Computer Simulation

Module 5: Arena

Dave Goldsman, Ph.D.

Professor

Stewart School of Industrial and Systems Engineering

A Manufacturing System in Detail

Part 1. Introduction + Advanced Transfer Panel

Coming Up…

A bunch of additional lessons related to our **Manufacturing Example**!

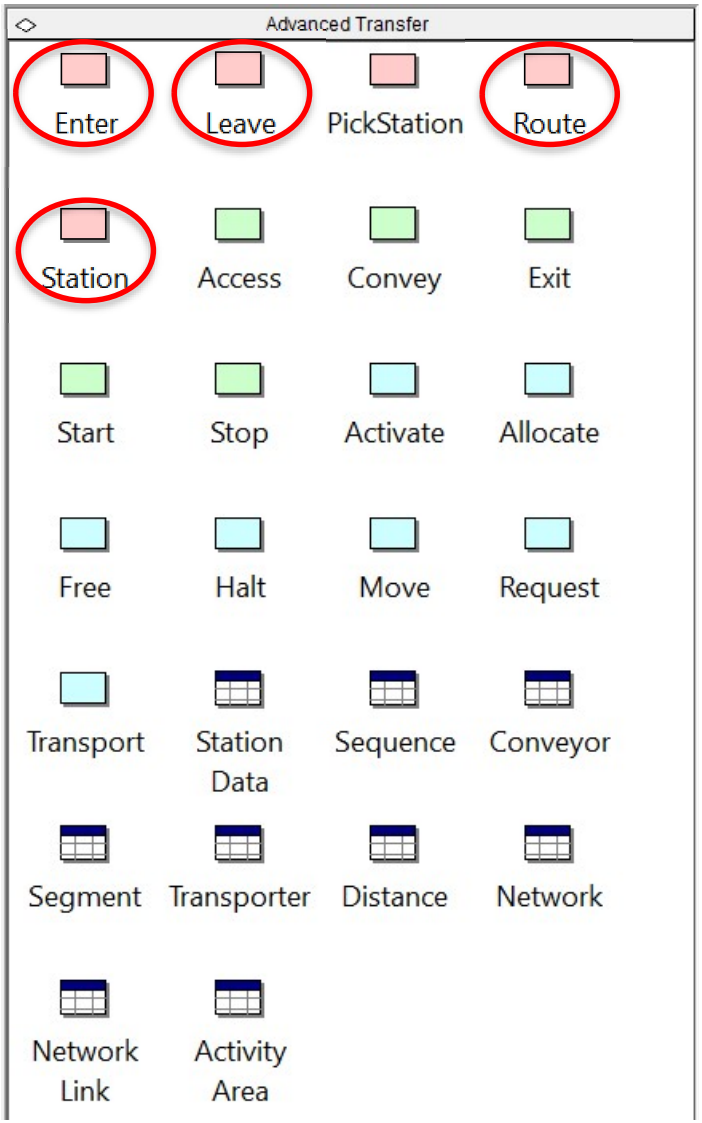
1. Advanced Transfer Panel Modules related to movement
   - Station, Route, Enter, Leave
2. Sequences of visitation locations
3. Sets and Advanced Sets (e.g., sets of Sequences)
4. Detailed walk-through of the model
5. Parts can move in a variety of ways:
   - By themselves
   - Via transporters
   - Via conveyors
   - Requires construction of transporter and conveyor paths

