ASSIGNMENT **Answer all the question** **30 marks**

1. A producer of computer aided design software for the aerospace industry receives numerous calls for technical support. Tracking software is used to monitor response and resolution times. In addition, the company surveys customers who request support using the following scale:
   0 – did not exceed expectations
   1- Marginally met expectations
   2- Met expectations
   3- Exceeded expectations
   4- Greatly exceeded expectations

The questions are as follows:

Q1: Did the support representative explain the process for resolving your problem?

Q2: Did the support representative keep you informed about the status of progress in resolving your problem?

Q3: Was the support representative courteous and professional?

Q4: Was your problem resolved?

Q5: Was your problem resolved in an acceptable amount of time?

Q6: Overall, how did you find the service provided by our technical support department?

A final question asks the customer to rate the overall quality of the product using this scale:

0- Very poor
1- Poor
2- Good
3- Very good
4- Excellent

A sample of survey responses and associated resolution and response data are provided in the Excel file *customer support survey.* Use charts and descriptive statistics you deem appropriate to convey the information in these sample data and write a report to the manager explaining your findings and conclusions. 10 marks

Answer:

Step 1:

Hypothesis testing- It is the statistical procedure to accept or reject the statistical hypothesis based on the assumption of a population parameter. A random sample is used to test the hypothesis.

There are two types of hypotheses mentioned below:

1. *Null hypothesis - It is a hypothesis which states that between two variables there is no statistical significance. It is generally, the hypothesis disapproved or discredited by the researcher or experimenter. It is denoted by H0. The null hypothesis can be either rejected or fail to be rejected depending on the p-value.*

2. *Alternative hypothesis: It is a hypothesis that states that there is some statistical significance between the two variables. It is generally the hypothesis that the researcher's prediction is true. It is denoted by Ha. This hypothesis reflects the observed effect of the experiment. For an alternative hypothesis, the mathematical formulation can be an inequality or not equal sign. Alternative hypothesis can be two-tailed or one-tailed.*

Step 2:

As per the problem, the customer survey worksheet shows that the ratings given by customers to several attributes like ease of use, quality, price and service on scale of 1 to 5. The survey collect opinion of 200 customers from different region.

Here, the significant difference among rating of attributed for product/service is to determine. In order to determine this, the chi-square test will be used. Assume the null hypothesis that there is no significant difference in ratings of attributes and assume

alternative hypothesis that there is significant difference.

The following is the data summarize from the survey:

Rating	region	quality	Ease of use	Price	Total
1	3	2	3	9	17
2	8	2	4	21	35
3	25	16	17	40	98
4	86	75	109	87	357
5	78	105	67	43	293
Total	200	200	200	200	800

Step 3:

In the first step, calculate the expected frequency of the cross-tabulation in each cell as follows:

	A	B	C	D	E	F
9	Expected frequency					
10	Rating	region	quality	Ease of use	Price	Grand Total
11	1	=F2*$B$7/800	=F2*$C$7/800	=F2*$D$7/800	=F2*$E$7/800	=SUM(B11:E11)
12	2	=F3*$B$7/800	=F3*$C$7/800	=F3*$D$7/800	=F3*$E$7/800	=SUM(B12:E12)
13	3	=F4*$B$7/800	=F4*$C$7/800	=F4*$D$7/800	=F4*$E$7/800	=SUM(B13:E13)
14	4	=F5*$B$7/800	=F5*$C$7/800	=F5*$D$7/800	=F5*$E$7/800	=SUM(B14:E14)
15	5	=F6*$B$7/800	=F6*$C$7/800	=F6*$D$7/800	=F6*$E$7/800	=SUM(B15:E15)
16	Total	=SUM(B11:B15)	=SUM(C11:C15)	=SUM(D11:D15)	=SUM(E11:E15)	=SUM(F11:F15)

The computed expected frequency is shown below:

	A	B	C	D	E	F
9	Expected frequency					
10	Rating	region	quality	Ease of use	Price	Grand Total
11	1	4.25	4.25	4.25	4.25	17
12	2	8.75	8.75	8.75	8.75	35
13	3	24.5	24.5	24.5	24.5	98
14	4	89.25	89.25	89.25	89.25	357
15	5	73.25	73.25	73.25	73.25	293
16	Total	200	200	200	200	800

Step 4

Now, using the following formula of chi-square statistic, compute the chi-square statistic as follows:

$$\chi^2 = \sum \frac{(f_o - f_e)^2}{f_e}$$

Where, f_0 is the observed frequency and is the expected frequency. Thus, using the above formula, the chi-square statistic can be computed as follows:

The computed value of the chi-square statistic is shown below:

	A	B	C	D	E	F
18	Chi-square Statistic					
19	Rating	region	quality	Ease of use	Price	Grand Total
20	1	0.3676	1.1912	0.3676	5.3088	7.2353
21	2	0.0643	5.2071	2.5786	17.1500	25.0000
22	3	0.0102	2.9490	2.2959	9.8061	15.0612
23	4	0.1183	2.2752	4.3704	0.0567	6.8207
24	5	0.3080	13.7619	0.5333	12.4923	27.0956
25	Total	0.8685	25.3845	10.1459	44.8140	81.2128

