Department of Statistics
STATS 326: Applied Time Series
Summer Semester, 2019
Test 2
Total Marks = 100

1. The slight negative linear trend is clearer.
   The seasonal component is more constant so we can fit an additive model.
   (10 marks)

2. Yes, the assumptions appear to be satisfied.
   The Residual Series is stationary and appears to be iid $N(0,\sigma^2)$ except for one slightly large positive residual (around observation 55). The 5-number summary of the residuals shows very slight right skewness which is of no real concern.
   The plot of the acf shows only 1 very slightly significant lag at lag 4 which is of no real concern.
   All estimates are significant except for 2 levels of the seasonal factor (Feb p-value = 0.074 and Dec p-value = 0.57).
   (15 marks)

3. Jan 79:
   4.1101689 – (0.0025536*97) + (0.2956986*log(189)) = 5.412446954
   exp(5.412446954) = 224.179739 = 224 cubic feet*100

   Feb 79:
   4.1101689 – (0.0025536*98) – (0.1324948*1) + (0.2956986*5.412446954)
   = 5.327874287
   exp(5.327874287) = 205.9996123 = 206 cubic feet*100

   Mar 79:
   4.1101689 – (0.0025536*99) – (0.3500717*1) + (0.2956986*5.327874287)
   = 5.082735768
   exp(5.082735768) = 161.2144986 = 161 cubic feet*100

   RMSEP
   = sqrt(1/3*[(256 – 224.179739)^2 + (250 – 205.9996123)^2 + (198 – 161.2144986)^2])
   = 37.86703
   (20 marks)

4. Exactly as given in Q3.
   (5 marks)

5. RMSEP
   = sqrt(1/3*[(256 – 221.7432099)^2 + (250 – 202.6037295)^2 + (198 – 166.4215455)^2])
   = 38.37157
   (10 marks)

6. Holt-Winters as it has the lowest RMSEP of 29.69486
   (5 marks)

7. The RMSEPs only cover January to March. We would need a full year of 12 monthly predictions for 1979 to calculate RMSEPs and select the model with the lowest value.
   (5 marks)

8. sim1: MA(2) as we have cut-off at lag 2 in the acf and persistence in the pacf

   sim2: AR(2) as we have decay in the acf and cut-off at lag 2 in the pacf

   sim3: ARMA(1,1) as we have decay in the acf and in the pacf but no indication of the order required so we begin with ARMA(1,1)

   sim4: White Noise as there are no significant lags in the acf or the pacf so the series is iid $N(0, \sigma^2)$
   (20 marks)

9. $\pm 1.96/\sqrt{1000} = \pm 0.061980642$
   (10 marks)