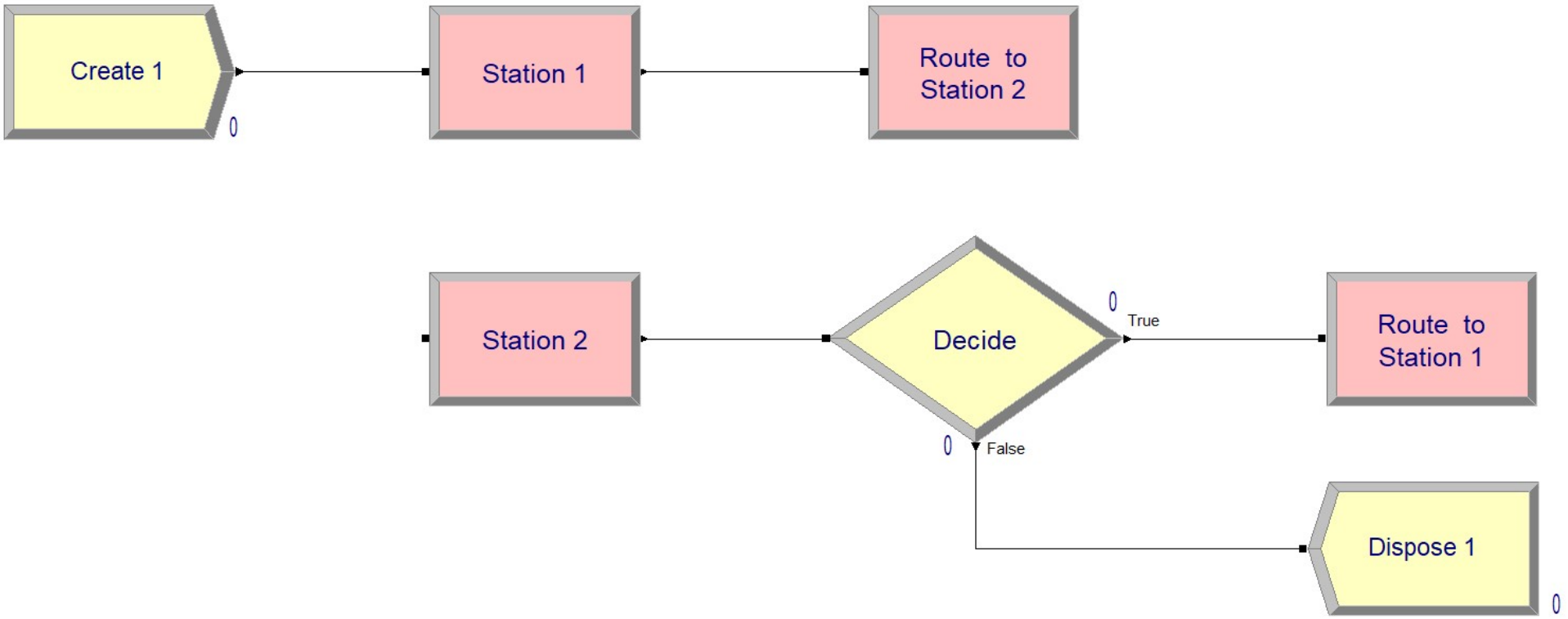
Advanced Transfer

An entire panel related to movement

1. This Lesson: Where you move
   - **Station:** Somewhere you can go to
   - **Route:** Tells you where you're going. Similar to Connect, except it takes time
   - **Enter:** General way to get into a Station
   - **Leave:** General way to depart a Station
2. Subsequent Lessons: How you move

Mini-Demo with Station and Route!




Create 1
0
Station 1
Route to Station 2
Station 2
Decide
0
True
0
False
Route to Station 1
Dispose 1
0

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Part 2. Sequences

Coming Up…

A bunch of additional lessons related to our **Manufacturing Example**!

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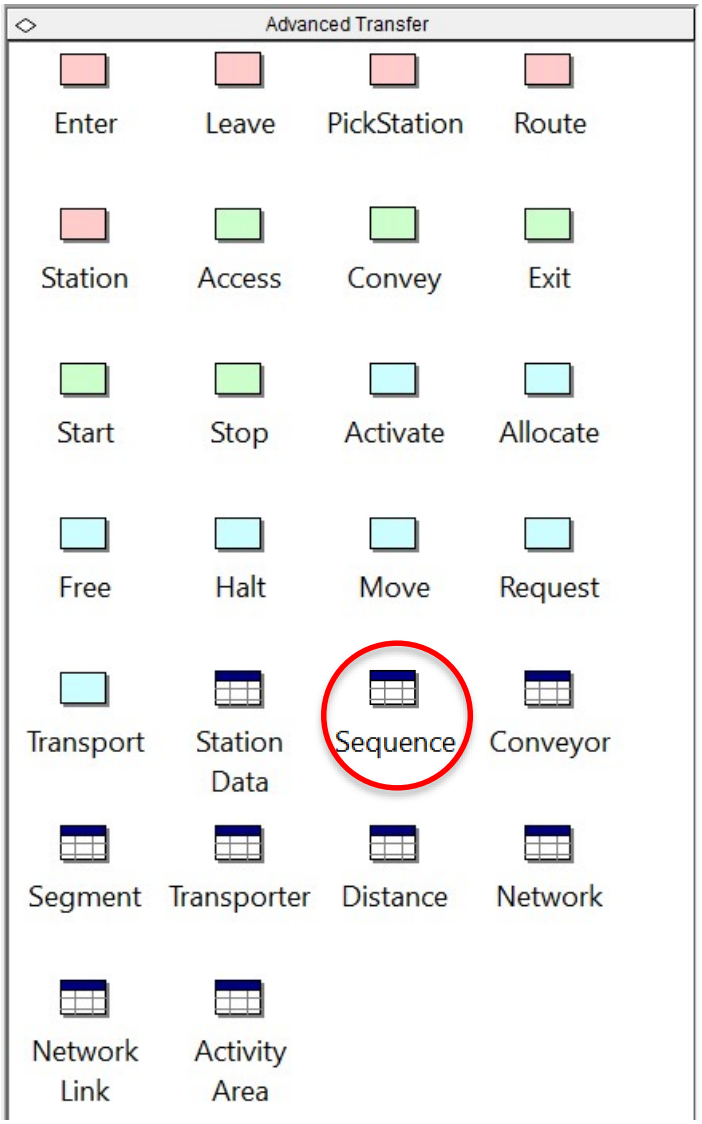
Sequences

Each type of customer follows a different path (**sequence**) thru the system.

- A sequence goes from station to station
- Maybe have different service time distribution at each station (depending on customer type and place in visitation sequence).

Example:

- Part Type 1's visit stations 1 > 2 > 3 > 4
- Part Type 2's visit 1 > 2 > 4 > 2 > 3
- Part Type 3's visit 2 > 1 > 3
- Each with different service times distributions



Defining Sequences and Assigning Attributes

Three different Sequences

Sequence - Advanced Transfer

	Name	Steps
1	Part 1 Process Plan	5 rows
2	Part 2 Process	
3	Part 3 Process	

Double-click here to ad

Steps — Part Type 2 Sequence

	Station Name	Step Name	Next St	Assignments
1	Cell 1	Part 2 Step 1		0 rows
2	Cell 2	Part 2 Step 2		1 rows
3	Cell 4	Part 2 Step 3		1 rows
4	Cell 2			
5	Cell 3			
6	Exit Syst			

Double-click

Assignments — Type 2 Process Time at Cell 2

	Assignment Type	Attribute Name	Value
1	Attribute	Process Time	TRIA(4 , 6 , 8)

Double-click here to add a new row.

Demo Time!

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Part 3. Advanced Sets

Coming Up…

A bunch of additional lessons related to our **Manufacturing Example**!

