

# Stat 346 Homework 2

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Feb. 13, 2014

## 1 Problem 1

### 1.1 Part a

The residuals are not normally distributed, indicating a nonlinear relationship. Possible fixes include non-linear regression or a transformation on X.

### 1.2 Part b

These residuals seem to be normally distributed with constant variance. This indicates that the model is a good fit.

### 1.3 Part c

The errors are not normally distributed. This might be fixed with a transformation on Y.

### 1.4 Part d

The variance on the residuals is not constant. This might be fixed with a transformation on Y.

## 2 Problem 2

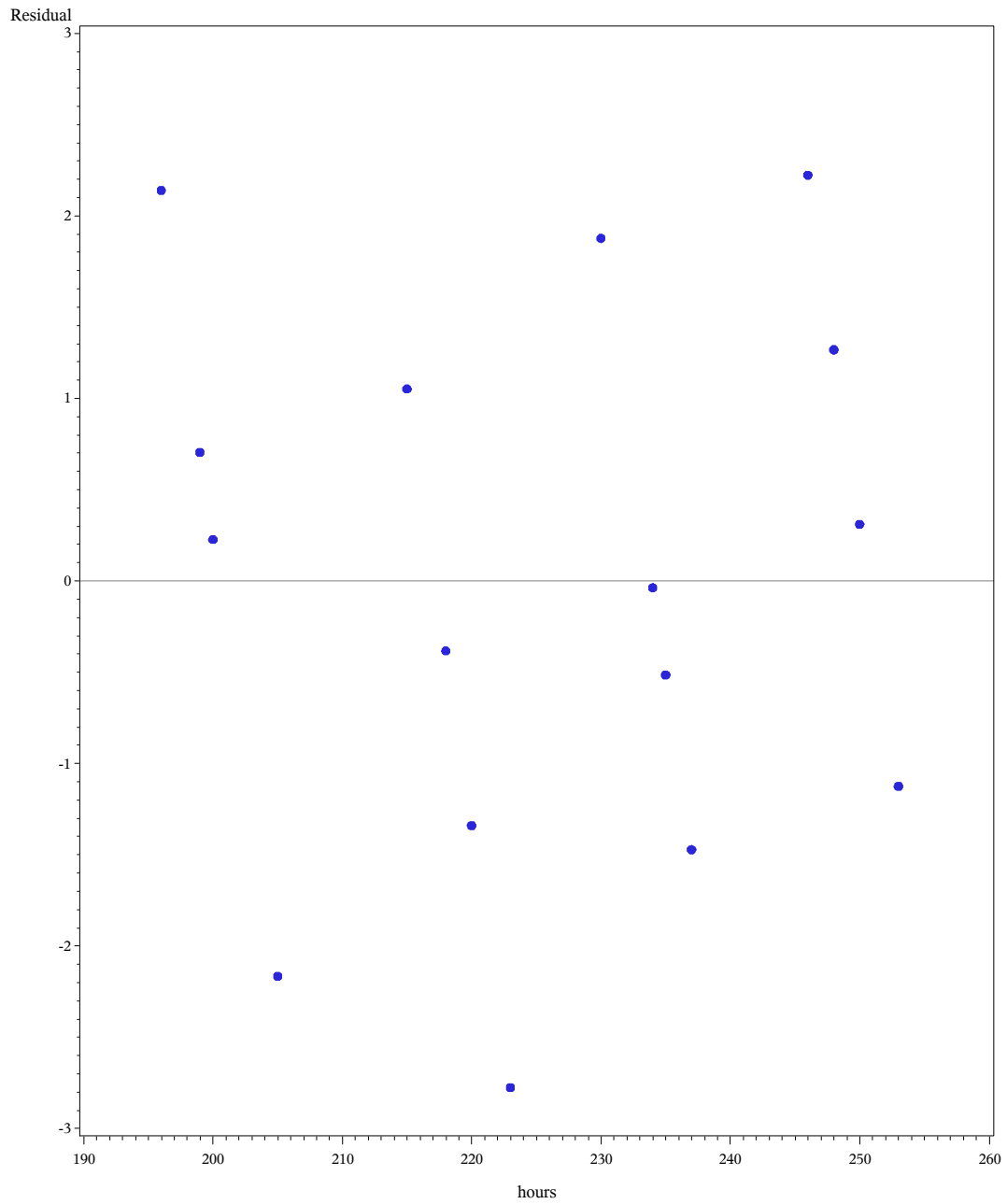
### 2.1 Part a

The residuals seem normally distributed and support a linear trend.

