

EABSS Workshop 2023

Co-Creation of Agent-Based Social Simulation Models

Introduction to AnyLogic and Java

Content

- AnyLogic
- Objects and Java in 10 Minutes ;-)
- Live Implementation Demo

WHAT'S
NEXT



AnyLogic

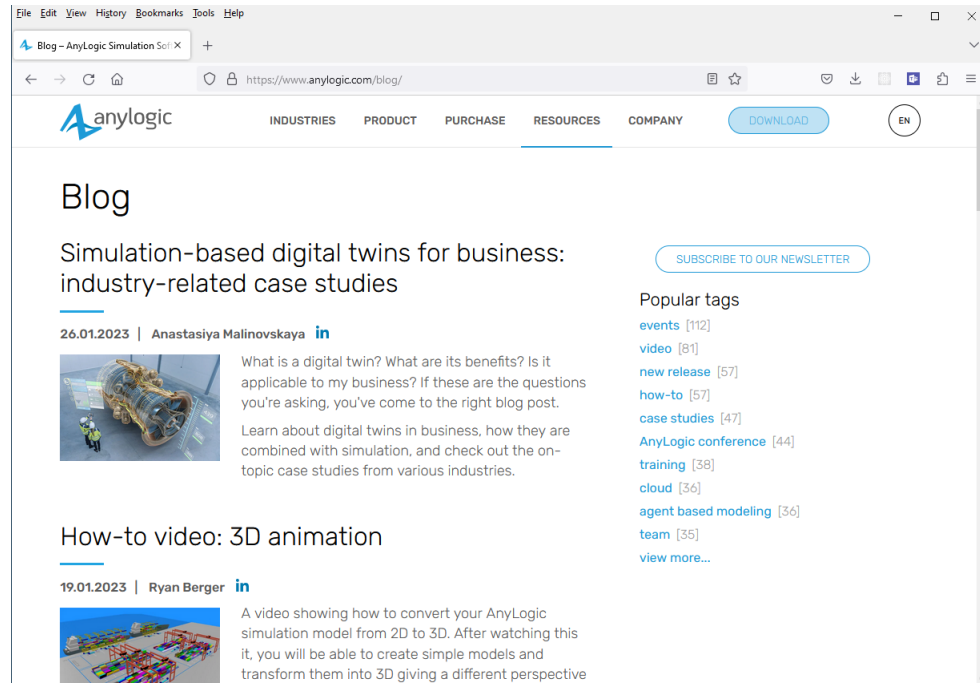
AnyLogic

- The latest version available for download is AnyLogic 8.8.1 PLE
 - Win: https://files.anylogic.com/anylogic-ple-8.8.1.x86_64.exe
 - Mac: <https://files.anylogic.com/anylogic-ple-8.8.1.dmg>
 - Linux: https://files.anylogic.com/anylogic-ple-8.8.1.linux.x86_64.tgz.bin
- In AnyLogic you are not writing the full code of Java classes from the beginning to the end; instead you are entering pieces of code and expressions in numerous small edit boxes in the properties of various model elements

