

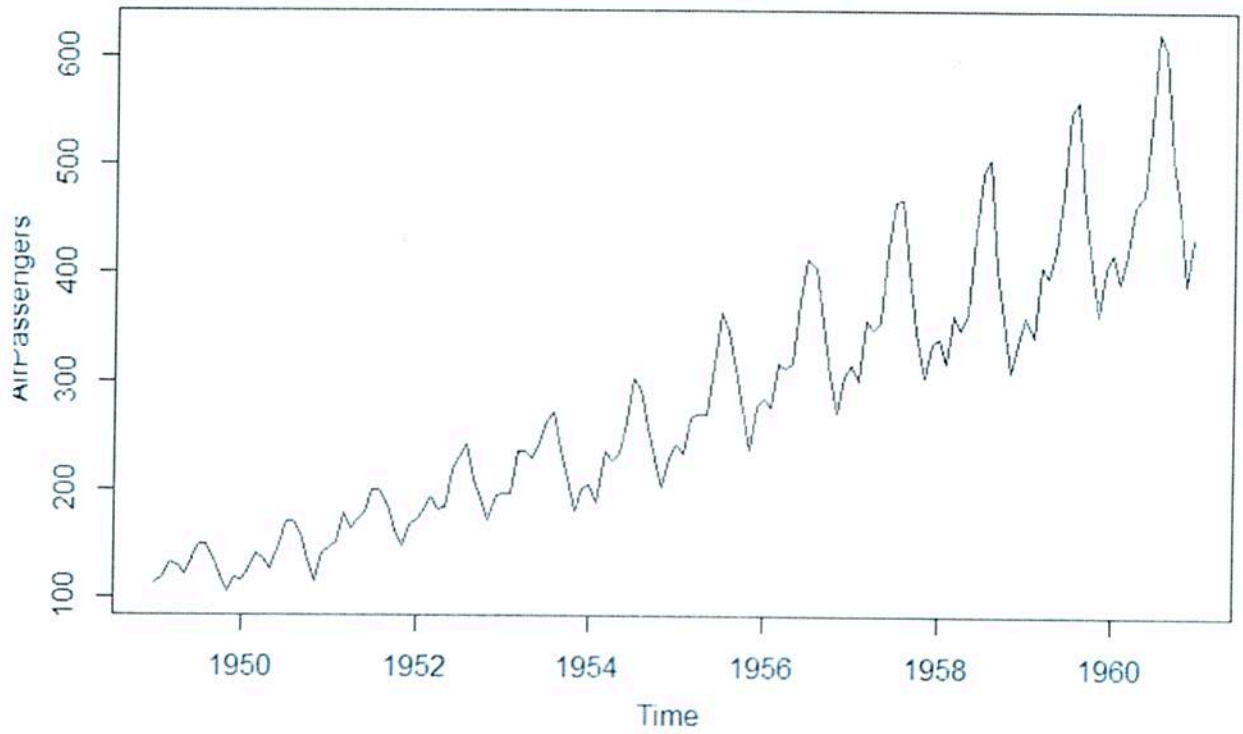
**Instructions:** Answer each question as thoroughly as possible. Round answers to 4 decimal places as needed. Exact answers are best when possible. Be sure to answer all parts of each question.

1. Using the built-in data on AirPassengers, perform the following analyses of the time series.
  - a. Plot the time series and paste the graph below.
  - b. Use the `decompose()` function to decompose the time series into seasonal, trend and random components. Plot the graph(s) and paste them below. Describe the trend.
  - c. Calculate the first differences. Plot the resulting differences. Does it appear stationary? Plot the first differences in a histogram and qqplot. Do the values appear to be normal? Paste all three graphs below.
  - d. From your decomposition object, extract the random element and plot a histogram and qqplot. Do these errors appear to be normal? Plot the graphs below.

