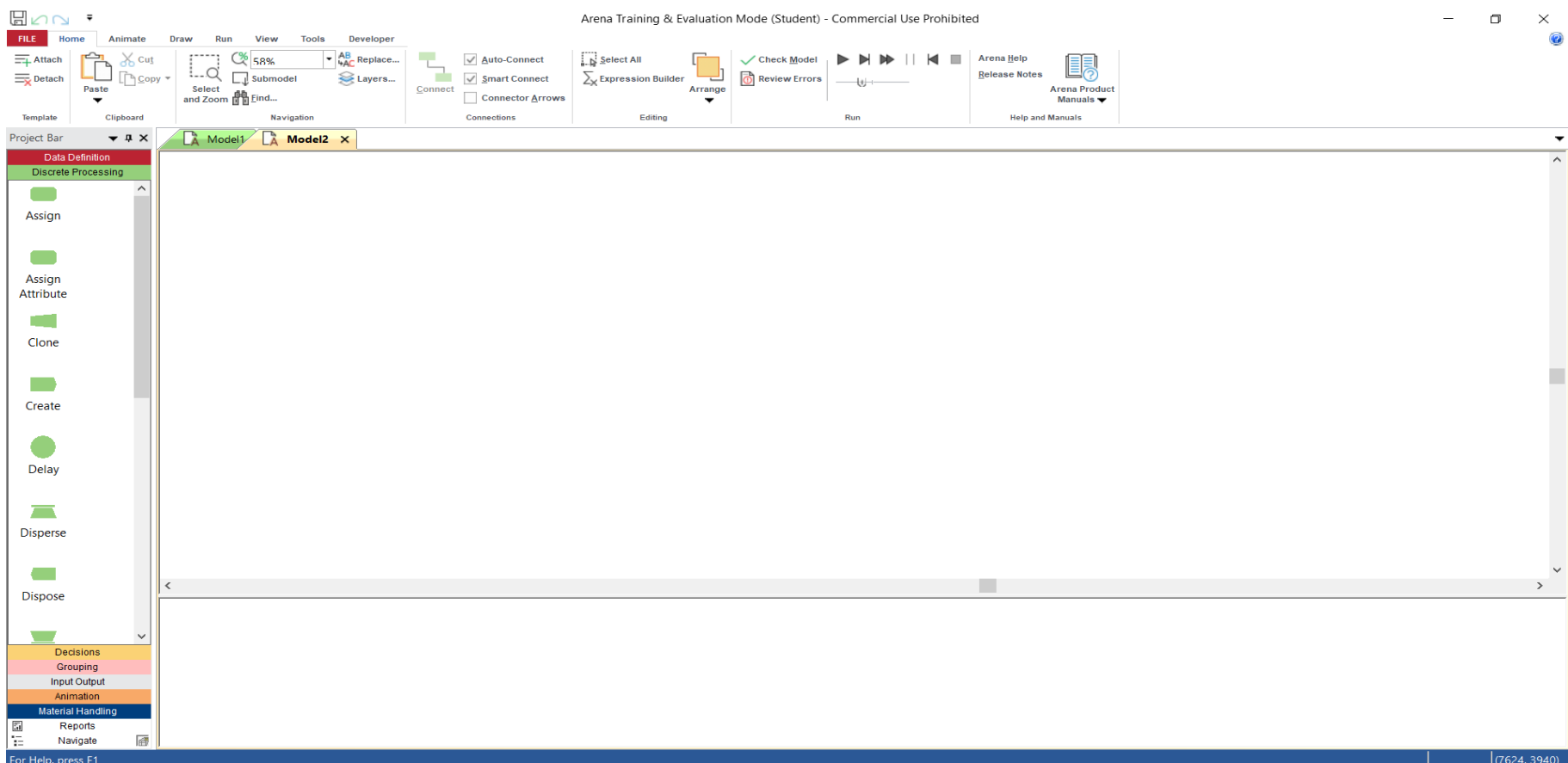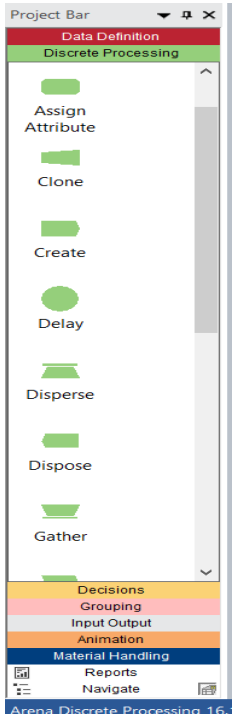# System Modelling and Simulation

Prof. Alireza Mousavi

Changes in the Arena interface

The main interface of Arena. On the right side of the screen (big blank box) is where you will build your simulation models. To build a model you need to drag and drop the processes from the Project Bar on the left side of the screen.

This is the Project Bar. It is located on the left side of your screen. Compared to previous versions of Arena, the Project Bar now follows a more logical grouping based on what you wish to do.

For more detailed explanations of Arena interface, click "**Arena Help**" on the top right and then click "**Tour of the Arena user interface**".

Let's build our first simulation!

