
To be submitted Wednesday, April 23, before class

Problem 8: [Testing the Residuals I] Simulate 200 values x_1, \dots, x_{200} of the stochastic process

$$X_t = \sin\left(\frac{t}{20}\right) + Z_t, \quad t \in \mathbb{Z},$$

where $(Z_t)_{t \in \mathbb{Z}}$ is a sequence of independent identically distributed random variables with mean zero and variance .25. In all tests below use a significance level $\alpha = .05$.

- (a) Plot the simulated data;
- (b) Check the data for whiteness using the sample ACF (Method 1);
- (c) Check the data for whiteness using a version of the Portmanteau test (Method 2). In R, you may apply the command `Box.test` with `type="Ljung"` and `lag=20`;
- (d) Check the data for normality using the qq plot (Method 4). The critical value for the test statistic R^2 can be obtained from $P(R^2 < .987) = .05$.

Problem 9: [Testing the Residuals II] Download the files `prob9a.dat` and `prob9b.dat` from the course website. Each file contains 200 simulated values obtained from two different stochastic processes.

- (a) Plot both data sets;
- (b) Utilize qq plots to decide which of the two data sets is obtained from a normal distribution (visual inspection of the plots suffices);
- (c) Estimate the mean and variance of both processes. Is there correlation in the data?

Problem 10: [Detecting Linear Trends, Extra Credit] Download the file `prob10.dat` from the course website. It contains 100 simulated values of some stochastic process.

- (a) Use the rank test (Method 3) to decide whether there is a linear trend in the data;
- (b) Remove the trend and test the resulting residuals for whiteness with a method of your choice.