### 2.2 Part b

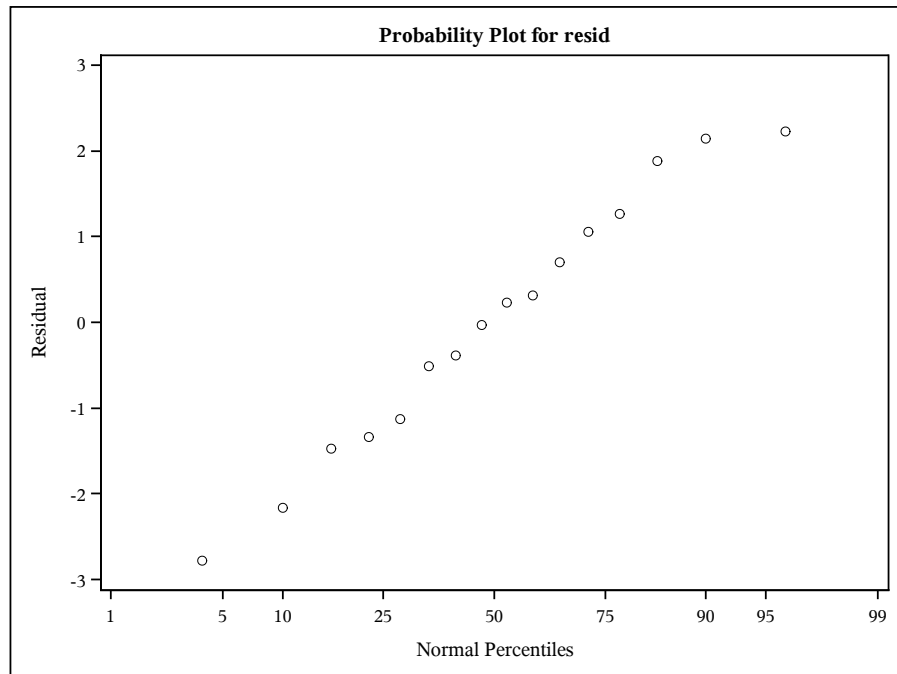
$$\begin{aligned}s\{b_1\} &= 2.125 \times 10^{-2} \\ t(1 - 0.05/2, 16 - 2) &= t(0.975, 14) = 2.145 \\ b_1 &= 0.47833 \pm 2.145 * 2.125 \times 10^{-2} \\ &= (0.43275, 0.52392)\end{aligned}$$

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**Plastic Hardness**  
Residuals vs. time

***Plastic Hardness***  
***Normal Probability***

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### 2.3 Part c

$$\hat{Y} = 37.7759$$

$$s\{\hat{Y}\} = 0.5851$$

$$\hat{Y} \pm t(1 - 0.05/2, 16 - 2)s\{\hat{Y}\} = 2.145 * 0.5851$$

$$(36.5209, 39.0309)$$

### 2.4 Part d

$$R^2 = 1 - \frac{SSE}{SSTO} = 1 - \frac{34.342802}{1280} = 0.9731$$

### 2.5 Part e

1. General Linear Test
2. ANOVA
3. T-test

## 3 Problem 3

### 3.1 Part a

	ORIGINAL REGRESSION	REGRESSION WITH OUTLIER
Fitted Regression Equation	$\hat{Y} = 2.11405 + 0.03883X$	$\hat{Y} = 3.04977 + 0.00090502X$
R-Square	0.0726	0.0011
MSE	0.38829	0.41822
$SE\{b_1\}$	0.01277	0.00250
P-Value	0.0029	0.7178

### 3.2 Part b

The residuals plot is much more extreme.

### 3.3 Part c

Yes, you could construct a sequence diagram over the dates, or perhaps school years, at which the GPA and ACT scores were collected.