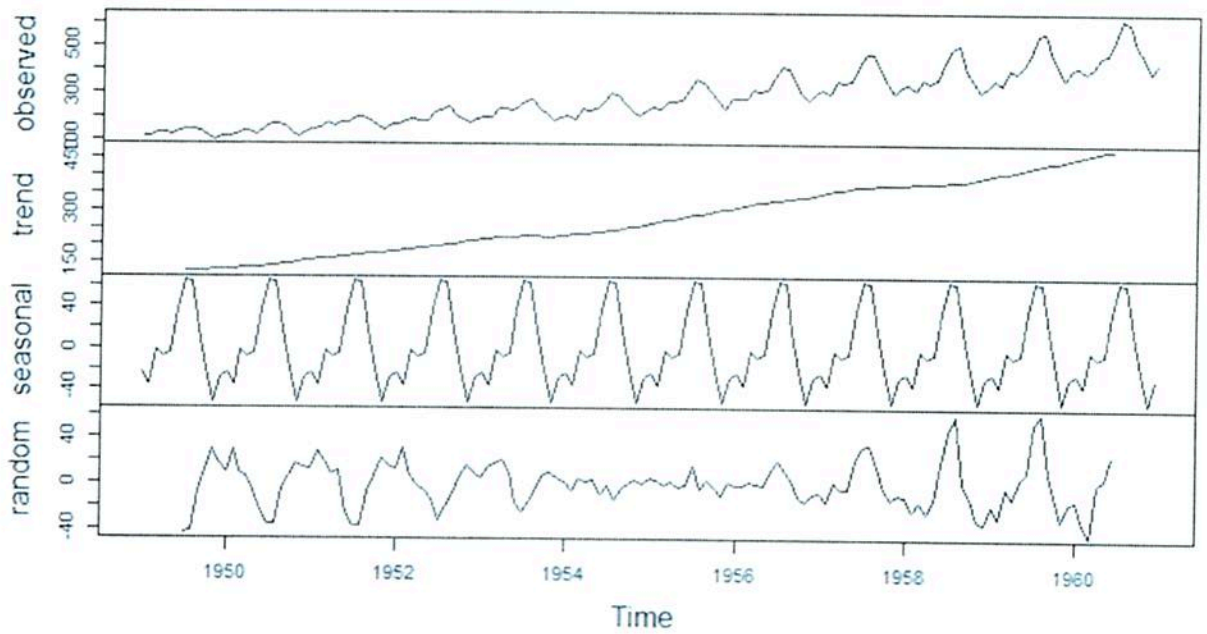
b. The trend is increasing and nearly linear

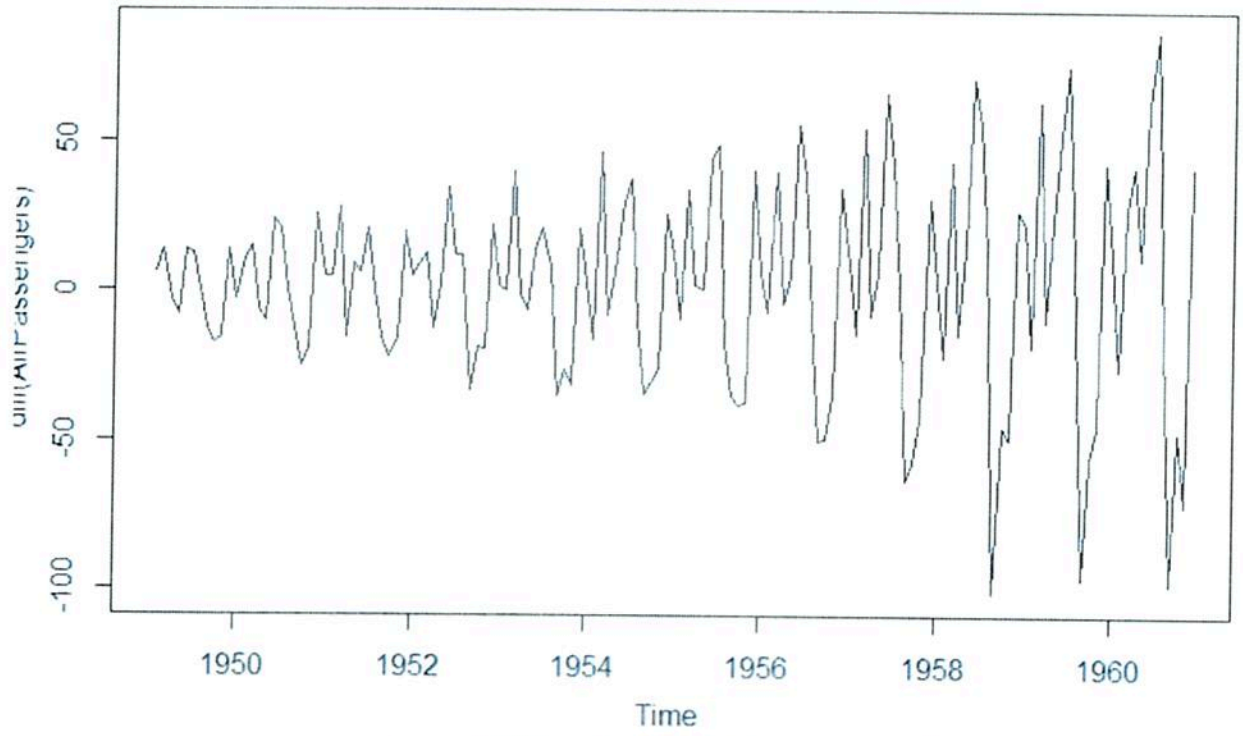
c. The first differences appear to have an increasing variance  
histogram & qqplot suggest a left skew

