Problem 1

(a) It is a ARMA(2,1). $\phi_1 = 0.8, \phi = -0.3, \theta = 0.1$

(b) It is a ARI(1,1). $\phi = 0.9, \theta = 0$

(c) It is a ARMA(2, 2). $\phi_1 = 0.4, \phi_2 = -0.4, \theta_1 = 0.1, \theta_2 = -0.05$

Problem 2

(a) $\{Y_t\}$ is not stationary for its expectation is related to time t.

(b) $\nabla Y_t = \beta_1 + e_t$ is stationary.

(c) $\{Y_t\}$ is not stationary for its expectation is related to time t.

(d) $E\{\nabla Y_t\} = E\{\beta_1\}$ is not related to time t.

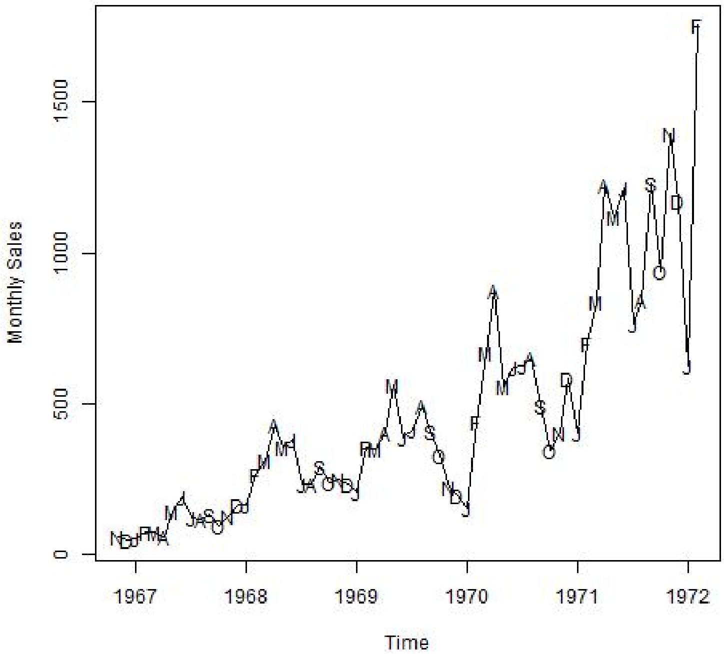
$$Cov\{\nabla Y_t, \nabla Y_s\} = \begin{cases} Var\{\beta_1\} + \sigma_e^2, & t = s, \\ Var\{\beta_1\}, & t \neq s \end{cases}$$

So $\{Y_t\}$ is stationary.

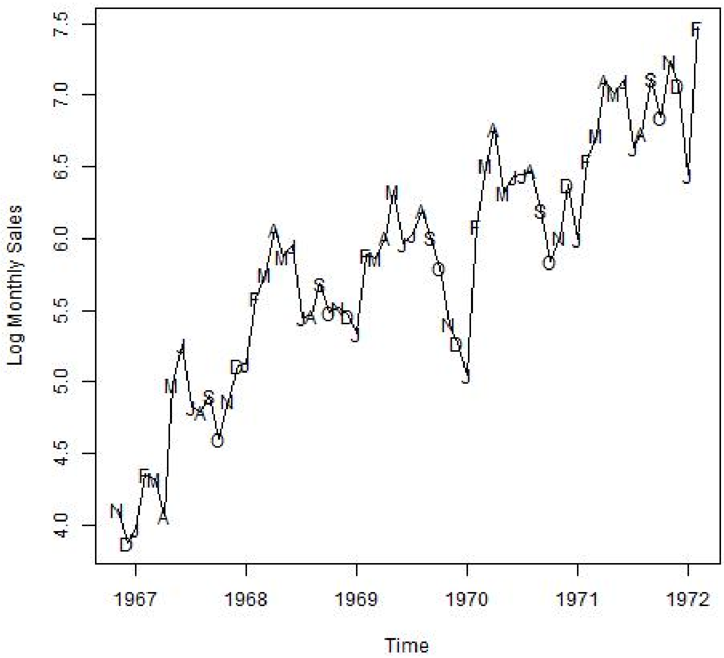
Problem 3

(a) As we would expect with recreational vehicles in the U.S., there is substantial seasonality in the series. However, there is also a gereral upward ”trend ” with increasing variation at the higher levels of the series.