The story and the model
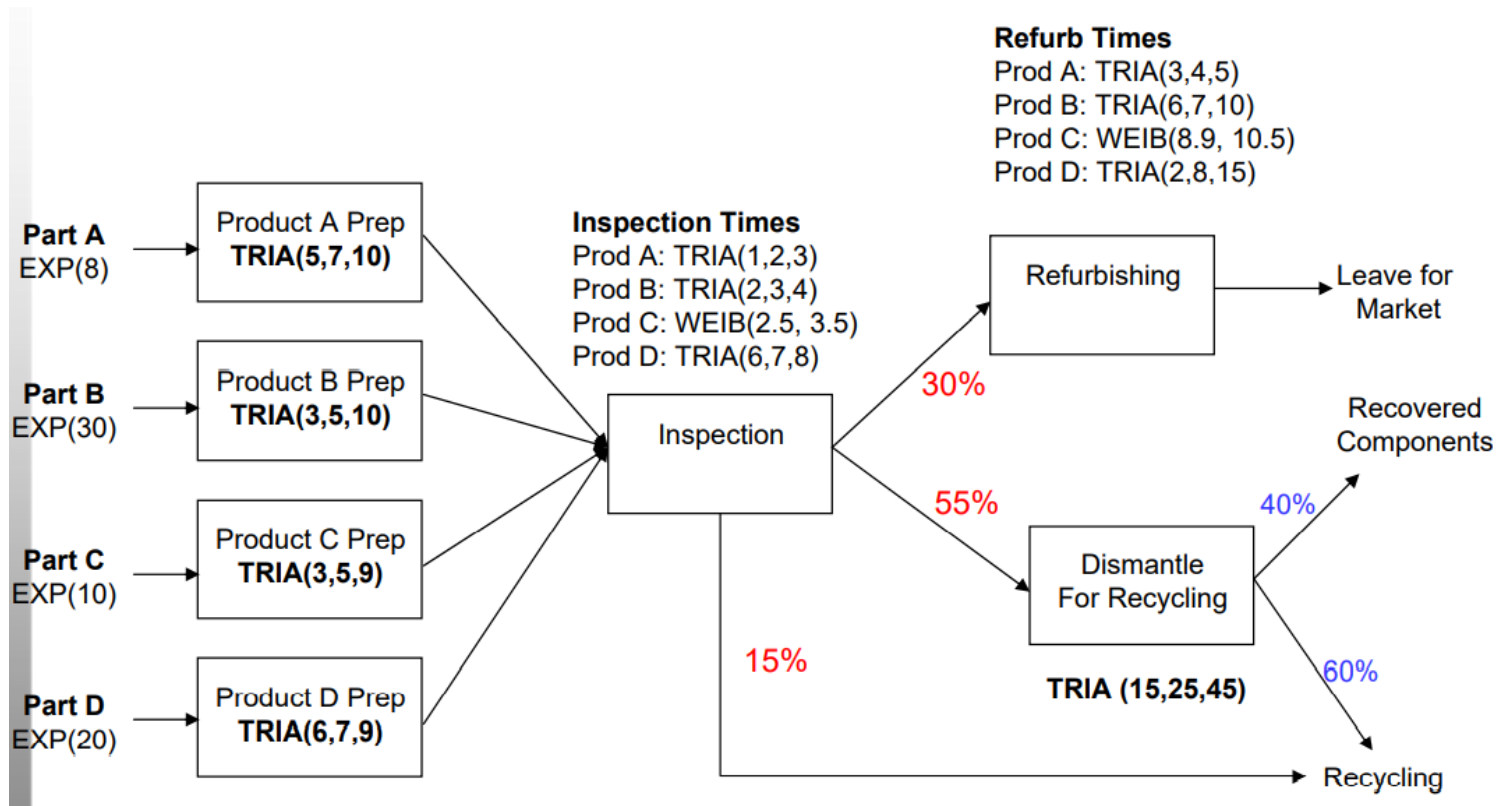
Creating the four products (1)

To create the four products we drag and drop the ***Create*** module from the ***Discrete Processing*** Tab in the ***Project Bar***.

Part A
EXP(8)

Part B
EXP(30)

Part C
EXP(10)

Part D
EXP(20)

Creating the four products (2)

Part A
EXP(8)

Part B
EXP(30)

Part C
EXP(10)

Part D
EXP(20)

To assign the values for each product we double click on the **Create** module that we just dragged and dropped and we put the corresponding values there.

Do not forget to change the **Units** from Hours to Minutes !!

Assigning Attributes (1)

Part A
EXP(8)

Part B
EXP(30)

Part C
EXP(10)

Part D
EXP(20)

To assign the attributes for each product we double click on the ***Assign Attribute*** module that we just dragged and dropped and we put the corresponding values there.

Assigning Attributes (2)

For each Product, three attributes will be added : *Arrival Time*, *Inspection Time* and *Refurbishment Time*.
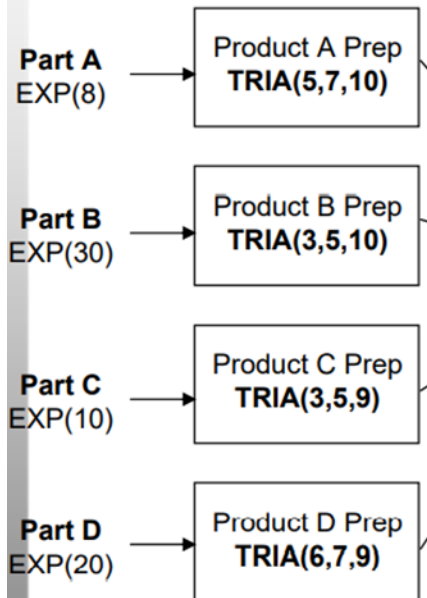
Assigning Attributes (3)

