Lab Assignments SBDA131C

Dated: 13-10-17

Due date: 02 December

1. A sample of 25 physically and mentally healthy males participated in a sleep experiment in which the percentage of each participants total sleeping time spent in a certain stage of sleep was recorded. The variance computed from the sample data was 2.25. Construct 95 percent confidence intervals for σ^2 and σ.

   Find the following integral numerically using Trapezoidal rule and compare the value obtained analytically. Obtain the same integral using Simpsons 1/3 rule and compare.

   $$\int_0^1 \frac{3}{1+x^2}dx$$

   Write down a routine program for obtaining the integrals.

2. Compare Euler mid-point and Runge-Kutta method of solving first order differential equations. Solve the following first order differential equation using both methods and compare:

   $$\frac{dy}{dx} = tan(y), \qquad y(0) = 1.$$

   Write computer routines.

3. Use prediction-correction method to solve the following equation:

   $$\frac{dy}{dx} = -y^2, \qquad y(0) = 1.$$

   Write a computer routine.

   Krantz et al. investigated dose-related effects of methadone in subjects with torsade de pointes, a polymorphic ventricular tachycardia. In the study of 17 subjects, nine were being treated with methadone for opiate dependency and eight for chronic pain. The mean daily dose of methadone in the opiate dependency group was 541 mg/day with a standard deviation of 156, while the chronic pain group received a mean dose of 269 mg/day with a standard deviation of 316. Compute a 95% confidence interval for the difference of the means and clearly state your assumptions.

4. Explain what is maximum likelihood estimation.

   Use Simpson's 3/8 rule to obtain the following integral numerically and compare with Simpson's 1/3 rule.. Write down a routine for obtaining the integral.

   $$\int_0^1 \sqrt{x}dx$$

5. The purpose of a study by Moneim et al. was to examine thumb amputations from team roping at rodeos. The researchers reviewed 16 cases of thumb amputations. Of these, 11 were complete amputations while five were incomplete. The ischemia time is the length of time that insufficient oxygen is supplied to the amputated thumb. The ischemia times (hours) for 11 subjects experiencing complete amputations were

   4.67; 10.5; 2.0; 3.18; 4.00; 3.5; 3.33; 5.32; 2.0; 4.25; 6.0

   For five victims of incomplete thumb amputation, the ischemia times were

   3.0; 10.25; 1.5; 5.22; 5.0

   Treat the two reported sets of data as sample data from the two populations as described. Construct a 95 percent confidence interval for the ratio of the two unknown population variances.

6. A study is conducted concerning the blood pressure of 60 year old women with glaucoma. In the study 200 60-year old women with glaucoma are randomly selected and the sample mean systolic blood pressure is 140 mm Hg and the sample standard deviation is 25 mm Hg.

   a. Calculate a 95% confidence interval for the true mean systolic blood pressure among the population of 60 year old women with glaucoma.

   b. Suppose the study above was based on 100 women instead of 200 but the sample mean (140) and standard deviation (25) are the same. Recalculate the 95% confidence interval. Does the interval get wider or narrower? Why?

   Solve the following equation using Gauss-elimination method. Write down a computer code for the method.

$$\begin{aligned} 3x + 2y - 6z &= 6 \\ 5x + 7y - 5z &= 6 \\ x + 4y - 2z &= 8 \end{aligned}$$

7. The following scores represent a nurses assessment (X) and a physicians assessment (Y) of the condition of 10 patients at time of admission to a trauma center.
   X : 18 13 18 15 10 12 08 04 07 03

   Y : 23 20 18 16 14 11 10 07 06 04

   (a) Construct a scatter diagram for these data. (b) Deduce the best curve that fits the data. Try to use Computer for determining the least square fit. Conduct hypothesis test for reaching a conclusion regarding the relationship between X and Y.

8. Methadone is often prescribed in the treatment of opioid addiction and chronic pain. Krantz et al. studied the relationship between dose of methadone and the corrected QT (QTc) interval (shown below) for 17 subjects who developed torsade de pointes (ventricular tachycardia nearly always due to medications). QTc is calculated from an electrocardiogram and is measured in mm/sec. A higher QTc value indicates a higher risk of cardiovascular mortality. A question of interest is how well one can predict and estimate the QTc value from a knowledge of methadone dose. Answer it by means of regression analysis. Draw scatter diagram.

   Methadone dose (mg/day): 1000 550 97 90 85 126 300 110 65 650 600 660 270 680 540 600 330
   QTc (mm/sec): 600 625 560 585 590 500 700 570 540 785 765 611 600 625 650 635 522
   a) Compute the coefficient of determination. (b) Use the t statistic to test the null hypothesis that $\beta_1 = 0$ at the .05 level of significance. (c) Determine the p value for each hypothesis test. (d) State your conclusions in terms of the problem. (e) Construct the 95 percent confidence interval for β_1 .

9. Digoxin is a drug often prescribed to treat heart ailments. The purpose of a study by Parker et al. was to examine the interactions of digoxin with common grapefruit juice. In one experiment, subjects took digoxin with water for 2 weeks, followed by a 2-week period during which digoxin was withheld. During the next 2 weeks subjects took digoxin with grapefruit juice. For eight subjects, the average peak plasma digoxin concentration (Cmax) when taking water is given in the first row of below. The second row contains the percent change in Cmax concentration when subjects were taking the digoxin with grapefruit juice [GFJ (%) change]. Use the Cmax level when taking digoxin with water to predict the percent change in Cmax concentration when taking digoxin with grapefruit juice. Draw scatter diagram.

   Cmax (ngl/ml) with Water: 2.34 2.46 1.87 3.09 5.59 4.05 6.21 2.34

   Change in Cmax with GFJ (%): 29.5 40.7 5.3 23.3 -45:1 -35:3 -44:6 29.5

   a) Compute the coefficient of determination. (b) Use the t statistic to test the null hypothesis that $\beta_1 = 0$ at the .05 level of significance. (c) Determine the p value for each hypothesis test. (d) State your conclusions in terms of the problem. (e) Construct the 95 percent confidence interval for β_1 .