Yuanyou Yao
yyao93@wisc.edu



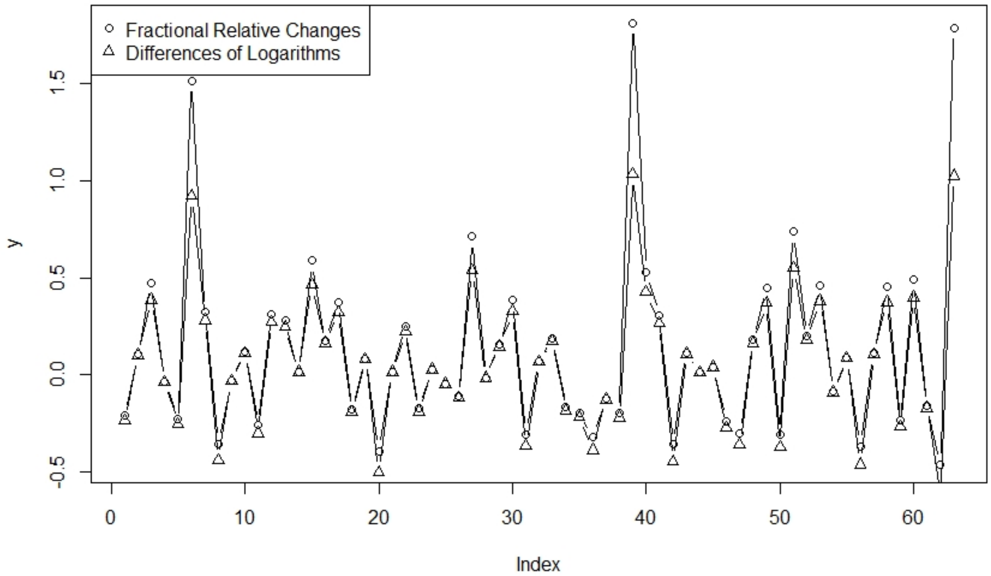
(b)



In this we see that the seasonality is still present but that now the upward trend is accompanied by much more equal variation around that trend.

Yuanyou Yao
yyao93@wisc.edu

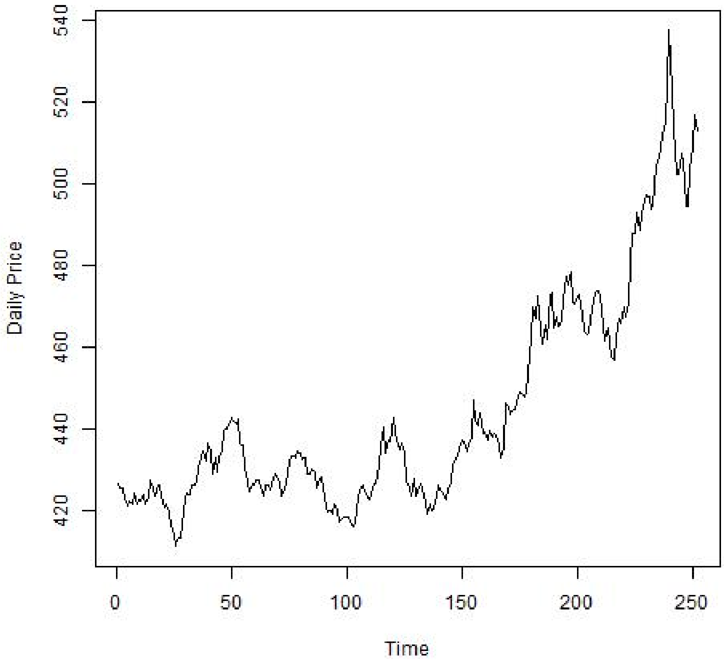
(c)



