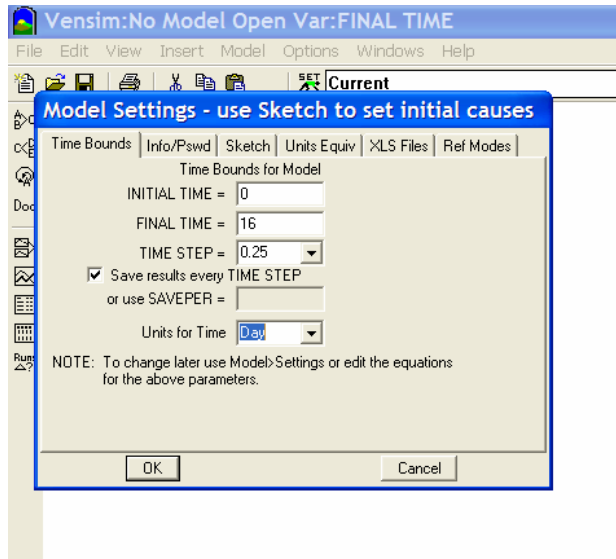
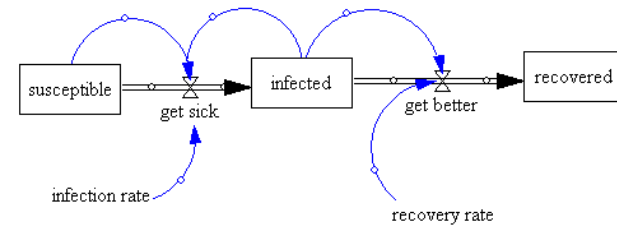


VenSim Tutorial

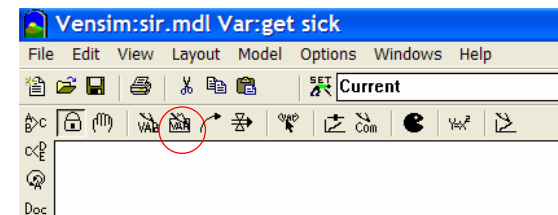
1. Open VenSim and start a new model (File->New).
2. For this first model, choose a final time of 16 days (be sure to change the units) and a time step of 0.25.

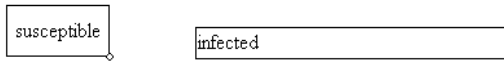


3. The model that we are going to create is the SIR (susceptible-infected-recovered) model of the flu. In the SIR model, susceptible people catch the flu from infected people, and infected people eventually get better. Recovered people do not catch the flu a second time. In order to build this model in VenSim, we first want to draw the model as a Systems Dynamics diagram involving stuff that changes (boxed variables or stocks), processes leading to change (flows), constants to be calculated (unboxed variables, sometimes referred to as a converter and denoted by a circle), and dependencies (curved arrows). A VenSim diagram that describes the SIR model would look something like

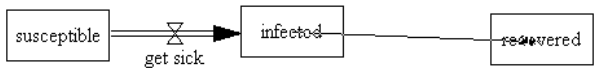


4. Begin building this model by creating your stocks or box variables—the stuff of which you are calculating change. Click on the box variable icon in the toolbar, and click once on the screen. Enter the name of the variable, and press enter. Continue entering your box variables until you are done.

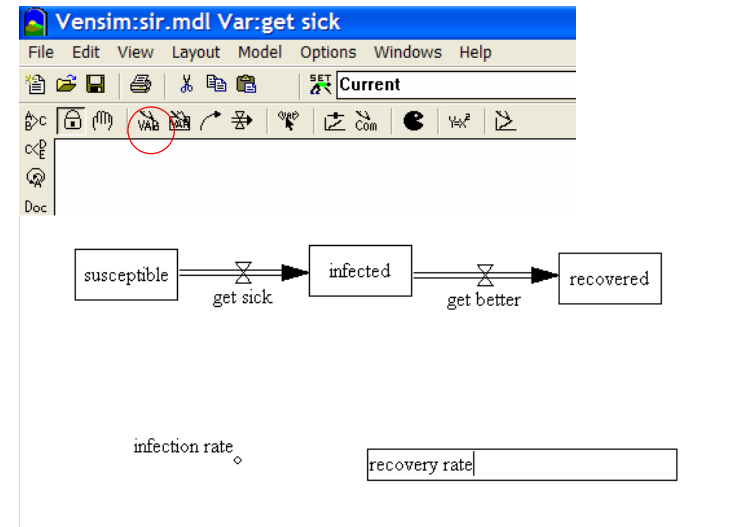




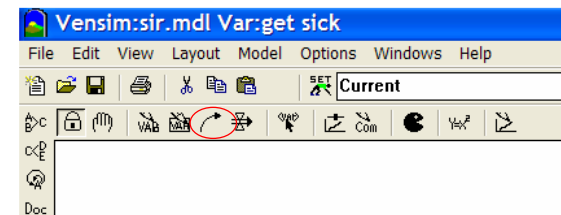
5. Create your flows. You will need a flow from susceptible to infected to represent healthy people getting sick, and one from infected to recovered to represent sick people getting better. To do this, select the flow tool (the thick arrow) from the toolbar and click once on the source of the flow followed by clicking once on the destination of the flow. Be sure to click in the middle of your source and destination—if you see “clouds” that means you have people going into or coming out of thin air.

