CS 436: Homework #0

Professor Arti Ramesh

Academic Honesty Pledge

I have done this assignment completely on my own. I have not copied it, nor have I given my solution to anyone else. I understand that if I am involved in plagiarism or cheating I will have to sign an official form that I have cheated and that this form will be stored in my official university record. I also understand that I will receive a grade of 0 for the involved assignment for my first offense and that I will receive a grade of F for the course for any additional offense.

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Problem 1

Derive maximum likelihood estimators for parameter p based on a Bernoulli(p) sample of size n.

Solution

$$\hat{p} = \bar{X}$$

Problem 2

Derive maximum likelihood estimators for parameter p based on a Binomial(N, p) sample of size n. Compute your estimators if the observed sample is (3, 6, 2, 0, 0, 3) and N = 10.

Solution

$$\hat{p} = \frac{\bar{X}}{N}$$

$$\hat{p} = \frac{\frac{3+6+2+0+0+3}{6}}{10} = \frac{\frac{14}{6}}{10} = \frac{140}{6} = \frac{140}{6} = 23.33...$$

Problem 3

Derive maximum likelihood estimators for parameters a and b based on a Uniform (a, b) sample of size n.

Solution

$$\hat{a} = \text{smallest } X_1$$

$$\hat{b} = \text{largest } X_1$$

Problem 4

Derive maximum likelihood estimators for parameter μ based on a $Normal(\mu, \sigma^2)$ sample of size n with known variance σ^2 and unknown mean μ.

Solution

$$\hat{\mu} = \frac{\sum X_i}{N}$$

Problem 5

Derive maximum likelihood estimators for parameter σ based on a $Normal(\mu, \sigma^2)$ sample of size n with known mean μ and unknown variance σ^2.

Solution

$$\hat{\sigma} = \sqrt{\frac{\sum X_i - \mu}{n}}$$

Problem 6

Derive maximum likelihood estimators for parameters (μ, σ^2) based on a $Normal(\mu, \sigma^2)$ sample of size n with unknown mean μ and variance σ^2.

Solution

$$\hat{\mu} = \text{Sample mean}$$

$$\hat{\sigma} = \text{Sample standard deviation}$$