Math 404 HW 9 Spring 2024. Due Tuesday, April 9. **One page, 3 problems**.

1) For a certain insurance coverage, at most one claim per year can be submitted (per risk). There are two types of groups. In the good group, the expected annual number of claims for each risk (or policyholder at risk if there is one risk for each policyholder) is 0.1. For the bad group the expected annual number of claims for each risk is 0.2. The probability that a group is good is 70%. A group of 10 risks submits 2 claims in one year. Determine the expected number of claims for a single risk submitted by this group in the following year. Fill out the following table.

Hint: the group of 10 risks has a $\text{bin}(q = 0.1, m = 10)$ likelihood and $\text{bin}(q = 0.2, m = 10)$ likelihood for the good and bad groups. Note that the hypothetical mean is for $m = 1$ risk. Want the Bayesian premium which should be a number between 0.1 and 0.2. We are assuming that the 10 risks all come from the good or bad group, but it is not known whether the group is good or bad. Follow the two examples done in class.

	good	bad	sum if applicable
prior probabilities	0.7	0.3	1
likelihood (of experience)		0.3020	
joint probabilities		0.09060	
posterior probabilities			1
hypothetical means	0.1		
Bayesian premium			

2) Suppose $X \sim N(\theta, \sigma^2)$ where $\theta \sim N(\mu, \tau^2)$.
a) Find $E(X)$.
b) Find $V(X)$.
Hint: $X|\theta \sim N(\theta, \sigma^2)$. Assume σ^2, μ and τ^2 are constants.

3) Limited fluctuation credibility methods are used. Claim counts are Poisson(0.1). Claim sizes have mean 1000 and coefficient of variation 2.
a) You want the number of claims for a group to be within 5% of the expected 90% of the time. How many members must the group have for full credibility?
b) You want aggregate losses for a group to be within 5% of the expected 90% of the time. How many expected claims much you observe to give full credibility to the experience?
c) You want the number of claims for a group to be within 5% of the expected 90% of the time. How much expected aggregate losses must be incurred for the group to be given full credibility?

The website (https://www.soa.org/) has a search box in the upper right corner. Type *credibility* to get several documents, including *Credibility Theory Practices* and *Credibility Educational Resource for Pension Actuaries*.