Virtual University	Final-term EXAMINATION SEMESTER Fall 2004 STA-301 Statistics and probability(Paper-1)	Total Marks:50 Duration:120min

Student ID / Login ID.	
Name.	
PVC Name /Code	
Date	

Maximum Time Allowed: (2 Hours)

Please read the following instructions carefully before attempting any of the questions:

1. **Attempt all questions. Marks are written adjacent to each question.**
2. **Do not ask ay questions about the contents of this examination from anyone.**
   a. **If you think that there is something wrong with any of the questions, attempt it to the best of your understanding.**
   b. **If you believe that some essential piece of information is missing, make an appropriate assumption and use it to solve the problem.**
   c. **Write all steps, missing steps may lead to deduction of marks.**
3. **You are allowed to use the calculator & Statistical tables in order to solve the questions.**
4. **For your convenience we are providing you the following symbols,**

$$\rfloor \;,\cap,\; X_\; t\langle \quad ,t\langle(v),\;,\circledR_1,\circledR_2,\;,\propto,\propto_1,\propto_2,\propto_3,\propto \;{}_4,\propto_2,\propto_2^3,\;,\lceil_2,\lceil_4,\rfloor x,\rfloor y,\rfloor xy,\rfloor x_2,\rfloor + \;{}^{+\rfloor}$$

$$2^{(v)} \qquad \rfloor\!\rfloor$$

$$y_2,$$

For Teacher's use only

Questions	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Marks								
Questions	Q9	Q10		Total				
Marks								

Question No: 1 **Marks:1**

If mean=median=mode then curve is symmetric.

- ○ True
- ○ False

Question No: 2 **Marks:1**

Distribution Function is also called the step function.

- ○ True
- ○ False

Question No: 3 **Marks:1**

In the case of sampling with replacement as well as in the case of sampling without replacement, we have:

$\mu_{\bar{x}} = \mu$

- ○ True
- ○ False

Question No: 4 **Marks:1**

The rejection region is also called the critical region.

- ○ True
- ○ False

Question No: 5 **Marks:4**

Describe the continuous and discrete random variable with example.

Continuous Random Variable:

A random variable is called continuous if the set of value is an entire interval on the number line i.e., the sample space S is continuous. The outcomes of an experiment are represented by the point on the line.

Discrete Random Variable:

A random variable is called discrete if the set of values it taken is a collection of isolated points on a real line i.e., the sample space S is a discrete sample space. The outcomes of an experiment is noted.

Question No: 6 **Marks:4**

Define and describe the Least Significance Difference (LSD).

When the null hypothesis of equal means is rejected by **F-Test** after the **ANOVA** we can test the significance of difference between means of treatments by using the ordinary two samples **t-Test** on every pair at significance level **α**.

The smallest difference is called the least significance difference(LSD) and is given by:

$$LSD = t_{\frac{\alpha}{2};(v)} \sqrt{\frac{2(MSE)}{r}}$$

Where, **MSE** is a mean square error, **r** is the size of equal samples, and $t_{\frac{\alpha}{2};(v)}$ is the value of t.

Question No: 7 **Marks:4**

Write down the properties of normal distribution.

The following are the main properties of the normal distribution:

1- Continuous Distribution

The normal probability distribution is a continuous distribution that ranges from $-\infty to +\infty$.

2- Total Probability

The total area under the normal curve is unity.

3- Mods and Maximum ordinate

The normal probability function is unimodal, its mode is μ and its maximum ordinate at x = μ is

$$f(\mu)=\frac{1}{\sigma\sqrt{2\pi}}$$

4- Symmetrical Distribution

The normal probability distribution is a symmetrical distribution. Thus

i) Mean = Median = Mode

ii) $x_{0.75}-\mu=\mu-x_{0.25}$ Where, μ is mean, $x_{0.25}$ is 1st Quartile and $x_{0.75}$ is 3rd Quartile.

iii) All odd order moments about mean are zero.

$$\mu_1=\mu_3=\mu_5=....=0$$

5- Special areas under the curve

i) $P(\mu-\sigma<X<\mu+\sigma)=0.6827$

ii) $P(\mu-2\sigma<X<\mu+2\sigma)=0.9545$

iii) $P(\mu-3\sigma<X<\mu+3\sigma)=0.9973$

NOTE:

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6- Median, Quartiles, Quartile Deviation

$$x_{0.5}=\mu,\quad x_{0.25}=\mu-0.6745\sigma,\quad x_{0.75}=\mu+0.6745\sigma$$

$$Q.D(X)=\frac{x_{0.75}-x_{0.25}}{2}=0.6745\sigma\approx\frac{2}{3}\sigma$$

$$\mu=\frac{x_{0.25}+x_{0.75}}{2},\qquad \sigma=\frac{x_{0.75}-x_{0.25}}{1.349}$$