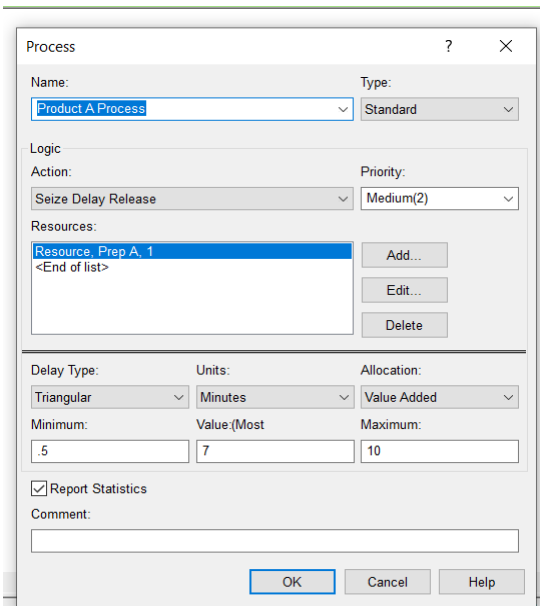To add these attributes, click the **Add...** button on the right and then put the values as shown in the pictures.
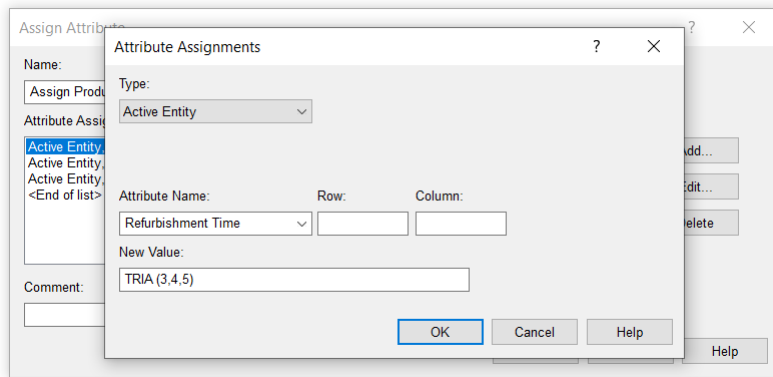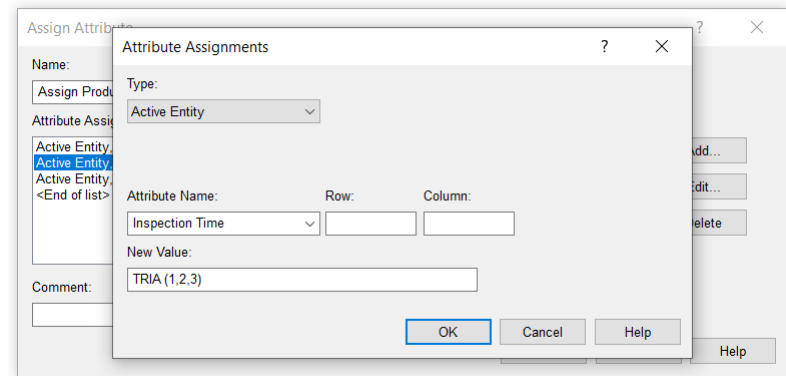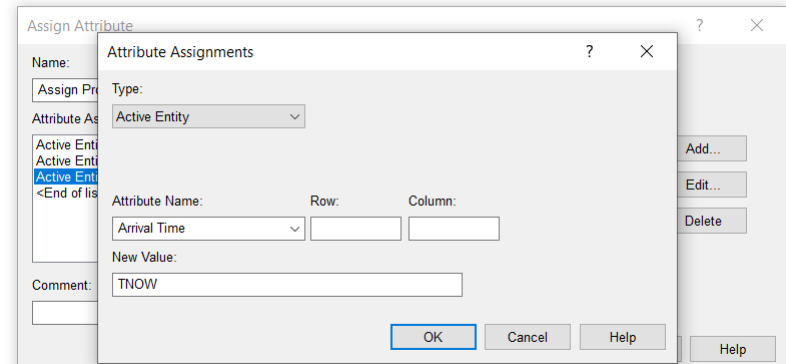
Product Preparation (1)

At this stage, we need to drag and drop a ***Process*** module for each product from the ***Discrete Processing*** tab.
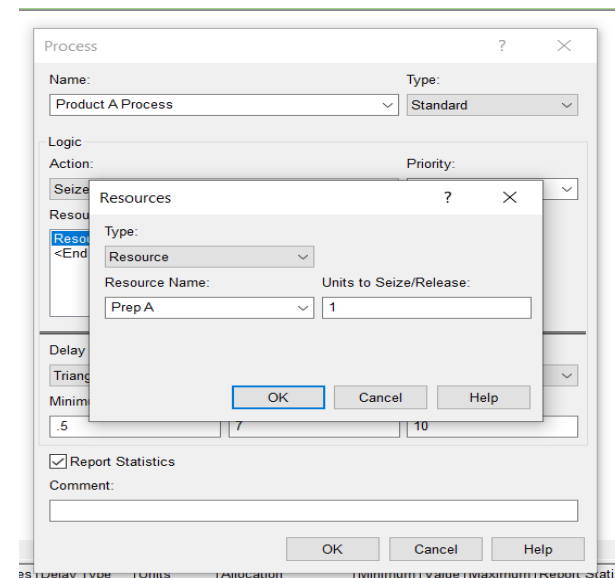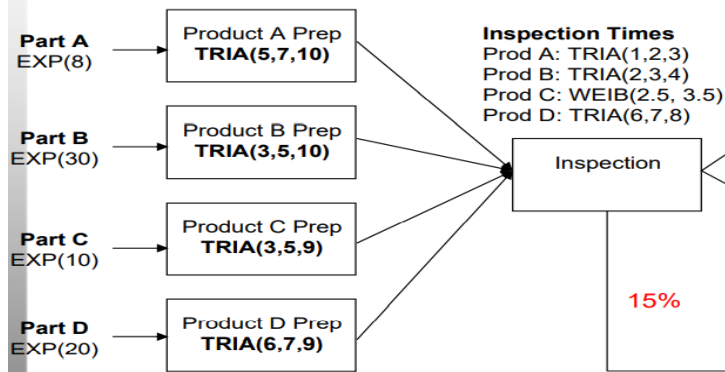
Product Preparation (2)

