1. The following table provides the quarterly sales of a company. Use simple exponential smoothing with $\alpha = 0.1$ and $l_0 = 100$ to forecast the sales for the year 2025.

Year	Q4 2023	Q1 2024	Q2 2024	Q3 2024
Sales	200	160	150	160

2. Derive the observation and state equations of ETS(M,A,A).

3. In this exercise, we will study the uncertainty of the ETS(A,N,N) model.

   Source: Section 8.8 Exercise 17-18 from *Forecasting: Principles and Practice* (3rd ed).

   (a) Show that the forecast variance is given by $\sigma_h^2 = \sigma^2(1 + \alpha^2(h-1))$

   (b) Write down the 95% prediction intervals as a function of l_t, α, h, σ, assuming normally distributed errors.

4. Analyze the following time plots. Which ETS models would be appropriate?

   Source: Section 8.8 from *Forecasting: Principles and Practice* (3rd ed).

   (a) Figure 1 showing the Australian gas production.

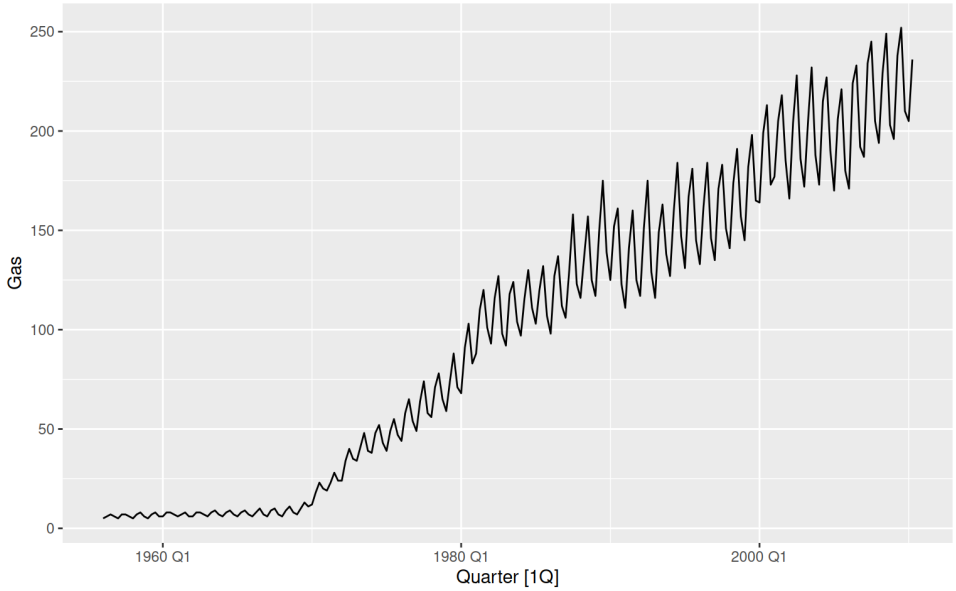

Figure 1: Time plot of the Australian gas production.

   (b) Figure 2 showing the quantity of Canadian lynx trapping.

   (c) Figure 3 showing the total domestic overnight trips across Australia.

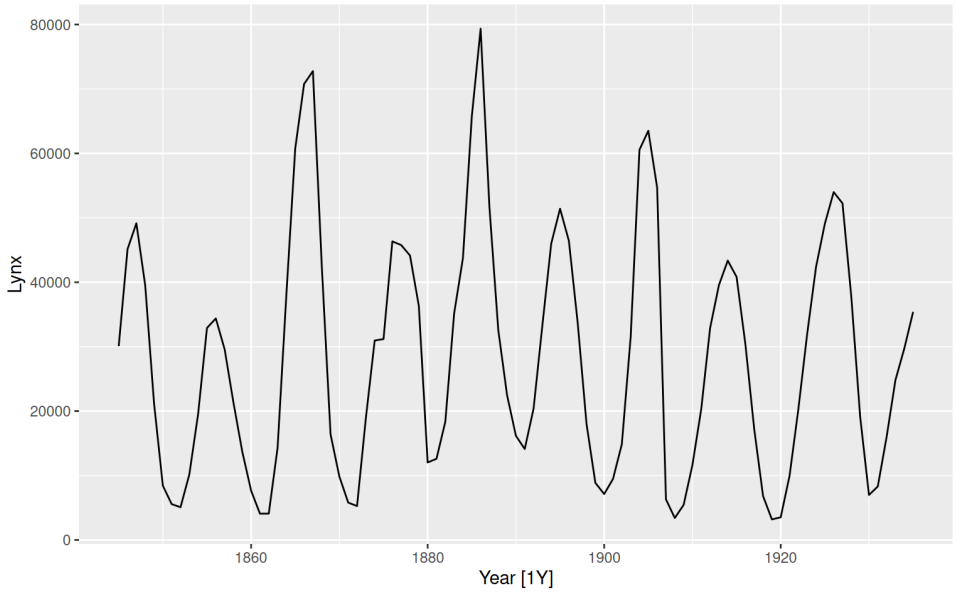

Figure 2: Time plot of the Canadian lynx trapping.

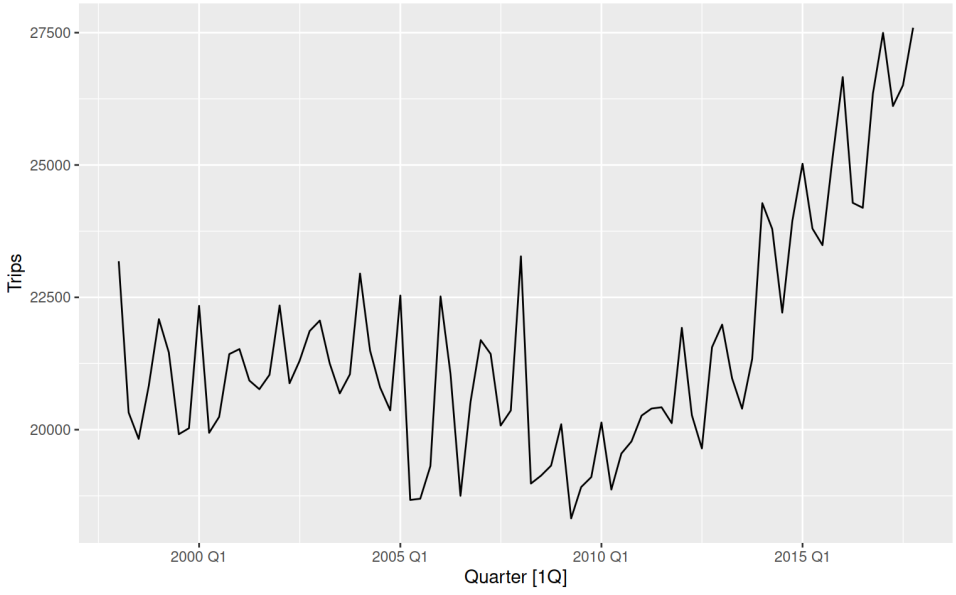

Figure 3: Time plot of the total domestic overnight trips across Australia.