Problem Formulation:

Setting of Objectives and Overall Project Plan:

A simulation study is to be conducted in order to assess the performance of this manufacturing facility, partly based on observed historical data of the inspectors' and workstations' service times.

Metrics for evaluation:

The quantities of interest are: the facility “throughput" or product output per unit time, the probability (or proportion of time) that each workstation is busy, the average buffer occupancy of each buffer, the probability (or proportion of time) that each inspector remains “blocked" (and therefore idle).

An additional objective is to possibly improve the policy that Inspector 1 follows when delivering C1 components to the different workstations, in order to increase throughput and/or decrease the inspectors “blocked" time

Model Conceptualization:

A manufacturing facility assembles three different types of products (P1, P2, P3) and having different components (C1, C2, C3) as follows:

* P1: C1
* P2: C1, C2
* P3: C1, C3

Two inspectors (I1, I2) clean and repair the components as follows:

* I1: C1
* I2: C2, C3 (Randomly)

The inspectors will never have to wait for components. There is an infinite inventory of them always immediately available.

There are three workstations in the facility, named W1, W2, and W3, which assemble products P1, P2, P3, respectively. After the components pass inspection they are sent to their respective workstations. Each workstation has a buffer capacity of two components, with one buffer available for each of the component types needed. A product can begin being assembled only when components of all types required are available. If all workstation buffers for a specific type of components are full, the corresponding inspector who finished inspecting a component with the same type is considered “blocked" until there is an opening, at which time the inspector can resume processing and sending components of that type.

In the present mode of operation, Inspector 1 routes components C1 to the buffer with the smallest number of components in waiting (i.e., a routing policy according to the shortest queue). In case of a tie, W1 has the highest and W3 the lowest priority.

Data collection:

Historical data of the inspectors' and workstations' service times given in units of minutes as in the following files

* Inspector 1 inspection time: servinsp1.dat
* Inspector 2 inspection time for component 2: servinsp22.dat
* Inspector 2 inspection time for component 3: servinsp23.dat
* Workstation 1 processing time: ws1.dat
* Workstation 2 processing time: ws2.dat
* Workstation 3 processing time: ws3.dat

Model Translation:

Programming Language: Python

Reason for choosing Python is that it has all the available statistical and function components prebuilt. Additionally, there is no need to learn it as it not a specialised tool. This comes in handing with the short project deliverables time.

UML Diagrams:

