CREATING A HETEROGENEOUS POPULATION

Rating: Basic
Prerequisites: "Building a Minimalist Network-Based Model Framework"
Estimated Time Required: 1 hour

This exercise shows one simple way to create a population that is heterogeneous in terms of agent attributes. For simplicity, we focus on models where the heterogeneous attribute is *static* – i.e. does not change over time. Other exercises will examine cases of dynamic attributes.

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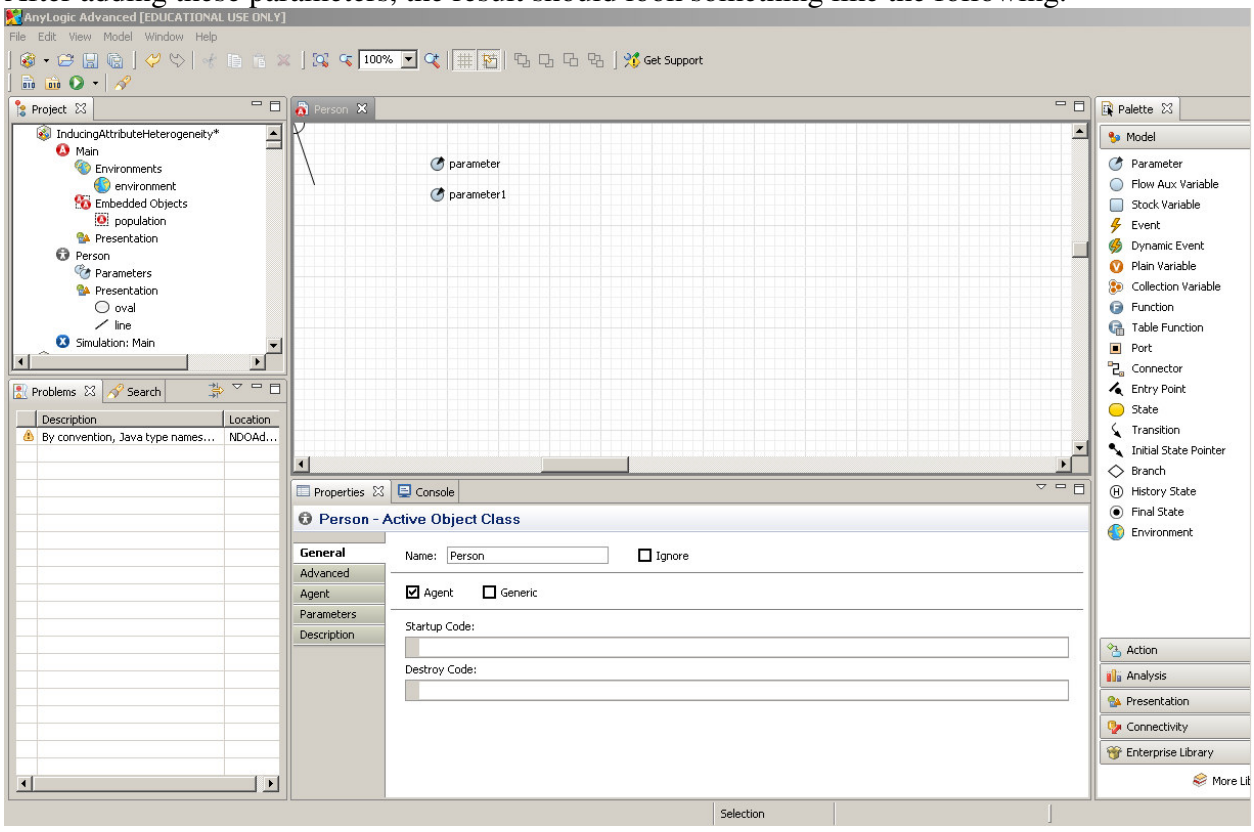
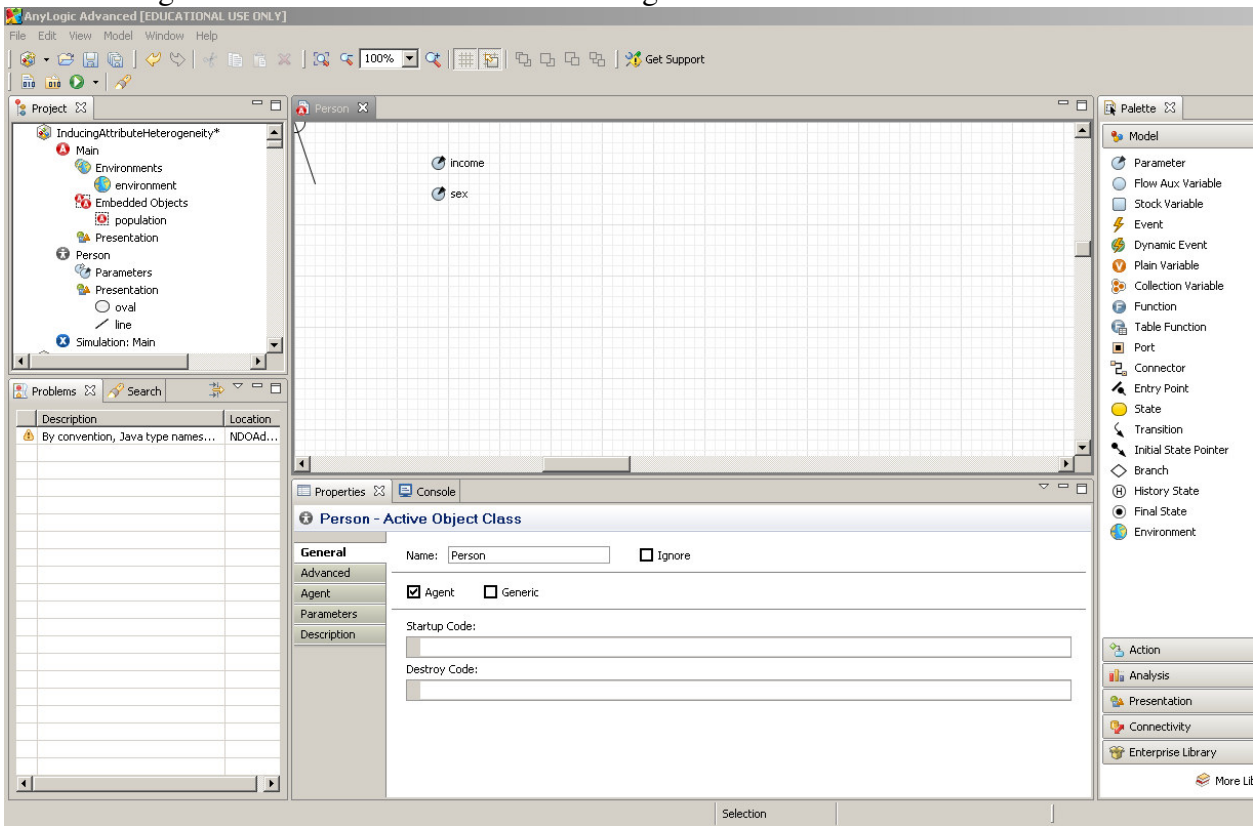
1. Open the model you built for the exercise "Building a Minimalist Network-Based Model Framework", or the pre-provided model "MinimalistNetworkABMModel"
2. Save the model to a new model, entitled "InducingAttributeHeterogeneity"
3. Double click on "Person" in the "Project" menu. This should open the canvas for the "Person" class, showing the visual specification of a "Person" in this model. Currently, this contains only the visual representation of a person (consisting of an oval and a line).
4. Open the "Model" tab of the "Palette" window
5. Add two parameters in turn to the "Person" canvas. Note that the procedure for adding each such parameter differs by version of AnyLogic. For our version of AnyLogic, drag the "Parameter" from the palette to the canvas.

After adding these parameters, the result should look something like the following.