Thus, the value of chi-square statistic is 81.2128. Since the cross-tabulation contains 5 rows and 4 columns, so the degree of freedom is 12. $[=(5-1)(4-1)]$

Using the degree of freedom 12 and level of significance 0.05, the critical value of chi-square and p-value can be computed as follows:

	A	B
27	**P-Value**	=CHISQ.TEST(B2:E6,B11:E15)
28	**Critical value**	=CHISQ.INV.RT(0.05,12)

The computed value of critical value of chi-square and p-value is shown below:

	A	B
27	**P-Value**	0.0000
28	**Critical value**	21.0261

Thus, the chi-square critical value is 21.0261 and p-value is 0.0000.

On comparing the values, it can be concluded that test statistic (81.2128) is more than the test critical value (21.0261), hence, the null hypothesis rejected. Also, the p -value (0.00) is less than level of significance (0.05) and this results in rejection of null

hypothesis. Hence, there is significant difference in ratings of attributes.

Q2. At one of the Management Institutes.xls , a sample of 55 second Year MBA students was selected, and information gathered relating to their age, background of graduation, work experience prior to joining MBA, CGPA score at the end of First Year, and area of specialization. The collected data is given below:

a. Present the above data with the help of tables, charts and graphs.

b. Calculate the measures of location and dispersion of CGPA, age and work experience for all backgrounds and specializations. Combine these measures, wherever possible, for all the backgrounds and specializations separately. Discuss the findings.

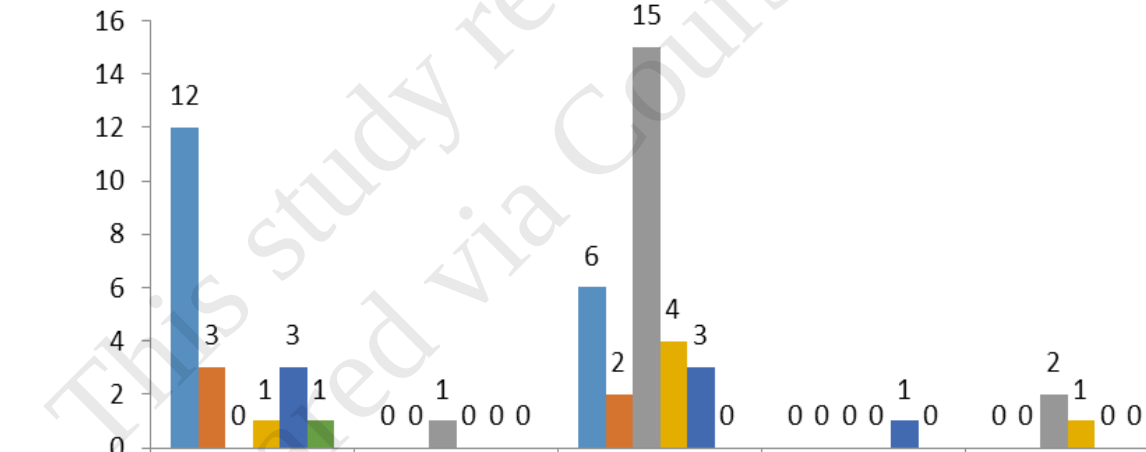
c. Study and comment on correlations between CGPA and age for students of all backgrounds viz. commerce, science etc.,

d. Summarize your findings and present a managerial report. 10 marks

Answer:

