Quantitative analysis for managerial applications

Business, Management

Assignments

1. A sum of `8550 is to be paid in 15 installments where each installment is `10 more than the previous installment. Find the first installment and the last installment. Let x = the first payment.

The sequence of 15 payments is

(1) x, x+10, x+20, x+30, ... , x+140

The sum of these 15 payments is

(2) 15x + 10*(14*15/2) or

(3) 15x + 1050

Now set (3) equal to the total sum to be made and get

(4) 15x + 1050 = 8550 or

(5) 15x = 7500 or

(6) x = 500

The last payment in (1) is x + 140 or (7) 15th = 640

Answer: The first payment is $500 and the last payment is $640. I'll leave it to you to add up the sequence of (1) to " prove" that our answer is right. LOL

2. A salesman is known to sell a product in 3 out of 5 attempts. While another salesman in 2 out of 5 attempts. Find the probability that

a. No sales will happen

b. Either of them will succeed in selling the product

Let A be the event that the first salesman will sell the product and B be the event that the second salesman will sell the product. Given

(1) Probability that no sales will happen = $P(A') \times P(B')$

(2) Probability that either of the salesmen will succeed in selling the product = $P(A') \times P(B) + P(A) \times P(B')$

3. A hundred squash balls are tested by dropping from a height of 100 inches and measuring the height of the bounce. A ball is " fast" if it rises above 32 inches. The average height of bounce was 30 inches and the standard deviation was ¾ inches. What is the chance of getting a " fast" standard ball? Total no. of observations N = 100 Mean, μ 30inches Standard deviation, σ = 3/4 inches= 0. 75 inches Suppose 'x' is the normal variable= 32 inches

4. Explain the chi-square testing- (i) as a test for independence of attributes, and (ii) as a test for goodness of fit.

About the Chi-Square Test

Generally speaking, the chi-square test is a statistical test used to examine differences with categorical variables. There are a number of features of the social world we characterize through categorical variables - religion, political preference, etc. To examine hypotheses using such variables, use the chi-square test. The chi-square test is used in two similar but distinct circumstances: a. or estimating how closely an observed distribution matches an expected distribution - we'll refer to this as the goodness-of-fit test b. for estimating whether two random variables are independent.

The Goodness-of-Fit Test

One of the more interesting goodness-of-fit applications of the chi-square test is to examine issues of fairness andcheatingin games of chance, such as cards, dice, and roulette. Since such games usually involve wagering, there is a significant incentive for people to try to rig the games, and allegations of missing cards, " loaded" dice, and " sticky" roulette wheels are all too common.

So how can the goodness-of-fit test be used to examine cheating in gambling? It is easier to describe the process through an example. Take the example of dice. Most dice used in wagering have six sides, with each side having a value of one, two, three, four, five, or six. If the die being used is fair, then the chance of any particular number coming up is the same: 1 in 6. However, if the die is loaded, then certain numbers will have a greater likelihood of appearing, while others will have a lower likelihood. One night at the Tunisian Nights Casino, renowned gambler Jeremy Turner (a. k. a. The Missouri Master) is having a fantastic night at the craps table. In two hours of playing, he's racked up $30, 000 in winnings and is showing no sign of stopping. Crowds are gathering around him to watch his streak - and The Missouri Master is telling anyone within earshot that his good luck is due to the fact that he's using the casino's lucky pair of " bruiser dice," so named because one is black and the other blue. Unbeknownst to Turner, however, a casino statistician has been quietly watching his rolls and marking down the values of each roll, noting the values of the black and blue dice separately.

After 60 rolls, the statistician has become convinced that the blue die is loaded.

Got in Trouble	No	Trouble	Total
Boys	46	71	117
Girls	37	83	120
Total	83	154	237

At first glance, this table would appear to be strong evidence that the blue die was, indeed, loaded. There are more 1's and 6's than expected and fewer than the other numbers. However, it's possible that such differences occurred by chance. The chi-square statistic can be used to estimate the likelihood that the values observed on the blue die occurred by chance. The key idea of the chi-square test is a comparison of observed and expected values.

How many of something was expected and how many were observed in some process? In this case, we would expect 10 of each number to have appeared and we observed those values in the left column. With these sets of figures, we calculate the chi-square statistic as follows: Using this formula with the values in the table above gives us a value of 13. 6. Lastly, to determine the significance level we need to know the " degrees of freedom. " In the case of the chi-square goodness-of-fit test, the number of degrees of freedom is equal to the number of terms used in calculating chi-square minus one.

There were six terms in the chi-square for this problem - therefore, the number of degrees of freedom is five. We then compare the value calculated in the formula above to a standard set of tables. The value returned from the table is 1. 8%. We interpret this as meaning that if the die was fair (or not loaded), then the chance of getting a $\chi 2$ statistic as large or larger than the one calculated above is only 1. 8%. In other words, there's only a very slim chance that these rolls came from a fair die. The Missouri Master is in serious trouble. Testing Independence

The other primary use of the chi-square test is to examine whether two variables are independent or not. What does it mean to be independent, in this sense? It means that the two factors are not related. Typically in socialscienceresearch, we're interested in finding factors that are related - educationand income, occupation and prestige, age, and voting behavior. In this case, the chi-square can be used to assess whether two variables are independent or not. More generally, we say that variable Y is " not correlated with" or " independent of" the variable X if more of one is not associated with more of another.

If two categorical variables are correlated their values tend to move together, either in the same direction or in the opposite. Example Return to the example discussed in the introduction to chi-square, in which we want to know whether boys or girls get into trouble more often in school. Below is the table documenting the percentage of boys and girls who got into trouble in school:

Got in Trouble	No	Trouble	Total
Boys	46	71	117
Girls	37	83	120
Total	83	154	237

To examine statistically whether boys got in trouble in school more often, we need to frame the question in terms of hypotheses.