d. The random errors appear to be right skewed in the histogram  
and qqplot.

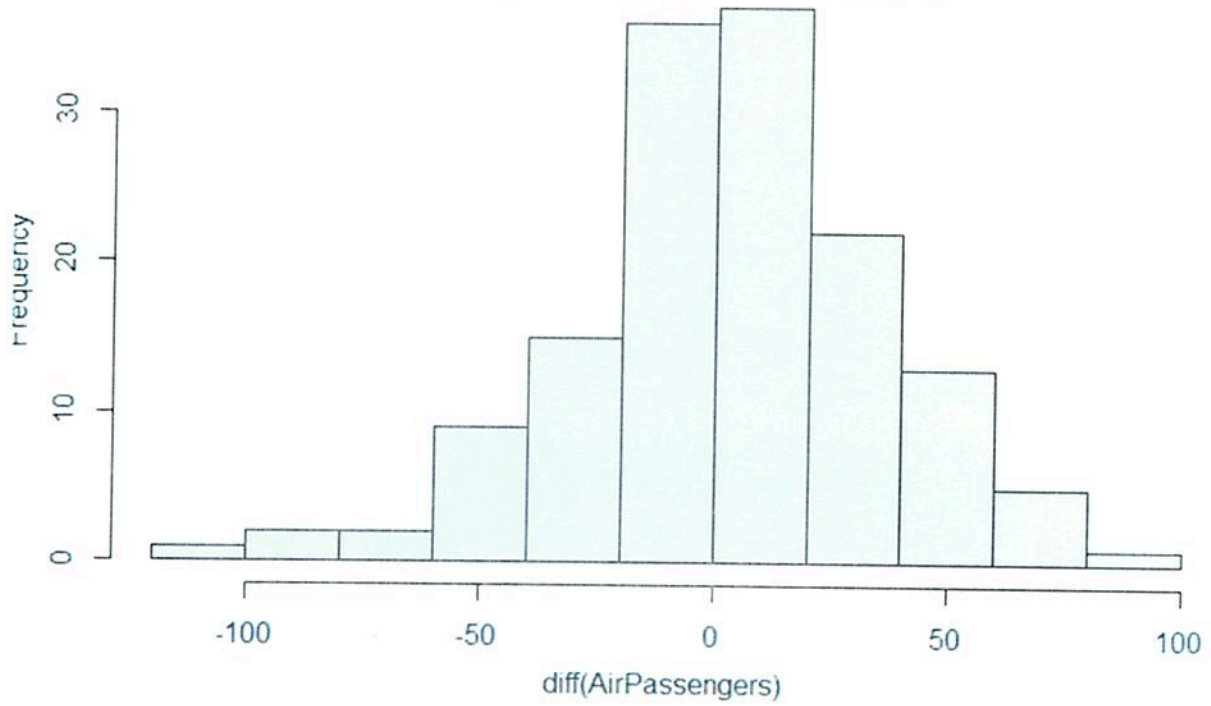


