BioSys PhD | Earthsystems PhD - Parametric Inference

EXERCISES

1. Two different methods of analysis were used to determine the concentration of paracetamol (% m/m) in tablets. Ten tablets of ten different lots were used in the experiment, whose aim was to determine if both methods gave different results. In order to reduce variability both methods were used in each tablet. The results are shown in the following table:

M1	84.63	84.38	84.08	84.41	83.82	83.55	83.92	83.69	84.06	84.03
M2	83.15	83.72	83.84	84.20	83.92	84.16	84.02	83.60	84.13	84.24

   Can we say that the results produced by the two methods are different?

2. The population proportion of individuals under 40 diagnosed with lung cancer that survive at least five years is unknown. In a random sample of 260 such patients, 30 survive at least five years.

   (a) Give a justification for why statistical inference based on the normal distribution is appropriate.

   (b) Give a 95% confidence interval for the population five-year survival rate for this type of patient.

   (c) Test the hypothesis that the population five-year survival rate is 10% versus the alternative that it is higher. State hypothesis, calculate the test statistic and report a p-value. Summarize your findings in the context of the problem.

3. The body temperature data set `Data_Pr3.txt` contains the body temperature (Fahrenheit) and the gender of 130 volunteers, 65 men and 65 women. Answer the following question justifying the distributions considered to perform the tests.

   (a) Is the mean body temperature of human adults really 98.6°F (37°C)? ($\alpha = 0.05$)
   (Ignore differences due to gender)

   (b) Is the mean body temperature of women higher than the mean body temperature of men? ($\alpha = 0.05$)

   (c) Construct the 90% confidence interval for the difference of means for both genders. Use this interval to test the hypothesis of the means' difference, $\mu_{women} - \mu_{men}$, being equal to one.

4. Many studies have suggested that there is a link between exercise and healthy bones. Exercise stresses the bones and this causes them to get stronger. One study examined the effect of jumping on the bone density of growing rats. There were three treatments: a control with no jumping, a low-jump condition (the jump height was 30 centimeters), and a high-jump condition (60 centimeters). After 8 weeks of 10 jumps per day, 5 days per week, the bone density of the rats (expressed in mg/cm) was measured. Here are the data:

Group	Bone density (mg/cm)									
Control	611	621	614	593	593	653	600	554	603	569
Low jump	635	605	638	594	599	632	631	588	607	596
High jump	650	622	626	626	631	622	643	674	643	650

   Carry out an analysis of variance. Report the statistic with its degrees of freedom and p-value. What do you conclude? ($\alpha = 0.05$)