

## Discrete Event Simulation Lab Work (14.04.2022)

### Problem Description:

In a manufacturing system, after rough parts are manufactured, they must pass through a finishing department. Parts arrive for the finishing process in the warehouse with an interarrival rate uniformly distributed within the interval  $120 \pm 20$  minutes. There are three types of parts in the system: 18% of the parts are of Type 1, 31% is of Type 2 and the remaining are of Type 3.

The finishing work consists of 7 steps carried out in order. The time interval it takes to perform each step for each type of part is given in Table 1. The step times are uniformly distributed within the given intervals in the table. At most two parts can be processed at each finishing station at a time.

- Step 1: Bringing a part in from the warehouse.
- Step 2: Loading the part onto the first finishing station.
- Step 3: Carrying out the first finishing process.
- Step 4: Loading the part onto the second finishing station.
- Step 5: Carrying out the second finishing process.
- Step 6: Unloading the part from the second finishing station.
- Step 7: Taking the part back to the warehouse.

The parts are very heavy so for steps 1,2,4,6 and 7, a crane must be used. There is only one crane in the manufacturing system and it is used also by other departments. The other departments require to use the crane with an interarrival time distributed exponentially with average 60 minutes. For each request, the duration of the time the other departments use the crane is a uniformly distributed random variable in the interval  $20 \pm 10$  minutes. Requests coming from the other departments to use the crane have higher priority than those coming from within the finishing department.

Implement the above simulation using GPSS World. Run the simulation for 10 consecutive 8 hour shifts and gather all queue statistics. Assume there is no time gap between shifts.

**Table 1:** Times required for completing each step for each type of part.

	Type 1	Type 2	Type 3
Step 1	$12 \pm 3$ minutes	$12 \pm 3$ minutes	$12 \pm 3$ minutes
Step 2	$10 \pm 3$ minutes	$10 \pm 3$ minutes	$10 \pm 3$ minutes
Step 3	$80 \pm 20$ minutes	$50 \pm 15$ minutes	$65 \pm 20$ minutes
Step 4	$15 \pm 7$ minutes	$15 \pm 7$ minutes	$15 \pm 7$ minutes
Step 5	$110 \pm 30$ minutes	$90 \pm 20$ minutes	$130 \pm 10$ minutes
Step 6	$10 \pm 4$ minutes	$10 \pm 4$ minutes	$10 \pm 4$ minutes
Step 7	$12 \pm 3$ minutes	$12 \pm 3$ minutes	$12 \pm 3$ minutes