We double click on the **Process** module and we put the corresponding name on the **Name** Tab. Then in the **Action** tab we choose "**Seize Delay Release**". A **Resources** panel will show, on which we need to specify the Resource.

To specify the Resource, we click **Add…** and we put the Resource name (Prep A for Product A, Prep B for Product B etc.).
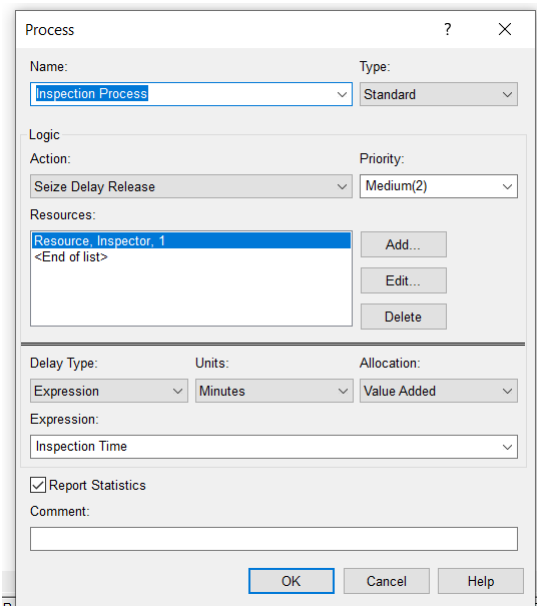
Inspection (1)

Inspection Times
Prod A: TRIA(1,2,3)
Prod B: TRIA(2,3,4)
Prod C: WEIB(2.5, 3.5)
Prod D: TRIA(6,7,8)

To add the Inspection part, we drag and drop a ***Process*** module to our model.

Inspection (2)

To configure the Inspection process, we double click it and then we put the values. We choose again "Seize Delay Release in the Action Tab.
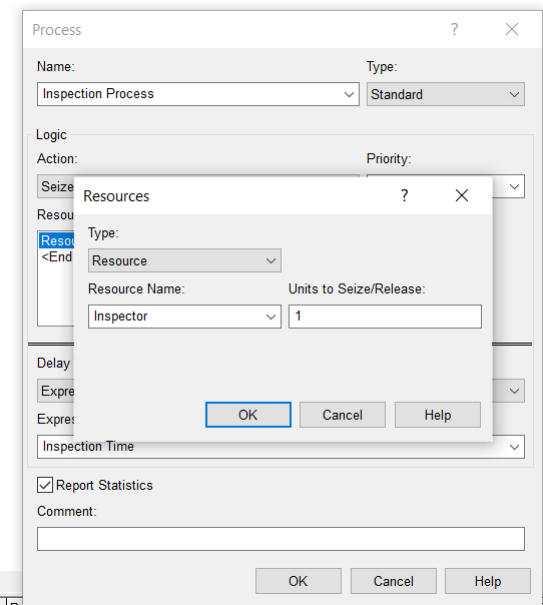
We follow the same steps as before and we add a resource like in the picture on the right.

Inspection Outcome (1)
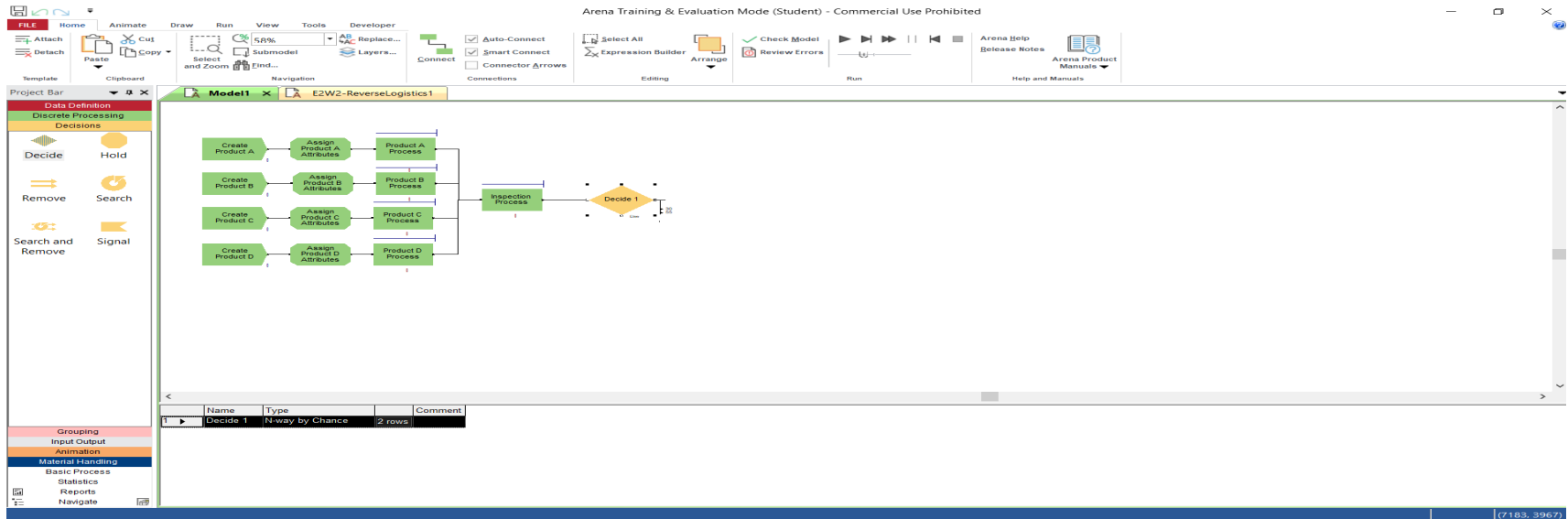
To create the Inspection Outcome, we drag and drop a **Decide** module from the **Decisions** Tab in the Project Bar.

