1. Numericals on conditional probability **(Bayes' Theorem)**
2. Suppose that in an adult population the proportion of people who are both overweight and suffer hypertension is 0.09; the proportion of people who are not overweight but suffer hypertension is 0.11; the proportion of people who are overweight but do not suffer hypertension is 0.02; and the proportion of people who are neither overweight nor suffer hypertension is 0.78. An adult is randomly selected from this population.
3. Find the probability that the person selected suffers hypertension given that he is overweight.
4. Find the probability that the selected person suffers hypertension given that he is not overweight.
5. Compare the two probabilities just found to give an answer to the question as to whether overweight people tend to suffer from hypertension.
6. Credit card Numerical
7. How can the Beta-Binomial distribution model be used for over-dispersion?
8. For Beta distribution with shape parameter α, scale parameter β, mean μ and standard deviation σ, prove that α=(μ^2-μ^3)/σ^2 -μ.
9. Compare Rejection Sampling Vs Importance Sampling. **(Also can come for individual explanation with advantages and disadvantages)**
10. The National Center for Health Statistics (NCHS) published a report in 2005 entitled *Health, United States,* containing extensive information on major trends in the health of Americans. Data are provided for the US population as a whole and for specific ages, sexes and races.  The NCHS report indicated that in 2002 Americans paid an average of $3,302 per year on health care and prescription drugs. An investigator hypothesizes that in 2005 expenditures have decreased primarily due to the availability of generic drugs. To test the hypothesis, a sample of 100 Americans are selected and their expenditures on health care and prescription drugs in 2005 are measured.  The sample data are summarized as follows: n = 100, , and s = $890. Is there statistical evidence of a reduction in expenditures on health care and prescription drugs in 2005? Is the sample mean of $3,190 evidence of a true reduction in the mean or is it within chance fluctuation? Consider 5% level of significance with critical value = -1.645. **(Numericals of similar type)**
11. A random sample of 500 U.S. adults is questioned regarding their political affiliation and opinion on a tax reform bill. The results of this survey are summarized in the following contingency table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Favor | Indifferent | Opposed | Total |
| Democrat | 138 | 83 | 64 | 285 |
| Republican | 64 | 67 | 84 | 215 |
| Total | 202 | 150 | 148 | 500 |

Test if the political affiliation and their opinion on a tax reform bill are dependent at a 5% level of significance using Chi-Square test. Consider 5% level of significance with critical value = 5.991. **(Numericals of similar type)**

1. Explain Monte Carlo Integration in brief.
2. Explain the need of Monte Carlo Method in Bayesian Computation.
3. The data below show the sugar content of a fruit (SUGAR) for different numbers of days after picking (DAYS).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| X (day) | 0 | 1 | 2 | 3 | 4 |
| Y (sugar level) | 2 | 3 | 5 | 4 | 6 |

1. Find the least square regression line y = a x + b.
2. Use the least squares regression line as a model to estimate the sugar level in the fruit when x=10.
3. How Bayesian linear regression is different from traditional linear regression.
4. **(Numericals of similar type)**
5. Bioassay Experiment
6. Heart Transplant Mortality Rate
7. Multinomial Model
8. Fairness of coin
9. Conjugate pairs and Mixed Conjugate Pairs
10. Bayesian Robustness
11. Write a summary of various R libraries and functions used for studying **(any one can come)**

i. MCMC Simulation

ii. Metropolis Hastings Algorithm

iii. Gibbs Sampling

**(Study which libraries are common in all)**

1. Explain how MCMC model can be used for **(any one can come)**

i. Estimating flower height

ii. Estimation candy color

iii. Heart Transplant Mortality rate

iv. Model data with Cauchy error

1. MCMC Algorithm
2. Metropolis Hastings Algorithm
3. Gibbs Sampling
4. Probit Regression with Missing Data using Gibbs Sampling.
5. Discrete Markov Chain
6. Robust Modeling with Gibbs Sampling\
7. Hierarchical Regression Priors in Gibbs Sampling.