COURSE PROJECT: STUDY OF A MANUFACTURING FACILITY

1. System Description

A manufacturing facility assembles *three* different types of products, named P1, P2, and P3. These products consist of one or more component types. There are *three* different types of components, named C1, C2, and C3. Product P1 contains component C1, product P2 contains components C1 and C2, and product P3 contains components C1 and C3.

Two inspectors clean and repair the components. Inspector 1 works on C1 components. Inspector 2 works on C2 and C3 components in random order. 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, that assemble products P1, P2, P3, respectively. After the components pass inspection they are sent to their respective workstation. 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 component are full, the corresponding inspector is considered "blocked" until there is an opening, at which time the inspector can resume processing and sending components of that type.

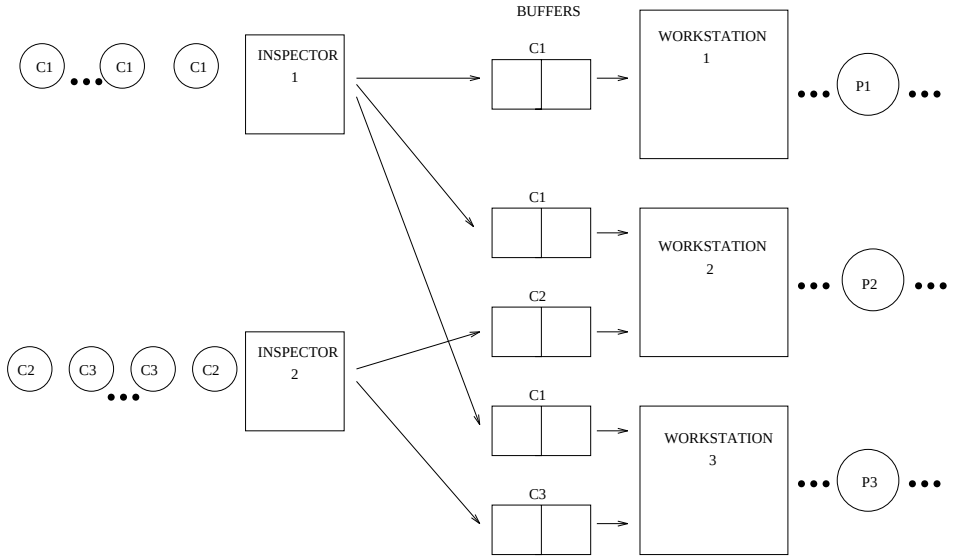

Figure 1: Schematic illustration of the manufacturing facility.

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.

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* given in units of *minutes* (provided in separate data files ".dat"). The quantities of interest are the facility "throughput" or product *output* per unit time, and the probability (or proportion of time) that the inspectors remain "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.

2. Project Requirements

Conduct a complete simulation study of this manufacturing facility (in general, try to follow steps 1–12 of page 14 of the textbook as closely as possible). Be thorough in explaining all steps, stating all assumptions, and specifically referring to all equations, statistical techniques and literature that you use. For executing the simulation you can use any computer platform and any language you want, with MODSIM III preferred but not mandatory.

Specific requirements include statistical justification/validation of the random aspects of the model (input modeling); *steady-state* estimates of the quantities of interest accompanied by 95% confidence intervals with a width that does not exceed 20% of the estimated values; and finally, at least one recommendation for an alternative operating policy in the facility (with appropriate statistical justification).