Department of Statistics & Operations Research
College of Science, King Saud University

*STAT 145*
*Final Examination*
*Second Semester1431 – 1432 H*

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| | اسم الطالب |

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| | رقم التحضير | | الرقم الجامعي |
| | اسم الدكتور | | رقم الشعبة |

- Mobile Telephones are not allowed in the classrooms.
- Time allowed is **3 Hours**.
- Answer all questions.
- Choose the nearest number to your answer.
- For each question, put the code (**Capital Letters**) of the correct answer in the following table beneath the question number. **Do not use pencil or red pen**.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |
| **B** | **D** | **A** | **C** | **A** | **C** | **B** | **C** | **B** | **D** |
| **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** |
| **D** | **D** | **B** | **A** | **B** | **A** | **A** | **B** | **C** | **A** |
| **21** | **22** | **23** | **24** | **25** | **26** | **27** | **28** | **29** | **30** |
| **C** | **D** | **C** | **B** | **B** | **D** | **D** | **A** | **C** | **C** |
| **31** | **32** | **33** | **34** | **35** | **36** | **37** | **38** | **39** | **40** |
| **B** | **A** | **D** | **D** | **C** | **A** | **B** | **C** | **C** | **A** |
| **41** | **42** | **43** | **44** | **45** | **46** | **47** | **48** | **49** | **50** |
| **B** | **D** | **D** | **B** | **A** | **A** | **D** | **A** | **C** | **B** |

| Term Marks | Final Exam. Marks | Total Marks |
|---|---|---|
| | | |

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**Following are the weights (in kg) for a sample of 6 children.**

**13, 20, 18, 12, 15, and 12.**

(1) The mean of the data is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | 12 | B) | 15 | C) | 10 | D) | 18 |

(2) The median of the data is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | 17 | B) | 12 | C) | 10 | D) | 14 |

(3) The mode of the data is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | 12 | B) | 20 | C) | 15 | D) | 2 |

(4) The variance of the data is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | 3.347 | B) | 3.055 | C) | 11.200 | D) | 9.333 |

(5) The coefficient of variation ( C.V.) of the data is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | 22.3% | B) | 17.4% | C) | 74.7% | D) | 62.22% |

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**Temperatures recorded at 2 pm for 5 days of a year, for a city are:**

**7, 4, 0, -5, and 40.**

(6) The range of temperatures is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | 33 | B) | 40 | C) | 45 | D) | 5 |

(7) The most suitable measure of centre for the data is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | Mean | B) | Median | C) | Mode | D) | Range |

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**Let A and B denote two events defined on the same sample space with P(A) = 0.6, P(B) = 0.4, and $P(A \cup B) = 0.74$, then:**

(8) The events A and B are:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | independent | B) | mutually exclusive | C) | dependent | D) | impossible |

(9) The $P(\overline{A} \cap \overline{B})$ is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | 0.18 | B) | 0.26 | C) | 0.50 | D) | 1.00 |

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**Consider the following cumulative frequency distribution table for the ages of all workers in a certain factory.**

| Age | Cumulative frequency |
|---|---|
| 26 - 35 | 10 |
| 36 - 45 | 40 |
| 46 - 55 | 50 |

(10) Percentage of workers in the age group 36 - 45 is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | 40% | B) | 80% | C) | 30% | D) | 60% |

(11) Number of workers having age 36 or more is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | 90 | B) | 50 | C) | 10 | D) | 40 |

(12) The true class limits for the first class are:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | 26 - 35 | B) | 21.5 - 35.5 | C) | 25.5 - 34.5 | D) | 25.5 - 35.5 |

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**Let A and B be two independent events. Suppose that P(A) =0.6 and P(B) =0.3 then**

(13) $P(\overline{A} \cap B)$ is equal to:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | 0.08 | B) | 0.12 | C) | 0.20 | D) | 0.42 |

(14) $P(A \cup B)$ is equal to:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | 0.72 | B) | 0.90 | C) | 0.10 | D) | 0.7 |

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**Suppose that a town has 20% of men known to have a certain disease. A certain medical test is applied to randomly selected 500 men. The following data is obtained.**

| | **Disease** | | |
|---|---|---|---|
| **Test** | **Present** | **Absent** | **Total** |
| **Positive** | **82** | **80** | **162** |
| **Negative** | **38** | **300** | **338** |
| **Total** | **120** | **380** | **500** |

Let an individual be selected at random from the sample.

