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SOLVED ASSIGNMENT

All In One

BCS-040

Statistical Techniques

Prepared by

ISM

730-339-3555

www.ignoustudymentor.com

@ism_ignoustudymentor_

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STEP 1

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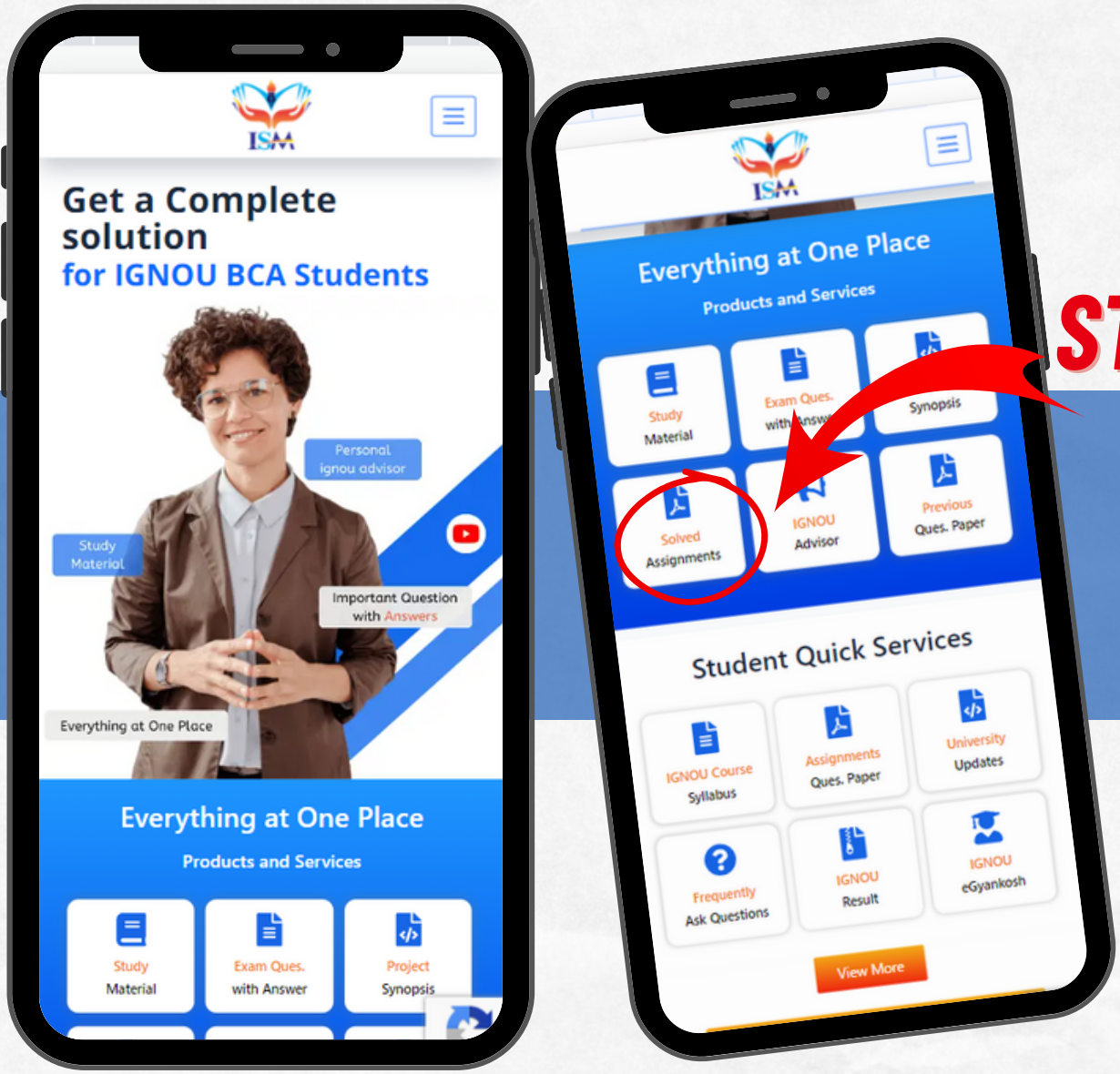

STEP 2

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STATISTICAL TECHNIQUES [SEM-4]

Ques Q6. Suppose A and B are two independent events, associated with a random experiment. If the probability of occurrence of either A and B equals 0.6, while probability that only A occurs equals 0.4, then determine the probability of occurrence of event B.

Ans.

Given that,

$P(A \cup B) = 0.6$

$P(A) = 0.4$

$P(A \cap B) = P(A) \cdot P(B)$

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$0.6 = 0.4 + P(B) - P(A) \cdot P(B)$

$0.6 - 0.4 = P(B)(1 - 0.4)$

$0.2 = P(B)(0.6)$

$P(B) = \frac{0.2}{0.6}$

$P(B) = \frac{1}{3} = 0.333$

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STATISTICAL TECHNIQUES [SEM-4]

Ques Q7. A chemical firm wants to determine how four catalysts differ in yield. The firm runs the experiment in three of its plants, types A, B, C. In each plant, the yield is measured with each catalyst. The yield (in quintals) are as follows:

Plant	Catalyst			
	1	2	3	4
A	2	1	2	4
B	3	2	1	3
C	1	3	3	1

(a) Perform an ANOVA and comment whether the yield due to a particular catalyst is significant or not at 5% level of significance. Given F36-4.76.

(b) Construct ANOVA table for one-way classification.

