Problem 1. Consider quarterly data for 10 years (see Homework 1 and 2) on a response variable, ski sales (in millions of dollars) and a predictor variable which is a leading economic indicator, viz., personal disposable income (in billions of current dollars).

(i) Analyze the residuals from the model in (i) of HW2 (referred to as model HW2(i)) in order to assess whether they have dependence structure using graphical procedures (plot of residuals versus time, and a plot of the sample autocorrelation function); and numerical procedures (Box-Ljung portmanteau test, McLeod-Li portmanteau test, the turning point test, and the difference-sign test).

(ii) Check whether the residuals satisfy the assumption of normality of the errors.

(iii) Fit an additive Holt-Winters procedure to the first 36 observations of the time series data on ski sales, allowing automatic optimization of the smoothing constants. Predict the ski sales for the last year.

(iv) Fit a multiplicative Holt-Winters procedure to the first 36 observations of the time series data on ski sales, allowing automatic optimization of the smoothing constants. Predict the ski sales for the last year (last 4 observations).

(v) Based on the MAPE criterion, compare model HW2(i), model in (iii) above, and model in (iv) above, in terms of their forecasting performance.

Problem 2. Brockwell and Davis, Problem 1.4