STAT 221/231 Tutorial Test 3

Wednesday November 30 in your scheduled tutorial time.
You may ONLY write in your assigned tutorial time.

Seating is predetermined so please check your seat assignment at
https://odyssey.uwaterloo.ca/teaching/schedule
Bring your Watcard. Only Pink-tie or Blue-goggles calculators may be used.

You may bring one (1) **double-sided**, letter sized (8.5 x 11 inches), handwritten page of notes to the test (no photocopies).

Tutorial Test 3 will focus on the material in Section 5.3 and Sections 6.1-6.2, however you must still know the material from Chapters 1-5.

In particular you should know and understand the following:

Section 5.3:

How to use the likelihood ratio test statistic to test $H_0 : \theta = \theta_0$ for each of the following:

Binomial(n, θ), Geometric(θ), Negative Binomial(k, θ), Poisson(θ), Exponential(θ), $G(\theta, \sigma)$ where σ is known

How to use the likelihood ratio test statistic to test $H_0 : \theta = \theta_0$ given a model and a set of data, and how to obtain the approximate $p - value$ using Normal tables.

Sections 6.1-6.2:

Model assumptions for simple linear regression model:

$$Y_i \backsim G(\alpha + \beta x_i, \sigma) \qquad i = 1, 2, \ldots, n \text{ independently}$$

where α, β and σ are unknown parameters and the x_i's are known constants.

Maximum likelihood estimates and least squares estimates of α and β (page 194)

Unbiased estimate of σ^2 (pages 194-195)

The derivation of the distribution of the maximum likelihood estimator of β (pages 195-196)

Confidence interval for β (page 197)

How to test the hypothesis of no relationship ($H_0 : \beta = 0$) (page 197)

Confidence interval for mean response at x: $\mu(x) = \alpha + \beta x$ (pages 198-199)

Prediction interval for response Y at x (pages 201-202)

See the Summary of Distributions for Simple Linear Regression (Table 6.2, page 205)

How to check the model assumptions for simple linear regression (pages 206-208) using:

(1) scatterplot of data and fitted line

(2) residual plots:

(i) $(x_i, \hat{r}_i)$, $i = 1, \ldots, n$ where $\hat{r}_i = y_i - \hat{\mu}_i$ and $\hat{\mu}_i = \hat{\alpha} + \hat{\beta} x_i$.

(ii) $(x_i, \hat{r}_i^*)$, $i = 1, \ldots, n$ where $\hat{r}_i^* = \hat{r}_i / s_e$ (same as the graph in (i) except y axis is rescaled).

(iii) $(\hat{\mu}_i, \hat{r}_i^*)$, $i = 1, \ldots, n$.

(3) qqplot of the residuals

There will also be short answer and multiple choice questions on the R code used in Assignments 1, 2, 3 and 4.

You need to be able to read the output from the following R commands similar to the questions on Assignment 4:

t.test()

and

RegModel<-lm(y∽x)
Summary(RegModel)

You should do the following problems in the Course Notes:

Chapter 5, Problems 9-13
Chapter 6, Problems 1-9