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   - Station, Route, Enter, Leave
2. Sequences of visitation locations
3. Sets and Advanced Sets (e.g., sets of Sequences)
4. Detailed walk-through of the model
5. Parts can move in a variety of ways:
   - By themselves
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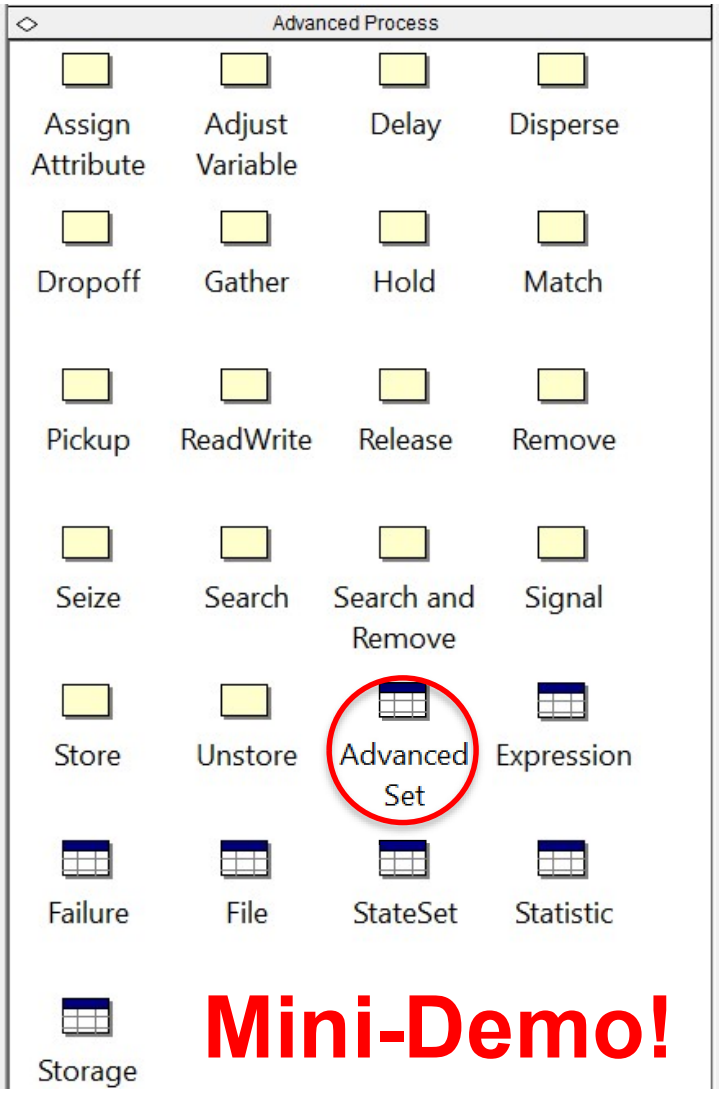
Advanced Sets

- Found in Advanced Process panel
- Used for kraaAaZy types of sets, e.g., sets of sequences!
- Our Advanced set will be called Part Sequences, and will consist of the "elements" (sequences):

  {Part 1 Process Plan, Part 2 Process Plan, Part 3 Process Plan}
- Think of Part Sequences as a vector,

  Part Sequences(2) = Part 2 Process Plan



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Part 4. Model Walk-Through

Coming Up…

A bunch of additional lessons related to our **Manufacturing Example**!