AnyLogic

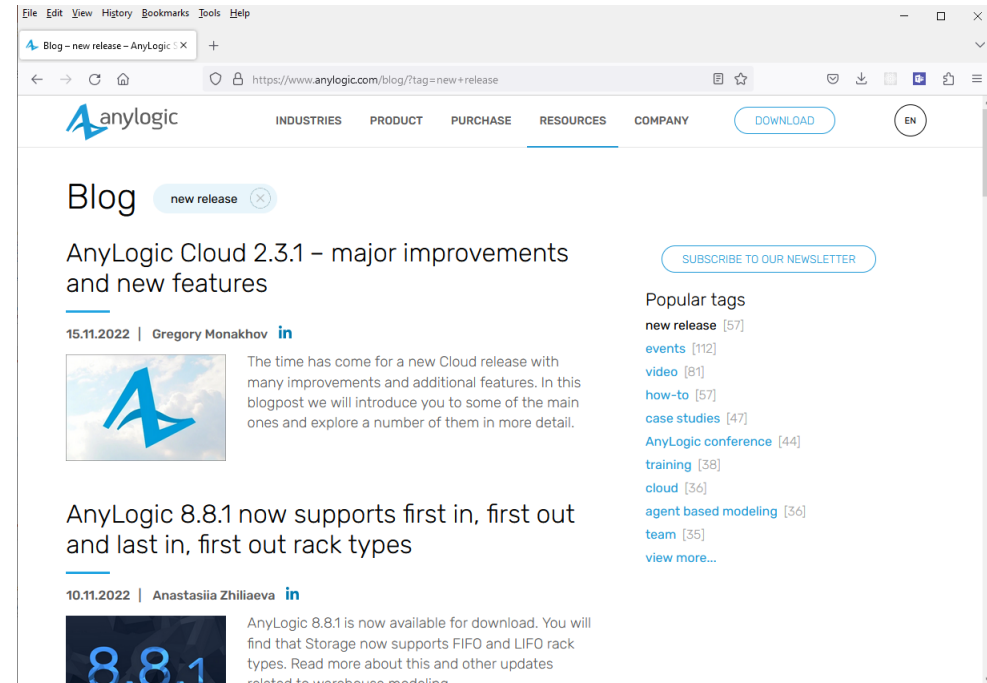
- AnyLogic Blog

- <https://www.anylogic.com/blog/>



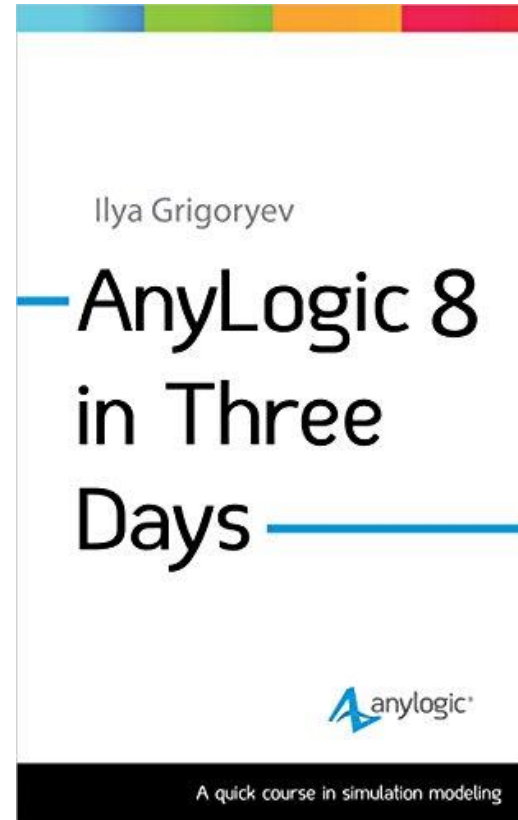
- AnyLogic Blog (new releases)

- <https://www.anylogic.com/blog/?tag=new+release>



AnyLogic

- Free tutorial book



<https://www.anylogic.com/upload/book.php?lang=English>

AnyLogic "Hello World!"

The screenshot displays the AnyLogic software interface for a simulation model. The main workspace shows a simple flow from a 'source' node to a 'sink' node. The Properties panel on the right is configured for the 'source - Source' node with the following settings:

- Name: source
- Arrivals defined by: Rate
- Arrival rate: 1 per second
- Set agent parameters from DB:
- Multiple agents per arrival:
- Limited number of arrivals:
- Location of arrival: Not specified
- Agent: (expanded)
- Advanced: (expanded)
- Actions:
 - On before arrival: (empty)
 - On at exit: (empty)
 - On exit: `if(agent.getId()==100)System.out.println("Hello World")`
- Advanced: (expanded)
- Description: (empty)

AnyLogic Process Modelling

The screenshot displays the AnyLogic Personal Learning Edition interface. The main workspace shows a process model with a 'source' node connected to a 'service' node, which is connected to a 'sink' node. A 'resourcePool' is positioned below the 'service' node. The 'Properties' window on the right is titled 'service - Service' and contains the following settings:

- Name: service (with 'Show name' checked)
- Ignore:
- Seize: (alternative) resource sets, units of the same pool
- Resource sets (alternatives): resourcePool 1
- Queue capacity: 100
- Maximum queue capacity:
- Delay time: triangular(0.5, 1, minutes)
- Send seized resources:
- Agent location (queue):
- Agent location (delay):
- Priorities / preemption:

AnyLogic Process Modelling

The screenshot displays the AnyLogic Personal Learning Edition interface. The main workspace shows a process model with three components: a source, a service, and a sink, connected in a linear sequence. A resource pool is positioned below the service component. The source component is highlighted with a blue box. The Properties window on the right is open to the 'source - Source' tab, showing various configuration options. The 'Arrival rate' section is highlighted in red, indicating the current configuration: 'Arrival rate' is set to 1 per minute. Other visible settings include 'Name' (source), 'Arrivals defined by' (Rate), 'Set agent parameters from DB' (unchecked), 'Multiple agents per arrival' (unchecked), 'Limited number of arrivals' (unchecked), and 'Location of arrival' (Not specified). The 'Agent' section is expanded to show 'Advanced' settings: 'Custom time of start' (unchecked), 'Add agents to' (default population selected), and 'Forced pushing' (checked). The 'Actions' section is also visible but empty.

