HW1 (Monte Carlo Simulation using Numpy)

Please note that you are only allowed to use general "Python" and "Numpy" commands (as covered in lectures 1 - 4) to complete tasks 1 – 10. The use of Pandas and other libraries is not permitted.

Also, keep in mind that optimizing for fewer resources (such as memory and CPU usage) and shorter computation times will earn you some bonus points.

Please form groups of four people for your homework and final project. No assignments will be accepted after the 24 October 2023.

Here are the step-by-step hints for your assignment:

Step 1: Data Preparation

In the dataset, separate the "Consumption" and "Withdrawal" categories from the "category" label in the Power plot data. Calculate WF (Eq. (1)) and WP (Eq. (2)) separately for each of these categories.

Step 2: W_F Calculation

For W_F (Eq. (1)), calculate it only if the type is Natural gas or Coal (meaning the cycle is Fuel). For Operating and Non-operating cycles, set W_F to 0. You can assume W_F = 0 for Nuclear to simplify calculations.

Step 3: Assumptions for Eq. (1)

In Eq. (1), assume UCF=1, LHV= 52.2, and Ex_F^0=0.052 (for Natural gas), and UCF=1, LHV= 30.2, and Ex_F^0=0.034 (for Coal). Also, set LT=30 (for Coal, Natural gas, Nuclear, and Geothermal) and LT=15 (for PV, Wind, and CSP) to simplify calculations.

Step 4: Generating Random Values

For Eqs. (1) and (2), create random sets of 10 unique values for each RV and FU from their specified ranges (Table 3). Use these sets to obtain Operating and Non-operating W_F and W_P.

Step 5: Calculation of W_F and W_P

In Eq. (3), WF and WP will be the summation of the values obtained by multiplying them with random sets of 10 unique RV and FU values within the given ranges (Table 3). Be sure to sum the values from the Operating stage with those from the Non-operating stage (as indicated by the cycle label in the dataset) to obtain the final W_F and W_P. Keep in mind that your final arrays can become very large if you don't restrict the number of digits after the decimal point for floating-point numbers.

You are expected to submit a .ipynb file with explanations written as markdown statements between code cells. Your code should report 14 arrays (Consumption and Withdrawal) for 7 technologies (PV, Wind, CSP, Coal, Natural gas, Nuclear, and Geothermal).