(15) The probability that the selected person has the disease is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | 0.20 | B) | 0.24 | C) | 0.68 | D) | 0.32 |

(16) The probability that the test gives a false negative result is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | 0.32 | B) | 0.68 | C) | 0.21 | D) | 0.79 |

(17) The sensitivity of the test is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | 0.68 | B) | 0.16 | C) | 0.51 | D) | 0.79 |

(18) Suppose that 20% of men in the town have the disease, the predictive probability negative for the test is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | 0.37 | B) | 0.91 | C) | 0.09 | D) | 0.89 |

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**In a large population of people, 34% have blood type A+. We choose randomly 8 persons from this population. Let X = the number of persons having blood type A+ among the 8.**

(19) The values of the parameters of the distribution of X are:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | 3 and 0.34 | B) | 8,and 0.66 | C) | <u>8 and 0.34</u> | D) | 8 and 34 |

(20) The probability that there is exactly one person with blood type A+ is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | <u>0.1484</u> | B) | 0.0028 | C) | 0.3400 | D) | 0.0185 |

(21) The probability that there is at least one person with blood type A+, is :

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | 0.1484 | B) | 0.1844 | C) | <u>0.9640</u> | D) | 0.0360 |

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The number of serious surgical operations that are performed in a hospital during a day follows a Poisson distribution with an average of 5 persons per day, then:

(22) The probability that no operations is performed in the next day is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | 0.99996 | B) | 0.08972 | C) | 0.54210 | D) | <u>0.0067</u> |

(23) The probability that 5 operations are performed in the next day is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | 0.2145 | B) | 0.8521 | C) | <u>0.175</u> | D) | 0.5124 |

(24) The average number of operations that are performed in two days is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | 20 | B) | <u>10</u> | C) | 5 | D) | 30 |

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**In a population of people, X = the body mass index (in kg/m$^2$) is normally distributed with mean $\mu$ = 25 and standard deviation $\sigma$ = 2. For a randomly chosen person,**

(25) $P(24 < X < 26) =$

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | 0.6915 | B) | <u>0.3830</u> | C) | 0.2085 | D) | 1 |

(26) $P(X = 21) =$

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | 0.9772 | B) | 0.0228 | C) | 1 | D) | <u>0</u> |

(27) The value of k such that $P(X > k) = 0.2578$, is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | 0.257 | B) | 25 | C) | - 0.65 | D) | <u>26.3</u> |

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**A sample of size 100 is taken from a population having a proportion $p_1 = 0.8$. Another independent sample of size 400 is taken from a population having a proportion $p_2 = 0.5$.**

(28) The sampling distribution for the difference in sample proportions has a mean equal to:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | 0.3 | B) | 1.3 | C) | 0 | D) | 0.8 |

(29) The sampling distribution for the difference in sample proportions has a standard error equal to:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | 0.015 | B) | 0.0022 | C) | 0.047 | D) | 0.1239 |

(30) $\mathrm{P}(\hat{p}_1 - \hat{p}_2 < 0.2) =$ :

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | 0.4423 | B) | 0.993 | C) | 0.0166 | D) | 0.2415 |

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**Suppose it has been established that for a certain type of clients, the average length of a home visit by a public health nurse is 45 minutes with a standard deviation of 15 minutes, and that for a second type of clients, the average home visit time is 30 minutes with a standard deviation of 20 minutes. If a nurse randomly visits 35 clients from the first population and 40 from the second population, then**

(31) The mean of the difference between two sample means is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | 5 | B) | 15 | C) | 20 | D) | 35 |

(32) The standard error of the difference between two sample means is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | 4.0532 | B) | 16.4286 | C) | 8.2143 | D) | 0.5241 |

(33) The probability that the average length of home visit will differ between the two groups by 20 or more is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | 0.8907 | B) | 0.4215 | C) | 0.5 | D) | 0.1093 |

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**A researcher wishes to determine if vitamin E supplements could increase cognitive ability among elderly women. In 1999 the researcher recruits a sample of elderly women age 75-80. At the time of the enrollment into the study, the women were randomized to either take Vitamin E, or a placebo for six months. At the end of the six month period, the women were given a cognition test. Higher scores on this test indicate better cognition. The mean of the test scores of 81 women who took vitamin E supplements was $\overline{X}_1$ = 27, while the mean of the test scores of the 90 women who took placebo supplements was $\overline{X}_2$ = 24 Assuming the two populations follow approximately two different normal distributions with standard deviations, $\sigma_1$ = 6.9 and , $\sigma_2$ = 6.2, respectively.**

(34) The point estimate for the difference between the two population means ($\mu_1$-$\mu_2$):

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | 27 | B) | 24 | C) | 6.2 | D) | 3 |