We define the name and t the type of Decision will be N-way by Chance. Then we click the Add… button and we put 30 and 55.

Inspection Outcome (2)

It can be seen that the percentages are shown for each decision and also there is an **Else** output on the module. As our percentages add up to 85%, there is still 15% left. This 15% is represented through the **Else** output. The 30% will be connected to the **Refurbishing** process, the 55% will be connected to the **Dismantling** process and the **Else** (15%) will be connected to the **Recycling** process.
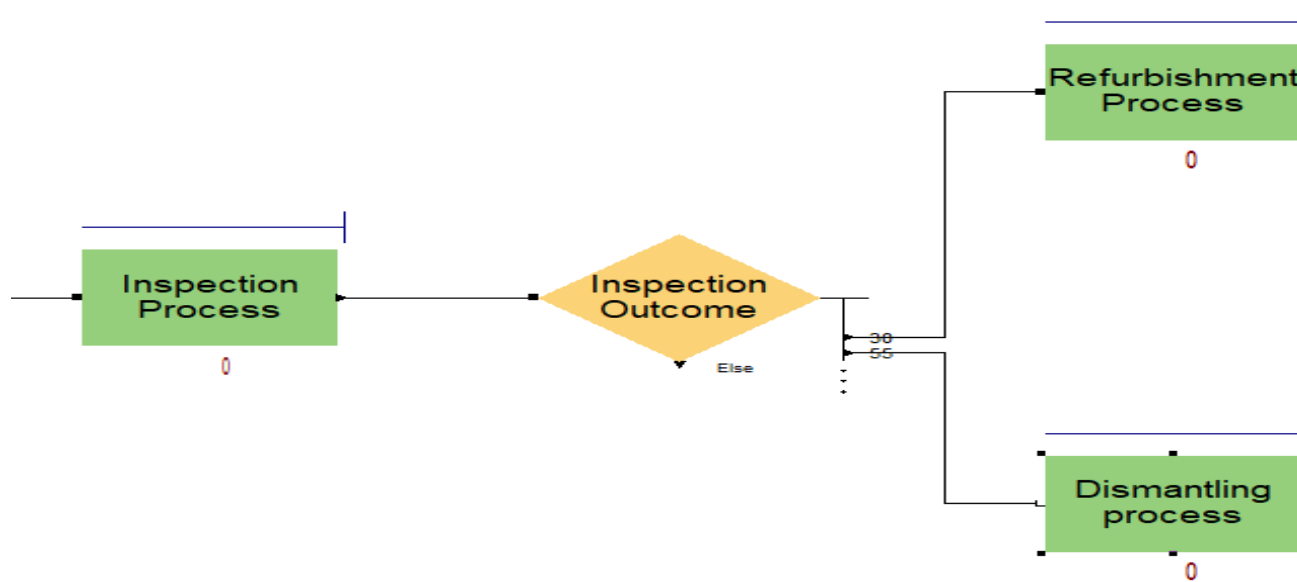
Inspection Outcome (2)

It can be seen that the percentages are shown for each decision and also there is an **Else** output on the module. As our percentages add up to 85%, there is still 15% left. This 15% is represented through the **Else** output. The 30% will be connected to the **Refurbishing** process, the 55% will be connected to the **Dismantling** process and the **Else** (15%) will be connected to the **Recycling** process.

Refurbishment and Dismantling processes (1)

As it can be seen, we added two Process modules, one for **Refurbishment** and one for **Dismantling**. Pay close attention that each process is connected to the **Inspection Outcome** to its corresponding percentage.
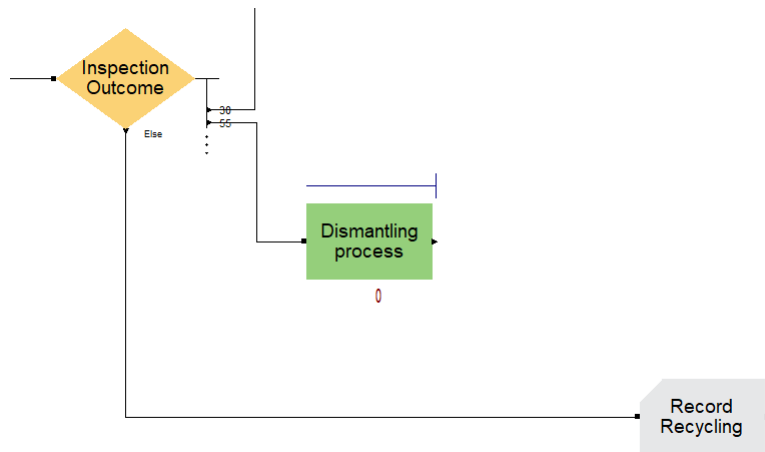
Refurbishment and Dismantling processes (2)

The Refurbishment process is set up as in the picture. As a Resource we add "**RefTechnician**" as it shows in the picture on the left. Pay attention to the Units, it should be Minutes!!

