Schumacher B.; 09.01.2019

Levelpack 5

Level	**5-1** (partially implemented)	**Title:** Working with Libraries – Multiagent
Task	Simulation tools often comprise libraries for specific application areas. Using these libraries save you modeling and programming effort. The libraries contain objects with a pre-defined logic. Often objects of the library can be combined with the standard objects you already know. In this levelpack you are exploring some libraries. We begin with a library to create a multiagent simulation. An agent is an autonomous entity. The agent takes decisions based on the agent's observation of its environment. Now, you'll find in your toolbox the object "area". Every "area" you instantiate in your modeling frame, can be interpreted as an area that has a capacity of one movable unit at one time. When you connect a Source and a Drain to interconnected areas, the movable units produced by the Source will automatically find the shortest way to the Drain. Add a grid of 8 x 4 areas closely located to each other in your frame. Add a Source and a Drain and connect each to one area of your choice. Delete two areas of your choice – except the ones that are connected to the Source and the Drain. Run the simulation for 1 day and observe the behavior of the movable units. Check the throughput.	
KPI	Throughput after one day.	
Purpose	Working with the multiagent library.	
Popup Text	Great, you did your first steps with a user-defined library. Let's go on and explore more functionalities such as the behavior considering colliding material flows on this library.	

Level	**5-2** (partially implemented)	**Title:** Multiagent – colliding flows
Task	After exploring how to model with the user-defined multiagent library, we are performing a small example with crossing material flows. Create a grid of 8 x 4 areas closely located to each other in your frame. Add one source "Source" on bottom left and the source "Source1" on bottom right. Add one drain "Drain1" on top left and the drain "Drain" on top right. Adjust in the sources that the destination of the movable units produced is for the Source the Drain and for the Source1 the Drain1. Each source produces 10 movable units in an interval uniformly distributed between 2 and 30 seconds. Delete two areas of your choice, which are not connected to the sources and drains. Run the simulation and observe the flow of the movable units. How long does it take to route the movable units to their respective drains?	
KPI	Time to complete all 20 jobs.	
Purpose	Exploring the behavior of the multiagent library considering colliding material flows.	
Popup Text	You recognized that the movable units are performing a sidestep in case of a clash and evaluate based on their new position the shortest way to the destination. Let's go on and perform a layout planning in the next task.	

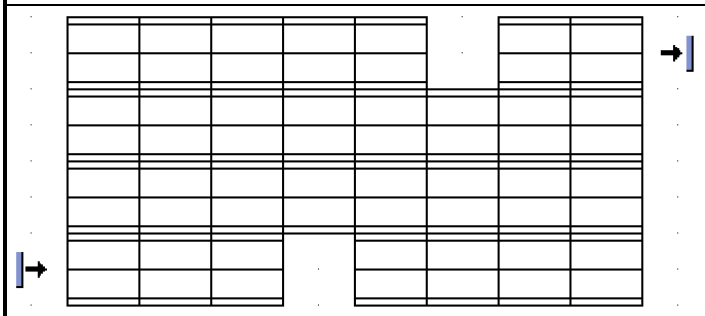
Level	**5-3** (partially implemented)	**Title:** Multiagent – layout planning
Task	In this task you are performing a layout planning, considering that the agents will autonomously find their way to the respective destinations. The agents take decisions with respect to the routing based on sensing their surroundings. Create a grid of 14 x 7 areas, closely located next to each other. Three sources and three drains are located in the frame. Check the figure for knowing where to connect these objects. We assume that the sources produce 15 movable units each in a constant interval of 30 seconds. The destination of the movable units produced at Source[x] is Drain[x], e.g. Source1 → Drain1, …. At one time, only one movable unit can be lacated in one area. Passing one location takes seven seconds. Build the model according to the description above. On top middle of the grid, two areas are missing. This is the layout restriction you should take into consideration when performing the following experiments. Per experiment, always remove two more areas in y-direction and measure the total time required to perform the overall 45 jobs. Perform experiments: Check the influence of the increasing bottleneck for the total time required to perform all jobs.	
KPI	Time to complete all 45 jobs.	
Purpose	Get an impression of how to use multiagent simulation models for the purpose of layout planning.	
Popup Text	Now you got an impression of using multiagent simulation for layout planning for determining bottlenecks. Let's go on and perform a case study considering the routing of automated guided vehicles in the next task.	