(35) The standard error for the difference between the two sample means is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | 6.9 | B) | 6.2 | C) | 1.007 | D) | 3 |

(36) A lower limit of a 95% confidence interval for the difference between the two population means is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | 1.0263 | B) | 4.9745 | C) | 5.9120 | D) | 1.2354 |

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**Six healthy three year old female sheep were injected with the antibiotic Gentamicin, at a dosage of 10 mg/kg body weight. Their blood serum concentrations (mg/ml) of Gentamicin after injection were 33; 26; 34; 31; 23; 25, the summary statistics for these data are**

| n | mean | Standard deviation | SE of mean |
|---|---|---|---|
| 6 | 28.67 | 4.59 | 1.87 |

**Assuming the data follows approximately a normal distribution,**

(37) At the 90% level of confidence, the reliability coefficient is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | 2.33 | B) | 2.015 | C) | 3.215 | D) | 1.96 |

(38) The 90% confidence interval for the population mean score on this test is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | (27.412, 30.145) | B) | (24.48, 29.10) | C) | (24.902, 32.438) | D) | (32.48, 39.55) |

(39) The value of the test statistic, for testing the hypothesis $H_0 : \mu = 30 \ vs \ H_1 : \mu < 30$ is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | -2.2587 | B) | 2.5812 | C) | -0.7112 | D) | 3.3412 |

(40) At the 5% significance level, the critical region is :

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | (-∞, -2.015) | B) | (-2.015, 2.015) | C) | (2.015, ∞) | D) | (2.58, ∞) |

(41) At the 5% significance level, we are able to :

| | | | | | |
|---|---|---|---|---|---|
| A) | Reject $H_0$ | B) | Can not reject $H_0$ | C) | Decision is not possible |

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**A Biostatistician, found that among 2000 boys in the age group 7 to 12 years, 400 were overweight. On the basis of this study:**

(42) The standard error of the sample proportion of the overweight boys in the age group 7 to12 years is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | 0.0500 | B) | 0.0221 | C) | 0.6587 | D) | 0.0089 |

(43) The 99% upper confidence limit for the population proportion of the overweight boys in the age group 7 to12 years is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | 0.5000 | B) | 0.0221 | C) | 0.6587 | D) | <u>0.223</u> |

(44) The value of the test statistic for testing the hypotheses the proportion of boys in the age group 7 to 12 years is 0.18, is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | -2.2587 | B) | <u>2.33</u> | C) | -0.7112 | D) | 3.3412 |

(45) At the 5% significance level, can we conclude that more than 18% of boys in the age group 7 to 12 years are overweight:

| | | | | | |
|---|---|---|---|---|---|
| A) | <u>Yes</u> | B) | No | C) | Decision is not possible |

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**A sample of 25 freshman nursing students made a mean score of 77on a test designed to measure the attitude toward the dying patients. The sample standard deviation was 10. Assume that the data comes from a normal population.**

(46) The statistical hypothesis for testing the hypothesis that the mean score is different than 80 is:

| | | | |
|---|---|---|---|
| A) | <u>$H_0: \mu = 80 \ vs \ H_1: \mu \neq 80$</u> | B) | $H_0: \mu = 80 \ vs \ H_1: \mu < 80$ |
| C) | $H_0: \mu = 80 \ vs \ H_1: \mu > 80$ | D) | $H_0: \mu = 77 \ vs \ H_1: \mu < 77$ |

(47) The appropriate test statistic for testing the mean score is different than 80 is:

| | | | |
|---|---|---|---|
| A) | $z = \frac{x - 80}{\sigma}$ | B) | $z = \frac{\bar{x} - 80}{\sigma / \sqrt{n}}$ |
| C) | $t = \frac{x - 80}{S / \sqrt{n}}$ | D) | <u>$t = \frac{\bar{x} - 80}{S / \sqrt{n}}$</u> |

(48) The value of the test statistic for the statistical hypothesis is:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) | <u>-1.500</u> | B) | -2.025 | C) | 3.258 | D) | 0 |

(49) The test rejects, at 5% significance level, the hypothesis that the mean score is 80 if:

| | | | |
|---|---|---|---|
| A) | $z > 1.96$ | B) | $z < -1.96 \quad or \quad z > 1.96$ |
| C) | <u>$t < -2.064 \quad or \quad t > 2.064$</u> | D) | $t > 1.71$ |

(50) At the 5% significance level we are able to :

| | | | | | |
|---|---|---|---|---|---|
| A) | Reject $H_0$ | B) | <u>Can not reject $H_0$</u> | C) | Decision is not possible |