LAB – 2

A TWO-STAGE MANUFACTURING PROCESS

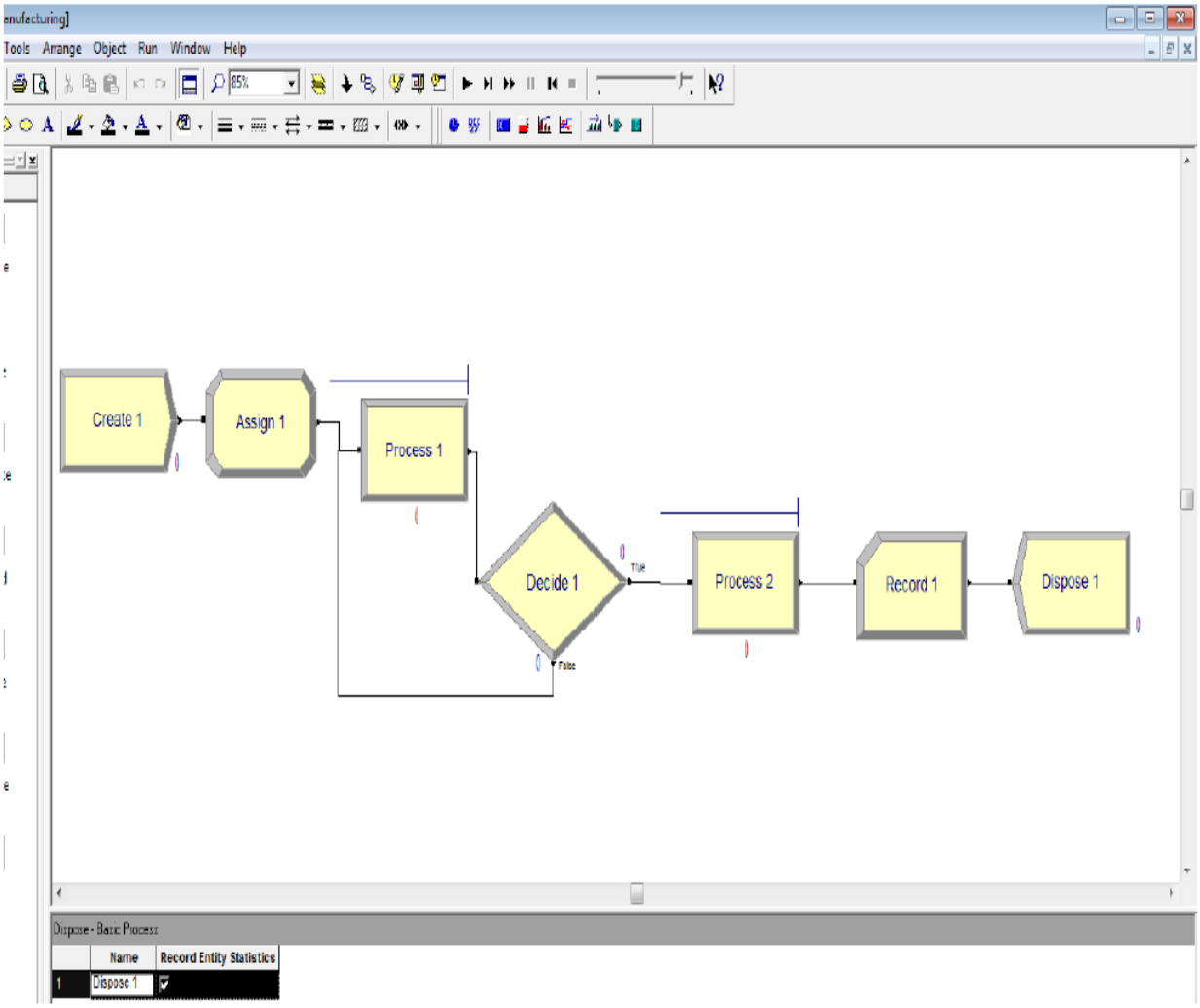
LAB # 2 simulating a two-stage manufacturing model

This problem presents a two-stage manufacturing model with two processes in series.

Jobs arrive at an assembly station with exponentially distributed inter-arrival times of mean 8 hours. Assume that the assembly process has all the raw materials necessary to carry out the operation. The assembly time is uniformly distributed between 2 and 6 hours. After the process is completed, a quality control test is performed and past data reveals that 15% of the jobs fail the test and go back to the assembly operation for rework. Jobs that pass the test go to the next stage, which is a painting operation that takes 3 hours for each unit. We are interested in simulating the system for 100,000 hours to obtain process utilizations, average job waiting times and average job flow times (the elapsed time for a job from start to finish).