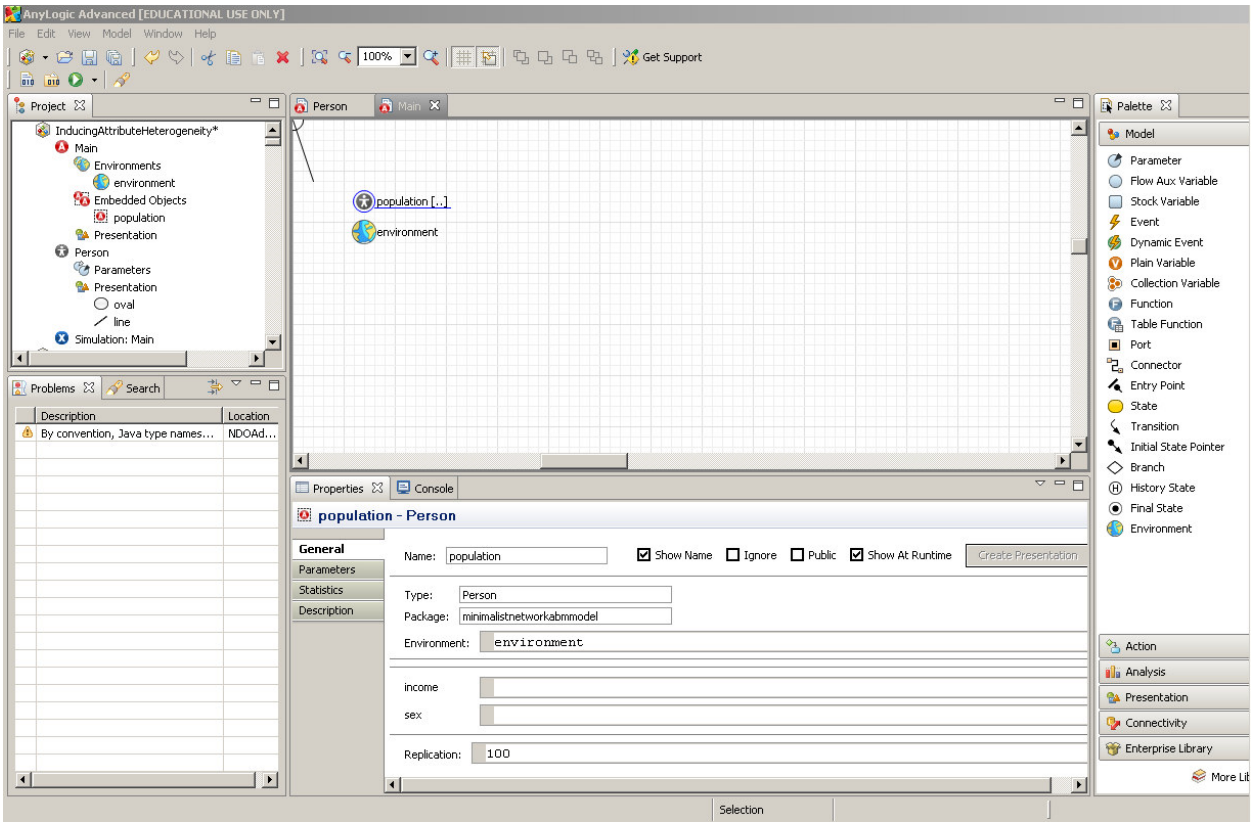


6. Click on the first parameter you created. The "Properties" window in the screen below should display the characteristics of this parameter. In the "Name" field, type "income" (as per our convention established in earlier exercises), this should be without the quote marks).
7. Click on the second parameter. (Note that when you do this, the name of the first parameter should have been updated automatically to reflect your stated name change.) The "Properties" window will again be updated. You will change several of the associated properties.
    a. In the "Name" field, type "sex" (as per our convention established in earlier exercises), this should be without the quote marks).
    b. In the "Type" field, select "int". Note that we have chosen here to encode "Sex" as an integer, with "0" indicating a female, "1" indicating a male. There are two other good options.
        i. We could have named the field "isMale", and used a "Boolean" Type (indicating that the associated value is either true or false).
        ii. We could have custom-defined and used what is called a Java "Enum", which would allow us to use the values "Male" and "Female".

