Homework 5

STAT 212

Spring 2025

Instructions

- The homework is due on **Apr. 11, 2025**, 11:59 pm.
- The homework should be submited electronically via Canvas.
- Please upload a single PDF containing the solutions in the correct order. If you include scanned images, make sure that they are organized and easy to read.

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1. (50 points) (Problem 5, on pages 382–383 of textbook, Section 10.4). An experiment was performed to determine the effect of four different chemicals on the strength of a fabric. Five fabric samples were selected and each chemical was tested once in random order on each fabric sample. The total sum of squares for this data is SST = 8.4455. Some additional summary statistics are given in the partially filled ANOVA table below:

	Df	Sum Sq	Mean Sq	F value
treatment				
block		5.4530		
Residuals		0.5110		

Figure 1

   (a) Which of the two factors in this study, that is, which of the factors "chemical" and "fabric," is the blocking factor?

   (b) Complete the ANOVA table and test the null hypothesis at level $\alpha = 0.05$ that the four chemicals do not differ in terms of the mean strength of the fabric. Report the p-value.

2. (50 points) It is hypothesized that when homing pigeons are disoriented in a certain manner, they will exhibit no preference for any direction of flight after takeoff (so that the direction X should be uniformly distributed on the interval from 0° to 360°). To test this, 120 pigeons are disoriented, let loose, and the direction of flight of each is recorded. The resulting raw data is then categorized into several intervals and the counts are tabulated below. Use the χ^2 test at level 0.10 to see whether the data support the hypothesis.

Direction	$[0°, 45°)$	$[45°, 90°)$	$[90°, 135°)$	$[135°, 180°)$
Frequency	12	16	17	15

Direction	$[180°, 225°)$	$[225°, 270°)$	$[270°, 315°)$	$[315°, 360°)$
Frequency	13	20	17	10