Math 310 Winter 2021 HW 3 Due Sunday March 21st at midnight.

Your work should be typed and submitted through Canvas.

1. The article "Towards Improving the Properties of Plaster Moulds and Castings" describes several ANOVAs carried out to study how the amount of carbon fiber and sand additions affect various characteristics of the molding process. The attached data is on casting hardness and on wet-mold strength.

   (a) An ANOVA for wet-mold strength gives SSSand=705, SSFiber=1278, SSE=843, and SST=3105. Test for the presence of any effects using $\alpha = 0.05$

   (b) Carry out an ANOVA on the casting hardness observations using $\alpha = 0.05$

   (c) Plot the sample mean hardness against sand percentage for different levels of carbon fiber. Is the plot consistent with your analysis in part (b)?

2. A chemical engineer has carried out an experiment to study the effects of the fixed factors of vat pressure (A), cooking time of pulp (B), and hardwood concentration (C) on the strength of paper. The experiment involved two pressures, four cooking times, three concentrations, and two observations at each combination of these levels. Calculated sums of squares are SSA = 6.94, SSB = 5.61, SSC = 12.33, SSAB = 14.40, and SST = 70.82. Construct the ANOVA table, and carry out appropriate tests at significance level 0.05.

3. The article "Effect of Cutting Conditions on Tool Performance in CBN Hard Turning" reported the accompanying data on cutting speed (m/s), feed (mm/rev). depth of cut (mm), and tool life (min). Carry out an ANOVA on tool life, assuming the absence of any factor interactions (as did the authors of the article).

4. Suppose the expected cost of a production run is related tot he size of the run by the equation $y = 4000 + 10x$ Let Y denote an observation on the cost of a run. If the variables' size and cost are related according to the simple linear regression model, could it be the case that $P(Y > 5500 \text{ when } x = 100) = 0.05$ and $P(Y > 6500 \text{ when } x = 200) = 0.10$? Explain.

5. Show that b_1 and b_0 of expressions (12.2) and (12.3) in your book satisfy the normal equations on page 626.

6. Show that the "point of averages" $(\bar{x}, \bar{y})$ lies on the estimated regression line.