

**INDIAN STATISTICAL INSTITUTE
CHENNAI CENTRE**

M.STAT I. 2014-15 Semester II

Time Series Part II

Final Examination

4.5 points to each question

Maximum Marks 15

Monthly data on the Federal Reserve Board Production Index time series is called *prodn* in the R package *astsa*; $n = 372$. Plots of the time series $\{Y_t\}$ and its nonseasonal and seasonal differences indicate that the series exhibits trend and periodic behavior (period=12).

- (a) Write a suitable structural model for Y_t which incorporates a trend T_t , a seasonal component S_t , and a random error v_t . Suppose I ask you to model the trend by an AR(1) specification with error w_{t1} , while S_t should have an additive seasonal structure with error w_{t2} .
Hint: Recall how you modeled the *jj* data.
- (b) Cast the structural model in (a) as a suitable DLM, making sure that your model satisfies all assumptions on the observation and state equations. Show the observation and state equation setup, and identify all the components: $q, p, A_t, R, \mathbf{x}_t, \Phi, Q$.
- (c) Explain anything special you had to do in order to accommodate the structural time series model as a Gaussian DLM.
- (d) Suppose I used R code to fit the DLM model to the first 360 observations, holding out the last 12 for forecast evaluation, and are stored in R as $y[361], \dots, y[372]$. Suppose the corresponding forecasts are given to you in $\text{fore}[1], \dots, \text{fore}[12]$. How will you obtain the Mean Absolute Percent Error (MAPE), and can you show R code for computing this?