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   - Station, Route, Enter, Leave
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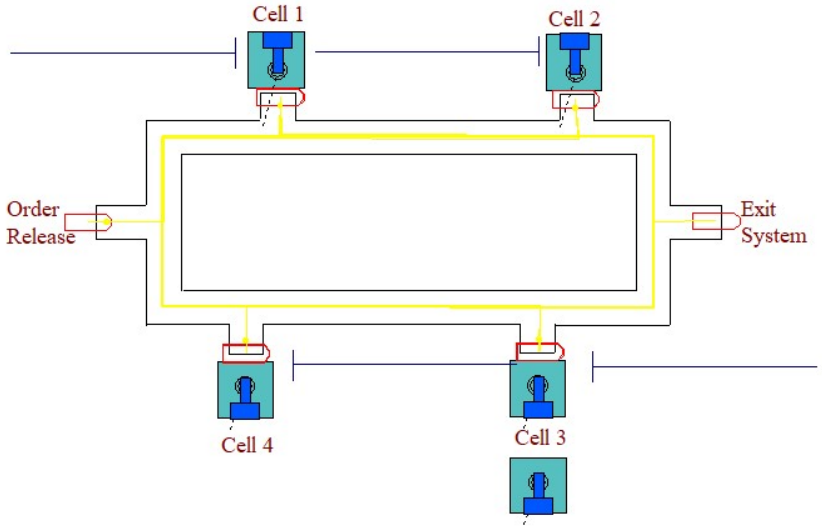
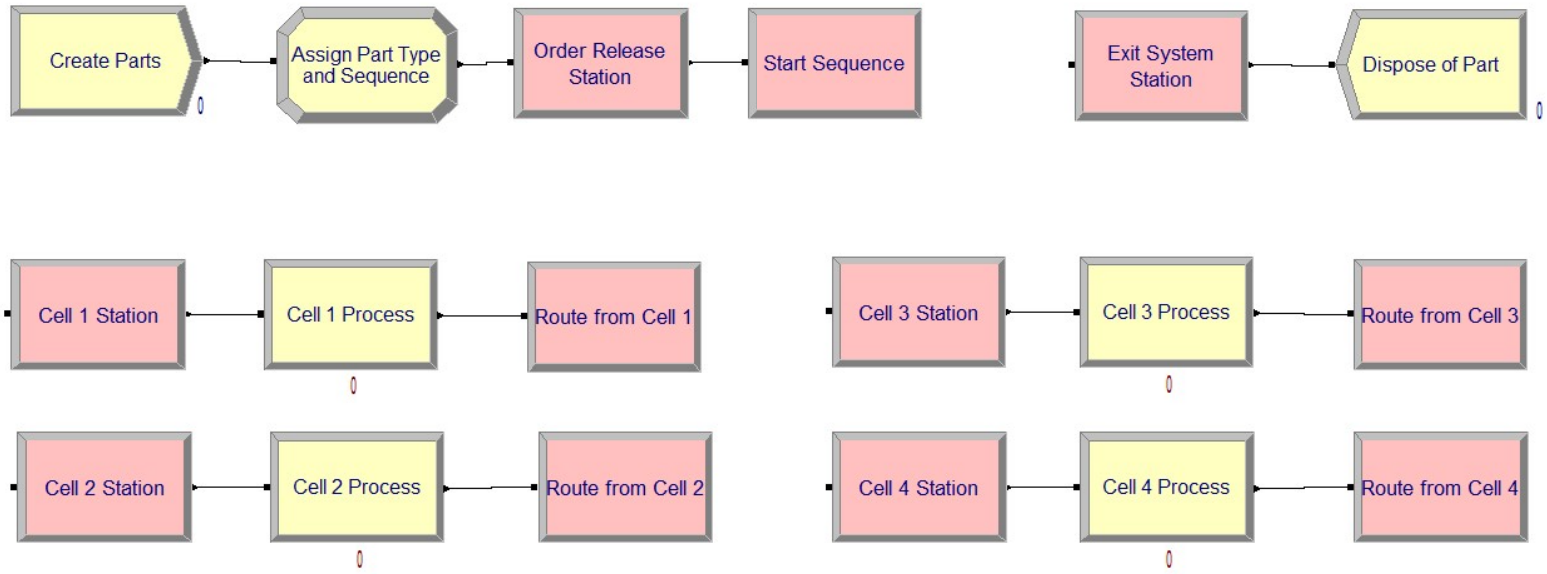
Description

- Manufacturing cell with three types of parts.
- Each part type follows a different path ("sequence") thru the system.
  - Different service times at each station (depending on part type and place in visitation sequence).
  - E.g., Part Type 2's visit stations 1 > 2 > 4 > 2 > 3, each with different service times.
- Movement requires the Advanced Transfer template
  - Route, Station modules (will look at Enter and Leave modules later)
  - Sequences spreadsheet
  - Advanced Sets (which is where the sequences come in).
- Service times usually handled in Sequence definitions (except Cell 1)
- Cell 3 has two servers: An old slow guy, and a young 20% faster guy

Demo Time!


