STAT 3851 - Statistical Data Analysis II
Exam 01 — Part I

Note: Time limit for Part I of the exam is _35 minutes_

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Date: 03/30/2021

SHOW ALL WORK!

Question No.	Score
01	$\overline{}$ 20
02	$\overline{}$ 20
03	$\overline{}$ 20
04	$\overline{}$ 20
05	$\overline{}$ 20
Total	$\overline{}$ 100

1. During new product development, companies often involve "lead users" (i.e., creative individuals who are on the leading edge of an important market trend). Creativity and Innovation Management published an article on identifying the social network characteristics of lead users of children's computer games. Data were collected for $n = 326$ children and following variables measured:

y = lead-user rating (measured on a 5-point scale).

x_1 = age (years).

x_2 = Degree of centrality (measured as the number of direct ties to other peers in the network).

x_3 = Betweenness centrality (measured as the number of shortest paths between peers).

A first order model for y was fit to the data, yielding the following LS prediction equation.

$$\hat{y} = 3.58 - 0.06x_1 - 0.01x_2 + 0.42x_3$$

(a) Give a practical interpretation the estimate of β_3 in the model.

(b) A test of $H_0 : \beta_3 = 0$ vs. $H_a : \beta_3 \neq 0$ resulted in a t-test statistic of 4.21 and a $p-value$ of 0.002. Conduct the appropriate 4-step hypothesis test. Let $\alpha = 0.05$.

   i.

   ii.

   iii.

   iv.

2. Botanists at the University of Toronto conducted a series of experiments to investigate the feeding habits of snow geese. The botanists were interested in predicting weight change (y) as a function of digestion efficiency (x_1), acid-detergent fiber (x_2) (all measured as percentages) and diet (x_3) (plants or duck chow). They conducted 42 feeding trials. The first-order model $E(y) = \beta_0 + \beta_1 x_1 + \beta_2 x_2$ was fit to the data.

Predictor	Estimate	Std. Error	t value	$Pr(>|t|)$
(Intercept)	12.1800	4.4020	2.77	0.009
DIGEST	-0.02654	0.0535	-0.50	0.623
ADFIBRE	-0.4578	0.1283	-3.57	0.001

(a) What are the qualitative and quantitative variables described in the problem?

(b) Which predictor variables have been used to fit the given first-order multiple linear model?

(c) Use the output and write the model equation for weight change, y.

(d) Interpret the β_1-estimate in the equation.

(e) Find a 95% CI for β_2. (Hint: z^* value for a 95% CI is 1.96)
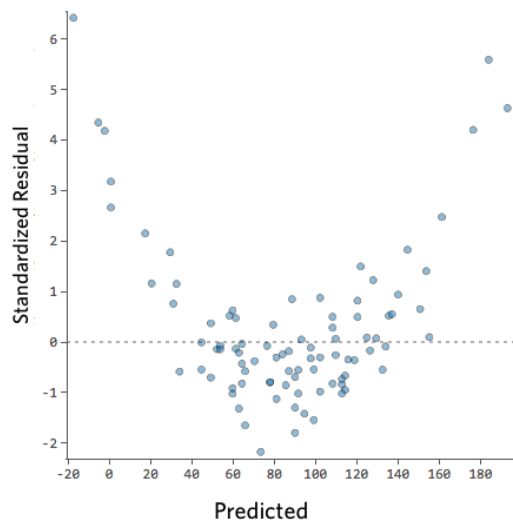
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3. Answer the following questions.

   (a) Name two measures that we can use to assess the accuracy of a model.
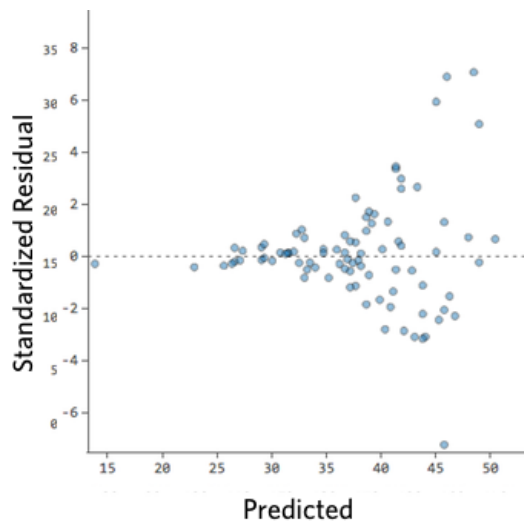
      i.

      ii.

   (b) Consider the following residual plots. What conclusions you can make regarding the models that produced these residual plots?

Answer:

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