Stat637 Homework 1-2

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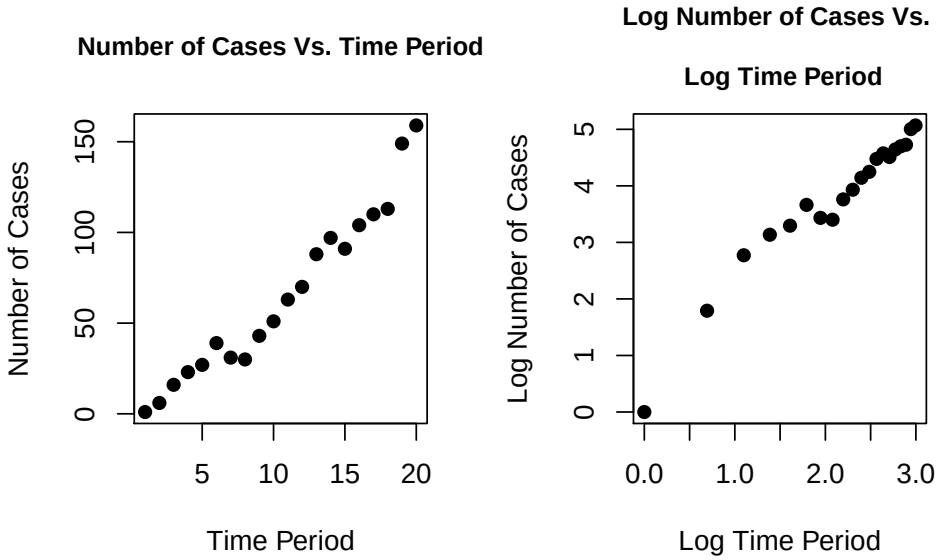
1 AIDS Data

1.1 Plot of Number of Cases Against Time Period



2 Computing Estimates for $b^{(t)}$

With starting values of $b^{(0)} = (0, 0)$, the aliterative weighted least squares algorithm computed esitmates that converged to (0.995998, 1.32661). Using the *glm* function in R, the estimate computed were also (0.995998, 1.32661). The table below summarizes the value of the estimates and their 95% confidence intervals.

	Estimate	Lower 95% CI	Upper 95% CI
Intercept	0.995998	0.663377	1.328619
Slope	1.326610	1.199930	1.453289

3 Deviance

3.1 Linear Model

Model:

$$y_i = \beta_0 + \beta_1 x_i + \epsilon_i,$$

where $i = 1, ..., 50$ and $\epsilon \sim N(0, 1)$. x's were generated from $N(4, 1)$.

The residuals deviance for this model is $\sum_{i=1}^{n} \frac{(y_i - \boldsymbol{x_i'\beta_{mle}})^2}{2\sigma^2}$.

For the model with a covariate, the deviance is 31.920652.
For the model with onlt the intercept, the deviance is 968.774313.
These values agree with the output in R.

3.2 Normal Model

Model:

$$y_i \ N(4, 1),$$

where $i = 1, ..., 50$.

The residuals deviance for this model is also $\sum_{i=1}^{n} \frac{(y_i - \boldsymbol{x_i'\beta_{mle}})^2}{2\sigma^2}$.

For the model with a covariate, the deviance is 55.810183.
For the model with onlt the intercept, the deviance is 55.961981.
These values agree with the output in R.

3.3 Comparison To Corresponding Saturated Models

The Deviance, D, for these models is distributed $\chi^2_{(m-p)}$ Therefore, the

- linear model with only the intercept is siginificantly different from its saturated model.
- linear model with the covariate is not siginificantly different from its saturated model.
- normal model with only the intercept is not siginificantly different from its saturated model.
- normal model with the covariate is not siginificantly different from its saturated model.

3.4 Comparison of Intercept-only Model to Covariate Model

The Deviance, Δ D, for these models is distributed $\chi^2_{(1)}$ Therefore, for

- linear model, the covariate model is significantly better that the intercept0-only model. (Δ D = 936.853661)
- normal model, the covariate is not siginificantly than the intercept-only model. (Δ D = 0.151798)