Map your process in a flowchart

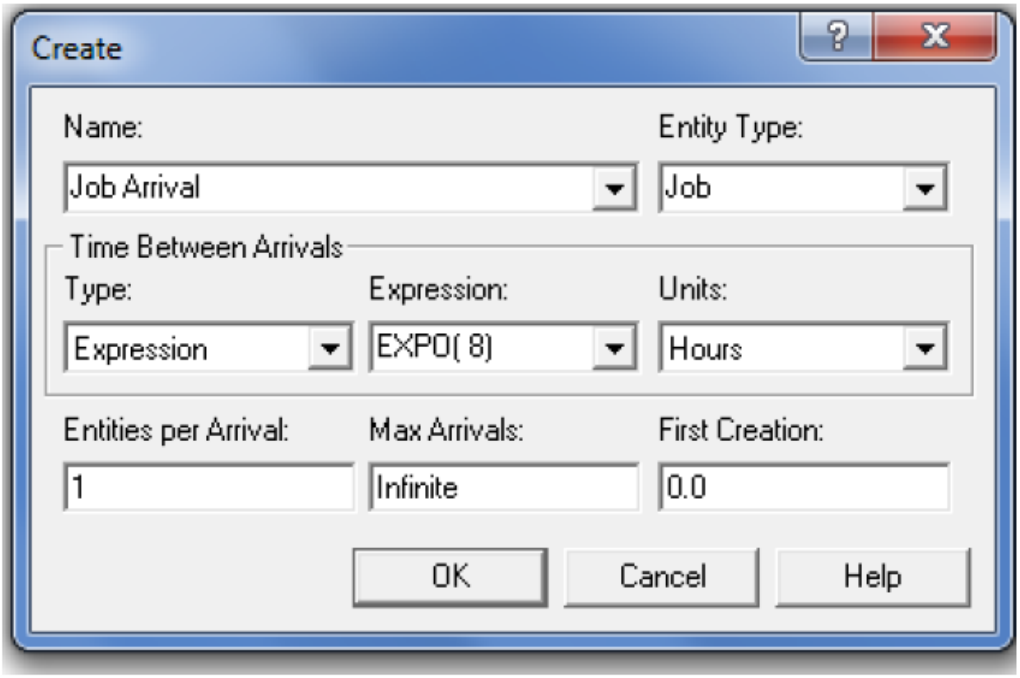
We'll be building a *chart*—also referred to as a *process map* or a *model*—that describes a *flow*. First, draw the flowchart in Arena model window representing the two-stage manufacturing process. Refer to the Figure given below



Define Model Data

1-Initiate the job arrival (Create 1 module)

Double-click on the Create 1 module to open its property dialog.



→ In the Name field, type **Job Arrival**.

→ For the Entity Type, enter **Job** to name our entities.

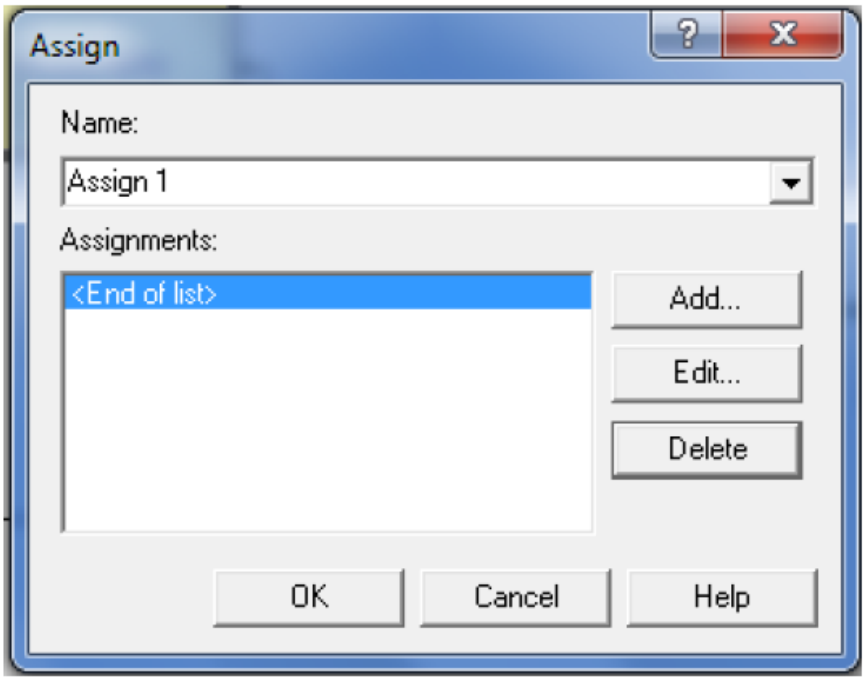
→ For the Time Between Arrivals section select Type as **Expression** from drop down list. Then in the Expression field, type **EXPO (8)**. Select **Hours** from the drop down list in Units field.