management_institute.xlsx

1. Present the data with the help of tables, charts and graphs.

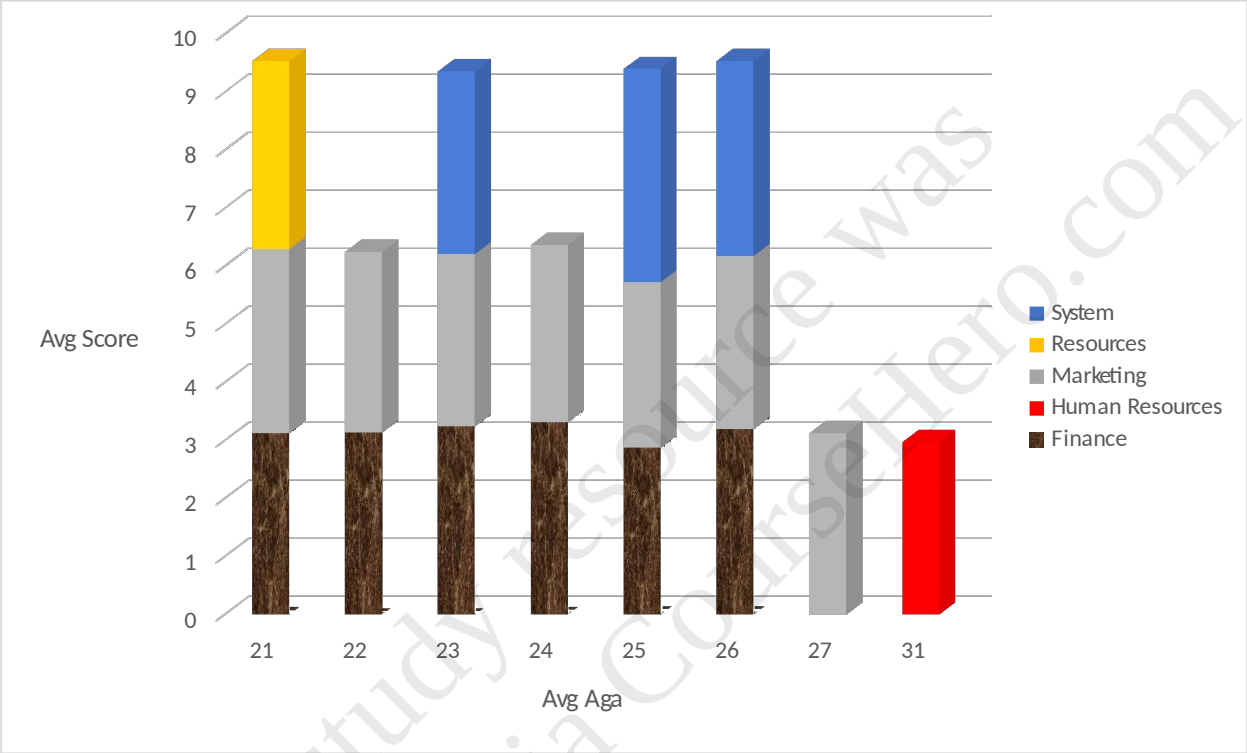


	Finance	Human Resources	Marketing	Resources	System
Commerce	12	0	6	0	0
Economics	3	0	2	0	0
Engineer	0	1	15	0	2
Information	1	0	4	0	1
Science	3	0	3	1	0
Technology	1	0	0	0	0

2.Discussion Outcome:

- ***Most of the Student has obtain for Marketing. This means two things , either the college has good faculty & facility for Marketing OR In Marketing has more jobs & opportunity.***
- ***Most of Engineering Students has obtain the Marketing & They have not obtained the Finance & Resources as a specialization.***
- ***To do this course Max students Background is Commerce & Min student Background is Technology***
- ***Only one student has taken Resources as a specialization.***

3. *Age Vs Avg Score Chart in different Specialization*



Q3. An economist believes that during periods of high economic growth, the US dollar appreciates with probability 0.70; in periods of moderate economic growth, the dollar appreciates with probability 0.40; and during periods of low economic growth, the dollar appreciates with probability 0.20. During any period of time, the probability of high economic growth is 0.30, the probability of moderate growth is 0.50, and the probability of low economic growth is 0.20. Suppose the dollar has been appreciating during the present period. What is the probability we are experiencing a period of high economic growth?

5 Marks

Answer:

The probability we are experiencing a period of high economic growth = 0.467 [Upto 3 decimal places]

Explanation:

Suppose the dollar has been appreciating during the present period. What is the probability we are experiencing a period of high economic growth?

Let A be the event that dollar is appreciating
H be the event that the period is of high economic growth
M be the event that the period is of medium economic growth
L be the event that the period is of low economic growth

We wan to find P(H | A) $= P(A|H)*P(H)+P(A|M)*P(M)$
$+P(A|L)*P(L)P(A|H)*P(H) = 0.7*0.3+0.4*0.5+0.2*0.20.7*0.3 = 0.467$ [Upto 3 decimal places]

Q4. The annual number of industrial accidents occurring in a particular manufacturing plant is known to follow a Poisson distribution with mean 12.

a. What is the probability of observing exactly 12 accidents during the coming year?
b. What is the probability of observing no more than 12 accidents during the coming year?
c. What is the probability of observing at least 15 accidents during the coming year?
d. What is the probability of observing between 10 and 15 accidents (inclusive) during the coming year?
e. Find the smallest integer "k" such that we can be at least 99% sure that the annual number of accidents occurring will be less than k. (5 marks)

Answer

The **Poisson distribution** is a discrete distribution. It is often used as a model for the number of events (such as the number of telephone calls at a business, number of customers in waiting lines, number of defects in a given surface area, airplane arrivals, or the number of accidents at an intersection) in a specific time period. It is also useful in ecological studies, e.g., to model the number of prairie dogs found in a square mile of prairie. The major difference between Poisson and Binomial distributions is that the Poisson does not have a

fixed number of trials. Instead, it uses the fixed interval of time or space in which the number of successes is recorded.

Parameters: The mean is λ. The variance is λ.

$$p(x, \lambda) = \frac{e^{-\lambda}\lambda^x}{x!} \qquad \text{for } x = 0, 1, 2, \cdots$$

λ is the parameter which indicates the average number of events in the given time interval.

Probability Function	Solution
P(X = 12, μ = 12)	0.1143679155
P(X ≤ 12, μ = 12)	0.5759652486
1 - P(X ≥ 14, μ = 12)	0.2279754677
P(10 ≤ X ≤ 15, μ = 12)	0.6020234908
P (X < k, μ = 12) = 0.99	K = 22