

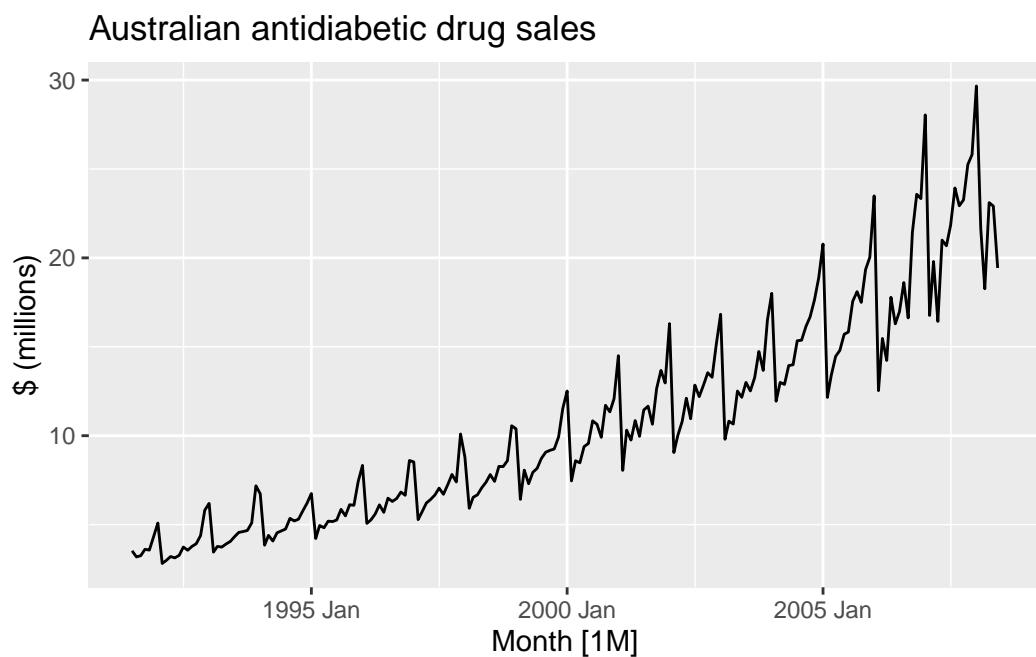
# Forecasting Methods

## Mock Exam

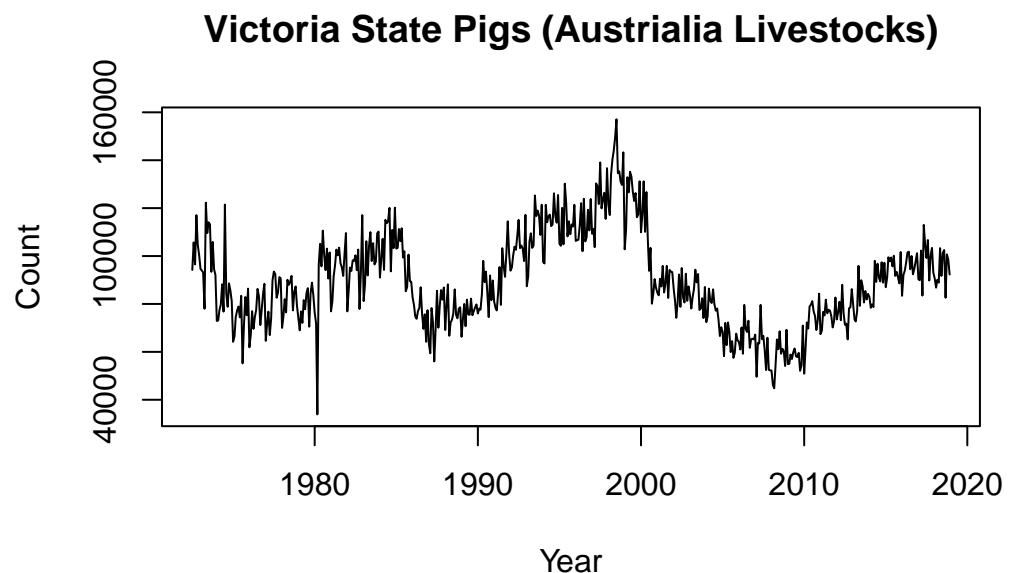
### Question 1 (25 points)

Explain the following plots in relation to the components of a time series.