→ For now leave the default value for the other Create module properties like Entities per Arrival is **1,** Max Arrival = **Infinite**, and First Creation = **0.0**

→ Click **OK** to close the dialog box.

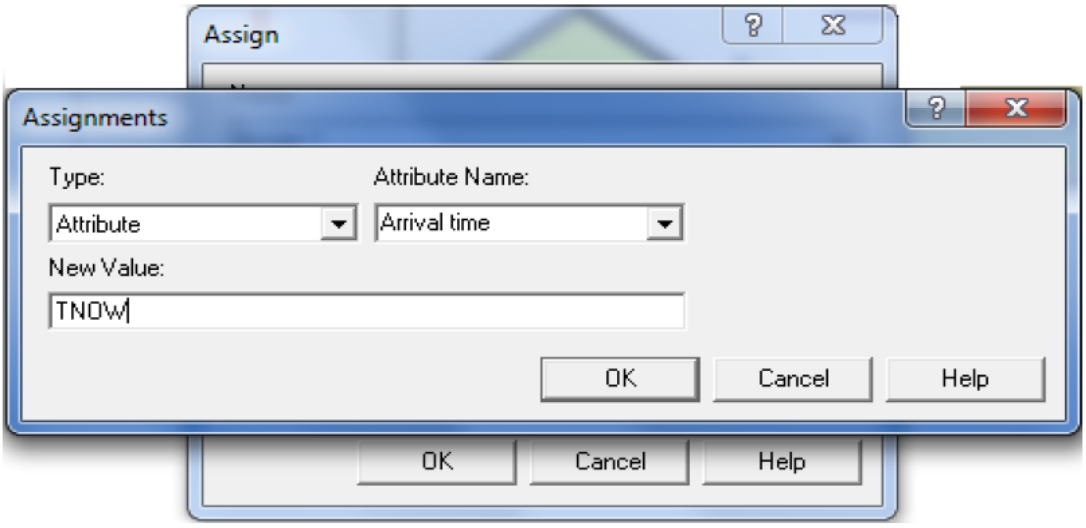
2-Store Arrival time (Assign 1 module)

Double-click on the Assign 1 module to open its property dialog.



→ In the Name field, type **Assign 1**.

→ Click Add… tab, new dialog box will appear as given below in the figure for adding Assignment.



→ In the Type field, Select **Attribute**.

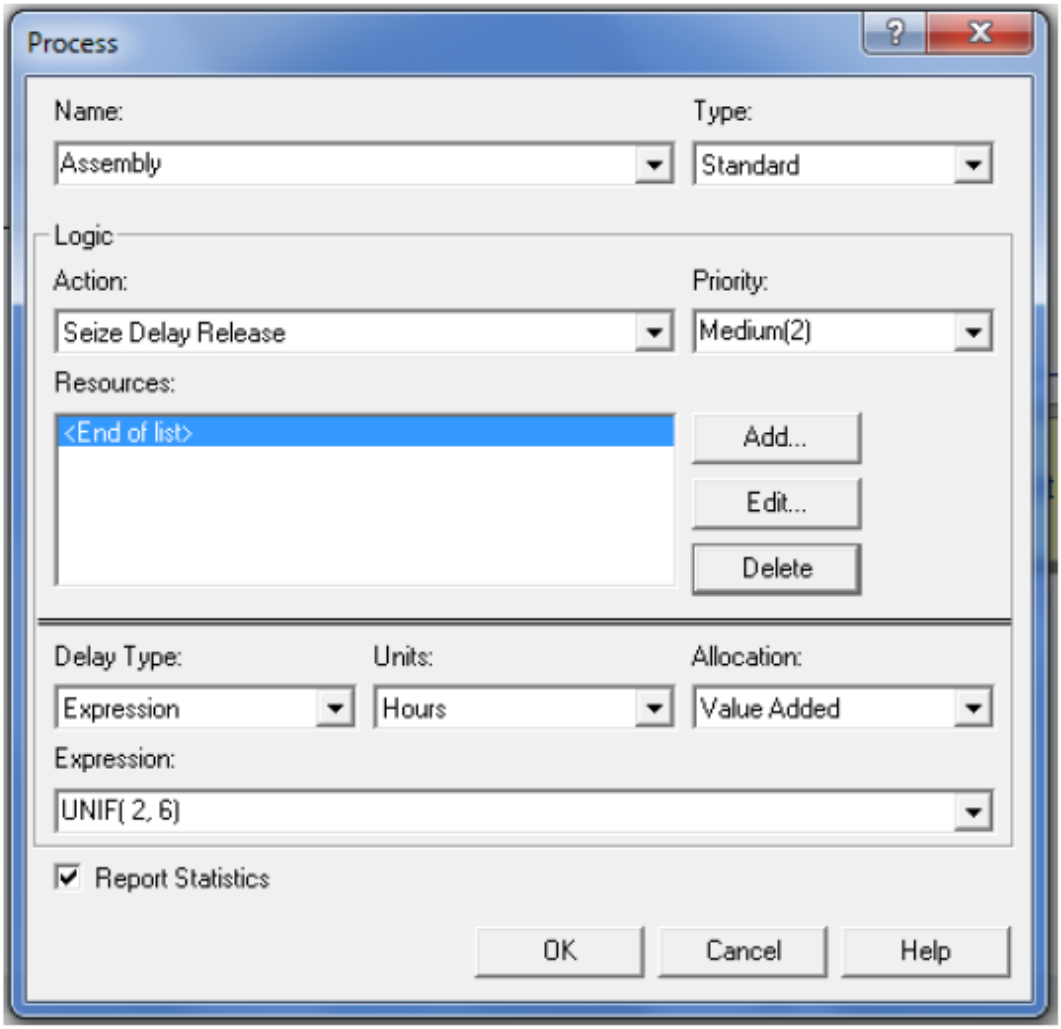
→ For the Attribute Name, Type **Arrival time.**