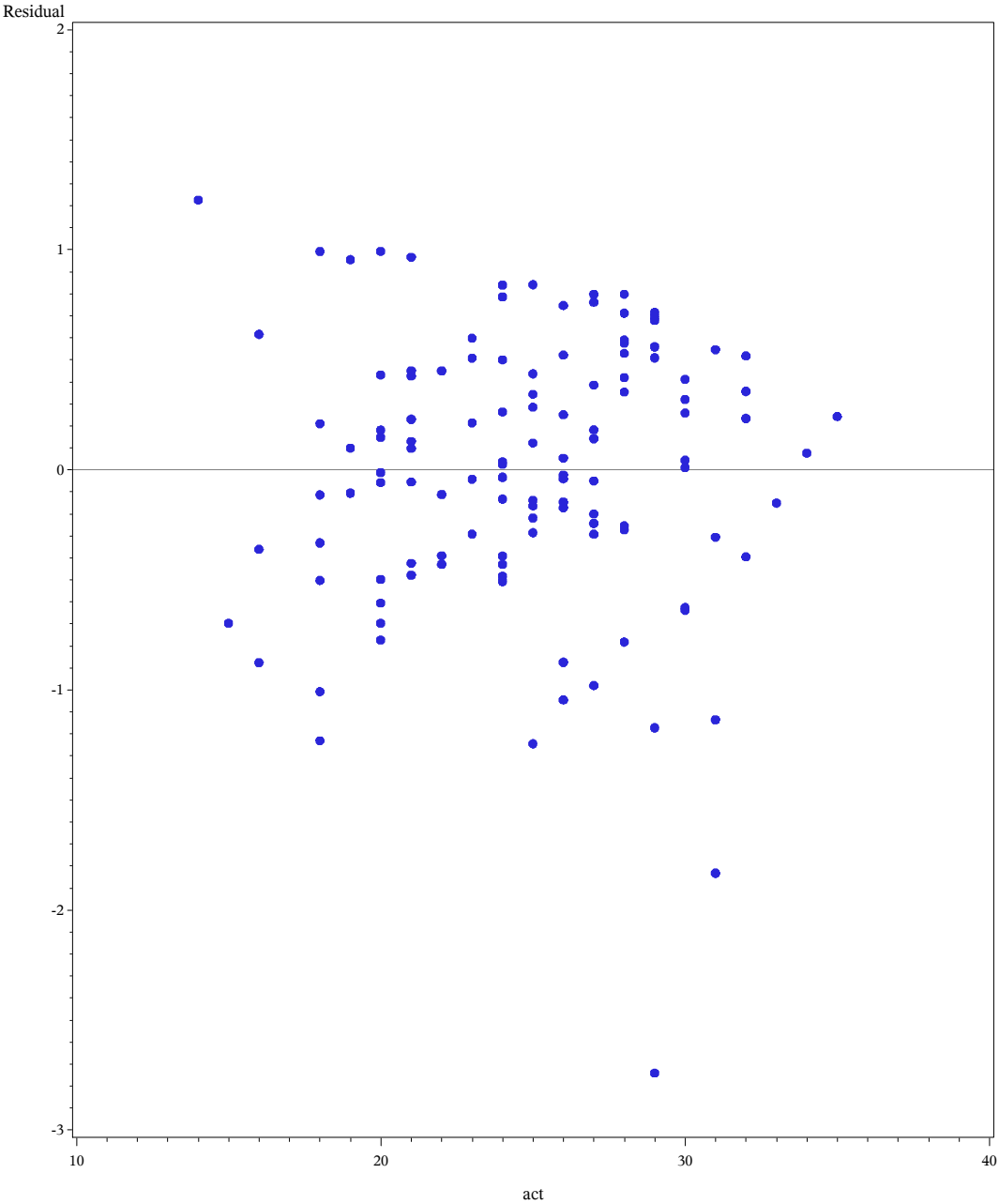
## 4 Problem 4

## 5 Problem 