UNIVERSITY OF BRITISH COLUMBIA
Department of Statistics
Stat 443: Time Series and Forecasting
Assignment 3

The assignment is due on **Thursday, March 20** at **9:00pm**.

- Submit your assignment online on `canvas.ubc.ca` in the **pdf format** through Gradescope.
- This assignment should be completed in **RStudio** and written up using **R Markdown**. Display the R code used to perform your data analyses.
- Please make sure your submission is clear and neat. The student is responsible for the submitted file being in good order (i.e., not corrupted).
- **Late submission penalty**: 1% per hour or fraction of an hour.
- In the event of technical issues with submission, you can email your assignment to the instructor to get a time stamp but submit it on canvas as soon as it becomes possible to make it available for grading.

The aim of this assignment is to explore the various forecasting approaches that were introduced in this course. You will re-visit the dataset of the average hourly wage rates in Canada from Assignment 1. As the COVID pandemic had a major impact on wage rates and such events cannot be well predicted using historical time series data alone, we will focus on the pre-pandemic period. The time series of monthly observations, from January 1997 to November 2024, is provided in file `employee_wages_total_industry.csv`. Use the data from January 1997 to December 2018 as the training set for model fitting and the data from January 2019 to December 2019 as the test set to assess forecast performance.

For each of the questions below, make sure to provide a full justification for your model choice, report the fitted model with all parameter estimates, include model diagnostics where appropriate, plot the test set with your model forecasts and corresponding 95% prediction intervals.

1. Use the seasonal decomposition model as in Assignment 1 but select and fit an ARMA model for the remainder term. Use the fitted model to forecast monthly values of the average hourly wage rates in Canada for the period from January to December of 2019.

2. Use the Box-Jenkins forecasting procedure based on a SARIMA model to forecast the monthly values of the average hourly wage rates in Canada for the period from January to December of 2019.

3. Use the Holt-Winters forecasting procedure to forecast the monthly values of the average hourly wage rates in Canada for the period from January to December of 2019.

4. Compare the three forecasting approaches above in terms of their Mean Squared Prediction Error (MSPE). Which method performs best in terms of this forecast accuracy measure? Discuss the pros and cons of the three methods.