Level	**5-4** (partially implemented)	**Title:** Multiagent – AGV planning routing
Task	You are designing in this task a multiagent simulation example considering the routing of automated guided vehicles (AGVs). Therefore, you are using additionally to the object "Area" the "AGVLoading" and "AGVUnloading". Create in the frame a grid of 14 x 7 areas, closely located next to each other. Two sources and one drain are to be instantiated in the frame. Check the figure for knowing where to place the objects. The source on top left named "Source_Transporter" creates 15 transporters in an interval of 30 seconds. The initial destination of the transporter is the area called "AGVLoading". The "Source_Entity" is connected to the area "AGVLoading". The "Drain_Entity" is to be connected to the area "AGVUnloading". Simulate the model for 1 hour. Check the behavior of the AGVs and determine the throughput.	
KPI	Number of transported Entities after 1 hour.	
Purpose	Using a multiagent simulation model for determining the routing of AGVs.	
Popup Text	Perfect that you explored now the AGV routing. Let's perform one more experiment determining the best number of AGVs.	

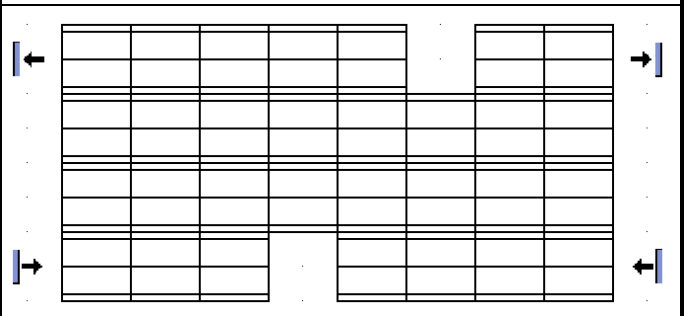
Level	**5-5** (partially implemented)	**Title:** Multiagent – AGV planning number of AGVs
Task	After having explored the functionalities of the multiagent class, we perform a simulation study in order to determine the best number of AGVs for a given layout. Create a grid of 14 x 7 areas, closely located next to each other. Delete the 12 areas as shown in the screenshot. In order to determine the best number of AGVs, you are performing an experiment. Change the number of AGVs to be produced (see attribute “number” in the “Source_Transporter” incrementally by 1 between 10 and 20, simulating always for 1 hour in between. Please make sure, that you keep track of the number of delivered Entities in the “Drain_Entity” after every simulation run. What is the best number of AGVs you would suggest to use?	
KPI	Number of AGVs.	
Purpose	Using a multiagent simulation model for determining the number of AGVs.	
Popup Text	With this kind of application of multiagent simulation you learned, that you can easily determine the best number of AGVs. Let’s go on, there are many more things to learn ☺	

Figures for Levels - Levelpack 5

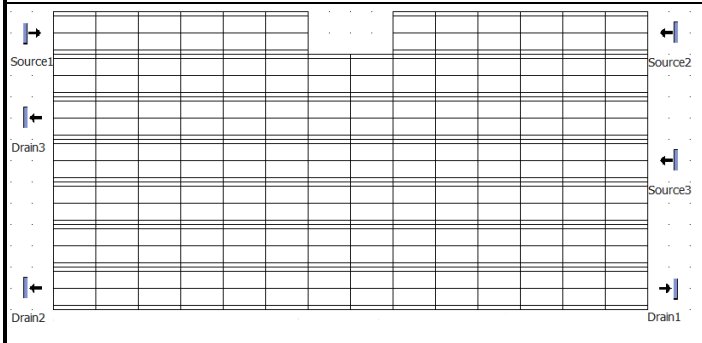
Level 5-1



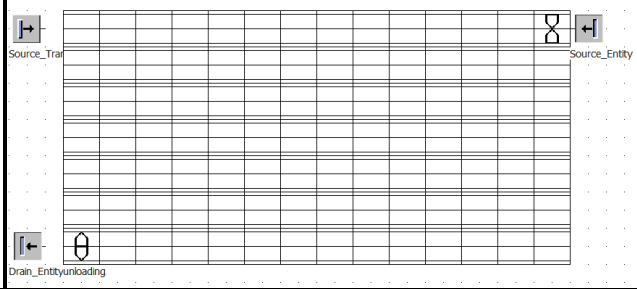
Level 5-2



Level 5-3



Level 5-4



Level 5-5