AnyLogic Personal Learning Edition [PERSONAL LEARNING USE ONLY]

File Edit View Draw Model Tools Help

Projects Palette Main

Process Modeling Library

- Queue
- Select Output
- Select Output5
- Hold
- Match
- Split
- Combine
- Assembler
- Move To
- Conveyor
- Resource Pool
- Seize
- Release
- Service
- Resource Send To
- Resource Task Start
- Resource Task End
- Downtime
- Schedule
- Enter
- Exit
- Batch

source service sink

resourcePool

Properties

source - Source

Name: source Show name

Ignore

Arrivals defined by: Rate

Arrival rate: 1 per minute

Set agent parameters from DB:

Multiple agents per arrival:

Limited number of arrivals:

Location of arrival: Not specified

Agent

Advanced

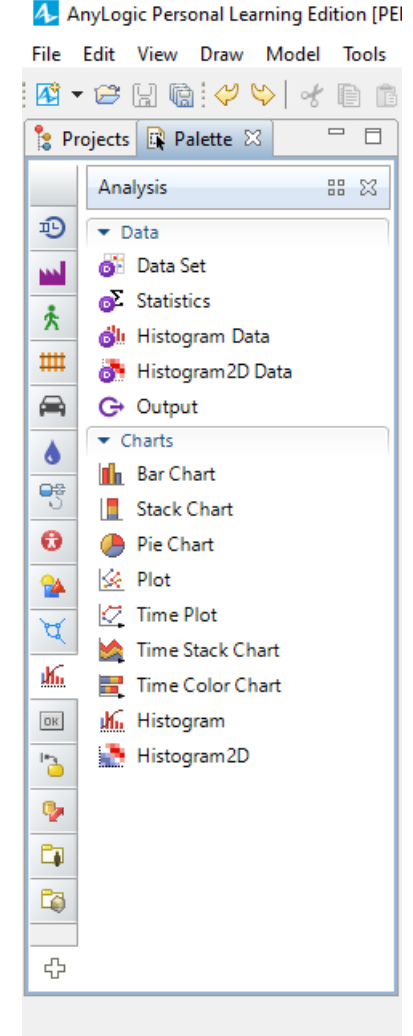
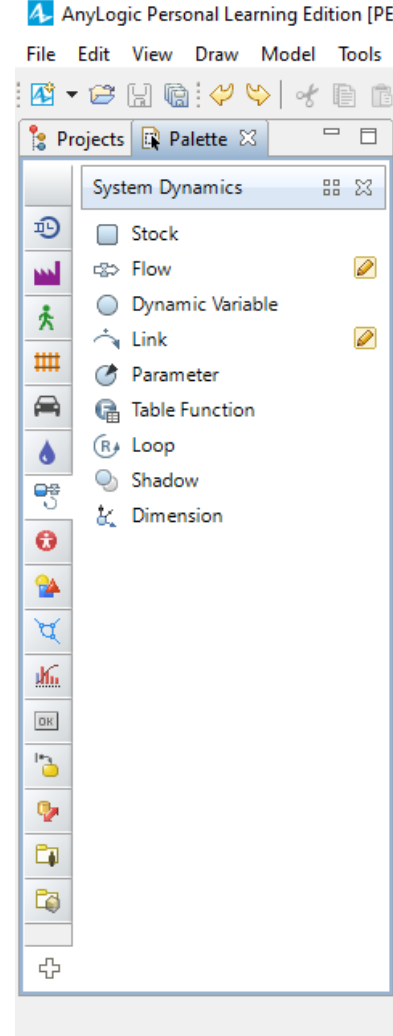
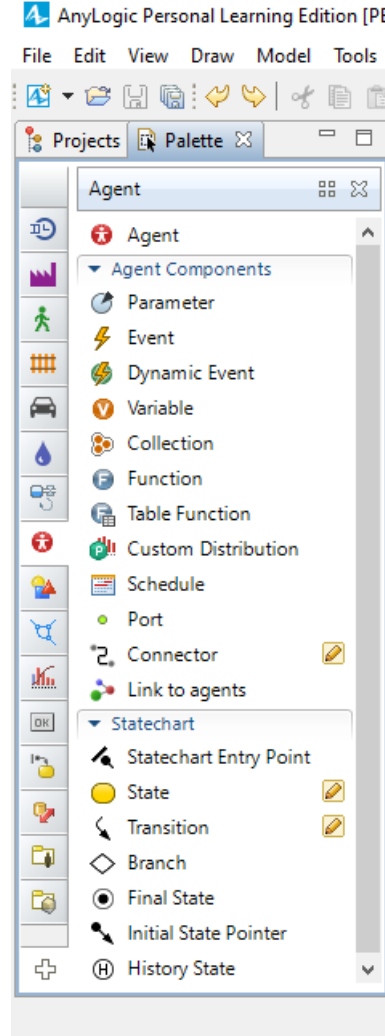
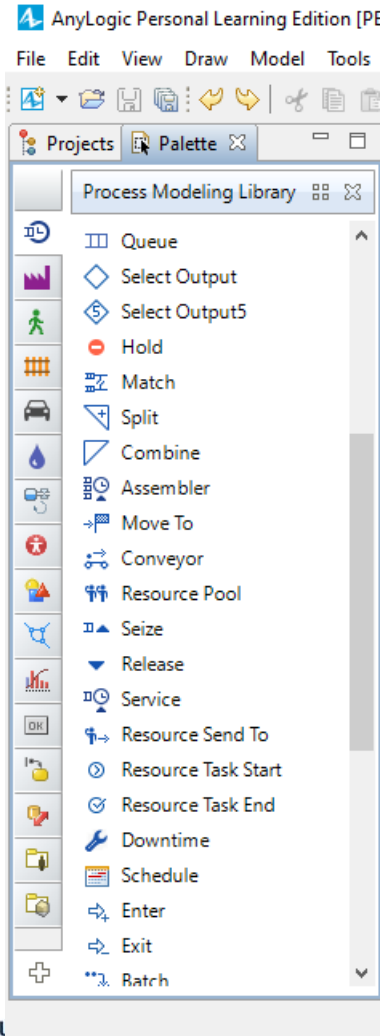
Custom time of start:

Add agents to: default population custom population

Forced pushing:

Actions

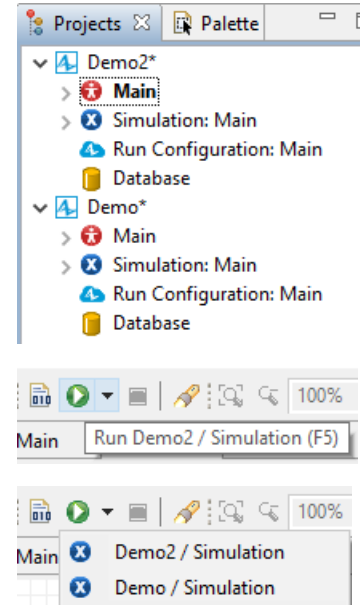
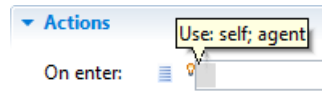
AnyLogic IDE



Things to Remember

- Important things

- F1: Help
- Ctrl-Space: Code completion support
- Ctrl-Enter: Perform refactoring (replace name occurrences)
- Make sure you select the correct model when pressing "Run"
- Make sure you set up model time units correctly in the "Model"
- Use the "magic lightbulb" ...



- Since AnyLogic v7

- Everything is called "Agent" (entities; resources; agents; ...)
- PLE version limits number of agents per simulation run to 50000 (**but you can reuse them**)

Running AnyLogic

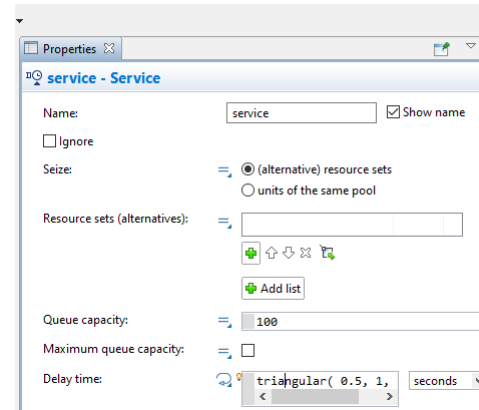
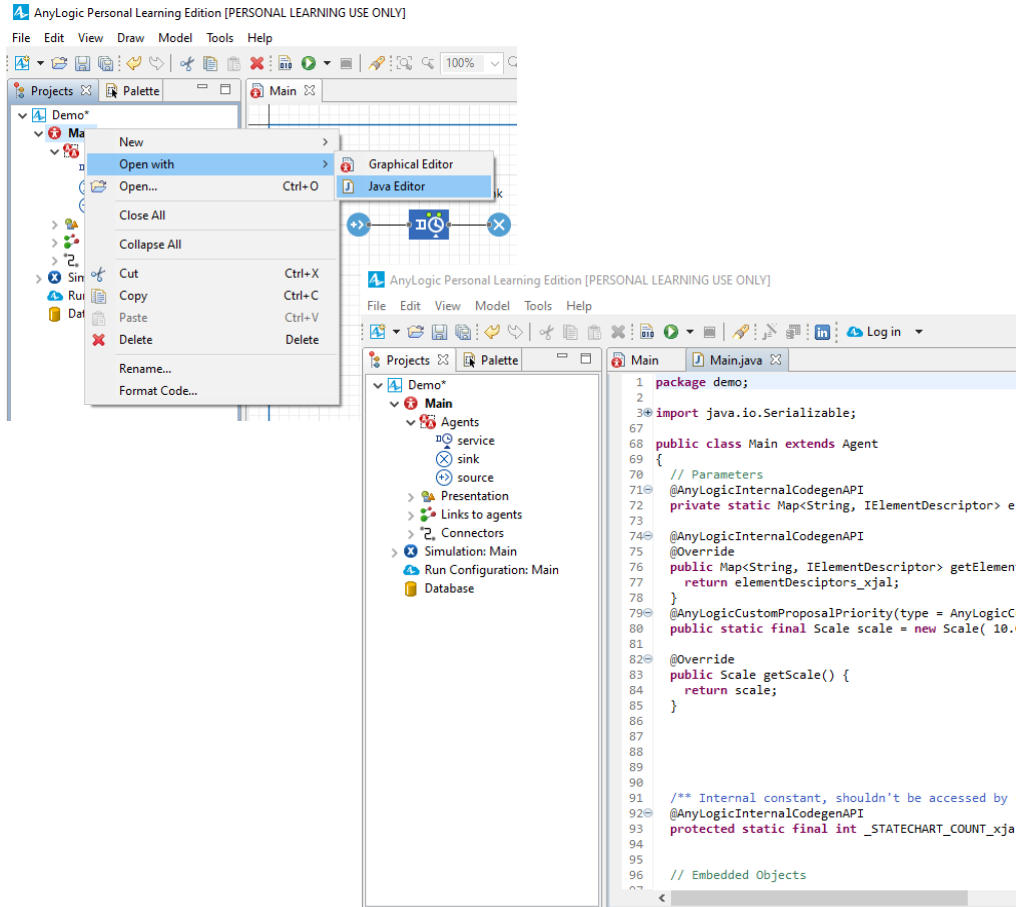
The screenshot displays the AnyLogic simulation environment. The main workspace shows a model diagram with three components: a 'source' (blue circle with a plus sign), a 'service' (blue square with a clock icon), and a 'sink' (blue circle with an X). The 'source' has a capacity of 102 and a throughput of 102. The 'service' has a capacity of 100 and a throughput of 1. The 'sink' has a capacity of 1 and a throughput of 1. Below the main diagram is a 'resourcePool' icon showing 0/1 resources.

