Department of Statistics, The Chinese University of Hong Kong
RMSC 6007 Risk and Financial Data Analytics with Python (Term 2, 2023–24)

Assignment 2 (Due on 28th February 2024)
Please submit your answers in `.ipynb` *format via Blackboard.*

1. Positions on a chess board are identified by a letter and a number. The letter identifies the column, while the number identifies the row, as shown in Figure 1: Write a program that reads a position from the user. Use an if

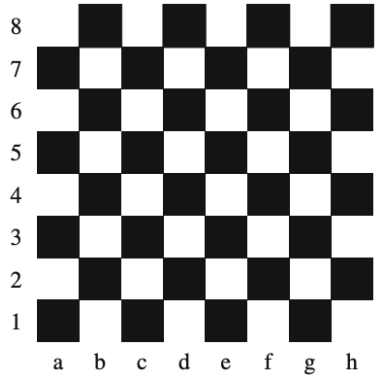

Figure 1: A checker board

statement to determine if the column begins with a black square or a white square. Then use modular arithmetic to report the color of the square in that row. For example, if the user enters a1 then your program should report that the square is black. If the user enters `d5` then your program should report that the square is white. Your program may assume that a valid position will always be entered. It does not need to perform any error checking.

2. Write a `Python` program to find a list with maximum and minimum length using `lambda` function.

Python environment:

```
Original list: #User input with the right format
[[0], [1, 3], [5, 7], [9, 11], [13, 15, 17]]

List with maximum length of lists:
(3, [13, 15, 17])

List with minimum length of lists:
(1, [0])
```

3. Write a `Python` class `Employee` with attributes like `emp_id`, `emp_name`, `emp_salary`, and `emp_department` and methods like `calculate_emp_salary`, `emp_assign_department`, and `print_employee_details`.

   `Sample Employee Data:`

```
"LEWIS", "MER44", 35000, "RESEARCH"
"MAX", "RBU01", 55000, "SALES"
"CHARLES", "FER16", 24000, "ACCOUNTING"
"PIERRE", "ALP010", 5000, "OPERATIONS"
```

You are required to

- Use '`assign_department`' method to change the department of an employee.
- Use '`print_employee_details`' method to print the details of an employee.
- Use '`calculate_emp_salary`' method takes two arguments: `salary` and `hours_worked`, which is the number of hours worked by the employee.

If the number of hours worked is more than 50, the method computes overtime and adds it to the salary. Overtime is calculated as following formula: (a) $\text{Overtime} = \text{Hoursworked} - 50$ and $\text{Overtime amount} = (\text{Overtime} \times (\text{Salary}/50))$.

4. Implement the ADF test procedure, consider testing for a unit root in the (natural) logarithm of the USD/CAD monthly spot exchange rate, denoted s_t, over the 30-year period 1991 - 2021. *(Hint: You may use install the package* `forex_python.converter` *and import* `CurrencyRates` *for this task.)*

5. [Adapted from Problem 2.3 of Tsay (2005)[1]] Download via `quandl` the monthly U.S. unemployment rate from January 1951 to Janurary 2022 from https://data.nasdaq.com/data/FRED/UNRATE-civilian-unemployment-rate. The data are seasonally adjusted and obtained from the Federal Reserve Bank in St. Louis. Build a time series model for the series and use the model to forecast the unemployment rate for March, April, and May of 2022. In addition, compute the average period of business cycles if they exist. (Note that more than one model fit the data well. You only need an adequate model.)

6. [Adapted from Problem 2.13 of Tsay (2005)] Consider the weekly log returns of Dow Jones Industrial Average (DJIA), a price-weighted index, from January 1980 to December 2021. You may obtain the data using `yf.download` directly or from an external spreadsheet/`.csv` file downloaded from the Internet.
   (a) Build an AR model for the series and check the fitted model.
   (b) Build an MA model for the series and check the fitted model.
   (c) Build an ARIMA model for the series and check the fitted model.
   (d) Compare the fitted AR, MA and ARIMA models. Argue why one is more preferred.

7. [Adapted from Problems 2.7–8 of Tsay (2005)] Consider the daily simple return of S&P 500 index from January 2010 to December 2021. Is there a Friday effect on the daily simple returns of S&P composite index? You may employ a simple linear regression model to answer this question. Estimate the model and test the hypothesis that there is no Friday effect. Draw your conclusion. *(Hint: You may use the function* `weekday()` *from the package* `datetime` *to extract from the dates about which days are Fridays.)*

- End -

[1] Tsay, R. S. (2005), *Analysis of Financial Time Series, 2nd Edition*: John Wiley & Sons: New Jersey.