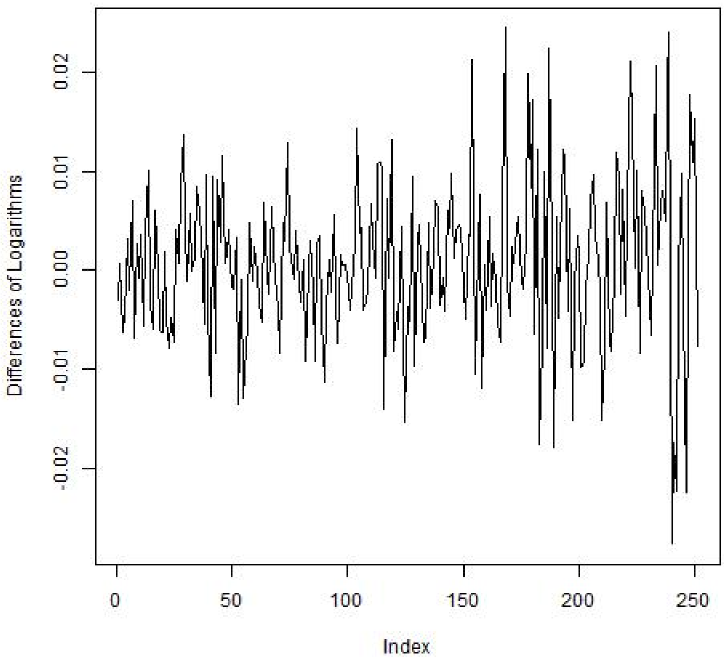
As we can see, logarithms have much more equal variation around upwarding trend, which is shown as a smoother upwarding trend comparing to previous graphs.

Problem 4

(a) There is substantial seasonality in the series. There is also a upwarding "trend" with increasing variation at the higher levels of the series.

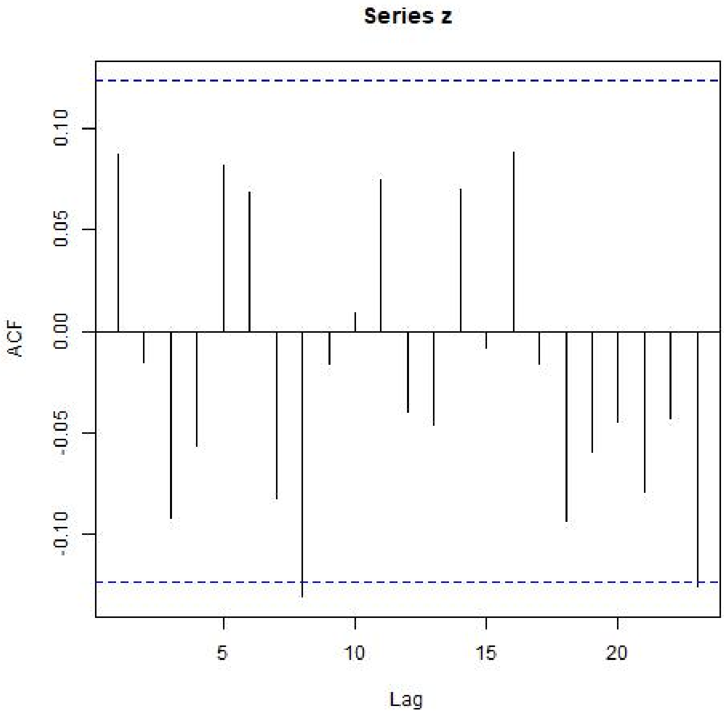


(b)



The differences go up and down around 0. however an increasing variation is shown at the higher levels of the series.

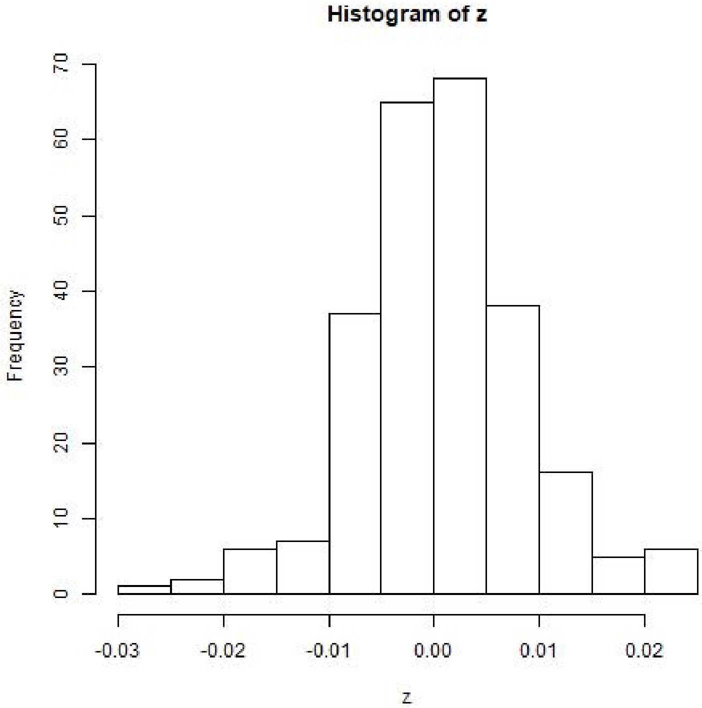
(c)