An error dialog box is overlaid on the workspace, titled 'Exception during discrete event execution'. The message reads: 'Model logic error: root.source: An agent was not able to leave the port root.source.out at time 1.83 / date Feb 5, 2021, 12:01:49 AM (current model time is 1.853). Consider increasing capacities and/or throughputs of the subsequent object(s) or using PULL protocol'. A link to 'Console' is provided for more details.

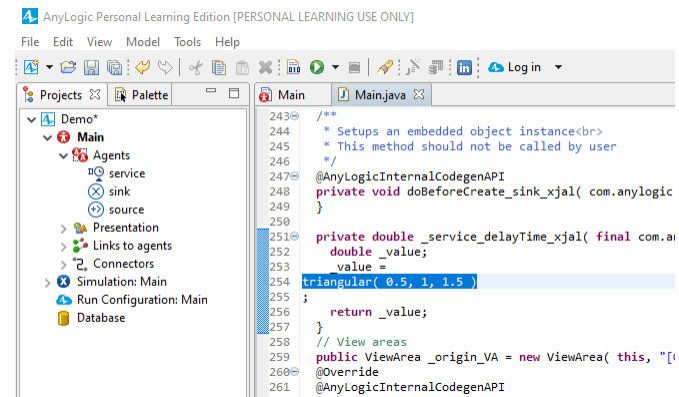
The right-hand side of the interface features a console window with a toolbar and a list of events. The console displays the following error message: 'Exception during discrete event execution: Model logic error: root.source: An agent was not able to leave the port root.source.out at time 1.83 / date Feb 5, 2021, 12:01:49 AM (current model time is 1.853). Consider increasing capacities and/or throughputs of the subsequent object(s) or using PULL protocol'. The console also shows a stack trace of the error.

The bottom status bar indicates the simulation is running at 1.75 seconds, with 9% of 512M memory used. The FPS is 39 and the step is 216.

