LEBANESE INTERNATIONAL UNIVERSITY

School of Engineering
Department of Computer and Communications Engineering
Spring 2016 – 2017
IENG370 – Industrial Systems Simulation
Final

Date: Monday June 5th, 2017 **Time: 10:30-12:30**

Name: _____ **ID: _____**

Instructions

Closed book/notes

Only basic calculators allowed

The booklet contains 8 pages (including cover)

Problem	Mark	Weight
I. (a)		18
I. (b)		9
I. (c)		9
I. (d)		9
II. Flow Chart		25
II. Block Parameters		15
II. Setup Parameters		10
Total		100

Problem I (50 pts):

Simulate by hand the operation of store served by one clerk for the first 25 minutes. The events are shown in the table below:

Clock Time	Customer Number	Event Type
0	1	Arrival
2	1	Departure
2	2	Arrival
3	2	Departure
6	3	Arrival
7	4	Arrival
9	3	Departure
9	5	Arrival
11	4	Departure
12	5	Departure
15	6	Arrival
19	6	Departure
25	7	Arrival

a) Fill the simulation table on the next page.

Just-Finished Event			Variables		Attributes		Statistical Accumulators									Event Calendar		
Entity No.	Time t	Event Type	$Q(t)$	$B(t)$	(In Queue)	In Service	P	N	$\sum WQ$	WQ_{max}	$\sum TS$	TS_{max}	$\int Q$	Q_{max}	$\int B$	Entity No.	Time	Type

b) Calculate the average waiting time in queue.

c) Calculate the time-average number in queue.

d) Calculate the utilization of the clerk.

Problem II (50 pts):

Develop a model of a three-workstation serial production line with high reject rates: 7% after each workstation. Parts rejected after the first workstation are sent to scrap. Parts rejected after the second workstation are returned to the first workstation where they are reworked, which requires a fresh "draw" from the processing-time distribution but increased by 50% from the distribution of the original operation. (This penalty factor of 1.5 applies only at Workstation 1 and not at Workstation 2 when the part returns to it.) Parts rejected at the third workstation are returned to the second workstation where they are reworked, with a 50% penalty there (but not on its revisit to Workstation 3). The operation times are TRIA(5, 9, 12), TRIA(5, 8.5, 13), and TRIA(6.5, 8.9, 12.5) for workstations 1, 2, and 3 respectively (all times are in minutes). Part interarrival times to the system are UNIF(6, 14). The simulation must run for 20,000 minutes, collecting statistics on the number in queue at each workstation, the number of scrapped parts, workstation utilizations, and average and maximum cycle times for parts that are not rejected at any workstation and for parts that are rejected at least once. Also, collect statistics on the number of times a rejected part was rejected.

Model the problem on Arena™.

Extra Page