The resulting screen should look like the following.



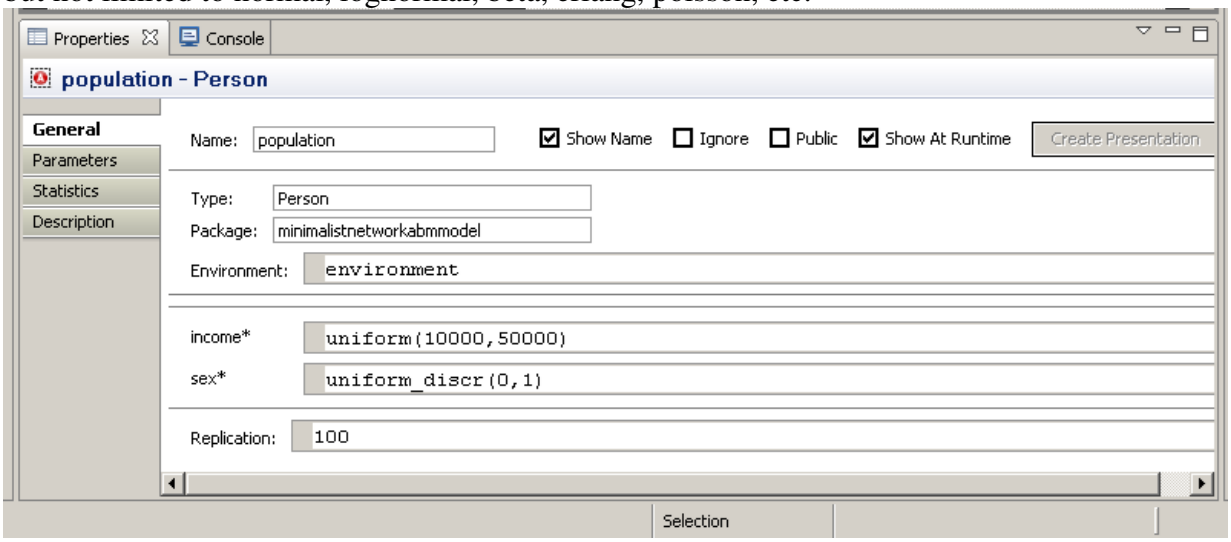
8. Double-click on the "Main" class in the "Project" window. Click on the "population []" variable, which represents the population of Persons. The properties window should be displayed below. It should look something similar to the image below.



