

考試科目	統計學	系所別	風險管理與保險學系 精算科學組	考試時間	2月3日(五)第4節																				
<p>1. (10pts) The likelihood of the economy improving, remaining stable, or declining is</p> <table border="1"> <thead> <tr> <th>State of the Economy</th> <th>Probability</th> </tr> </thead> <tbody> <tr> <td>improving</td> <td>0.3</td> </tr> <tr> <td>remaining stable</td> <td>0.5</td> </tr> <tr> <td>declining</td> <td>0.2</td> </tr> </tbody> </table> <p>The stock prices for Company A and Company B will experience the following changes:</p> <table border="1"> <thead> <tr> <th>State of the Economy</th> <th>Company A</th> <th>Company B</th> </tr> </thead> <tbody> <tr> <td>improving</td> <td>Increase 18%</td> <td>Increase 15%</td> </tr> <tr> <td>remaining stable</td> <td>Increase 8%</td> <td>Increase 7%</td> </tr> <tr> <td>declining</td> <td>decrease 13%</td> <td>decrease 6%</td> </tr> </tbody> </table> <p>Fill in the blank for the following statements about the percentage price changes for Company A and Company B.</p> <p>(a) (5pts) _____ Which company has the larger mean of the percentage change? Company A, Company B, or Both have same mean.</p> <p>(b) (5pts) _____ Which company has the larger variance of the percentage change? Company A, Company B, or Both have same mean.</p> <p>2. (5pts) If losses follow an exponential distribution with a mean of 1 and two independent losses are observed, the probability that either of the losses is more than twice the other is _____ (Fill in the blank).</p> <p>3. (10pts) Let X_1, X_2, \dots, X_n be a random sample from distributions with probability density functions $f(x; \theta) = e^{-(x-\theta)}, \theta \leq x < \infty, -\infty < \theta < \infty, 0$ elsewhere. Find the maximum likelihood estimator of θ.</p> <p>4. (20 pts) Please explain the following items.</p> <p>(a) (10 pts) The Central Limit Theorem</p> <p>(b) (10 pts) Prior and Posterior distribution</p>						State of the Economy	Probability	improving	0.3	remaining stable	0.5	declining	0.2	State of the Economy	Company A	Company B	improving	Increase 18%	Increase 15%	remaining stable	Increase 8%	Increase 7%	declining	decrease 13%	decrease 6%
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<p>5. (10 pts) For a one-year term life insurance policy of 1000:</p> <ul style="list-style-type: none"> (i) The premium is 30. (ii) The probability of death during the year is 0.02. (iii) The company has expenses of 2. (iv) If the insured survives to the end of the year, the company pays a dividend of 3. <p>Ignore interest. Calculate the variance in the amount of profit the company makes on this policy.</p> <p>6. (15 pts) The number of losses on a homeowner's policy is binomially distributed with parameters $m = 5$ and q. q varies by policyholder uniformly between 0 and 0.4. Calculate the probability of 2 or more losses for a policyholder.</p> <p>7. (15 pts) Demonstrate that the probability density function for a normally distributed random variable has inflection points at $x = \mu \pm \sigma$</p> <p>8. (15 pts) Let $Y_1 < Y_2 < \dots < Y_n$ be the order statistics of a random sample of size n from the exponential function $f(x) = e^{-x} \ 0 < x < \infty$</p> <ul style="list-style-type: none"> (a) (10 pts) Prove that $Z_1 = nY_1$, $Z_2 = (n-1)(Y_2 - Y_1)$, $Z_3 = (n-2)(Y_3 - Y_2)$, \dots, $Z_n = Y_n - Y_{n-1}$ are independent random variables and each Z_i are also from exponential distribution. (b) (5 pts) Prove that the general linear function $\sum_{i=1}^n a_i Y_i$, where a_i are some coefficients, can be expressed into a linear function of independent random variables. 					
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