CHAPTER 1

INTRODUCTION

1.1 Introduction to Time Series Analysis

A discrete time series is a sequence of observed values measured at discrete times. Some examples of time series data are monthly carbon dioxide concentrations in the atmosphere, daily closing price of the composite index of Bursa Malaysia, daily average temperature in Kuala Lumpur and the mean annual rainfall in Malaysia. Time series analysis is a rich and growing branch of statistics that has found many applications in economics, business, engineering, meteorology, sociology and ecology. The objectives of time series data analysis are mainly for description, explanation, prediction and control.

Time series data may exhibit patterns like trend, seasonality and cycle. Trend is a long term increase or decrease in the data and it could be linear or nonlinear. Seasonality is a periodic fluctuation that occurs on a fixed interval. The period could be year, month or day of the week. Sales of summer clothing or ice cream and household electricity consumption have been known to show seasonal pattern. Cycle also exhibits repeated pattern but its period is not necessarily fixed. Examples of cyclical patterns are business and economic cycles. In

general, the average length of a cycle is usually longer than that of seasonality and the magnitude of a cycle varies more than that of seasonality.

1.2 Objectives and Scope of This Study

The objective of this study is to analyze, model and forecast the movement of the monthly average **Bursa Malaysia Composite Index** (BMCI). The scope of this study involves model identification, model estimation, model validation and forecasting of future values of BMCI. Time series data were obtained from Bursa Malaysia (formerly known as Kuala Lumpur Stock Exchange). The daily closing values of Bursa Malaysia Composite Index from January 2000 until December 2004 were collected and grouped into successive months. Then for every month in a year, all daily closing indices in it are summed and divided by the total number of days. This average value will represent that particular month. It should be noted that the analysis commences with the data from January 2000 since there was a market crash in 1998 and 1999 is considered as a recuperation period. Year 2000 is selected since it is regarded as the beginning of a stable market operation. Two statistical softwares were used and they are R and Excel. The outputs from these softwares are analyzed and conclusions are derived. The performances of the ARIMA models are then compared to the performance of the Kalman filtering technique. Finally, the forecasting ability of the Kalman filter and ARIMA models is tested by predicting the future value of BMCI for January 2005.

1.3 Organization of Report

The organization of the remainder of this report is as follows. The necessary background information and literature review is presented in Chapter 2. This brief review includes fundamental concepts like mean, variance, autocorrelation, linear time series and Kalman filtering model development. It also has a survey of past work related to this study. Chapter 3 begins by outlining the fundamental assumptions and good attributes of a good ARIMA model. Then AR, MA, ARMA and ARIMA models are described along with the various statistical tests that are used in conjunction with these models. The following subsection is dedicated to a review of Kalman filter which includes its concepts and implementation. Chapter 4 describes the analysis and results of the AR, MA and ARMA models that are fitted to the BMCI data. This is followed by a discussion on the results of the implementation of Kalman filter. Finally in Chapter 5, conclusions are made and recommendations for future works are proposed.