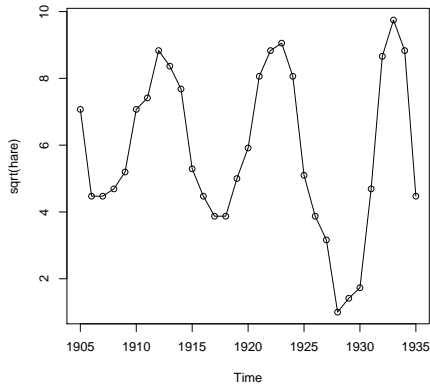


Name: _____

1. In this question, we consider an annual series of hare abundance from 1905 to 1935. The data are square root transformed.

(a) The data appear to be cyclical. Visually estimate the period of the data.



(b) An AR(2) model was fitted to the mean deleted data: $Y_t = 1.35Y_{t-1} - 0.78Y_{t-2} + e_t$ where Y_t equal the data minus 5.71, and e_t are of zero mean and variance 1.2. Is the fitted model stationary? Explain your answer to get credit.

(c) Show that the fitted model is quasi-periodic. Also compute its quasi-period.

2. Consider the following stationary AR(1) model: $Y_t = \phi Y_{t-1} + e_t$ where $\phi = -0.8$ and e_t are independent and identically distributed as $N(0, \sigma_e^2)$ where $\sigma_e^2 = 1$.

(a) Find the mean of Y_t .

(b) Compute the variance of Y_t .

(c) Find the autocorrelation of lag 3.

(d) Find the covariance between Y_t and Y_{t-3} .

3. State which of the following model(s) is/are stationary. Explain your answer to get credits. Below, $\{e_t, t = 0, 1, 2, \dots\}$ denotes a sequence of iid $N(0, \sigma^2)$ random variables, where $\sigma^2 > 0$.

(a) $Y_t = t \times (e_t - e_{t-1})$, for all integer t .

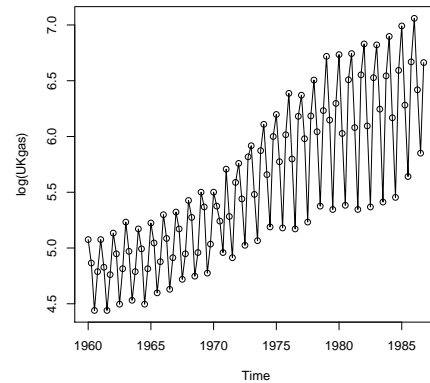
(b) $Y_t = \cos(t)$, for all integer t .

(c) $Y_t = 0.5Y_{t-1} + e_t$, for all integer t .

4. This question concerns the analysis of the quarterly UK gas consumption, in millions of therms. The data are log-transformed.

(a) A linear trend plus seasonality model was fitted to the data. Interpret the fitted model.

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	-136.7912	4.5556	-30.03	0.0000
quarter.Q2	-0.4206	0.0509	-8.27	0.0000
quarter.Q3	-0.9859	0.0509	-19.38	0.0000
quarter.Q4	-0.3433	0.0509	-6.75	0.0000
time(UKgas)	0.0724	0.0023	31.34	0.0000



(b) Below are some model diagnostics performed on the residuals. The p-value of the runs test and the Shapiro-Wilk test equal 0.91 and 0.2190, respectively. Comment on the model fit. State any caveats in the model interpretation in part (a).