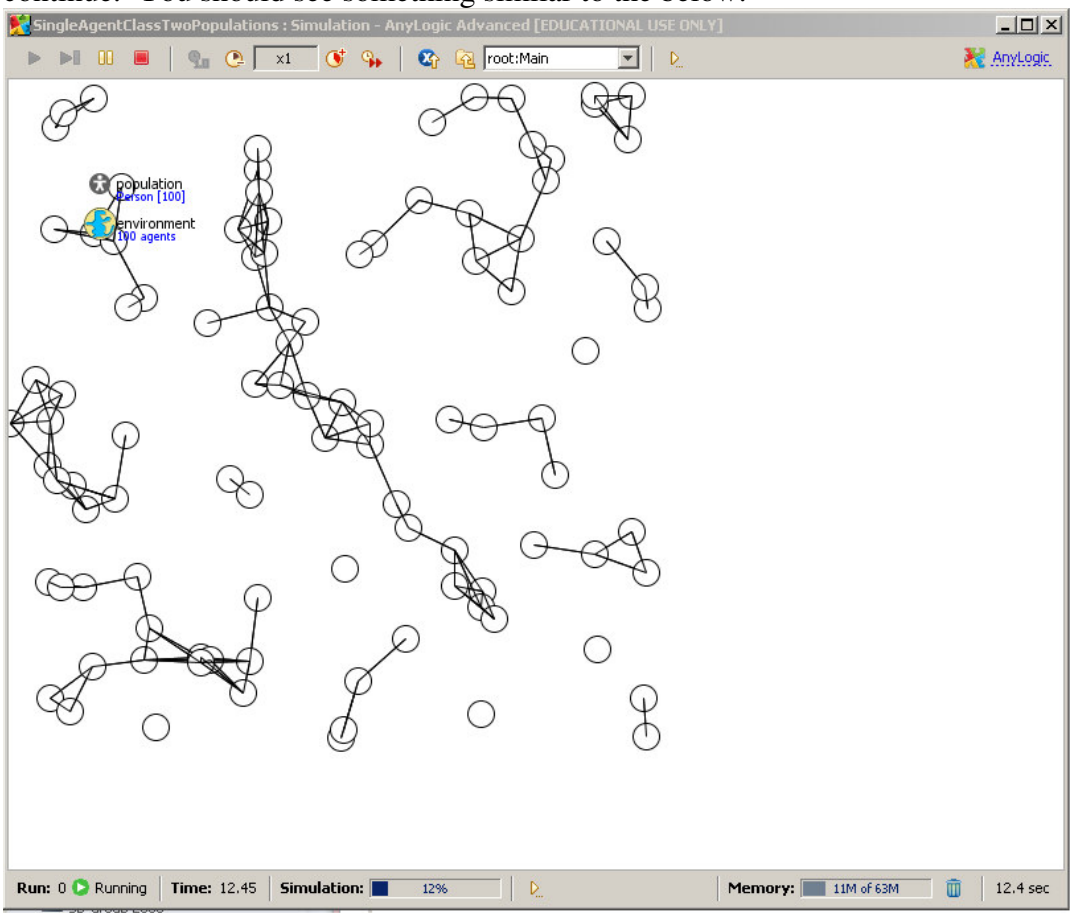
9. Please note especially in the "Properties" window the two fields associated with the parameters you have just created – "income", and "sex". These fields allow you to specify Java "expressions" that are run to calculate the value to use for each of these parameters when a particular agent in the population is to be created. In short, the expressions in these fields specify a recipe for determining the income and sex of the person to be created. Note that these expressions can be constants, but they can also be calculations that involve generated random numbers, other properties within "Main", and even the identity (index) of the person whose features are being determined. This final property would allow us, for example, to explicitly set different characteristics for different segments of the population. We will now give expressions for these values.
    a. For "income", we'll assume that a given person's income within our population of interest is drawn from a uniform distribution, with a minimum of $10,000, and a maximum of $50,000. A reference to the AnyLogic library would show that we can draw from a uniform distribution using the expression "`uniform(10000,50000)`".
    b. For sex, we'll assume for simplicity (wish!) that a person's sex is independent of income, and generate a value of 0 or 1 with equal likelihood. We note that this is also a uniform distribution, but that it is a *discrete* distribution – i.e. it must yield either 0 or 1. A reference to the AnyLogic library would show that this could be produced using the function `uniform_discr`. We therefore enter the formula "`uniform_discr(0,1)`"

The resulting properties for the population look as follows. It bears emphasizing that while we have confined our attention here to uniform distributions for simplicity,

AnyLogic supports drawing values form a wide variety of other distributions, including but not limited to normal, lognormal, beta, erlang, poisson, etc.



10. Run the experiment entitled "Simulation: Main" either by right-clicking on it and selecting "Run", or using the pull-down "Run" menu adjacent to the green "Run" button at the top of the screen. On the introductory screen, simply press the button to continue. You should see something similar to the below.



Click on the model exploration menu, that currently includes the text "root:Main". Pull this down. Your screen should look something like the following:

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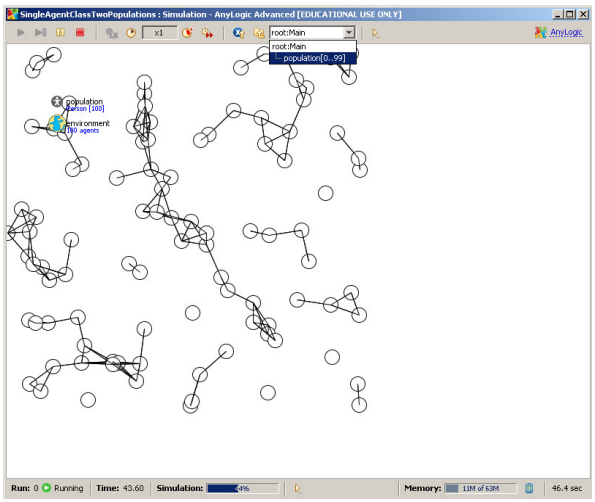
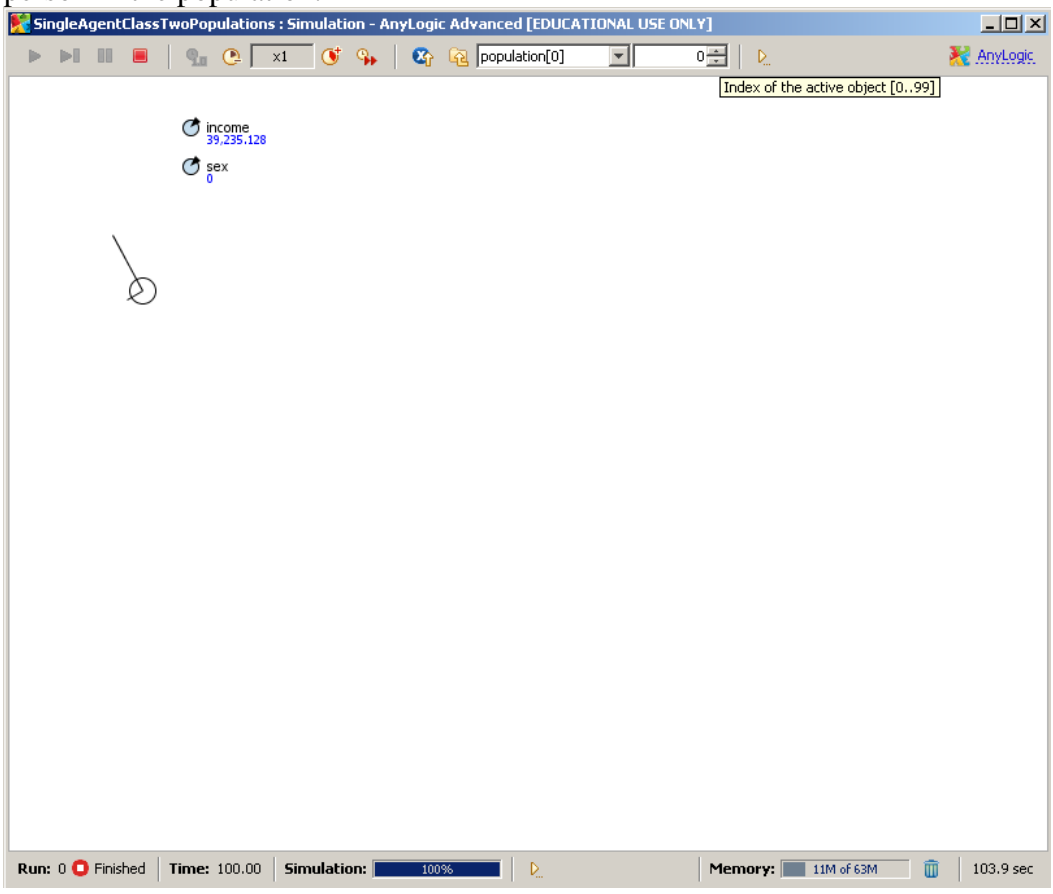


Click on the item highlighted above (which reads "population[0..99]").
Leaving the view of the model as a whole, you have now "drilled down" to the level of individuals, see a screen that shows the characteristics for a particular person – including their location within the network (shown by a their node and connections), the values associated with their properties (here, the two parameters you have created above). By clicking on the up-and-down arrows to adjust the numbers shown in the middle right corner (just to the upper left the yellow "tool tip" shown below), you can change the view to show different members of the population. The number itself shows the count of that person in the population.



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