→ Arrival time value is **TNOW**.

→ Click **OK** to close the dialog box. And again click **OK** to close the Assign dialog box.

3-Assembly (Process 1 module)

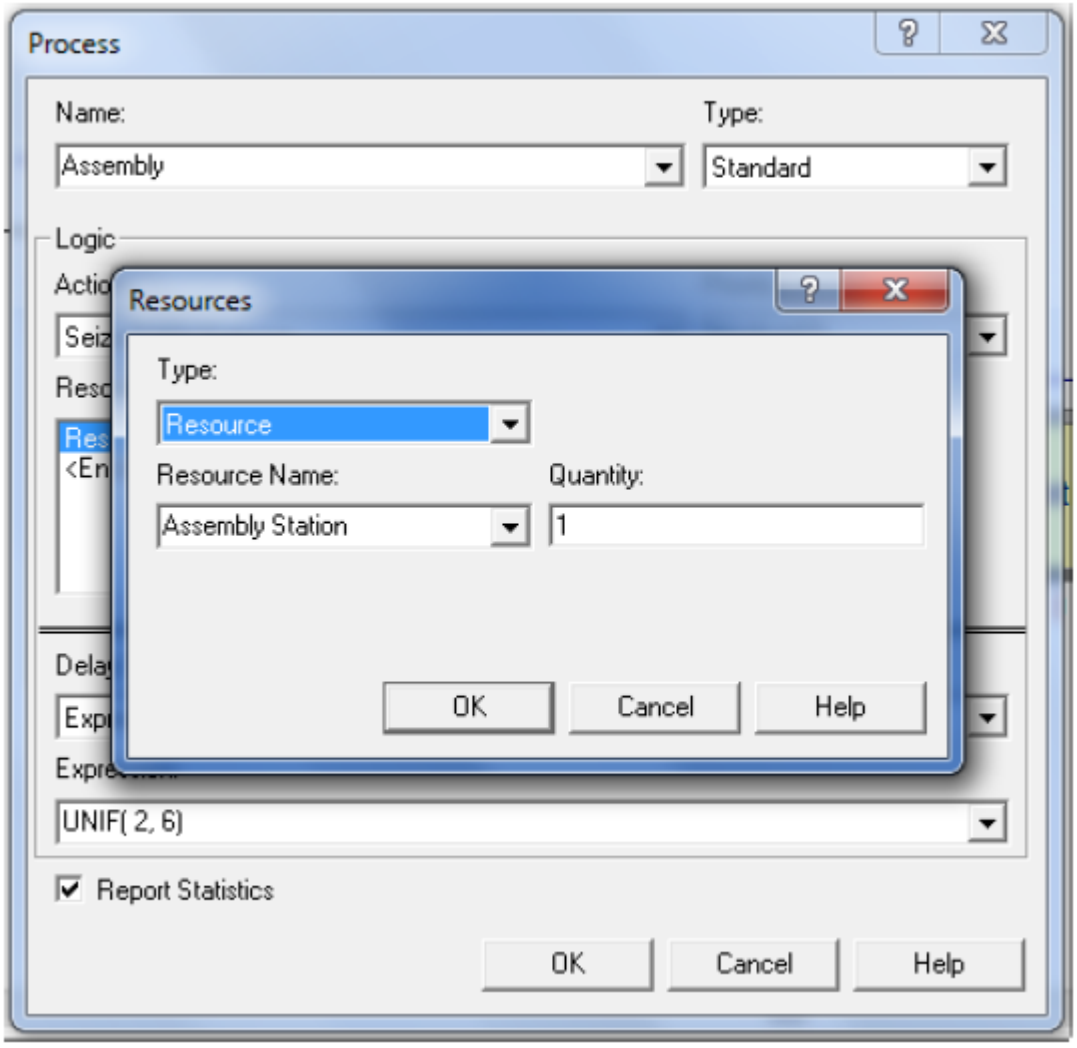
Double-click on the Process 1 module to open its property dialog.