**Decomposition of additive time series**

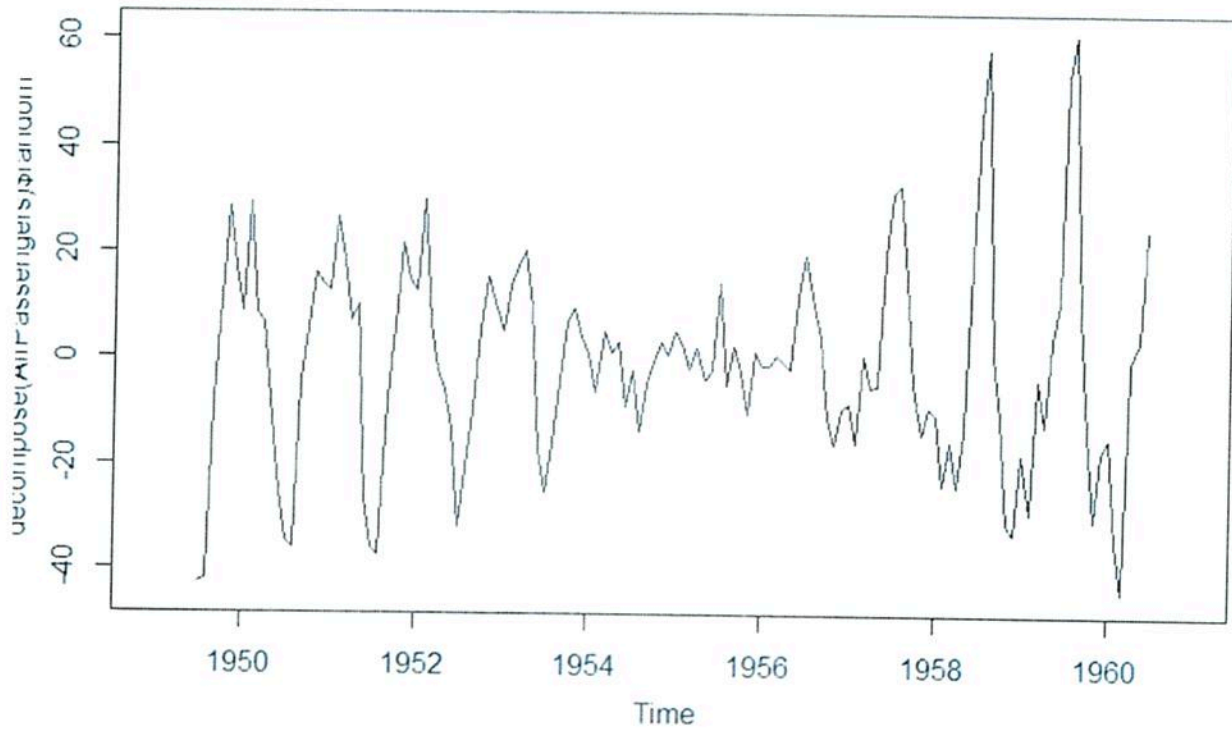
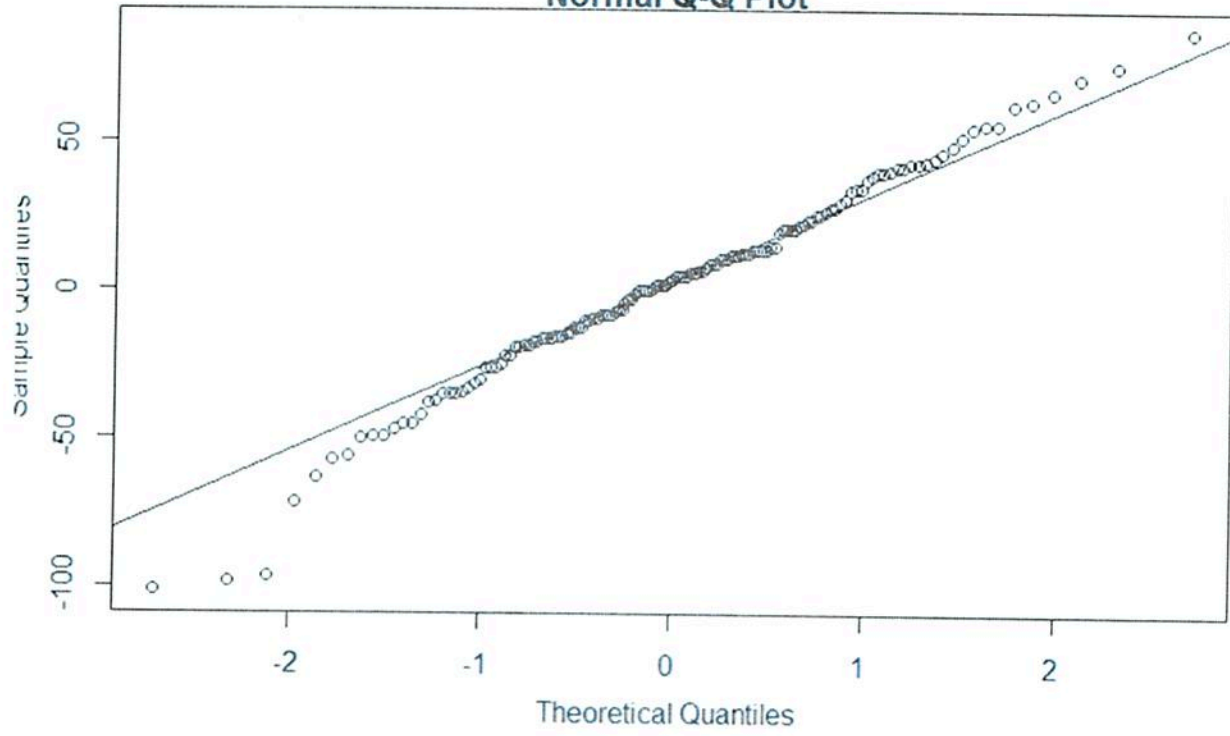




