and place it under your seat.
- Time allowed is 90 Minutes.
- Do not copy answers from your neighbors. They have different questions forms.
- Choose the nearest number to your answer.
- Do not use pencils or red pens.
- For each question, put the code (Capital Letters) of the correct answer in the following table beneath the question number.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |
| | | | | | | | | | |
| **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** |
| | | | | | | | | | |
| **21** | **22** | **23** | **24** | **25** | **26** | **27** | **28** | **29** | **30** |
| | | | | | | | | | |

Question1: Light trucks are produced on assembly line A and assembly line B. A random sample of 60 light trucks produced on the first assembly line A showed that 18 had a defect. Another independent random sample of 90 light trucks produced on the second assembly line B showed that 16 had a defect. Let $P_A$ and $P_B$ be the true proportions of trucks with defect on the two assembly lines. Then:

(1) The point estimate of the difference between the two the true proportion ($P_A - P_B$) is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| (A) | 0.250 | (B) | 0.401 | (C) | 0.122 | (D) | 0.103 |

(2) The lower bound of the 95% confidence interval for ($P_A - P_B$) is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| (A) | -0.018 | (B) | 1.911 | (C) | 2.0988 | (D) | 2.548 |

(3) The upper bound of 95% confidence interval for ($P_A - P_B$) is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| (A) | 1.688 | (B) | 1.911 | (C) | 2.098 | (D) | 0.262 |

- To test $H_0: P_A = P_B$ vr $H_1: P_A > P_B$ with level 0.01, then:

(4) The value of the test statistic used is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| (A) | 3.752 | (B) | 4.871 | (C) | 1.748 | (D) | 2.752 |

(5) The critical (or rejection) region is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| (A) | $(-\infty, -1.96)$ | (B) | $(-\infty, -2.325)$ | (C) | $(2.325, \infty)$ | (D) | $(1.96, \infty)$ |

(6) The decision is:

| | | | |
|---|---|---|---|
| (A) | Not reject $H_0$ | (B) | Reject $H_0$ |

- To test $H_0: P_A = P_B$ vr $H_1: P_A \neq P_B$ with level 0.01, then:

(7) The decision is:

| | | | |
|---|---|---|---|
| (A) | Not reject $H_0$ | (B) | Reject $H_0$ |

Question2: An experiment reported in Population Science compared fuel economies for two types of diesel mini-trucks. 12 $(=n_1)$ Volkswagen and 10 $(=n_2)$ Toyota were tested. The 12 Volkswagen averaged $\overline{x}_1 = 16$ kilometers per liter with a standard deviation $s_1 = 1.0$ kilometer per liter and the 10 Toyota trucks averaged $\overline{x}_2 = 11$ kilometers per liter with a standard deviation of $s_2 = 0.8$ kilometer per liter. Assume the distances per liter are approximately normally distributed with equal variances. We are interested in the 95% confidence interval for $\mu_1 - \mu_2$.

(8) The point estimate of the difference $\mu_1 - \mu_2$ between the two populations means is:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| (A) | 5 | (B) | 0.3 | (C) | 4 | | (D) | 0.5 |

(9) The pooled estimate of the population variance $\left(S_p^2\right)$ is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| (A) | 0.124 | (B) | 0.350 | (C) | 0.838 | (D) | 1.853 |

(10) The tabulated value (critical point) is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| (A) | 1.325 | (B) | 2.086 | (C) | 1.96 | (D) | 1.725 |

(11) The lower bound of the of the 95 % confidence interval of the difference between the two populations means $(\mu_1 - \mu_2)$ is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| (A) | 3.254 | (B) | 2.314 | (C) | 1.547 | (D) | 4.182 |

(12) The upper bound of the of the 95 % confidence interval of the difference between the two populations means $(\mu_1 - \mu_2)$ is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| (A) | 1.688 | (B) | 1.911 | (C) | 5.818 | (D) | 2.548 |

- To test $H_0: \mu_1 = \mu_2$ vr $H_1: \mu_1 > \mu_2$ with level 0.01, then:

(13) The value of the test statistic used is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| (A) | 12.756 | (B) | 1.871 | (C) | 5.590 | (D) | 15.813 |

(14) The critical (or rejection) region is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| (A) | $(-\infty, -1.645)$ | (B) | $(1.96, \infty)$ | (C) | $(2.845, \infty)$ | (D) | $(2.528, \infty)$ |

(15) The decision is:

| | | | |
|---|---|---|---|
| (A) | Accept $H_0$ | (B) | Reject $H_0$ |

Question3: We are interested in the content of a soft-drink dispensing machine. A random sample of 25 drinks gave a variance of 2.03 deciliters$^2$. Assume that the contents are approximately normally distributed.

(16) The point estimate of the population variance of the contents is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| (A) | 7.5 | (B) | 0.833 | (C) | 1.2 | (D) | 2.03 |

(17) The lower bound of the of the 90 % confidence interval of the population variance $\sigma^2$ is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| (A) | 2.22 | (B) | 3.19 | (C) | 1.34 | (D) | 1.96 |

(18) The upper bound of the of the 90 % confidence interval of the population variance $\sigma^2$ is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| (A) | 2.22 | (B) | 3.52 | (C) | 5.44 | (D) | 4.43 |

- The soft-drink machine is said to be out of control if the variance exceeds 1.15 deciliters$^2$. To test $H_0: \sigma^2 = 1.15$ vr $H_1: \sigma^2 > 1.15$ with 0.05 level of significance, then:

(19) The test statistic used is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| (A) | 7.500 | (B) | 0.833 | (C) | 42.365 | (D) | 10.823 |

(20) The critical region is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| (A) | $(36.415, \infty)$ | (B) | $(33.196, \infty)$ | (C) | $(1.96, \infty)$ | (D) | $(1.645, \infty)$ |

(21) The decision is:

| | | | |
|---|---|---|---|
| (A) | Not reject $H_0$ | (B) | Reject $H_0$ |

Question4: In a series of experiments to determine the absorption rate of certain pesticides into skin, measured amounts of two pesticides were applied to several skin specimens. For pesticide A, the variance of the amounts absorbed in $n_1 = 6$ specimens was $s_1^2 = 2.3$, while for pesticide B, the variance of the amounts absorbed in $n_2 = 10$ specimens was $s_2^2 = 0.6$. Assume that for each pesticide, the amounts absorbed are a simple random sample from a normal population.

(22) A point estimate of the ratio $\sigma_1^2 / \sigma_2^2$ of the two population variances is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| (A) | 0.213 | (B) | 0.533 | (C) | 0.873 | (D) | 3.833 |

- To test the claim that the variance in the amount absorbed is greater for pesticide A than for pesticide B, that is $H_0 : \sigma_1^2 = \sigma_2^2 \ vr \ H_1 : \sigma_1^2 \neq \sigma_2^2$ with 0.10 level of significance, then:

(23) The value of test statistic is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| (A) | 3.833 | (B) | 0.1 | (C) | 0.057 | (D) | 2.35 |

(24) The non-rejection region is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| (A) | $(-\infty, -1.96)$ | (B) | $(-1.96, \infty)$ | (C) | $(-1.96, 1.96)$ | (D) | $(0.21, 3.48)$ |

(25) The decision is:

| | | | |
|---|---|---|---|
| (A) | Not reject $H_0$ | (B) | Reject $H_0$ |