→ In the Name field, type **Assembly**. Keep the Type: as **Standard**.

→ In Logic Pan Select Action as **Seize Delay Release.** Priority is **Medium(2).**

→ Click **Add**… tab to add the resource for the process, then new window will pop-up.



→ For the Type Select **Resource** from drop down list.

→ Type Resource Name as **Assembly Station** and quantity required is **1**.

→ Click **OK** to close dialog box.

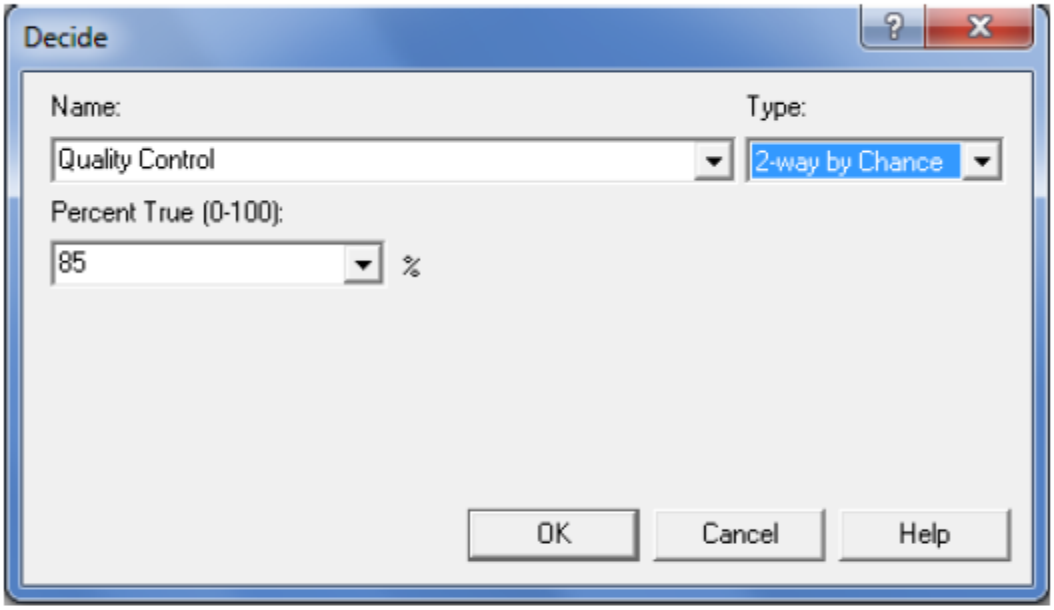
→ Select Delay Type is **Expression**, Units is **Hours** and In the Allocation field keep it as **Value Added.**

→ In Expression field, type **UNIF (2, 6).**

→ Click **OK** to close dialog box.

4-Quality Control (Decide 1 module)

Double-click on the Decide 1 module to open its property dialog.



→ In the Name field, type **Quality Control**.