7- Variance, Standard Deviation and Mean Deviation

$$Var(X)=\sigma^2$$

$$S.D(X)=\sigma$$

$$M.D(X)=\sigma\sqrt{\frac{2}{\pi}}=0.7979\sigma\approx\frac{4}{5}\sigma$$

8- Moments and Moment Ratios

$$\mu_1=0,\quad \mu_2=\sigma^2,\quad \mu_3=0,\quad \mu_4=3\sigma^4$$

$$\beta_1=\frac{\mu_3^{\,2}}{\mu_2^{\,3}}=\frac{0}{(\sigma^2)^3}=0,\qquad \beta_2=\frac{\mu_4}{\mu_2^{\,2}}=\frac{3\sigma^4}{(\sigma^2)^2}=3$$

9- Point of Inflexion

The points of inflexion of the normal probability density function are equidistant from mean μ, are at x = μ-σ and x = μ+σ. The normal distribution is a bell shaped distribution.

10- Asymptotic Curve

The normal curve is asymptotic to the x- axis, that is, $|x|$ grows without bound, the curve get closer and closer to the x-axis but always stay above it.

11- Reproductive Property

If X_1 and X_2 are two independent normal random variables having distributions $N(\mu_1,\sigma_1^2)$ and $N(\mu_2,\sigma_2^2)$

respectively, their sum $X_1 + X_2$ is also a normal variable having the distribution.

$N(\mu_1 + \mu_2, \sigma_1^2 + \sigma_2^2)$.

Question No: 8 **Marks:4**

Discuss on null and alternative hypothesis.

Null Hypothesis

A null hypothesis is denoted by H_0, is that hypothesis which is tested for possible rejection (or nullification) under the assumption that it is true.

A null hypothesis is always a statement of either (1) "no effect" or (2) "the status quo", such as the given coin is unbiased, there is no difference between the two production methods, or the production line requires no preventive maintenance, etc. This experiment is conducted to see if the null hypothesis is unreasonable.

Alternative Hypothesis

An alternative hypothesis is denoted by H_1, is that hypothesis which we are willing to accept when null hypothesis is rejected.

An alternative hypothesis gives the opposing conjecture to the given in the null hypothesis. The alternative hypothesis is often called research hypothesis, because this hypothesis expresses the theory that the experiment, believes this experiment is conducted to see if the alternative hypothesis is supported.

Question No: 09 **Marks:10**

A continuous random variable X that can assume values between x=1 and x=4 has a density function given by

$f(x) = \frac{1}{3}$

a. Show that the area under the curve is equal to 1.

b. Find $p(1.5 < X < 3)$

SOLUTION:

We are given that , a function

$f(x) = \frac{1}{3}$, and $1 \le x \le 4$

a) Show that the area under the curve is equal to 1.

We have to show that,

$$\int_{-\infty}^{+\infty} f(x)dx = 1$$

So,

$$\int_1^4 \frac{1}{3} dx = 1, \qquad \frac{1}{3}\int_1^4 dx = 1$$

$$\frac{1}{3}[x]_1^4 = 1, \qquad \frac{1}{3}[4-1] = 1$$

$$\frac{1}{3}[3] = 1, \qquad 1 = 1$$

Hence proved that the given function is a density function.

b) Find $p\left(1.5 < X < 3\right)$

$$P(1.5 < X < 3) = \int_{1.5}^{3} \frac{1}{3} dx$$

$$= \frac{1}{3}\int_{1.5}^{3} dx = \frac{1}{3}\left[x\right]_{1.5}^{3}$$

$$= \frac{1}{3}\left[3-1.5\right] = \frac{1}{3}\left[1.5\right]$$

$$= 0.5$$

Question No: 10 **Marks:10**

Let X and Y be two discrete r.vs with the following joint p.d.f.

x **y**	2	4
1	0.1	0.15
3	0.2	0.30
5	0.1	0.15

Find E (X) and E (Y).

SOLUTION:

We are given that a joint p.d.f.

x **y**	2	4	**h(y)**
1	0.1	0.15	0.25
3	0.2	0.30	0.50
5	0.1	0.15	0.25
g(x)	0.4	0.6	1

x	g(x)	xg(x)
2	0.4	0.8
4	0.6	0.24
Total	_	1.04

y	h(y)	yh(y)
1	0.25	0.25
3	0.50	1.5
5	0.25	1.25
Total	_	3

We have to find E(x) and E(y),

We know that,

$$E(X) = \Sigma x g(x)$$

$$= 1.04$$

And,

$$E(Y) = \Sigma y h(y)$$

$$= 3$$

THE END

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