AnyLogic IDE



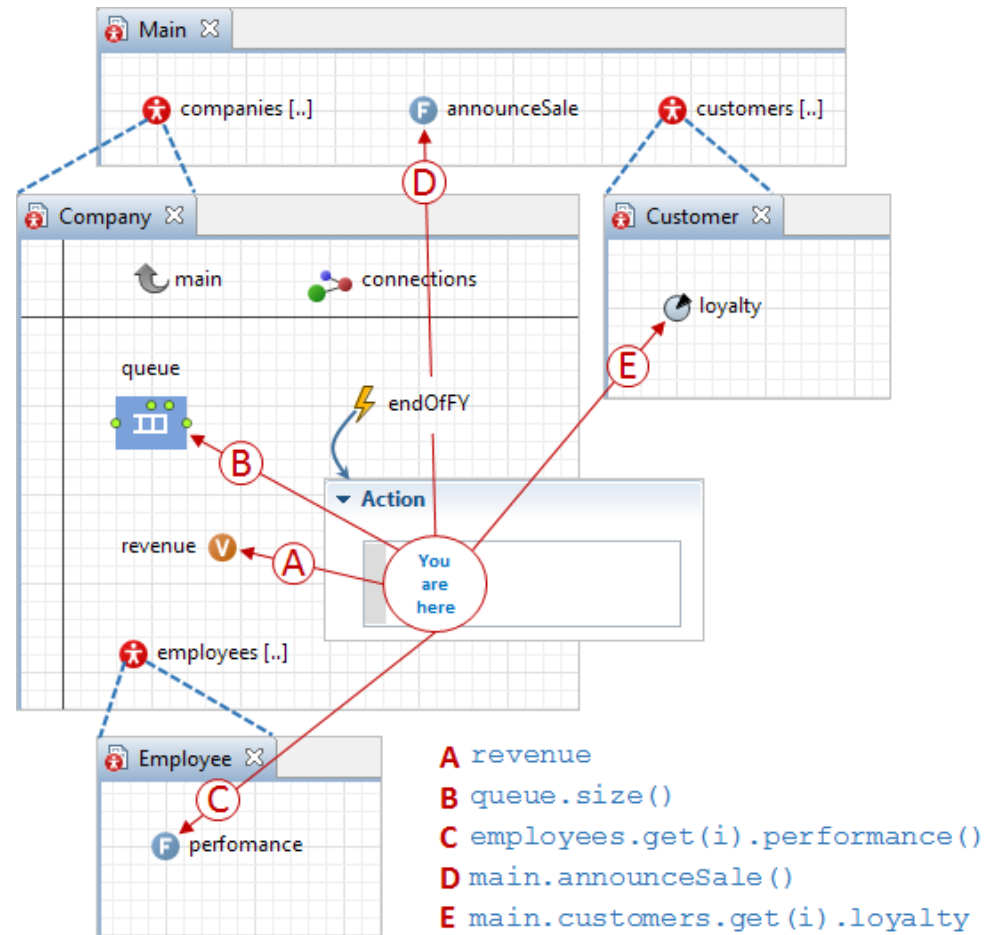
Press {Ctrl+J} to go to the point in the Java code that is associated with the current code snippet highlighted in the Properties window



AnyLogic Help

The screenshot shows the 'Help - AnyLogic 8 Personal Learning Edition' window. The search bar is empty, and the scope is set to 'All topics'. The 'Contents' pane on the left is expanded to 'Java Basics for AnyLogic', showing a list of topics including 'Java in AnyLogic', 'Primitive data types', 'Classes', 'Variables (local variables and class fields)', 'Functions (methods)', 'Expressions', 'Statements', 'Java arrays and collections', 'Comments', 'Naming conventions', 'Where am I and how do I get to...?', 'Adding Java classes', 'Adding Java interfaces', 'Code Completion Master', and 'AnyLogic functions'. The main content area displays the 'Advanced Modeling with Java >' section, followed by the 'Java Basics for AnyLogic' title and a 'Contents' list of links to the same topics as in the left pane. The status bar at the bottom shows the URL 'http://127.0.0.1:64907/help/nav/3_0'.

Where am I and how do I get to...?



WHAT'S
NEXT



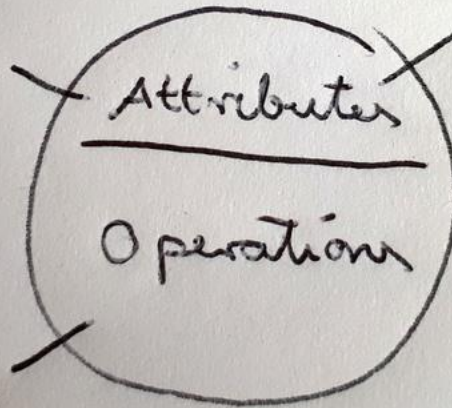
Objects and Java in 10 Minutes ;-)

①

Classes

↳ Blueprints for objects

Will be
different
values for
each object

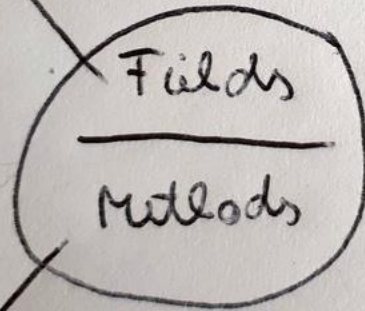


types:
primitives
or objects

generic

② Objects in Java (instantiations of classes)