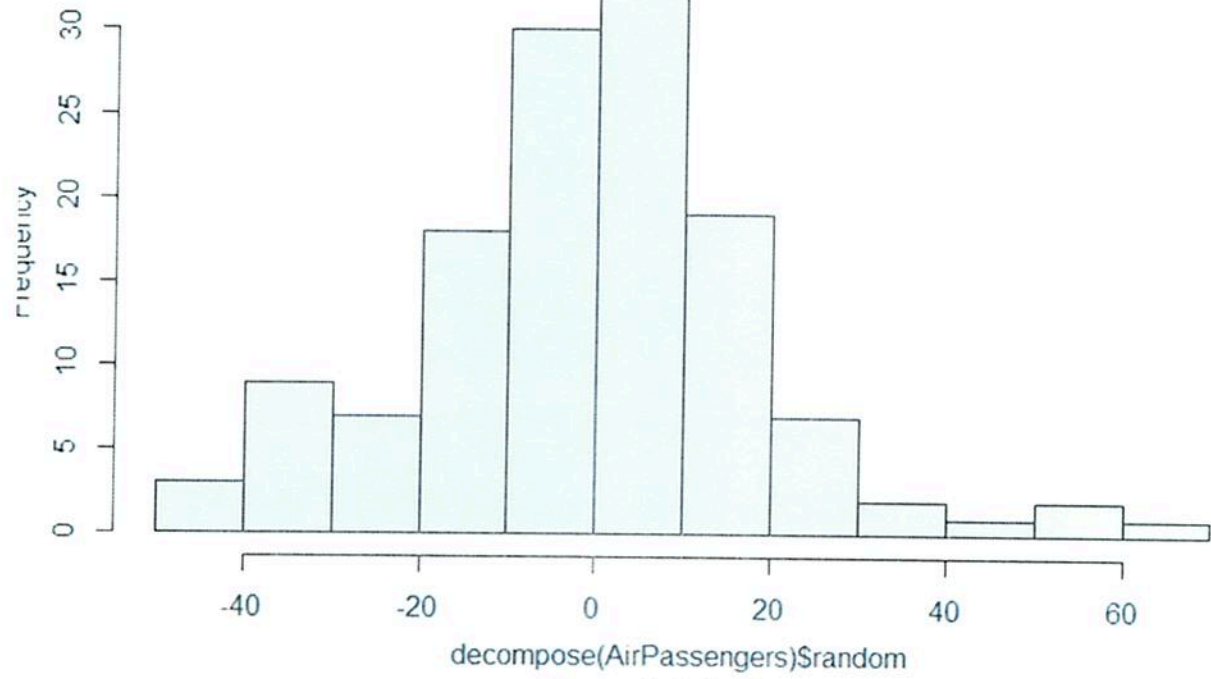
**Histogram of diff(AirPassengers)**



Normal Q-Q Plot



Histogram of decompose(AirPassengers)\$random



Normal Q-Q Plot

