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STAT 221
Pset 4
Nov 4, 2014

question 1. 1 $p(\lambda, \theta) \propto \lambda^{-1}$

$$\begin{bmatrix} N \\ \theta \end{bmatrix} = f\left(\begin{bmatrix} \lambda \\ \theta \end{bmatrix}\right)$$

$$p(N, \theta) = p(\lambda, \theta) * \left\| \begin{matrix} \frac{\partial \lambda}{\partial N} & \frac{\partial \theta}{\partial N} \\ \frac{\partial \lambda}{\partial \theta} & \frac{\partial \theta}{\partial \theta} \end{matrix} \right\|$$

Our Jacobian is $\begin{vmatrix} \theta & -\lambda N^{-2} \\ N & 1 \end{vmatrix}$

and its determinant is $\theta + \frac{\lambda}{N}$

$p(N, \theta) \propto \frac{1}{\theta N} * (\theta + \frac{\lambda}{N})$
$= \frac{1}{\theta N} * (\theta + \frac{\theta N}{N})$
$= \frac{2}{N}$
$\propto \frac{1}{N}$

2 It is an improper prior: $\int_0^\infty \int_0^1 \lambda^{-1} d\theta d\lambda \to \ln(\infty) - \ln(0)$. This cannot integrate to 1 with any constant factor.

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4 See R code

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