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STAT 324
Final Examination
Second Semester 1431 – 1432 H

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INSTRUCTIONS:

- Answer all questions.
- Do not copy answers from your neighbors; they have different question forms.
- Mobile Telephones are not allowed in the classroom.
- Time allowed is 3 Hours
- For each question, put the code of the correct answer in the following table beneath the question number. Please use capital letters: A, B, C, and D.

1	2	3	4	5	6	7	8	9	10
C	A	A	C	B	B	A	C	B	D

11	12	13	14	15	16	17	18	19	20
C	A	C	B	A	D	C	C	B	C

21	22	23	24	25	26	27	28	29	30
D	A	B	D	C	D	A	B	B	C

31	32	33	34	35	36	37	38	39	40
C	B	B	B	C	A	A	C	C	D

41	42	43	44	45	46	47	48	49	50
C	A	B	A		D	B	C	B	B

Term Marks	Final Exam. Marks	Total Marks

QUESTION (1)

Let X be a continuous random variable with probability density function given by:

$$f(x)=\begin{cases}2(1-x), & 0<x<1\\ 0, & elswhere\end{cases}$$

(1) The expected value of X [μ = E(X)] equals:

(A) 0.25	(B) 2.25	(C) 0.33	(D) 0.50

(2) The variance of X [σ^2 = Var(X)] equals

(A) 0.056	(B) 0.113	(C) 0.037	(D) 0.333

(3) $P(X=0.5)$ equals:

(A) 1	(B) 0.5	(C) 0.1	(D) 0

(4) $P(0.5<X<1)$ equals:

(A) 0.64	(B) 0.45	(C) 0.25	(D) 0.75

(5) The cumulative distribution function [F(x)] for 0 <x <1, equals:

(A) (2-x)	(B) x(2-x)	(C) x-2	(D) $x(x^2-1)$

QUESTION (2)

Suppose that a survey of 500 parents was conducted. The survey asked questions about whether or not the person had a child in college and about the cost of attending college. Results are shown in the table below.

	Cost Too Much (M)	Cost Just Right (R)	Cost Too Low (L)
Child is in College (A)	150	65	5
Child is not in College (B)	100	125	55

Suppose one person is chosen at random.

(6) The probability that the person thinks college cost is just right given that he has a child in college equals:

(A) 0.512	(B) 0.295	(C) 0.384	(D) 0.842

(7) The probability that the person does not have a child in college and he thinks that the college cost is too low equals:

(A) 0.11	(B) 0.20	(C) 0.917	(D) 0.25

(8) The probability that the person thinks college cost is too low or he does not have a child is in college equals:

(A) 0.242	(B) 0.38	(C) 0.57	(D) 0.83

QUESTION (3)

Suppose that a factory has two machines: machine A and machine B. These machines make widgets. Machine A makes 800 widgets per day and 1% of these are defective.

Machine B makes 200 widgets per day of which 2% are defective. If we select a widget product by the factory, then:

(9) The probability that a widget produced by the factory will be defective equals:

(A) 0.02	(B) 0.012	(C) 0.8	(D)0.03

(10) The probability that the widget is produced by machine A, given that it is defective equals:

(A) 0.9	(B) 0.333	(C) 0.03	(D) 0.667

QUESTION (4)

Consider the following probability function:

x	0	1	2	3
f(x)= P(X=x)	0.216	0.432	0.288	0.064

(11) The mean (expected value) of X equals:

(A) 1.5	(B) 0.25	(C) 1.2	(D) 1.8

(12) The variance of X equals:

(A) 0.72	(B) 2	(C) 2.16	(D) 1.25

(13) The P(X <2) equals:

(A) 0.288	(B) 0.432	(C) 0.648	(D) 0.936

QUESTION (5)

Let X and Y be two independent random variables such that $\mu_X = 1$, $\sigma_X^2 = 2$, $\mu_Y = -2$, and $\sigma_Y^2 = 1$

(14) The value of E(X-3Y+1) equals:

(A) 11	(B) 8	(C) – 4	(D) 40

(15) The value of Var(X-3Y+1) equals:

(A) 11	(B) 8	(C) 20	(D) – 7

(16) The value of $E(Y^2)$ equals:

(A) 1	(B) 2	(C) 0.8	(D) 5

(17) The lower bound for P(-4 < Y < 0) equals:

(A) 1.0	(B) 0.25	(C) 0.75	(D) 0.5

QUESTION (6)

Suppose that 15 % of new residential central air conditioning units installed by a supplier need additional adjustments requiring a service call. Assume that a recent sample of 7 such units constitutes a Bernoulli process. Let X be the number of units among these 7 that need additional adjustments.

(18) The probability that exactly 2 units need additional adjustments equals::

(A) 0.1564	(B) 1.0521	(C) 0.2097	(D) 0.1631

(19) The probability that at least one unit needs additional adjustments equals:

(A) 0.152	(B) 0.679	(C) 1.052	(D) 0.163

(20) The mean number of units that need additional adjustments equals:

(A) 0.15	(B) 0.32	(C) 1.05	(D) 0.16

(21) The variance of X equals:

(A) 0.5892	(B) 0.2598	(C) 0.5298	(D) 0.8925

QUESTION (7)

In a certain communications system, there is an average of one transmission error per 10 seconds. Let the distribution of transmission errors be Poisson, then:

(22) the probability that there is exactly 2 transmission error per 10 seconds equals:

(A) 0.184	(B) 0.285	(C) 0.124	(D) 0.247

(23) the probability that there is at least two transmission errors per 10 seconds equals:

(A) 0.814	(B) 0.264	(C) 0.352	(D) 0.514

(24) the probability of more than one error in a communication per half minute in duration equals:

(A) 0.950	(B) 0.262	(C) 0.738	(D) 0.801

(25) the average number of transmission errors per one minute equals:

(A) 7	(B) 8	(C) 6	(D) 4

QUESTION (8)

The diameters of steel disks produced in a plant are normally distributed with a mean of 2.5 cm and standard deviation of 0.02 cm.

(26) The probability that a disk picked at random has a diameter greater than 2.54 cm equals:

(A) 0.9772	(B) 0.2000	(C) 0.1587	(D) 0.0228

(27) The probability that a disk picked at random has a diameter less than 2.52 cm equals:

(A) 0.8413	(B) 0.3148	(C) 0.2716	(D) 0.4138

(28) The probability that a disk picked at random has a diameter less than 2.54 cm and greater than 2.52 equals:

(A) 0.6843	(B) 0.1359	(C) 0.3871	(D) 0.9124

QUESTION (9)

In an investigation on toxics produced by molds that infect corn crops, a biochemist prepares extracts of the mold culture and then measures the amount of the toxic substance per gram of solution. From six extracts of the mold culture the following information is obtained:

n	Mean ($\bar{X}$)	Standard deviation (S)
6	0.950	0.251

Assume that the data follows approximately a normal distribution.

(29) The standard error of the sample mean equals:

(A) 0.25	(B) 0.102	(C) 4.59	(D) 28.67

(30) A point estimate of the population mean equals:

(A) 1.87	(B) 4.59	(C) 0.950	(D) 0.25

(31) The lower bound of 90% confidence interval for the population mean equals:

(A) 2.412	(B) 1.48	(C) 0.744	(D) 0.12

QUESTION (10)

Samples of hamburger were selected from two different outlets of a large supermarket to measure the percentage of fat present in the meat, with the following summary data.