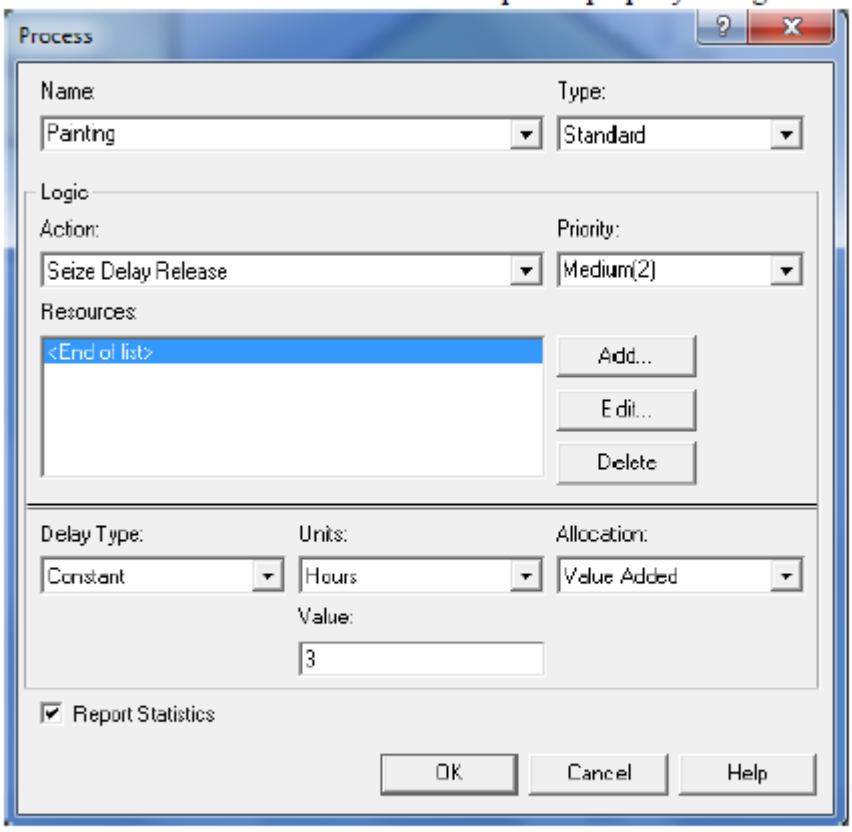
→ For Type select **2-way by Chance**.

→ Percent True (0-100) type **85**.

→ Click **OK** to close dialog box.

5-Painting (Process 2 module)

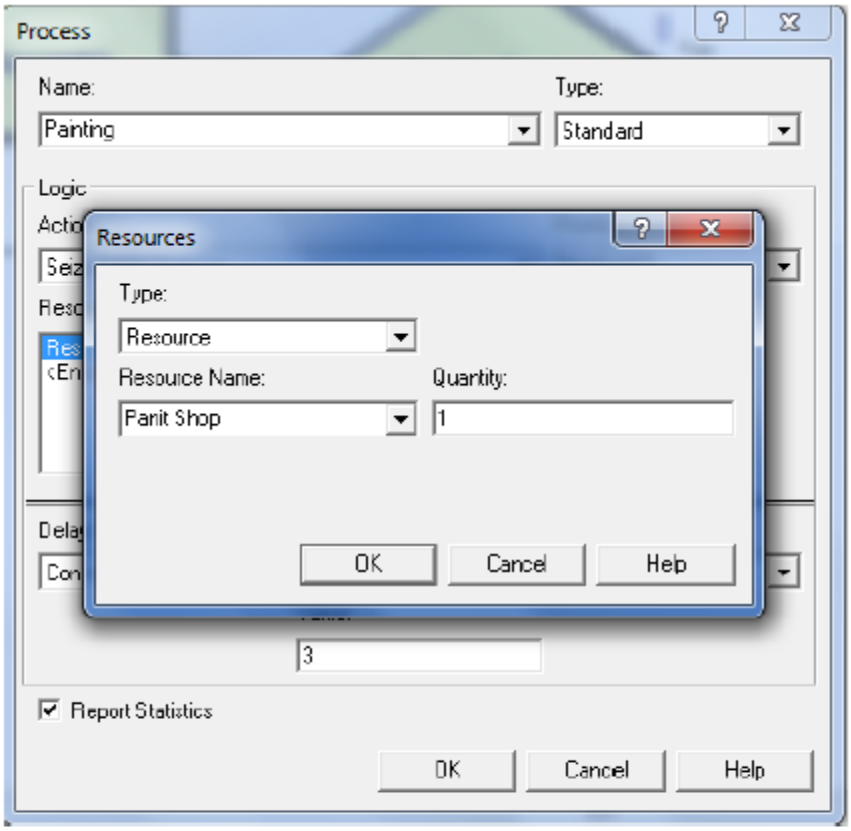
Double-click on the Process 2 module to open its property dialog.



→ In the Name field, type **Assembly**. Keep the Type: as **Standard**.

→ In Logic Pan Select Action as **Seize Delay Release.** Priority is **Medium(2).**

→ Click **Add**… tab to add the resource for the process, then new window will pop-up.



→ For the Type Select **Resource** from drop down list.

→ Type Resource Name as **Paint Shop** and quantity required is **1**.

→ Click **OK** to close dialog box.

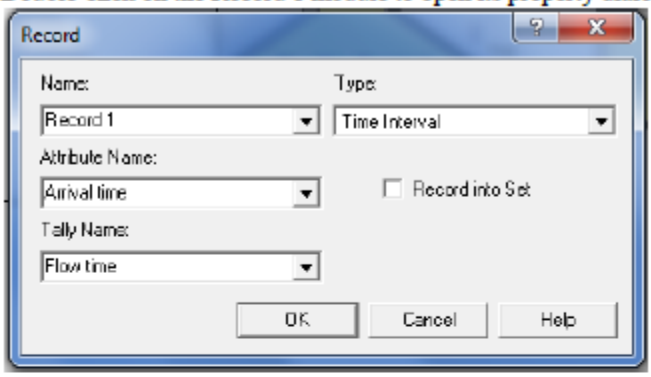
→ Select Delay Type is **Constant**, Units is **Hours** and In the Allocation field keep it as **Value Added.**

→ In Value field type **3.**

→ Click **OK** to close dialog box.

6-Record Flow time (Record 1 module)

Double-click on the Record 1 module to open its property dialog.



→ In the Name field, type **Record 1**.

→ In the Type field select **Time Interval**.

→ Attribute Name field will Appear, select Attribute Name **Arrival time**.

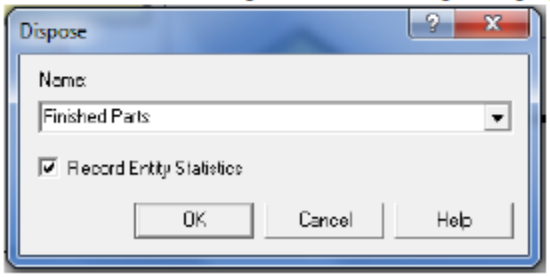
→ In the Tally Name field type Flow time.

→ Click **OK** to close the dialog box.

7-Finished Parts (Dispose 1 module)

All the work that we're interested in is done. Now, we'll remove the jobs from the model, terminating the process with a Dispose module

Double-click on the Dispose 1 module to open its property dialog.

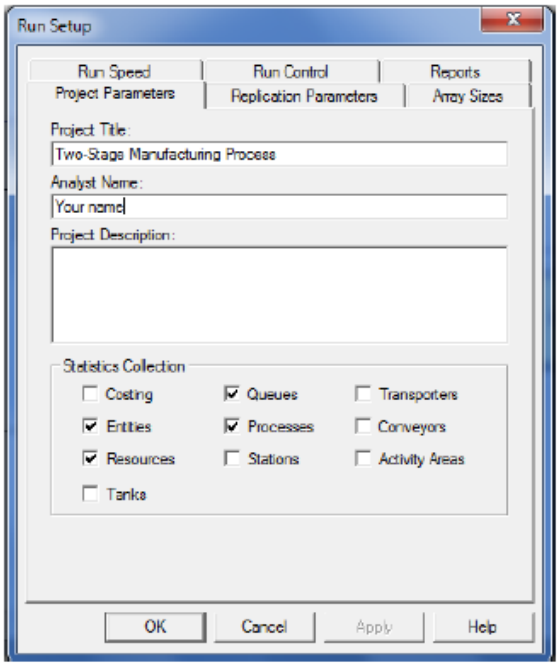


→ In the Name field, type **Finished Parts**.

→ Click **OK** to close the dialog box.

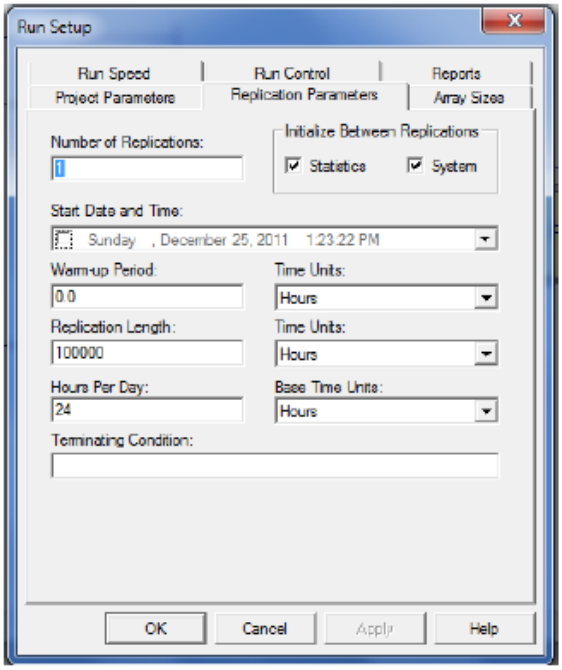
8-Prepare for Simulation (Run Parameter)

Open the Project Parameters dialog box by using the **Run** > **Setup** menu item and clicking the **Project Parameters** tab.