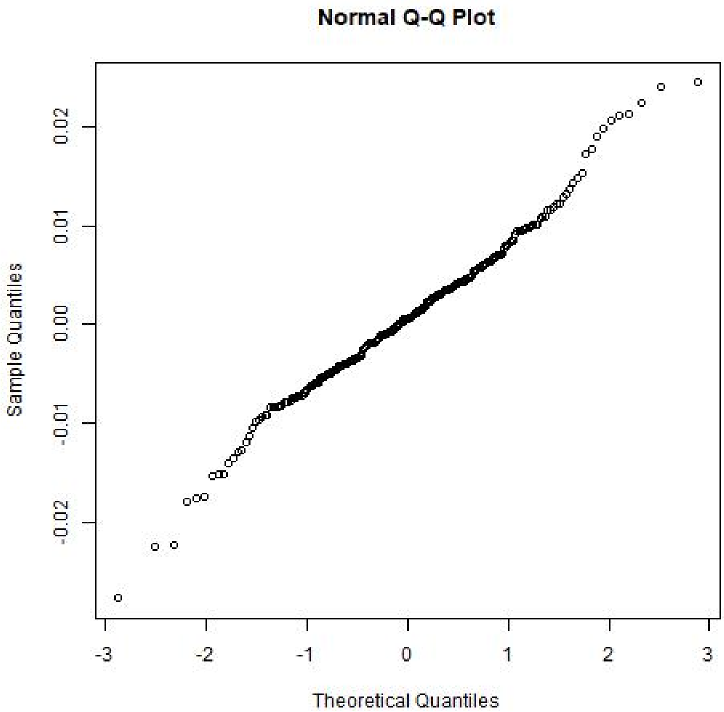
The formula $log(gold_t) - log(gold_{t-1})$, according to histogram, seems to have a normal distribution with mean 0. Comparing to random walk, we have $log(gold_t) = log(gold_{t-1}) + e_t$. And the ACF shows no pattern with time lag, we might conclude e_t's are independent.

(d) The formula $log(gold_t) - log(gold_{t-1})$, according to histogram, seems to have a normal distribution with mean 0. Comparing to random walk, we have $log(gold_t) = log(gold_{t-1}) + e_t$. And the ACF shows no pattern with time lag, we might conclude e_t's are independent.

Yuanyou Yao
yyao93@wisc.edu



(e)



With the QQplot, the normality is valid except for some outliers.

Problem 5 Using $\frac{2}{\sqrt{100}} = 0.2$ as a guide, we might consider MA(2) or MA(3) as possibilities. If MA(2) is tentatively assumed, then Equation (6.1.11), page 112, gives $Var(r_3) \approx (1+3[(-0.49)^2+(0.31)^2])/100 = 0.16724$ so that $r_3/\sqrt{Var(r_3)} \approx -0.21/\sqrt{0.16724} = -1.62$ and MA(2) is not rejected.

Problem 6 $\frac{2}{\sqrt{121}} = 0.18$ so an AR(2) model should be entertained.

Problem 7 $r_2/r_1 = 0.78, r_3/r_2 = 0.81, r_4/r_3 = 0.81$ and $r_5/r_4 = 0.76$ and we do not have $r_k \approx r_1^k$. This would seem to rule out an AR(1) model but support an ARMA(1,1) with $\phi \approx 0.8$.

Problem 8 The lack of decay in the sample acf suggests nonstationarity After differencing the correlations seem much more reasonable. In particular, $(1 + 2(-0.42)^2)$/100 = 0.0135 and $0.18/\sqrt{0.0135} = 1.55$. Therefore, an IMA(1,1) model warrants further consideration.

Problem 9

(a) $Corr(Y_t, Y_{t-k}) = \frac{Corr(X_t, X_{t-k})}{1+\sigma_N^2/\sigma_X^2} = c\phi^k$ for $k \geq 1$.

(b) This is the pattern of an ARMA(1,1) model.