HLWYM HEmails

From: Dennis Damon
Sent: Thursday, May 10, 2007 10:45 AM
To: Christopher Ryder
Subject: Re: Question
Attachments: beta_xoutofn_bayes.wpd

See attachment.

>>> Christopher Ryder 5/10/2007 9:48 AM >>>
Dennis,

From empirical data, we calculated the probability of dropping a heavy load to be 3/54,000 = 5.6E-5. This of course is a point estimate.

Yesterday, I was asking Lee Abramson about assigning a distribution to the probability. He said, as you would know, that one would start with a non-informative prior and update the prior with the estimated probability.

I asked Lee about the mechanics of this, suggesting using the Beta distribution. Is this what you would use? He also suggested that there may be software to perform the arithmetic. Is this necessary?

This is a low priority issue. At your convenience, I would appreciate chatting with you.

Thanks.

Chris

Christopher Ryder
(301) 415-6102
NMSS/HLWRS/SPAD/PAS
High Level Waste Repository Safety
Site Performance Assessment Directorate
Mail Stop T 7 F23
Room T 7K2
Tel: (301) 415-6102
Fax: (301) 415-5397

Hearing Identifier: HLW_YuccaMountain_Hold_EX
Email Number: 60

Mail Envelope Properties (Dennis.Damon@nrc.gov20070510104501)

Subject: Re: Question
Sent Date: 5/10/2007 10:45:01 AM
Received Date: 5/10/2007 10:45:01 AM
From: Dennis Damon

Created By: Dennis.Damon@nrc.gov

Recipients:
"Christopher Ryder" <Christopher.Ryder@nrc.gov>
Tracking Status: None

Post Office:

Files	**Size**	**Date & Time**
MESSAGE	959	5/10/2007 10:45:01 AM
beta_xoutofn_bayes.wpd	13672	

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

When one has data in the form x failures out of n trials, and wishes to estimate the true probability of failure, p, I also like using beta pdf's and Baye's theorem to get a density function on p. NUREG/CR-6823, the parameter estimation handbook, discusses this on pages 6-35 to 6-38. It recommends using a beta(1/2, 1/2) distribution as a non-informative prior, rather than a uniform distribution f(p)=beta(1,1)=1 (0<p<1). With that prior the posterior, given x failures in n trials, is beta(x+1/2, n-x+1/2); which has a mean of (x+1/2)/(n+1). I believe the estimator x/n is the maximum likelihood (mode) of this beta pdf. But I find these distributions useful only when either x or n is small. The beta pdf is the polynomial function of p with two parameters a and b:

$$\text{beta}(a,b) = \Gamma(a+b)\, p^{a-1}\, (1-p)^{b-1} / \Gamma(a)\Gamma(b)$$

where the gamma function $\Gamma(k) = (k-1)!$ when k is an integer. If not, Quattro pro has a gamma function in it. Mean = $a/(a+b)$ Variance = $ab/(a+b)^2(a+b+1)$

When both x and n are large, say x >30, the resulting beta pdf looks very much like a Gaussian.