TS Module 20 Seasonal models advanced HW

(The attached PDF file has better formatting.)

Homework assignment: auto sales

New auto sales vary by month. New models are released in October, in time for holiday sales of November and December. Sales in January and February are low, since cold weather and the high sales in the previous months leave low demand for new cars.

Part A: Compare the seasonality of auto insurance in the homework assignment for the previous module with the seasonality of auto sales in this homework assignment. We can model seasonality by a seasonal autoregressive parameter or by seasonally adjusted data.

- Monthly temperature is seasonal. But if 20X8 has a particularly cold January, we don't expect January 20X9 to be colder than usual.
- Insurance renewals depend on the number of policies written one year ago (or six months ago). If January 20X8 has a higher than usual policy count, we expect a higher than usual policy count in January 20X9 as well.

1. How would you model the seasonality of auto insurance?
2. How would you model the seasonality of auto sales?

Part B: Cars are durable and expensive goods.

Cars last several years. If a consumer buys a new car in year X, his or her demand for new cars is low in year X+1 and rises steadily lover subsequent years.

Cars are expensive. In tough economic times (recessions, high unemployment), demand for new cars is weak. In prosperous years, built-up demand for new cars causes high sales.

GDP shows weak cycles. Durable goods (cars, housing) show strong cycles.

1. How would you model the long-term cycles of auto sales? Use an annual model, not a monthly model, so you can avoid the monthly seasonality.
2. Assume GDP follows a weak cycle:
   a. Consumers who have not bought a new car recently are more likely to buy one if the economy is strong.
   b. Consumers who have bought a new are recently are unlikely to buy a second one for several years.
   c. Explain how you might model this process.

This homework assignment does not have a single correct answer. Economists model the sales of durable goods many ways. This homework assignment asks you to demonstrate that you understand how autoregressive and moving average processes work.