考 試 科 目	統計學	系　別	風險管理與保險學系/ 管理組	考 試 時 間	2 月 23 日(六) 第 三 節

1. Define the following terms:

   (1) p-value (5%)

   (2) significance level of a test (5%)

   (3) skewness (5%)

   (4) power of a test (5%)

2. Suppose a patient has Symptoms A and B. The physician therefore orders the patient admitted to the hospital for a physical examination. Assume that the results of the examination are consistent with either Disease C or Disease D. The probabilities of having Symptoms A and B given no disease, Disease C, and Disease D are 0.001, 0.9, 0.9 respectively. Also assume that the probabilities of having no disease, Disease C, and Disease D are 0.99, 0.001, 0.009 respectively. As a statistician, you are requested to help this physician to determine whether the patient has no disease, Disease C, or Disease D. What professional opinion would you offer? (10%)

3. Use a normal distribution to approximate the upper 2.5th percentile for a Chi-square distribution with a degree of freedom of 5,000? (10%) ($z_{0.95}$= 1.645; $z_{0.975}$= 1.96; $z_{0.9901}$= 2.33)

4. A statistician would like to compare how long it takes users of Drugs A and B, respectively to become ill after stopping taking these drugs. A study of group of 20 Drug A users is formed. The statistician also finds Drug B users who match each Drug A user. The mean difference (Drugs A minus B) in time to illness is four months with a standard deviation of eight months. What can you conclude from these data? (10%) ($t_{19, 0.975}$= 2.093; $t_{19, 0.99}$= 2.539; $t_{20, 0.975}$= 2.086; $t_{19, 0.99}$= 2.528)

5. A researcher is examining the effect of Drug A on Disease B. It is found that among 5,000 Drug A users, 13 people develop Disease B, while among 10,000 non-Drug A users, seven develop Disease B. Assess the data for statistical significance. (10%) ($\chi^2_{(0.99,1)}$= 6.63; $\chi^2_{(0.995,1)}$= 7.78; $\chi^2_{(0.99,4)}$= 13.28; $\chi^2_{(0.995,4)}$= 14.86)

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6. Suppose random variable X follows a continuous uniform distribution on the interval $0 < x < 12$. Random variable Y has a conditional distribution, given $X = x$, that is uniform on the interval $0 < y < x$. Please find the unconditional variance of Y. (10%)

7. Suppose you want to estimate a regression of x on y. $\sum x_i = 1{,}137$, $\sum y_i = 6.05$, $\sum x_i^2 = 54{,}749$, $\sum y_i^2 = 1.522$, $\sum x_i y_i = 262.96$. i ranges from 1 to 27, i.e., the number of sample size is 27.
   (1) Fit the regression line. (10%)
   (2) Test for the significance of the regression slope at the 5% level (10%)
   　　 ($t_{25,\,0.95} = 1.708$; $t_{27,\,0.95} = 1.703$; $t_{25,\,0.975} = 2.060$; $t_{27,\,0.975} = 2.052$)

8. You are formulating two hypotheses- a null and an alternative hypothesis. Suppose the null mean is 175, the alternative mean is 190, and the standard deviation is 50. You are considering carrying out a one-sided test at a significance level of 5% with a power of 90%. What is the required sample size? (10%) ($z_{0.90} = 1.28$; $z_{0.95} = 1.645$; $z_{0.975} = 1.96$; $z_{0.9901} = 2.33$)

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