ISGB 79AA – Advanced Python for Financial Programming
Assignment 6 - Fixed Income (revision 2)

This assignment has 2 parts. Submit your answers as:
- 2 Jupyter Notebooks, one for each part, named like:
    - LastnameFirstnameAsn6<part>.ipynb, for example SmithJohnAsn6a.ipynb

 In addition to Python code, place your answers to specific questions as comments in your Notebook. Also include a first line of your notebook(s) a comment like:
```
# Firstname Lastname Assignment 6
```


Part A – Fixed Income – Certicificate of Deposit (CD) - Compound Interest Schedule

An interest-at-maturity CD earns interest at a compounding frequency, and pays principal plus all earned interest at maturity. Write a function, called CompoundInterestSchedule, that creates and returns a pandas DataFrame, where each row has: time (in years, an integer starting at 1), starting balance, interest earned, and ending balance, for an investment earning compounded interest. Use a `for` (or `while`) loop to create this table. The equation for the ith year's ending balance is given by:

$$E_i = B_i \left(1 + r / f \right)^f$$

where:
E_i is year i's ending balance
B_i is year i's beginning balance (note: B_1 is the amount of the initial investment (principal)
r is the annual rate of interest (in decimal, e.g., 5% is .05)
f is the number of times the interest rate compounds (times per year)

The interest earned for a given year is E_i - B_i

Note the term of the investment (in years) is not in the above equation; it is used to determine how many rows the table will have.

Test your function by calling it, for example:
```
b = 1000 # initial balance of $1,000
t = 5 # 5-year investment
r = .05 # interest rate of 5%
f = 2 # semi-annual compounding
schedule = CompoundInterestSchedule(b, t, r, f)
print(schedule)
```

Part B – Fixed Income – Treasury Bond

Use QuantLib to model and perform calculations on the 30-year on-the-run Treasury bond. The 30-year on-the-run (last issued) bond can be found at this page:
 https://www.treasurydirect.gov/instit/annceresult/press/press.htm
under "Announcements and Results by Auction Year" | Bond | 30 Year | pdf

Current yields can be found at:
 https://www.bloomberg.com/markets/rates-bonds/government-bonds/us

B.1) Your code should:
 - construct the bond
      Treasury daycount for schedule generation is ql.Thirty360
      Date generation is from last date working backwards
      Settlement date is 1 business date after trade date
 - calculate (assume settlement date 2020-03-04, and yield for the 30yr bond from the
   Bloomberg page above) these measures using Quantlib
      flat price
      accrued interest
      full price (flat price + accrued)
      note: Treasury Bonds use ql.ActualActual daycount and ql.Semiannual compounding for
          calculations

There is online documentation for QuantLib as well as tutorials, for example:
https://www.quantlib.org/docs.shtml
https://leanpub.com/quantlibpythoncookbook/read

Also please refer to the Fixed Income notebooks covered in class and available in Blackboard, which contain statements that use Quantlib..