Projet PYTHON :

1. Goal

The goal of this programming project is to design and implement a multi-process and multithread

simulation in Python. This document deFines the functionalities that it has to implement

at a minimum. Any extensions and developments will act in your favor in the evaluation. In

addition, some points are deliberately left open for you to propose your own solution. Be

rigorous and creative!

2. Presentation

***2.1. Minimum speciations***

The program simulates an energy market where energy-producing and consuming homes,

weather conditions and random events contribute to the evolution of energy price over time.

Homes may choose to give away their surplus of energy to other homes that are in shortage, or

may sell it to the market thus contributing to the diminution of energy price. Homes in need of

energy will have to buy it from the market if others would not give away any. Naturally, energy

prices climb when the average consumption exceeds that of production. Temperature changes

also impact energy consumption, hence its price. Other events, such as the enactment of a law,

diplomatic tension etc. can impact energy prices.

***2.2. A minimal design***

The simulation involves 5 types of processes.

● home: represents an energy-producing and consuming home, with initial production and

consumption rates and energy trade policy which is one of three possibilities 1. always

give away, 2. always sell on the market, and 3. sell if no takers.

● market: represents the market with current energy price which evolves according to

transactions with homes (selling and buying), weather conditions and other events. The

market process is multi-threaded and carries out transactions with homes in separate

threads. Furthermore it limits the number of simultaneous transactions that can take

place with homes.

● weather: simulates weather parameters impacting energy consumption, such as

temperature and its variation over time.

● politics: simulates political events parameters impacting energy consumption, such

as diplomatic tension, wars.

● economics: simulates economic parameters of predeFined types that can impact the

energy price, such as money change rate, world macro-economy, carbon price.

**Inter-process communication:** Processes in the simulation communicate in the following way.

home processes communicate among themselves and with the market via message queues. The

weather process updates a shared memory with weather condition parameters. The politics

and economics processes, childs of market process, signals events to the latter which takes

the corresponding action impacting energy price. home and market processes update terminals

they are connected to permitting the operator of the simulation to track its progress.

Energy price: The energy price can be calculated according to the following linear model:

Une image contenant table

Description générée automatiquement

3. Solution

***3.1. Design***

Start with a diagram to better visualize the interactions between processes. The following

points need to be deFined:

● relationships between processes (parent-child or unrelated)

● messages exchanged between processes along with their types

● data structures stored in shared memory and how they are accessed

● synchronization primitives to protect access to shared resources or to count resources

● signals exchanged between processes, if any, and their types

● tubes involved in pairwise process communication, if any, and their types

Write down a Python-like pseudo-code of main algorithms for each process.

Relationships between processes :

messages exchanged between processes along with their types :

The market process is multi-threaded and carries out transactions with homes in separate

threads.

**Process : politics**

Political events parameters impacting energy consumption

(diplomatic tension, wars)

**Process : market**

Current energy price

Child / Impact

Weather conditions

**Process : weather**

Weather parameters impacting energy consumption

Temperature(t)

**Process : economics**

Economic parameters

Parent

Parent

Child / Impact

Transactions ***(message queues)***

**Shared memory**

**Process : home**

initial production

consumption rates

Weather :

Politics : embargo, diplomatic tension, wars

Economics : inflation du prix