1 Test assignment

1.1 Task

Write class that calculates portfolio performance in USD given asset weights in portfolio, asset prices in different currencies and currencies rate to dollar.

1.2 Description

Portfolio consists of a number of different assets. Relative share of each asset in total value of the portfolio is called "weight". Asset weights may vary in time. Moreover, assets can be priced in different currencies. Therefore, changes in portfolio value happen due to two reasons: changes in asset price and changes in currency exchange rate. We want to calculate total portfolio performance and its two components separately for our multi-currency portfolio.

More formally, consider n assets. Asset return for asset i at time t is described as following:

$$R_t^i = \frac{p_t^i - p_{t-1}^i}{p_{t-1}^i},$$

where p_t^i is asset i price at time t.

Currency return for asset i at time t is described as following:

$$CR_t^i = \frac{c_t^i - c_{t-1}^i}{c_{t-1}^i},$$

where c_t^i is exchange rate of asset i currency (to dollar) at time t.

Total return for asset i at time t is described as following:

$$TR_t^i = \frac{c_t^i p_t^i - c_{t-1}^i p_{t-1}^i}{c_{t-1}^i p_{t-1}^i}.$$

Consequently, portfolio return at time t is the weighted sum of all assets returns:

$$R_t = \sum_{i=0}^{n} w_t^i R_t^i,$$

$$CR_t = \sum_{i=0}^{n} w_t^i CR_t^i,$$

$$TR_t = \sum_{i=0}^{n} w_t^i TR_t^i,$$

Let portfolio performance at day 0 be 1: $P_0 = 1, CP_0 = 1, TP_0 = 1$. Then we can calculate performance for the following days as:

$$P_t = P_{t-1}(1 + R_t),$$
$$CP_t = CP_{t-1}(1 + CR_t),$$
$$TP_t = TP_{t-1}(1 + TR_t).$$

1.3 Input data

The following files are given:

- **prices.csv** Daily asset prices. Columns: asset ids, rows: dates
- **currencies.csv** Asset currency. Columns: currency, rows: asset id
- **weights.csv** Daily portfolio weights. Columns: asset id, rows: dates
- **exchanges.csv** Daily exchange rate (to dollar). Columns: currency names, rows: dates

If some dates are missing, take the last valid value.

1.4 Code structure

Class should have the following methods:

- `calculate_asset_performance(start_date, end_date)`
- `calculate_currency_performance(start_date, end_date)`
- `calculate_total_performance(start_date, end_date)`

Each method should return `pandas.Series` with portfolio performances from `start_date` to `end_date`.

Bonus task: create 3 classes and hierarchical relationships between them.

1.5 Tips

- Use pandas: https://pandas.pydata.org
- Follow PEP8 guidelines: https://pep8.org
- Write unittests: https://docs.python.org/2/library/unittest.html
- Use Python 2.7 or Python 3.4 and higher
- You can ask question by email: georgy.samoylov@rockscie.com, elizabeth.prosvirina@rockscie.com