(a)

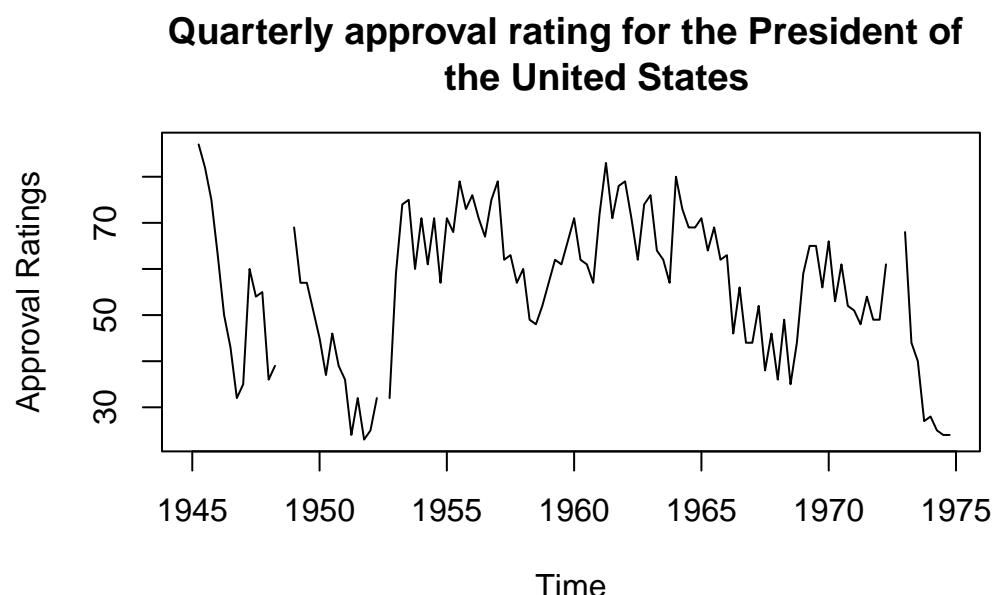


(b)

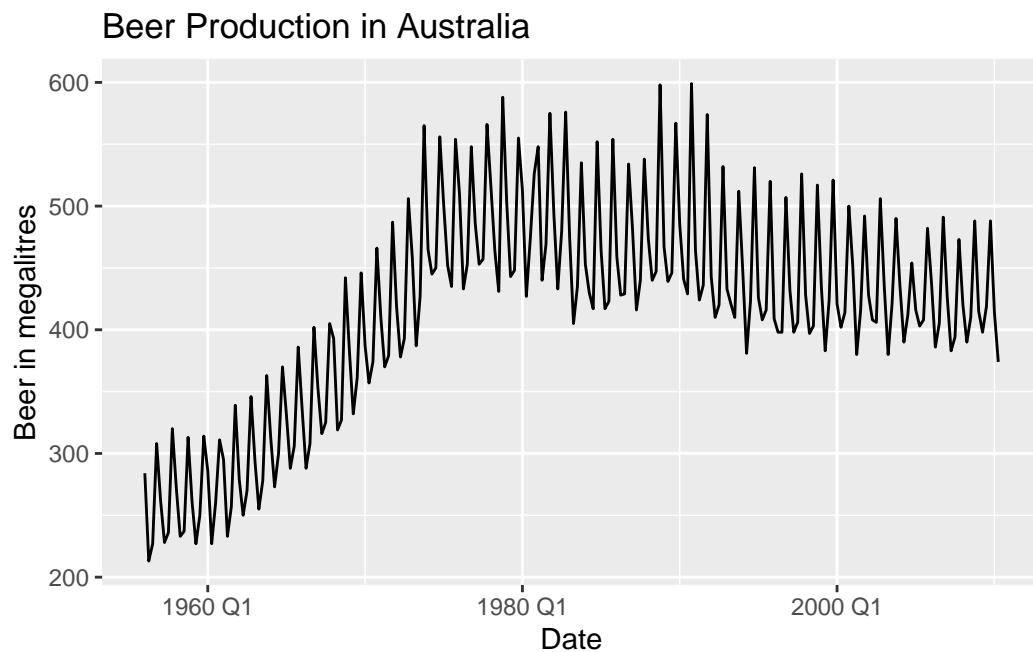


**Identify the components of the given time series. State and explain an appropriate model that can be applied.**

(c)



