

**Math 5637**  
**Risk Theory**  
**Fall 2015**  
**Final Examination**  
**December 11 - 16, 2015**

Due back to me by 5 PM on Wednesday, December 16, in my mailbox, under my door, or by email. You may consult with any written source, including textbooks, solution manuals, notes, websites, or anything else in writing. Remember to use Appendix A if you can! Do NOT consult with any other person. Doing so will be grounds for failing the course. The four questions will be equally weighted in the grading.

1. Individual loss amounts (ground up) this year follow a two parameter Pareto distribution with  $\alpha = 3$  and expected value 1000. Next year you confidently expect loss amounts to inflate by 5% uniformly across all losses. What will be the standard deviation next year for loss payments that are limited to 2,000 per payment with the original loss amount first subjected to a 200 deductible per loss before any payment? (HINT: use the fact that  $\beta(3, 1; u) = u^3$  to help your calculations.)
2. Write down formulas for the first five moments of the Inverse Gaussian random variable in terms of its parameters  $\mu$  and  $\theta$ .
3. Among all continuous non-negative random variables with mean  $\mu$ 
  - (a) Show which one has maximum entropy and tell me its name
  - (b) Write down the density for the CTM- $\tau$  transformation of the random variable in 3.a. and tell me its name
4. If  $S$  is a compound Negative Binomial - Negative Binomial random variable with parameters  $\beta_N = 2$  and  $r_N = .5$  for the primary variable and  $\beta_M = .5$  and  $r_M = 2$  for the secondary variable then calculate numerical values for the first 5 probabilities  $\mathbb{P}[S = 0]$ ,  $\mathbb{P}[S = 1]$ , ... ,  $\mathbb{P}[S = 4]$ .