STANFORD UNIVERSITY
STATISTICS DEPARTMENT

Statistics 207 Introduction to Times Series Analysis
Summer 2001

Take-home Midterm

Instructions: This is a take-home exam. Your are expected to work on the exam alone. If you have questions about the exam you may ask the instructor.

1. (Average Air Temperature Racife Brazil, 1953-1962.) The following problem is to describe and understand the variation in the temperature data.

   (a) Plot the data $\{x_t\}$ and describe its main features.

   (b) Perform a Classical Decomposition of the data, $X_t = S_t + T_t + I_t$.

   (c) Are there any unusual years in the data?

2. (Yield on short-term British government securities.) Find a suitable time-series model and compute forecasts up to 12 months ahead.

   (a) Plot the data and describe its main features. Is there a seasonal pattern?

   (b) Suggest and apply an appropriate transformation that transforms the data to a stationary time series.

   (c) Fit an ARIMA model to this set of data and justify your choice by examining the appropriate ACF, PACF, and residual plots.

   (d) Give the estimated model and the value of the AIC.

   (e) Calculate the formula for the one-step ahead forecast x_{n+1}^n.

   (f) Forecast the time series 12 months ahead. Comment.

3. (Monthly totals of international airline passengers, Jan. 1949 to Dec. 1960.) Fit an ARIMA model to the data and produce forecasts up to one year ahead.

   (a) Plot the data and describe its main features.

   (b) Suggest and apply a transformation that stabilizes the variance of the data.

   (c) Suggest and apply a transformation that transforms the data to a stationary time series.

   (d) Identify an appropriate ARIMA model for this set of data and specify any goodness-of-fit methods used in your selection process.

4. Problem 2.19, page 205.