Statistics and Probability Assignment

1. Karina makes mistakes in class according to Poisson process with an average rate of 1.2 mistakes per class.

● What is the probability that Karina makes at least 3 mistakes during one class?

$\lambda = 1.2$ [for 1 class]

This is following poison Distribution

$$P(X=x) = \frac{\lambda^x . e^{-\lambda}}{x!}$$

So here Karina makes atleast 3 mistakes during one class

i.e, $p(X \geq 3)$

$$p(X \geq 3) = 1 - [p(x=0) + p(x=1) + p(x=2)]$$

$$= 1 - \left[\frac{1.2^0 . e^{-1.2}}{0!} + \frac{1.2^1 . e^{-1.2}}{1!} + \frac{1.2^2 . e^{-1.2}}{2!}\right]$$

$$= 1 - [0.3012 + 0.3614 + 0.2169]$$

$$= 1 - 0.8795$$

$$= 0.1205$$

$$\boxed{p(X \geq 3) = 0.1205}$$

● What is the probability that Karina makes exactly 10 mistakes during two weeks of classes?

b) Karina makes exactly 10 mistakes during two weeks of class

∴ for two weeks 12 classes

$\lambda = 1.2(12)$

$= 14.4$

$P(X=10) = \frac{(14.4)^{10} \cdot e^{-14.4}}{10!} = \frac{213690909}{3628800}$

$\boxed{P(X=10) = 0.0588}$

suppose if we assume Karina teaches MWF lecture

then $\lambda = 1.2(6)$

$= 7.2$

$P(X=10) = \frac{(7.2)^{10} \cdot e^{-7.2}}{10!}$

$P(X=10) = 0.0770 \rightarrow$ for MWF lecture

M – monday

W = wednesday

f – friday

2. When Stephan plays chess against his favourite computer program, he wins with probability 0.60, loses with probability 0.10, and 30% of the games result is a draw. Assume that the event is independent.

- Find the probability that he wins 7 games and draws 5 games.

a) here it is following multinomial distribution

$$P(X_1=n_1,\ X_2=n_2,\ X_3=n_3\ \dots\ X_m=n_m) = \frac{n!}{n_1!\,n_2!\,n_3!}\, p_1^{n_1} \cdot p_2^{n_2} \cdot p_3^{n_3} \cdots p_m^{n_m}$$

$$= \frac{12!}{7!\,0!\,5!} \cdot (0.60)^7 \cdot (0.10)^0 (0.30)^5$$

$$= 0.05387$$

- Find the probability that Stephane’s fifth win happens when he plays his eighth

b) here the condition is stephenie's fifth win happens when he plays his eigth game

so it is following Negative binomial (n trials, give r succe-ss

$$= \binom{n-1}{n-r} p^r (1-p)^{n-r}$$

$$= 7C_4 \cdot (0.6)^5 \cdot (0.4)^3$$

$$= 0.17418$$

3. The personnel manager of a firm wants to compare the job satisfaction level of the employees among the firm's Finance, Purchase and Sales departments. A battery of questions are administered to randomly selected employees from each of the three departments resulting in the following job satisfaction level scores:

Finance: 14, 12, 13, 12, 11 Purchase: 18, 19, 20, 18, 16 Sales: 10, 12, 17, 11, 13

Finance	14	12	13	12	11
Purchase	18	19	20	18	16
Sales	10	12	17	11	13

Answer the following:

a. Is there a significant difference in job satisfaction level among the employes

From the three different departments?

b. Detect the departments which differ in job satisfaction level of its employees.

c. What assumptions are needed for validating the above analysis?

	Treatments		
	finance	Purchase	Sales
	14	18	10
	12	19	12
	13	20	17
	12	18	11
	11	16	13
Sum	62	91	63

sum of square table		
finance	Purchase	Sales
196	324	100
144	361	144
169	400	289
144	324	121
121	256	169
3844	8281	3969

GT	Grand total
CF	Correction factor
TSS	Total sum of square
Tr.S.S	treatment sum of square
E.S.S	Error sum of square
S.V	Source of variation
D.F	Degree of Freedom
S.S	Sum of square
M.S.S	mean sum of square
f.cal	f calculated value
f.tab	f table value

GT	216
CF	3110.4

H0	There is no difference between three jobs
H1	There is a significant difference between three jobs

TSS	151.6
Tr.S.S	108.4
E.S.S	43.2

S.V	D.F	S.S	M.S.S	f.cal	f.tab@5% LOS
between tr	2	108.4	54.2	15.0556	3.98
within tre	12	43.2	3.6		
Total	14	151.6			

	Result	F.cal value is greater than f.tab value at 5 per cent level of significance so, we reject H0
3.a	conclusio	Yes there is a significance difference between three jobs

3.b Detect the departments which differ in job satisfaction level of its employees

SE	1.2
LSD	4.776

Trt	mean	difference	comparision with lsd
Finance	12.4	-5.8	>4.776
Purchase	18.2	-0.2	<4.776
Sales	12.6	5.6	>4.776

Purchase having significant differ in job satisfaction level of its employees followed by Sales

C) What will happen are nedded for validating the above analysis?

1.H0 - There is no difference between jobs
2.H1 - There is a significant difference between jobs
3.Need to calculate the Mean for all treatments
4.Need to calculate the varience for all treatments

4. A normal distribution has standard deviation 16. We have null hypothesis (h 0): mean = 5 and alternative hypothesis (h 1): mean = k.

We reject the null hypothesis when > k-2

Find k and sample size (n) when P (Type 1 error) = 0.228 and P (Type 2 error) = 0.1587

5. A computer manufacturing company has three plants at X, Y and Z. To measure how many employees at these plants know about total quality management, a random sample of six employees was selected and a quality awareness test was administered. The test scores are given below:

Observation NO	**Test Scores**		
	Plant X	Plant Y	Plant Z
1	85	71	59
2	75	75	64
3	82	73	62
4	76	74	69
5	71	69	75
6	85	82	67

(a) Test the null hypothesis that the average test scores are the same for all three plants.

Assume that the variances of the score in the plants are the same

(b) Obtain a 95% confidence interval of the population mean for the plant at X.
Hint: For ANOVA, use excel for now.

Answer:-

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Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Column 1	6	474	79	34
Column 2	6	444	74	20
Column 3	6	396	66	32

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	516	2	258	9	0.002702899	3.682320344
Within Groups	430	15	28.66666667			
Total	946	17				

a) Here (F-cal > F-crit) and (P-value is <0.05) so we reject NULL hypothesis(H0)

b) The formula for the 95% confidence interval for the population mean is
$\mu+2(S.D)$ & $\mu-2(S.D)$

For plant-X			
Standard Deviation =	**5.830951895**		
Mean for Plant-X (μ) =	**79**		
Confidence Interval =	**90.66190379**	**&**	**67.33809621**