5, KNN #3.23

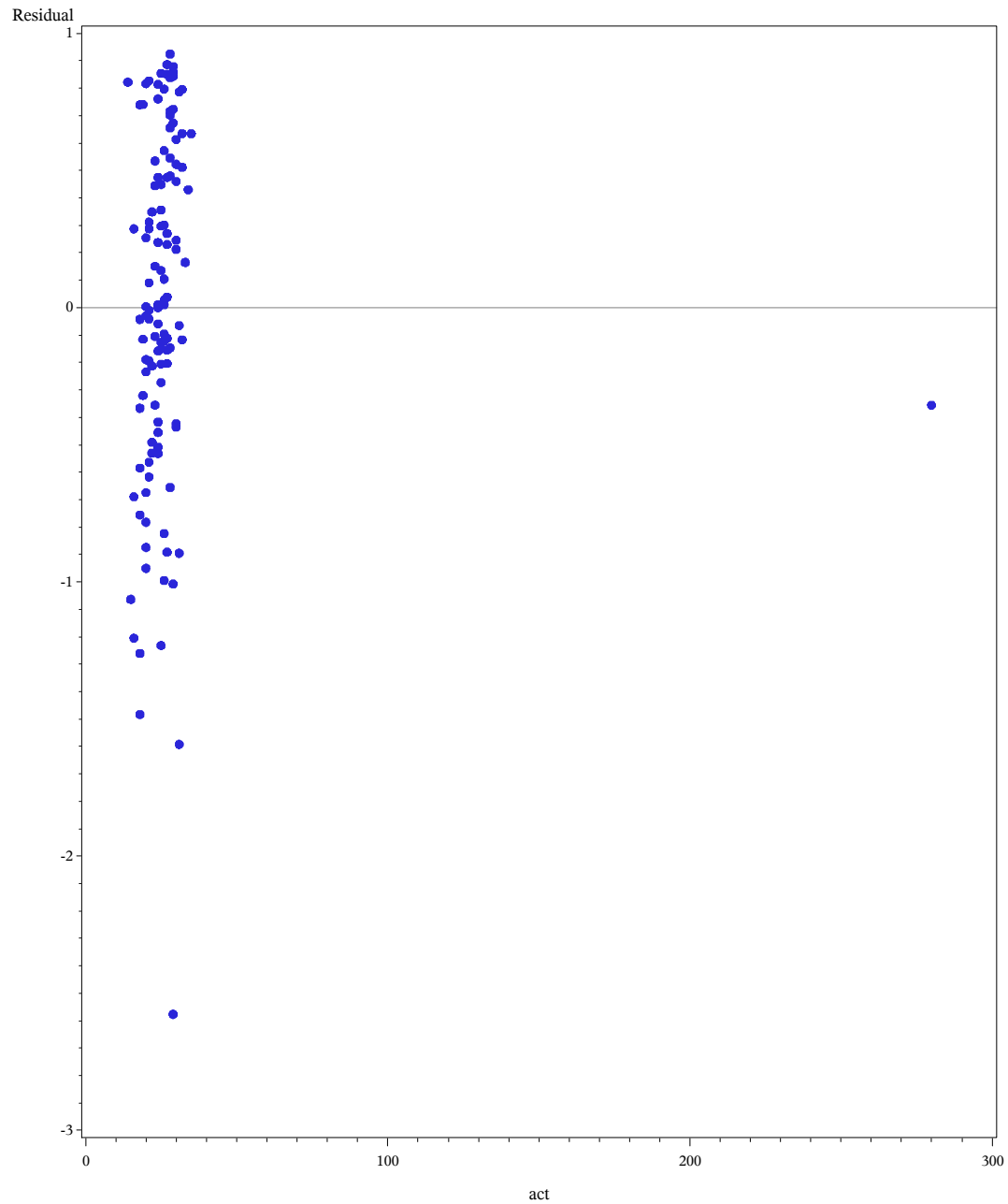
Full Model:

$$Y_{ij} = \mu_j + \epsilon_{ij} \quad (1)$$

GPA and ACT  
Residuals vs. time

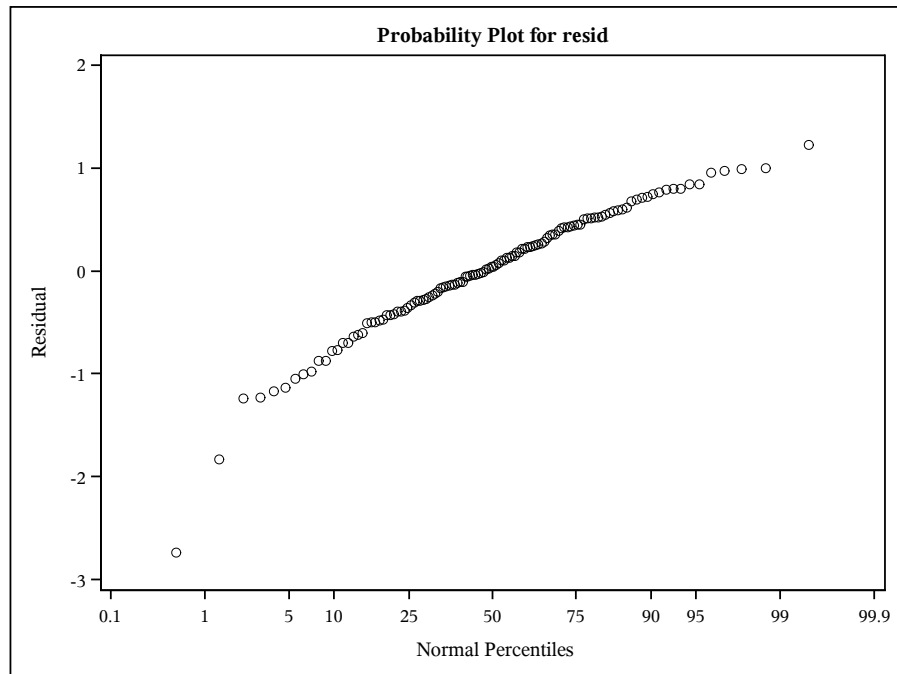


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**GPA and ACT with typo**  
Residuals vs. time

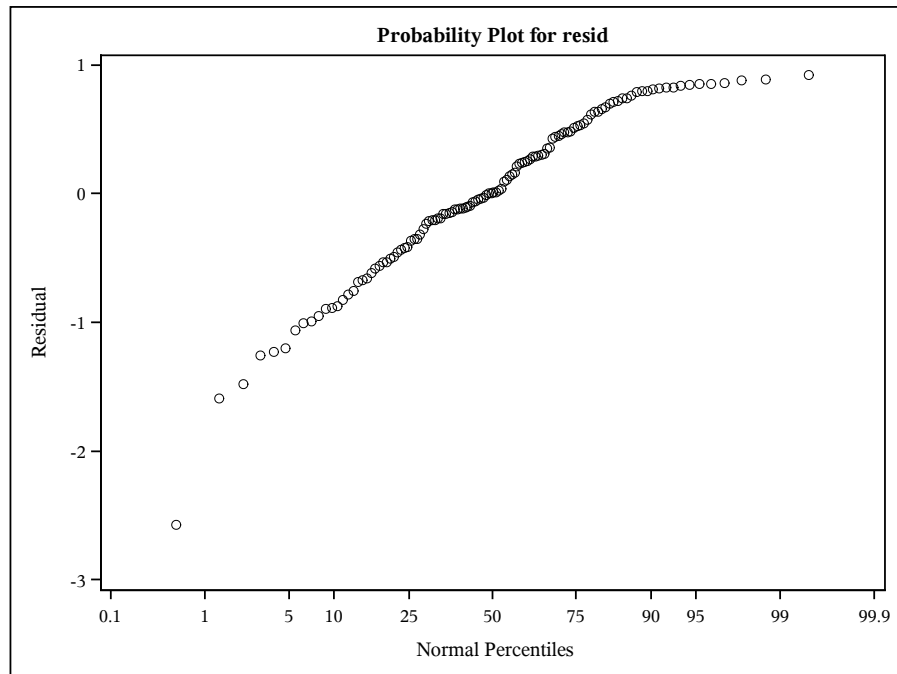
***GPA and ACT***  
***Normal Probability***

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***GPA and ACT with type  
Normal Probability***

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Degrees of freedom:  $n - c$

Reduced Model:

$$Y_{ij} = \beta_1 X_j + \epsilon_{ij} \quad (2)$$

Degrees of freedom:  $n - 2$