

## ECS526 Engineering Stats

### **Final Project: ARENA Simulation (Fall 2017)**

Assume you are an Airport Security Operation manager. You want to find how your operation will be affected with changes in Passenger Input Flow and Security Screening Probability.

Simulate, using the attached ARENA program, these two situations.

1. The original Operation, with Initial Arrival Rate and Security Screening Probability.
2. A Second Operation with Group Dependent values of above parameters.

Run both, collect and analyze data; then, determine the impact of changes in the Operation.

#### Simulation Parameters:

1. The arrival time distribution is Group Dependent with mean time in minutes.
2. The processing time distribution is constant (do not change).
3. The Security Processing distribution is also Group Dependent.

#### **Collect data from your Group ARENA simulation FOR SIX BATCHES<sup>1</sup>, for variables:**

**Number of passengers passing process (No. OUT), waiting time in Q, No. Waiting in Q, resource UTILIZATION, Total Cost (obtain these results PER BATCH or Replication).**

Obtain Confidence Intervals for the variables of interest from the simulation output:

Implement Minitab Normality GOF tests for all variables (Test probably will reject).

Implement CI for the differences between the proposed and new configuration parameters (using all the above parameter estimations) using the t test and assuming Normality.

Implement Hypothesis tests on (H0) the initial configuration vs. (H1) the new one, using the Paired Sample t test and Wilcoxon test.

Obtain Power of the Test for the Hypothesis Tests above, for Alternative  $\mu_1 = \mu_0 + D$ , (where  $D = \frac{1}{2}$  Std-Dev of the variable being tested)

Obtain the sample size “n” for a Hypothesis Tests that detects a difference of  $D = \frac{1}{2}$  Std-Dev. between the parameters being tested, (for  $\alpha=0.05$ ; and  $\beta=0.1$ )

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<sup>1</sup> Batch and replication here, are used as synonymous.

Group Distribution Parameters:

The Exponential Distribution is given with its Mean Time (in minutes).

The Security Parameter (e.g.  $p=0.97$ ) goes inside the ARENA Pass Security Module. It means that:

If  $p < 0.97$  then the passenger is CLEARED; otherwise, it is DENIED.

<u>Group No.</u>	<u>Arrival Dist Par</u>	<u>Chk Dist Par</u>	<u>Security Param</u>
One	Expon(2)	Trian(.75,1.5,3)	P = 0.97
Two	Expon(3)	Trian(.75,1.5,3)	P = 0.94
Three	Expon(4)	Trian(.75,1.5,3)	P = 0.95
Four	Expon(2)	Trian(.75,1.5,3)	P = 0.96
Five	Expon(3)	Trian(.75,1.5,3)	P = 0.97
Six	Expon(4)	Trian(.75,1.5,3)	P = 0.95
Seven	Expon(2)	Trian(.75,1.5,3)	P = 0.94
Eight	Expon(4)	Trian(.75,1.5,3)	P = 0.96
Nine	Expon(3)	Trian(.75,1.5,3)	P = 0.95

**FOR THE SECOND RUN EACH GROUP SHOULD SUBTRACT ONE UNIT TO ARRIVAL Exp Mean [E.G. FOR GRP ONE IS Exp(1)]. For now, leave Triangular Distribution as is; AND ADD TWO UNITS TO THE SECURITY PARAMETER (E.G. FOR GRP ONE IS  $P= 0.03 + 0.02 = 0.05$ )**

ECS526 TA can show you how to change the simulation parameters, run the simulation, and identify in its output the results of interest.

JLR.