Cell 1
Cell 2
Order Release
Exit System
Cell 4
Cell 3


Create Parts
Assign Part Type and Sequence
Order Release Station
Start Sequence
Exit System Station
Dispose of Part
Cell 1 Station
Cell 1 Process
Route from Cell 1
Cell 3 Station
Cell 3 Process
Route from Cell 3
Cell 2 Station
Cell 2 Process
Route from Cell 2
Cell 4 Station
Cell 4 Process
Route from Cell 4

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Part 5. Transporters and Conveyors

Coming Up…

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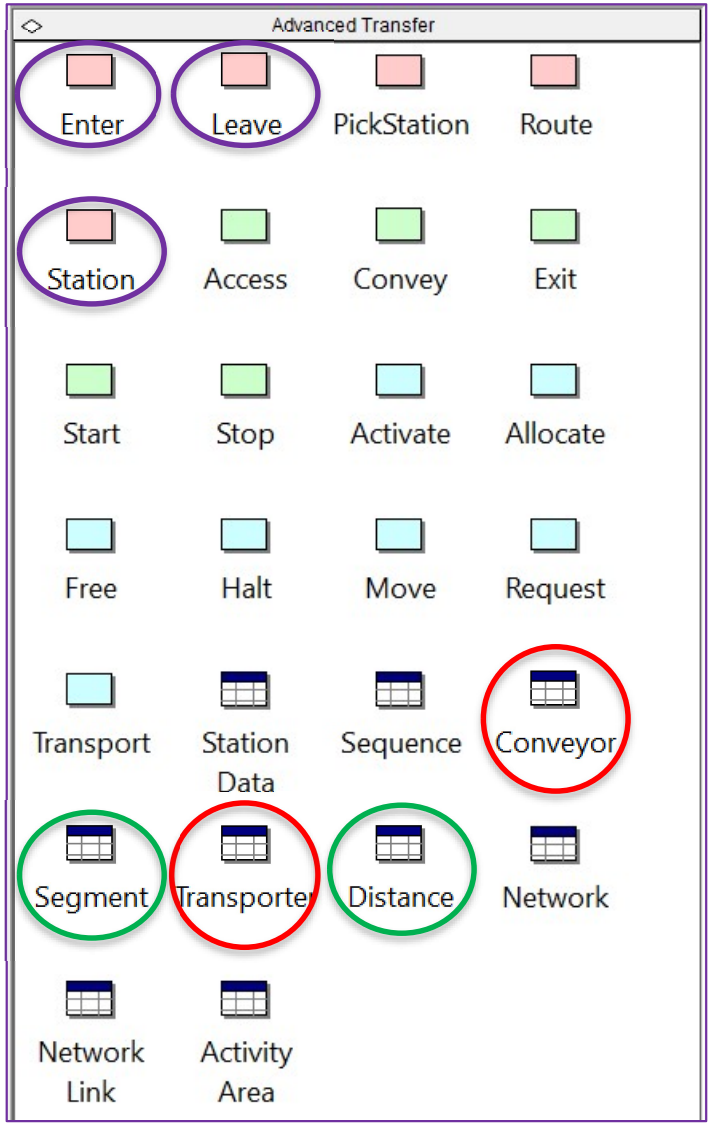
Other Ways to Move

We'll look at ENTER – LEAVE modules for Station-to-Station movement.

Different way you can travel, via…

- Resource (e.g., an assistant)
  - Seize-Release
- Transporter (e.g., a car)
  - Request-Free
  - Requires Distance Set
- Conveyor
  - Access-Exit
  - Requires Segment Set

Demo Time!



Summary

Last Few Lessons: We discussed in detail a small, yet sophisticated manufacturing cell, along with some variants involving movement.

This ends our module on Arena.

- We'll still see Arena later on.
- We only scratched the surface.

Next Time: An entire module on generating Unif(0,1)'s!!!