MA4030 - Assignment 1

Question 1

The quarterly sales (thousands) of a departmental store have been monitored for the past five years with the following information .

Total quarterly sales(thousands)

Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4
1996	48	58	57	65
1997	50	61	59	68
1998	52	62	59	69
1999	52	64	60	73
2000	53	65	60	75

(a) Obtain a time series plot to see if an additive model seems appropriate.
(b) Assuming the data to be seasonal, carry out the seasonal decomposition using an additive model. Also ask for four forecasts.
(c) Obtain the time series plot of sales with trend to see if an additive model seems appropriate.
(d) Saving the residuals as **Resi1**, perform residual analysis   producing descriptive statistics, a histogram with a normal plot. Also carry out Kolmogorov-Smirnov test for normality.
(e) Produce a time series plot of the errors.
(f) Do these look to be a good set of residuals.
(g) To build up a moving trend plus seasonal factor model produce moving averages and store them under the heading **Aver1**.
(h) Type in the appropriate seasonal factors as produced by the deseasonal composition in part (b) in a column under the heading **Seasonal** and calculate the **Fitted** values as **Aver1+ Seasonal.**
(i) Obtain a time series plot of Sales, Trend and Fitted using overley graphs on the same page. Does this model look a closer fit?
(j) Calculate residuals from this model as **Resi2=Sales-Fitted**
(k) Perform residual analysis for this model as before producing descriptive statistics, a histogram with a normal plot. Also carry out Kolmogorov-Smirnov test for normality.

(l) Producing a time series plot of both sets of errors   **Resi1** and **Resi2** on the same plot

Identify the set which look preferable.

(m) Assuming that the trend from the additive model is increasing by 0.3 per quarter, what would be your forecasts for the four quarters of 2001? Compare with those produced in part (b).

Question 2

(a) An MA(2) process is defined in terms of white noise $\{z_t\}$ by

$$X_t = Z_t + 0.8Z_{t-1} - 0.1 Z_{t-2}$$

Find the ACF of $\{X_t\}$ assuming that $Var(Z_t)=1 \ \forall \ t$.

Obtain the correlogram for the process. What do you notice.

Can you use this correlogram to identify an MA process.

(b) Show that the MA(2) process given by $X_t = Z_t - Z_{t-1} + 0.16Z_{t-2}$ is invertible. Explain why the correlogram of this process has only two spikes. Find their sizes.