(d)



## Question 2 (25 points)

(a) Is this series stationary? Explain

```
#####
# Augmented Dickey-Fuller Test Unit Root Test #
#####
```

```
Test regression none
```

Call:

```
lm(formula = z.diff ~ z.lag.1 - 1 + z.diff.lag)
```

Residuals:

Min	1Q	Median	3Q	Max
-122.86	-18.67	9.06	29.48	184.03

```

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
z.lag.1     -0.18769   0.04931 -3.806 0.000181 ***
z.diff.lag -0.38891   0.06172 -6.302 1.47e-09 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

Residual standard error: 42.38 on 232 degrees of freedom  
 Multiple R-squared: 0.2739, Adjusted R-squared: 0.2676  
 F-statistic: 43.75 on 2 and 232 DF, p-value: < 2.2e-16

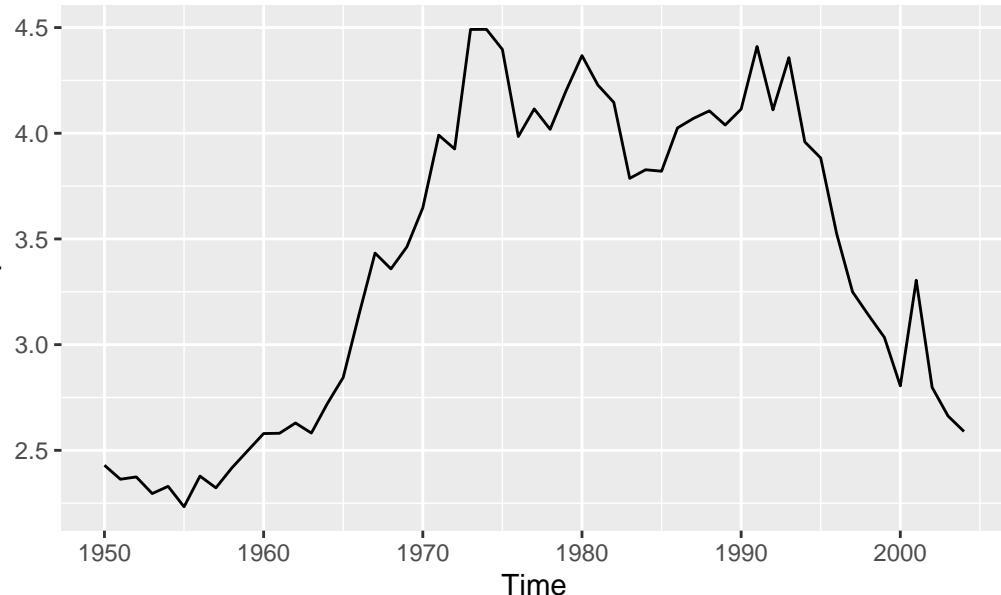
Value of test-statistic is: -3.8061

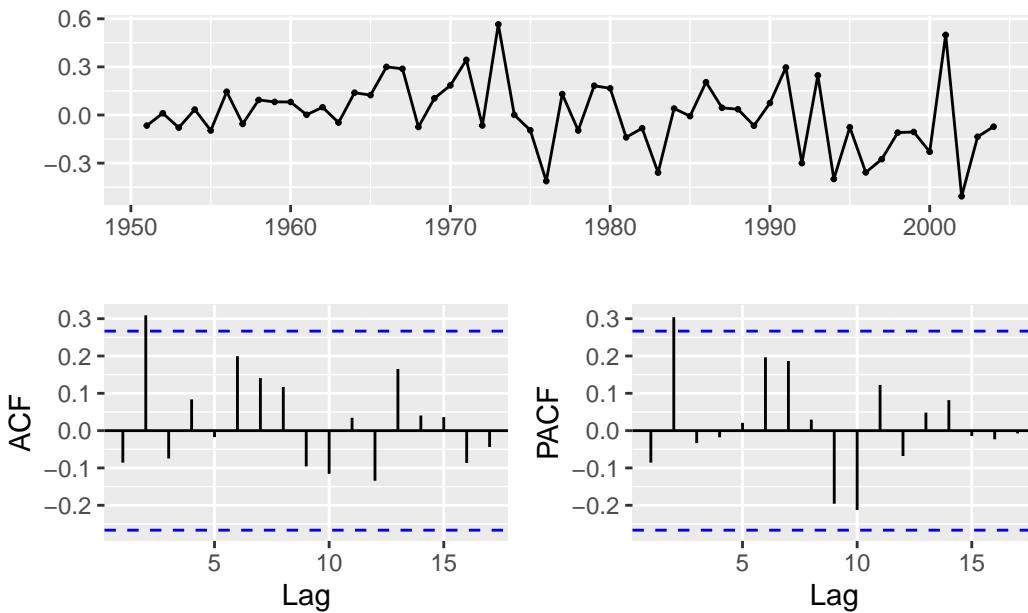
Critical values for test statistics:

	1pct	5pct	10pct
tau1	-2.58	-1.95	-1.62

**(b) Analyze the graphs of the original series and the first difference series below.**

- Identify an appropriate ARIMA(p,d,q) model.
- Should a constant be included in the ARIMA model? Explain.