The Dismantling process is set up as in the picture. As a Resource we add "**DisTechnician**" as it shows in the picture on the left. Pay attention to the Units, it should be Minutes!!

Recycling process (1)

Firstly, we will add a **Record** module from the **Input Output** tab in the Project Bar. We do that in order to record how many products have gone for Recycling. This **Record** module will be connected with the **Else** output of the **Inspection Output**.

We put as name "**Record Recycled** " and then we need to define the statistic. We click the "**Add…**" button and we fill the tabs as seen in the right picture.
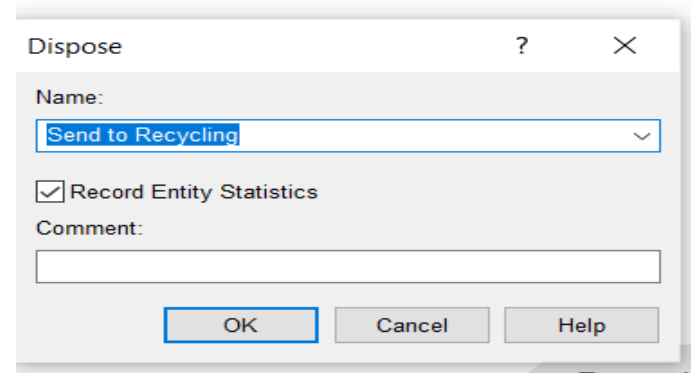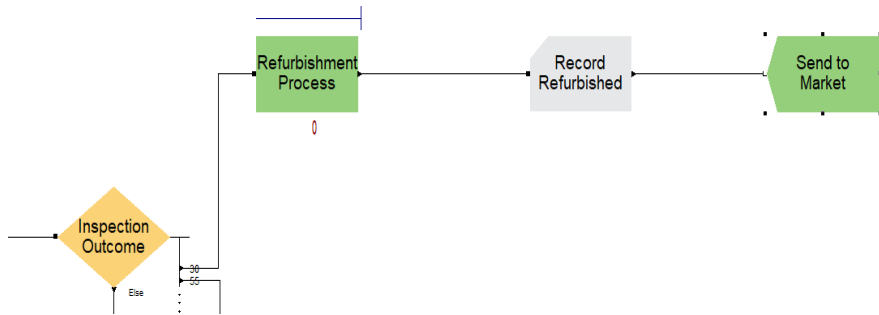
Recycling process (2)
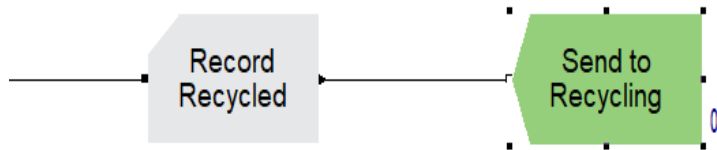
Next to the **Record** module we add a **Dispose** module from the Discrete Processing tab.

We put as name "**Send to Recycling**" and then we tick the "Record Entity Statistics" box.
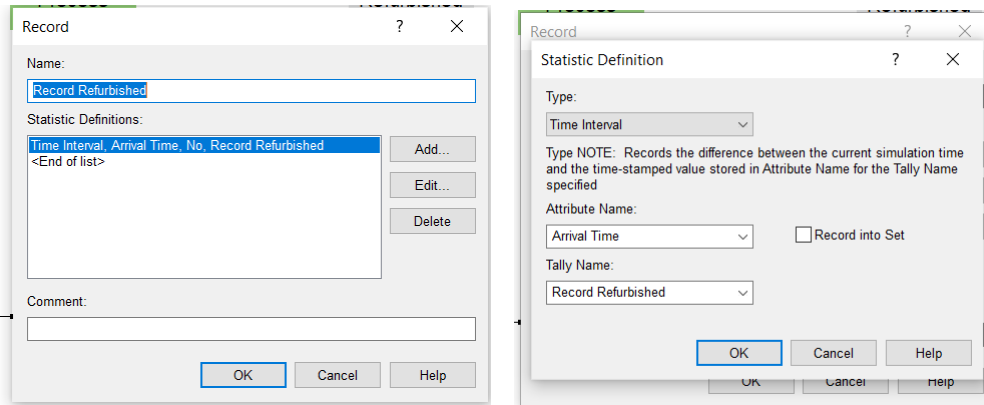
The recycling process is completed.
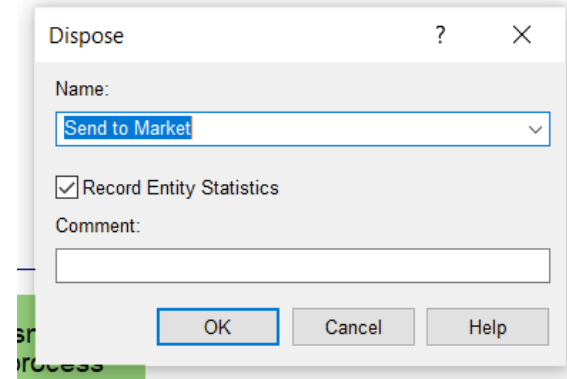
Refurbishment process (continuation)

For the **Refurbishment** process, we follow the same steps as we did in the **Recycling** process. We add a **Record** module and then a **Dispose** module. Their configurations can be seen in the following pictures.

