Statistical Inference Assignment 1

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February 6, 2020

1 Problem 1

- using method of moments technique we already know the values of mu-hat and sigma-hat so we use them in our data to find the value of the unknown parameters using MME. The values come out to be
  - mean : -0.009848722
  - sigma : 1.055886183
- using MLE technique we find the log-likelihood formula for normal distribution and then use routine nlminb to compute the value of the unknown parameters. We observe the values to be same as those obtained using MME in the previous part and also the convergence is achieved. The value of the objective function comes out to be 1446.129 at the estimated values of the parameters.
- We take the variance to be 1 and then for different values of mean plot the log-likelihood function values.

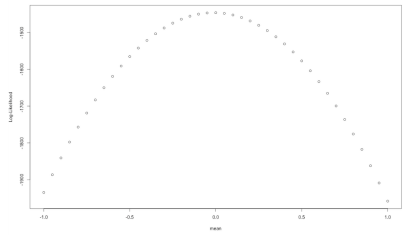

Figure 1:

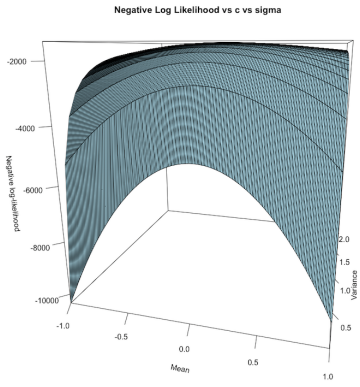

Figure 2:

2 Problem 2

- As we know that for a uniform distribution, the random variable is dependent on the parameter θ. So we add the indicator function to the likelihood function and upon finding the log likelihood we observe that, its a decreasing function of θ. So our theta-hat will be max value of $X_i's$.
- So using the optimize routine in R we find the value of maximum like-lihood estimate for uniform distribution with the given data.
  - the value of θ comes out to be 22.79992.
  - the value of objective function at theta-hat is 171.9716 (log-likelihood).
  - because the routine function minimizes and we need to find the maximum value so we use the negative log-likelihod function.
- Plotting the above resuts to see that maximum value is attained at the above estimate.

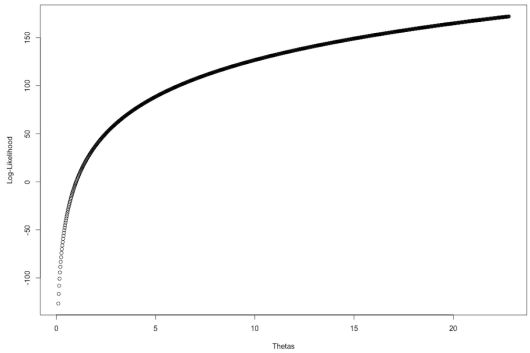

Figure 3:

3 Problem 3

- First, we model the geometric distribution for a 1000 observations. For geometric distribution to find the log-likelihood we use the alternate form of geometric distribution and estimate the value of unknown parameter in R using the nlminb routine.
  - The value of the unknown parameter comes out to be 0.5988022.
  - The value of the objective at the estimated value of p is 1124.735.
  - Convergence is achieved.
- We plot the log-likelihood for various value of p and observe that the maximum value is achieved at the estimated value of p.

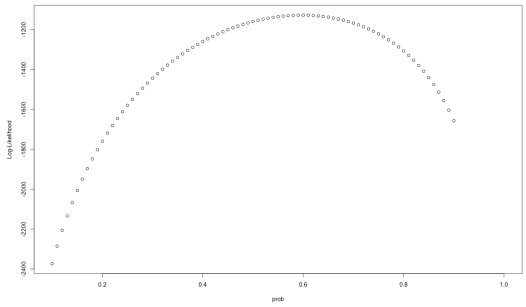
Log-Likelihood
-1200
-1400
-1600
-1800
-2000
-2200
-2400
0.2
0.4
0.6
0.8
1.0
prob

Figure 4: