Business Analytics Made Simple

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Why Analytics : If you are a Book Store business owner and if you wanted to verify the proportions of customers that visit your store from each category (Adults, Teens, Children, Retired) and stock books accordingly so as to increase your sales, reduce your inventory, and enhance customer satisfaction, here is a simple Business Analytics technique that can help you solve this business problem. The good thing is that you don't need to be an ace Statistician.

The following simple **case study** from a similar business scenario will help you understand how such business problems could be solved with statistical techniques using past performance data.

The Business : Assume you are the Owner of "Software for Success", a software company that specializes in exam prep CDs that provide unlimited simulated mock exams for various competitive exams. If you wanted to check if the proportions of questions that appear in the simulated mock exams from your CD are same as the proportions of questions that are claimed or expected to appear, here is a simple way to do that.

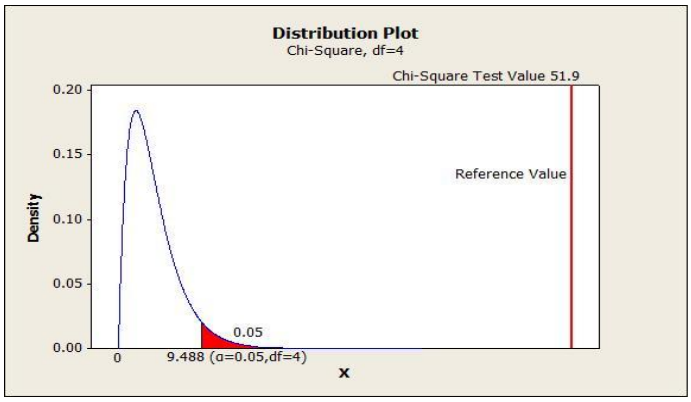
The Premise : Assume that each simulated mock exam consists of 200 Multiple Choice Questions (MCQ) from 5 subject areas. Out of 200 questions, suppose the expected proportions of questions in any simulated mock exam from five subjects namely Maths, Physics, Chemistry, General Aptitude, and English are 13%, 24%, 30%, 25%, 8 % respectively, then using statistical methods like Chi-Square Goodness-of-Fit test in Minitab®, a statistical software, can be a good idea to validate the claim without the intimidating calculations of Statistics.

First, let us construct the Null Hypothesis (Ho) and Alternate Hypothesis (Ha) for the claim. Then, let us say we want to be 95% confident in declaring our results. This means we are willing to take a chance of 5% error in our judgment. If this is OK with you, then the significance level is 5% (Alpha,α = 0.05) and Confidence Level is 95%.

Ho : The proportions of questions observed are equal to the expected.

Ha : The proportions of questions observed are not equal to the expected.

The Results : A mock test containing 200 questions from the prep.CD was done to observe the number of questions that actually appeared as against the expected from the prep.CD and the results were analyzed using Minitab® to get the following outputs.



Chi-Square Goodness-of-Fit Test for Observed Counts in Variable: Observed

Using category names in Subject Name

Category	Observed	Historical Counts	Test Proportion	Expected	Contribution to Chi-Sq.
Math	22	26	0.13	26	0.6154
Physics	91	48	0.24	48	38.5208
Chemistry	44	60	0.30	60	4.2667
General Aptitude	35	50	0.25	50	4.5000
English	8	16	0.08	16	4.0000

N	DF	Chi-Sq	P-Value
200	4	51.9029	0.000

Inference : From the Chi-Square distribution plot for Goodness-of-Fit analysis shown above, since the P-value = 0.000 < 0.05,we reject the Null Hypothesis (Ho). That means, we accept the Alternate Hypothesis (Ha) that there is a significant difference in the proportions of questions that appeared in the mock exam from what was expected. We usually make these sort of statements with 95% confidence. (However, in this example we can make this statement even with 100% confidence since the P-Value = 0.000)

This conclusion is also supported by the fact that the calculated Chi-square test statistic value 51.9 (reference value in the chart) is much greater than the critical Chi-square value of 9.488 (for $\alpha = 0.05$ & degrees of freedom, df = 4).

The business owner can increase the sample size (more number of mock tests) to see if the same trend exists in all simulated exams and, if so, can embark on revising the questions distribution pattern to align it to the expected pattern and issue a new version of the prep CD.

Other Applications : The Chi-Square Goodness-of-Fit test could be used to validate claims or hypotheses or assumptions in various business scenarios involving categorical variables / proportions like proportions of sales from various categories, nutrients in a potion, candies in a packet,composition of minerals in a metal, contaminants in potable water, calories in food products, distribution of people in a county, proportions of voters for a leader, proportions of defects, proportions of customers that visit a hotel / hospital / shopping mall etc.

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About the Author: The author, Ondiappan Arivazhagan "Ari", is an Honors graduate in Civil / Structural Engineering from University of Madras.He is a certified PMP, PMI-SP, PMI-RMP from PMI, USA. He is also a Master Black Belt in Lean Six Sigma and has done Business Analytics from IIM, Bangalore. He has 30 years of professional global project management experience in various countries around the World and has almost 14 years of teaching / training experience in Project management, Analytics, Risk Management and Lean Six Sigma .He is the Founder-CEO of International Institute of Project Management (IIPM), Chennai and can be reached at askari@iipmchennai.com