## *Record module*

Dispose module

Dismantling process (continuation) (1)

For the **Dismantling** process, we need to follow a different path than we did with **Recycling** and **Refurbishment**. This happens because we need to dismantle the products and some of them will be sent for **Recycling** and some for **Remanufacturing**. As a next step, we need to add a **Separate** module from **Grouping** tab in the Project bar.
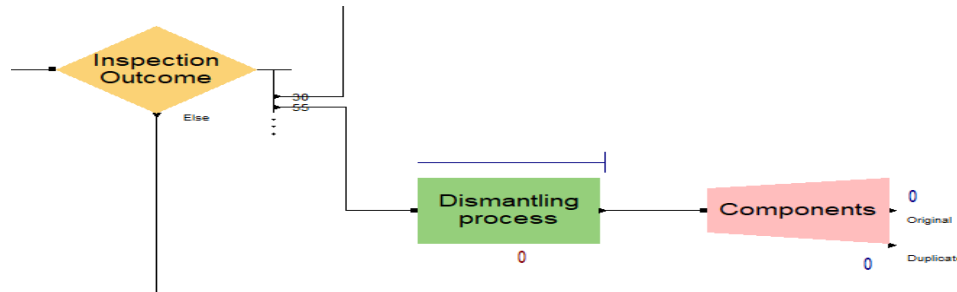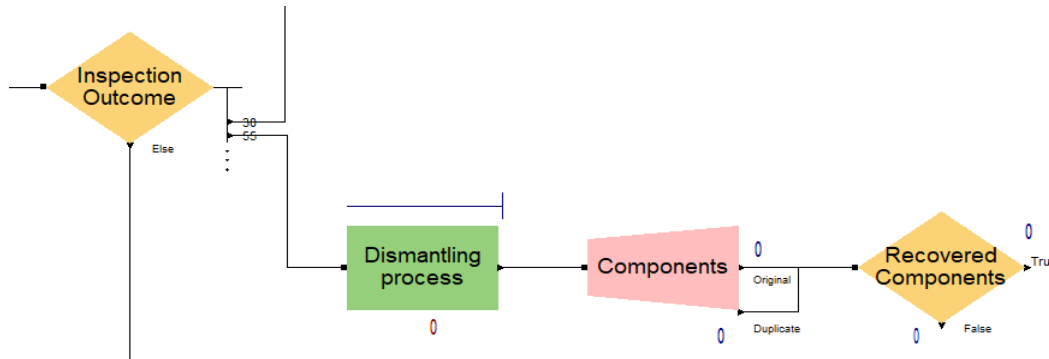

We will name the **Separate** module "**Components**". In Type, we will choose "**Duplicate Original**" and we will fill the rest as seen in the picture on the right.
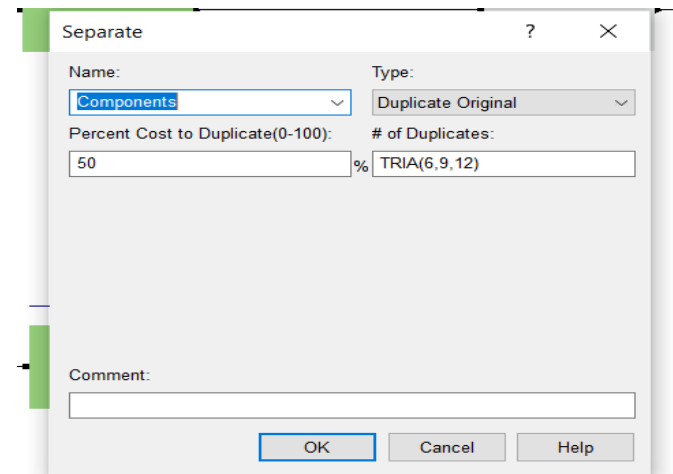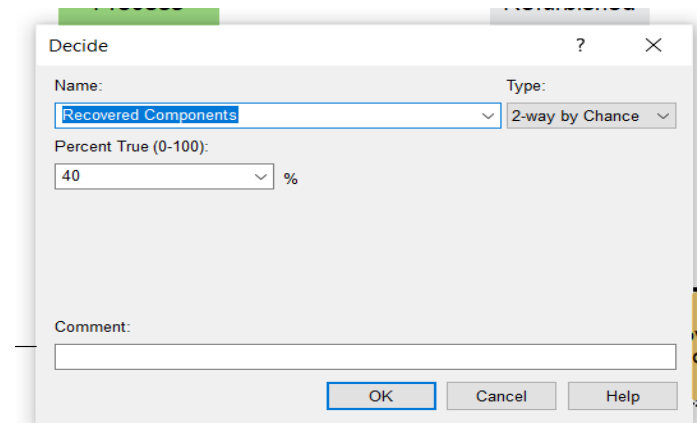
Dismantling process (continuation) (2)

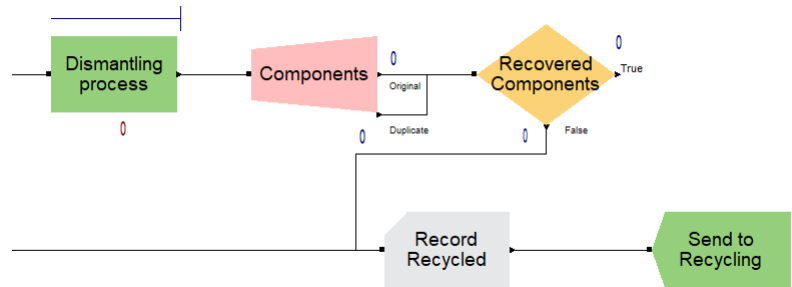After the **Separate** module, we add a **Decide** module.