In the Project Title field, type **Two- stage Manufacturing Process**; we'll leave the Statistics Collection check boxes as the defaults, with Entities, Queues, Resources, and Processes checked.

Next, click the **Replication Parameters** tab within the same Run Setup dialog box.



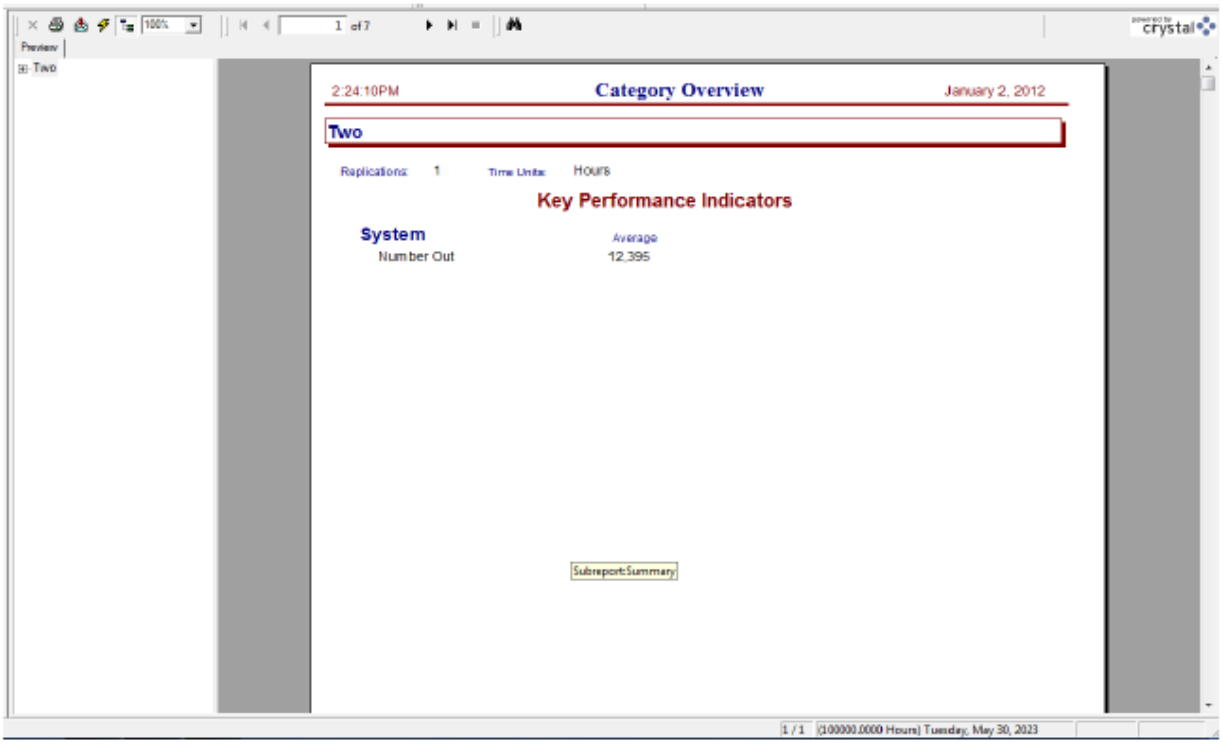
In the Replication Length field, type **100000**; and in the Time Units field directly to the right of Replication Length, select **Hours** from the drop-down list, leave the another values defaults.
Click **OK** to close the dialog box.

9-Run the Simulation (Run Parameter)

Start the simulation run by clicking the **Go** button or clicking the **Run** > **Go** menu item or using ▶ **Run** button in the main toolbar.

10-View Simulation Report

At the end of the run, Arena will ask whether you'd like to view reports. Click **Yes**, and the default report (the Category Overview Report) will be displayed in a report window, as shown below.



On the left side of each report window is a tree listing the types of information available in the report. The project name (in our case, Two) is listed at the top of the tree, followed by an entry for each category of data. This report summarizes the results across all replications (although, in this model, we have only one replication). Other reports provide detail for each replication. By clicking on the entries inside the category sections, you can view various types of results from the simulation run.

After you've browsed the Category Overview Report, you can close it by clicking on the window icon to the left of the **File** menu and clicking **Close**. You can look at other reports by clicking on their icons in the Project Bar. Each report will be displayed in its own window.
To return to the model window, close all of the report windows or select the model file from the Window menu.

After you have viewed the reports and returned to the model window, end the Arena run session by clicking the ■ **End** button in main toolbar.