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STATISTICAL TECHNIQUES [SEM-4]

H_0 : These Four catalysts differs in yield

H_1 : H_0 is false.

Plant	Catalysts			
	X_1	X_2	X_3	X_4
A	2	1	2	4
B	3	2	1	3
C	1	3	3	1
	6	6	6	8

$\bar{X_1} = \frac{6}{3} = 2$; $\bar{X_2} = \frac{6}{3} = 2$; $\bar{X_3} = 2$

$\bar{X_4} = \frac{8}{3} = 2.67$

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STATISTICAL TECHNIQUES [SEM-4]

$DF_{B/w} = K-1 = 4-1 = 3$

$DF_{within} = N-K = 12-4 = 8$

Grand Mean $(\bar{\bar{x}}) = \frac{26}{12} = 2.167$

$SS_{total} = \Sigma (x_i - \bar{\bar{x}})^2$

$= (2-2.167)^2 + (1-2.167)^2 + \ldots + (1-2.167)^2$

$= 12.417$

$SS_{within} = \Sigma (x_{i1} - \bar{x}_1)^2 + \Sigma (x_{i2} - \bar{x}_2)^2 + \Sigma (x_{i3} - \bar{x}_3)^2 + \Sigma (x_{i4} - \bar{x}_4)^2$

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STATISTICAL TECHNIQUES [SEM-4]

$= (2-2)^2 + (3-2)^2 + (1-2)^2 + (1-2)^2 + (2-2)^2 + (3-2)^2$
$+ (2-2)^2 + (1-2)^2 + (3-2)^2 + (4-2.67)^2 +$

$+ (3-2.67)^2 + (1-2.67)^2$

$= 3 + 3 + 1.7689 + 0.1089 + 2.7889$
$= 10.67$

$SS_{Btw} = SS_{Total} - SS_{within}$
$= 12.417 - 10.67$
$= 1.749$

$MS_{Btw} = \frac{SS_{Btw}}{DF_{Btw}} = \frac{1.747}{3} = 0.5823$

$MS_{within} = \frac{SS_{within}}{DF_{within}} = \frac{10.67}{8} = 1.334$

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STATISTICAL TECHNIQUES [SEM-4]

$$F\text{-ratio} = \frac{MS_{Between}}{MS_{within}} = \frac{0.5823}{1.334} = 0.4365$$

F_{ratio} (Calculated) $\leq$ F_{ratio} (Given)

H_0 is accepted

(b) We can conclude that, with 95% level of significance the yield due to particular catalyst is not significant.

Source of variance	DF	SS	MS	F
Between	3	1.747	0.5823	0.4365
within	8	10.67	1.334	
Total	11	12.417		

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STATISTICAL TECHNIQUES [SEM-4]

Ques.8 Explain the following with the help of an example each:

a) Binomial Distribution

b) t-test for men

c) Properties of good estimator

d) f-test for Equality of two variances

Ans. a) Binomial distribution is a common probability distribution that models the probability of obtaining one of two outcomes under a given number of parameters. It summarizes the number of trials when each trial has the same chance of attaining one specific outcome. The value of a binomial is obtained by multiplying the number of independent trials by the successes. Binomial distribution models the probability of occurrence of an event when specific criteria are met

Binomial Distribution Formula

$$P(x) = \binom{n}{x} p^x q^{n-x} = \frac{n!}{(n-x)!x!} p^x q^{n-x}$$

where
n = the number of trials (or the number being sampled)
x = the number of successes desired
p = probability of getting a success in one trial
q = 1 - p = the probability of getting a failure in one trial

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STATISTICAL TECHNIQUES [SEM-4]

For example, if we toss a coin, there could be only two possible outcomes: heads or tails, and if any test is taken, then there could be only two results: pass or fail. This distribution is also called a binomial probability distribution.

Ans. b) A T-test is the final statistical measure for determining differences between two means that may or may not be related. The testing uses randomly selected samples from the two categories or groups. It is a statistical method in which samples are chosen randomly, and there is no perfect normal distribution.The type of T-test to be conducted is decided by whether the samples to be analyzed are from the same category or distinct categories. The inference obtained in the process indicates the probability of the mean differences to have happened by chance.

For example, if one wishes to figure out if the mean of the length of petals of a flower belonging to two different species is the same, a T-test can be done. The user can select petals randomly from two other species of that flower and come to a standard conclusion.

Ans. C) Properties of good estimator

Bias: Bias refers to the expected difference between the estimated value of parameter (on a specific sample) and the “true” one (in the true model). Having unbiased estimates of parameters is important because they should lead to more accurate forecasts.

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STATISTICAL TECHNIQUES [SEM-4]

Efficiency: Efficiency means, if the sample size increases, then the estimated parameters will not change substantially, they will vary in a narrow range (variance of estimates will be small). In the case with inefficient estimates the increase of sample size and may lead to the change of a parameter.

Consistency: Consistency means that our estimates of parameters will get closer to the stable values (true value in the population) with the increase of the sample size.

Ans. D) The F statistic in an F test for the equality of two variances is calculated as the ratio of the larger sample variance to the smaller sample variance. It is used to determine whether the difference between the two sample variances is statistically significant.

Each member of the F-distribution family is specified by a pair of parameters called degrees of freedom and denoted df1 and df2 for different pairs of degrees of freedom.

An F random variable is a random variable that assumes only positive values.

If the variances are equal, the ratio of the variances will equal 1. For example, if you had two data sets with a sample 1 (variance of 10) and a sample 2 (variance of 10), the ratio would be 10/10 = 1

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