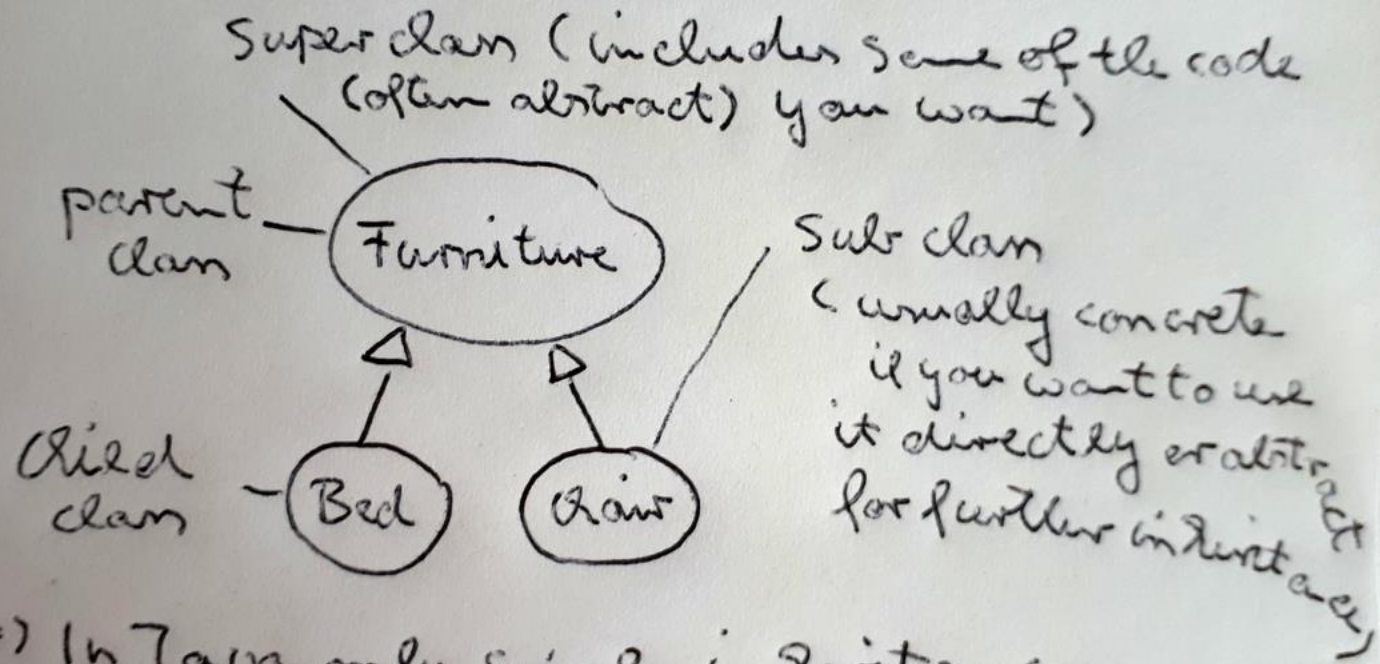
usually private - use getters and setters
(encapsulation) to access



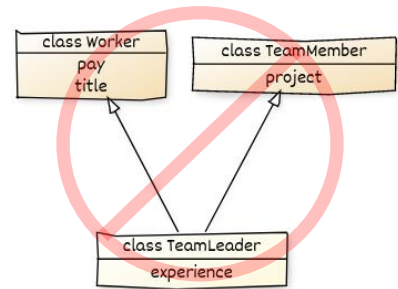
often used to
separate
concerns

usually public, unless helper methods
↳ accessible from other objects

③ Inheritance (of fields and methods)



=> In Java only single inheritance



④ Compile time Polymorphism (static binding)

↳ method overloading

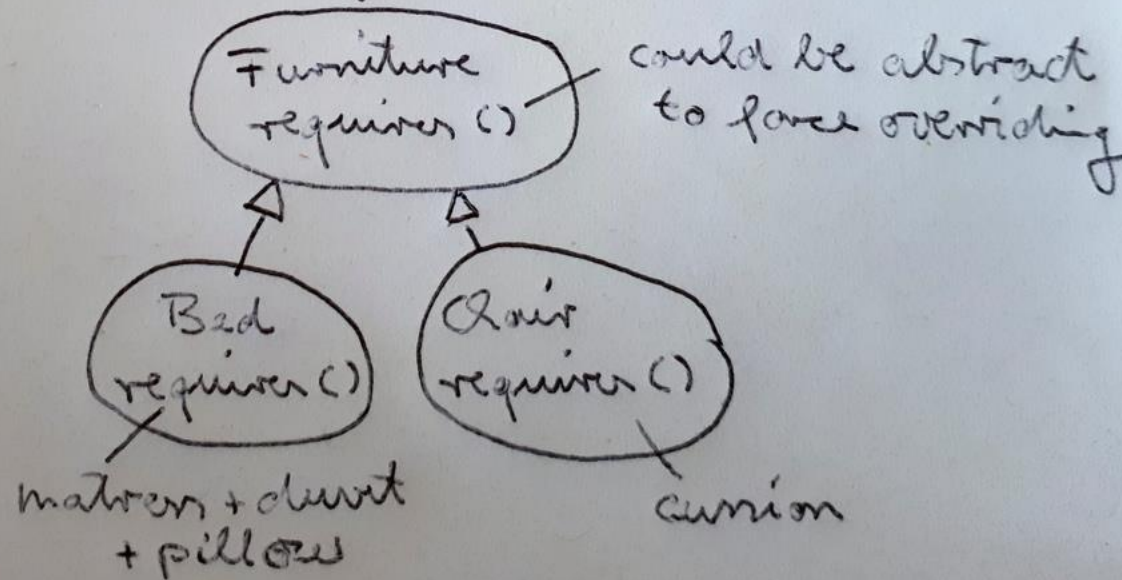
↳ multiple methods with same name but different parameter list