### Question 3 (25 points)

You are a sales analyst with access to monthly sales data for Lidl supermarket in Oldenburg, Germany, spanning from 1990 to 2020.

- (a) Outline the steps to follow for an accurate sales forecast.
- (b) Explain why data partitioning is important in forecasting.
- (c) What is the minimum duration you should select for your test data? Explain briefly

### Question 4 (25 points)

- (a) Choose the best model and explain?

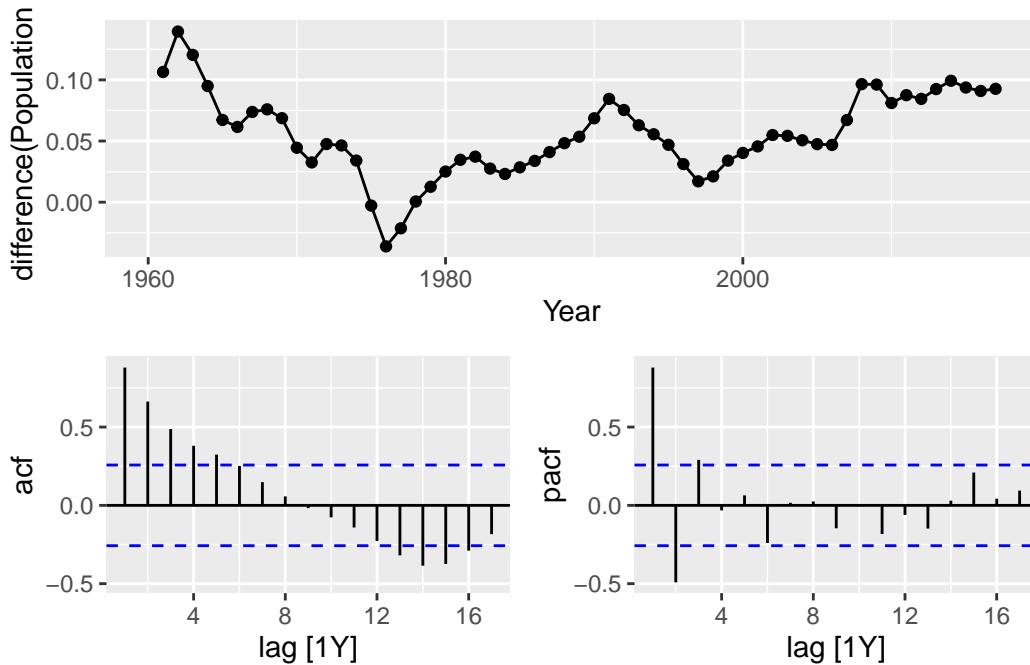
```
# A tibble: 6 x 2
  .model    AICc
  <chr>    <dbl>
1 arima010  668.
2 arima011  659.
3 arima012  660.
```

```

4 arima013  662.
5 arima110  657.
6 arima111  659.

```

**(b) Explain the selection of the model with parameters  $p=3$ ,  $d=1$ , and  $q=0$  by analyzing the ACF and PACF of the differenced series. Fill in the ARIMA ( , ) notation accordingly.**



**(c) What condition/s must a time series satisfy to apply an ARMA model, and why are these condition/s important?**

**(d) State and explain the different types of moving averages.**