We will name the **Decide** module "**Recovered Components**". In Type, we will choose "**2-way by Chance**" and we will put 40% in the **Percent True** tab.
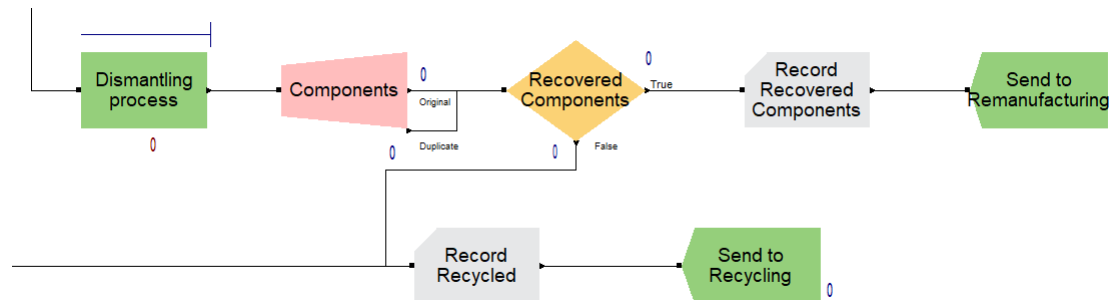
Dismantling process (continuation) (3)

The **False** output (60% chance) will be connected to the **Record Recycled** module.
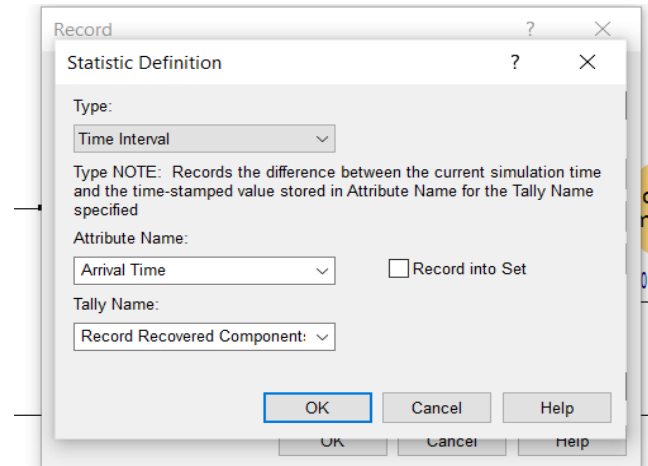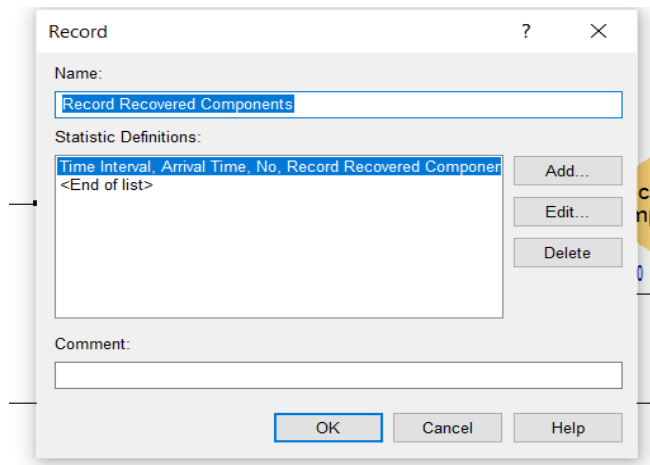

Then we will add a **Record** module and a **Dispose** module as we did in **Recycling** and **Refurbishment**.
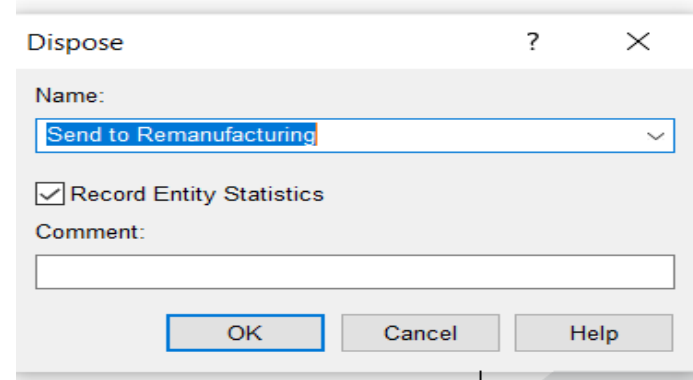
Dismantling process (continuation) (4)

The **Record Recovered Components** module will be connected to the **True** output of the **Recover Components** (40% chance). The configuration is as follows.

The **Dispose** module will be configured as it is shown in the picture on the right.

Whole simulation and run

The whole simulation can be seen in the picture. To run this simulation, we go to the **Run** tab and we choose **Settings**. From there, we can set the run parameters. Then, we click the **Go** button (play button), and the simulation is executed.