	Outlet 1	Outlet 2
n	5	10
mean	10.3	10.7
Standard Deviation	1.6	2.3

It is reasonable to believe that both outlets are drawn from two normal populations having the same variability. Hence,

(32) The pooled standard deviation is:

A)	1.95	B)	2.11	C)	4.38	D)	3.54

(33) The degrees of freedom of the pooled estimate in the previous question is:

A)	15	B)	13	C)	7.5	D)	10

(34) The 99% lower confidence limit for the difference between the two population means (μ_1-μ_2) is:

A)	0.5000	B)	-3.881	C)	0.6587	D)	0.0221

(35) The 99% upper confidence limit for the difference between the two population means is:

A)	0.5000	B)	0.2231	C)	3.081	D)	0.0221

(36) At the 99% confidence level, can we conclude that there is no significance difference between the two outlets:

A)	Yes	B)	No	C)	Decision is not possible		

QUESTION (11)

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 $p_2 = 0.5$.

(37) The sampling distribution for the difference in sample proportions has a mean equals:

(A) 0.3	(B) 1.3	(C) 0	(D) 0.8

(38) The sampling distribution for the difference in sample proportions has a standard error equals:

(A) 0.015	(B) 0.0022	(C) 0.047	(D) 0.1239

(39) $P(\hat{p}_1 - \hat{p}_2 < 0.2)$ equals:

(A) 0.4423	(B) 0.993	(C) 0.0166	(D) 0.2415

QUESTION (12)

A researcher wishes to compare the resistance of two types of wires. In a sample of 81 resistance readings of type A, the mean is $\overline{X}_A = 27$ ohm. In a sample of 90 resistance readings of type B, the mean is $\overline{X}_B = 24$ ohm. Assuming the two populations follow approximately two different normal distributions with standard deviations $\sigma_A = 6.9$ ohm and $\sigma_B = 6.2$ ohm.

(40) The point estimate for the difference between the two populations means (μ_A-μ_B):

(A) 27	(B) 24	(C) 6.2	(D) 3

(41) The standard error for the difference between the two sample means ($\overline{X}_A - \overline{X}_B$):

(A) 6.9	(B) 6.2	(C) 1.007	(D) 3

(42) the maximum amount of error to estimate 95% confidence interval for the difference between the two population means (μ_A-μ_B):

(A) 1.975	(B) 3.949	(C) 1.596	(D) 1.007

(43) A width of the 95% confidence interval for the difference between the two population means (μ_A-μ_B):

(A) 1.975	(B) 3.949	(C) 1.596	(D) 1.007

QUESTION (13)

A sample of 25 freshman students made a mean score of 77 on a test designed to measure the attitude toward colleges. The sample standard deviation was 10. Assuming the data comes from a normal population. Answer the following:

(44) The statistical hypothesis for testing the hypothesis that the mean score is different from 80 is:

(A) $H_0: \mu = 80$ vs $H_1: \mu \neq 80$	(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 $H_1: \mu < 77$

(45) The value of the test statistic equals:

(A) -1.500	(B) -2.025	(C) 3.258	(D) 0

(46) At the 5% significance level, the rejection region is:

(A) $(2.046, \infty)$	(B) $(5.821, 6.972)$
(C) $(-\infty, -2.046)$	(D) $(-\infty, -2.046) \cup (2.046, \infty)$

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

(A) Reject H_0	(B) Don't Reject H0	(C) Decision is not possible

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QUESTION (14)

A study was conducted to compare between the proportions of smokers in two universities. Two independent random samples gave the following data:

	Univ. (1)	Univ. (2)
Sample size	200	300
Number of smokers	100	120

We wish to conduct a hypothesis test to determine if this data provide sufficient statistical evidence to indicate that the percentage of students who smoke differs for these two universities, at $\alpha=0.01$.

$\frac{\alpha}{2} = 0.005$

(48) The null and alternative hypotheses is:

(A) $H_0: P_1=P_2$, $H_1: P_1>P_2$	(B) $H_0: P_1=P_2$, $H_1: P_1<P_2$
(C) $H0: P1=P2$, $H1: P1 \neq P2$	(D) $H_0: P_1<P_2$, $H_1: P_1>P_2$

(49) The value of the test statistic equals:

(A) 1.026	(B) 2.21	(C) 0.327	(D) 0.045

(50) The decision is:

(A) Reject H_0	(B) Don't Reject H0	(C) Decision is not possible