Public boolean order ()

public boolean order (int num, color col)

Run time Polymorphism

↳ method overriding



Polymorphism (many forms) in Java is a concept by which we can perform a single action in different ways

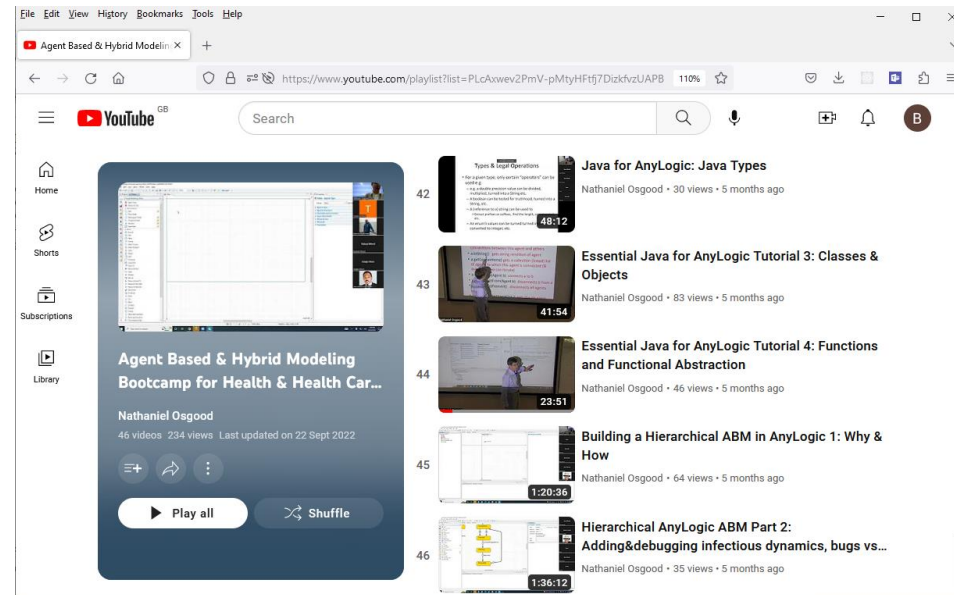
Free Java Course

- Amigoscode: Java Full Course - Java Tutorial for Beginners
 - <https://www.youtube.com/watch?v=j9VNCl9Xo80>



Java Basics for AnyLogic

- For useful advice see Nathaniel Osgood's YouTube videos
 - Check "Agent Based & Hybrid Modeling Bootcamp for Health & Health Care" playlist
 - <https://www.youtube.com/playlist?list=PLcAxwev2PmV-pMtyHFtj7DizkfzUAPB>
 - Towards the bottom of the playlist (video 42 to 46) you find "Java for AnyLogic" tutorials



WHAT'S
NEXT



Live Implementation Demo

Implementing the Office Scenario

The screenshot displays the AnyLogic Personal Learning Edition interface for an agent-based simulation model titled "OfficeWorker_Full_OO".

Project Tree (Left):

- OfficeWorker_Full_OO*
 - Main
 - OfficeWorker
 - Simulation: Main
 - Run Configuration: Main
 - Database
 - Resources

Flowchart (Center):

- Starts at "OfficeWorker_centralized".
- Transitions to "atHome" (yellow box).
- From "atHome", transitions to "elseWhere" (yellow box) and "atOffice" (yellow box).
- From "elseWhere", transitions back to "atHome".
- From "atOffice", transitions to "work" (yellow box) and "doze" (yellow box).
- From "work", transitions to "doze".
- From "doze", transitions back to "work".

State Transition Diagram (Bottom):

A stacked area chart showing the percentage of agents in different states over 60 hours. The x-axis is labeled "hours" (0 to 60) and the y-axis is labeled "Levels" (0% to 100%).

- atHome (Pink):** Starts at ~40%, peaks at ~50% around 15 hours, and ends at ~40%.
- atOffice (Blue):** Starts at ~10%, peaks at ~20% around 15 hours, and ends at ~10%.
- elseWhere (Orange):** Starts at ~50%, dips to ~30% around 15 hours, and ends at ~50%.

Properties Panel (Right):

OfficeWorker - Agent Type

- Name: OfficeWorker Ignore
- Agent actions**
 - On startup: []
 - On destroy: []
 - On arrival to target location: []
 - On before step: []
 - On step: []
- Agent in flowcharts**
- Dimensions and movement**
 - Initial speed: 10 meters per second
 - Rotate animation towards movement
 - Rotate vertically as well (along Z-axis)
- Space and network**
 - No agent populations live in this agent type
 - Select the agents you want to place in the environment: []

Bottom Status Bar: OfficeWorker_Full_OO | 1meters = 10px, X=579, Y=544

Any Questions?

