

When asked to explain something, provide an explanation that could be understood by someone who does not have formal training in statistical methods.

1. The following model has been fit to weekly total sales figures (in thousands of units) for the first 20 weeks after introduction of a new ink-jet printer.

$$\log(\text{Sales}) = Z_t^* = \beta_0 + \beta_1 t + a_t, \quad a_t \sim \text{nid}(0, \sigma_a^2)$$

where $t = 1, 2, \dots, 20$ is coded time and the * indicates that a log transformation has been used. Assume that the model fits well. The following results were obtained from the computer output: $\hat{\beta}_0 = .4$, $S_{\hat{\beta}_0} = .13$, $\hat{\beta}_1 = .2$, $S_{\hat{\beta}_1} = .01$, and $\sum_{i=1}^{20} (Z_t^* - \hat{Z}_t^*)^2 = 1.31$, where \hat{Z}_t^* , $t = 1, 2, \dots, 20$ are the fitted values from the model.

- (a) Note that $\hat{\beta}_1$ is related to trend. How would you describe trend for this model. Be as specific as you can.

- (b) Compute an estimate for σ_a .

- (c) Explain why σ_a has a nicer interpretation than σ_a^2 .

- (d) What is the practical interpretation of the estimate in Part 1b?

- (e) Compute an *approximate* prediction interval for sales at time 21.

- (f) Is this model for log sales Z_t^* stationary or not? Explain.

- (g) Is the model for the residual term a_t stationary or not? Explain.

2. List some of the things that you can learn by looking at a plot of time series data.
- -
 -
3. Suppose that Z_t comes from a stationary process. Consider the deviate process defined as $\dot{Z}_t = Z_t - \mu_Z$ where $\mu_Z = E(Z_t)$.
- (a) Briefly describe the relationship between Z_t and \dot{Z}_t .
- (b) What properties does \dot{Z} have that make it appealing for studying the properties of time series models?
4. For the following differencing schemes, write W_t as a function of past and present values of Z_t .
- (a) $W_t = (1 - B)^2 Z_t$
- (b) $W_t = (1 - B^{12})Z_t$
- (c) $W_t = (1 - B)(1 - B^{12})Z_t$
5. For purposes of description and modeling it is sometimes useful to consider the different “components” of a time series model. Briefly explain the difference between the periodic (also known as seasonal) component and the cyclical components of a time series. Give an example of each.
6. Briefly explain the purpose of a normal probability plot.

