MA 542: REGRESSION ANALYSIS

QUIZ - 7 **Name** Key

An endocrinologist was interested in exploring the relationship between the level of steroid (Y) and age (X) in healthy female subjects whose ages ranged from 8 to 25 years. She collected sample of 27 healthy females in this age range. The following is the summary (R) output for the fitted quadratic regression model. Here note that x is the centralized X.

```
Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) 21.09416    0.91415  23.075  < 2e-16 ***
x            1.13736    0.11546   9.851 6.59e-10 ***
xsq         -0.11840    0.02347  -5.045 3.71e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 3.153 on 24 degrees of freedom
Multiple R-squared:  0.8143,   Adjusted R-squared:  0.7989
F-statistic: 52.63 on 2 and 24 DF,  p-value: 1.678e-09
```

a) Perform a four step hypotheses test to test whether the quadratic term can be dropped from the model; use $\alpha = 0.05$.

Using t-test

Hypotheses:

$H_0: \beta_{11} = 0$ vs $H_1: \beta_1 \neq 0$

Test Statistic:

$T^* = -5.045$ (from the table)

P-value:

P-value $= 3.71 \times 10^{-5}$ (from the table)

Conclusion:

Since p-value $< \alpha = 0.05$, H_0 is rejected

So we don't have enough evidence to conclude that the quadratic term can be dropped.

(or quadratic term can not be dropped from the model).

b) Do you have enough information in the output to perform a hypotheses test to test whether or not there is a regression relation? If so, write down your conclusion based on the value in the output. (Mention the criteria you use clearly).

Yes we can use the F-test.

Since the p-value $= 1.678 \times 10^{-9} < \alpha = 0.05$, we reject $H_0: \beta_1 = \beta_{11} = 0$.

So there is a regression relation between level of steroid and age.

c) If the mean of the X values is 15.7777, Express the **fitted regression function** in terms of the **original variable** X

$$x = X - 15.7777$$

$$\hat{y} = 21.09416 + 1.13736x - 0.1184x^2$$

$$= 21.09416 + 1.13736(X - 15.7777) - 0.1184(X - 15.7777)^2$$

$$= 21.09416 + 1.13736X - 17.94492 - 0.1184(X^2 - 31.5554X + 248.9358)$$

$$\hat{y} = -26.32476 + 4.87352X - 0.1184X^2$$