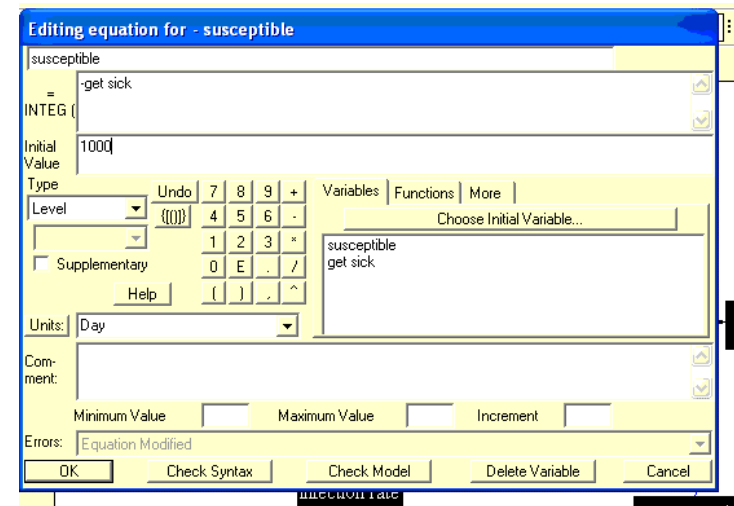
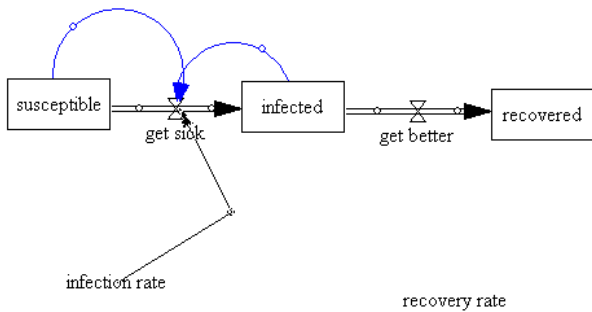


6. Create your constants and simple calculations. In this case, we need two constant, an infection rate and a recovery rate. In VenSim, the variable (unboxed) tool is used to do this. In VenSim, the variable (unboxed) tool is used to do this. Select the variable tool from the toolbar and click on the screen to place your constants.

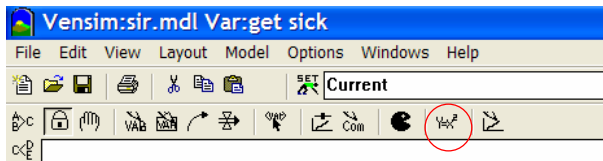


7. Indicate your dependencies. You need to indicate how flows and simple calculations depend on other items, but not box variables as they are computed automatically. For the SIR model, getting sick depends on the number of people available to get sick, the number of people spreading the flu, and the infection rate. Getting better depends on the recovery rate and the number of people who are sick and potentiall could get better. To add a dependency, click on the dependency tool (curved arrow), and click on the source of the dependency followed by the destination of the dependency. If you want to set the way that the arrow will be curve, you can click on an offset point between clicking on the initial and final point.



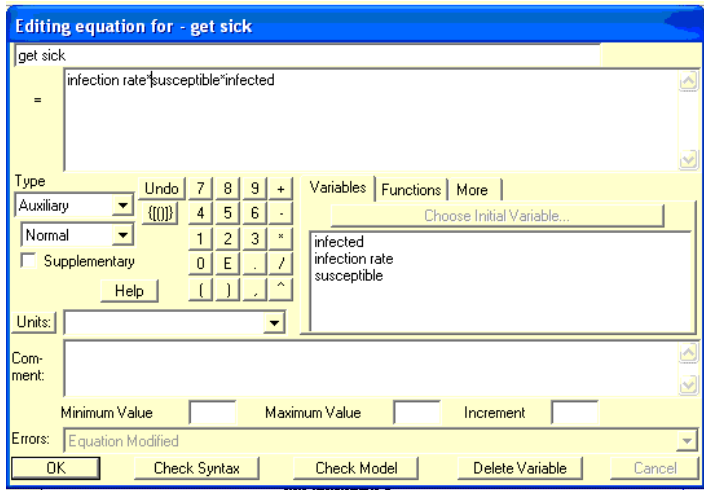


- At this point, your model diagram is complete, but the model has not yet been completely built. We need to initialize the values of the model. To begin initializing values, press the model editing button ($Y=x^2$). Notice that your items are all highlighted.

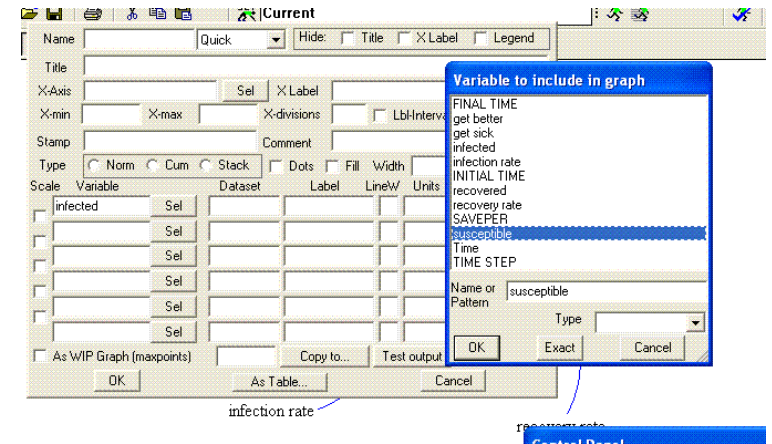
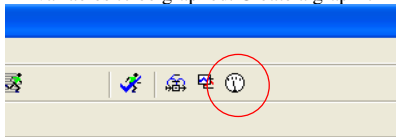


- Begin with initial values of box variables. Lets model a school with a population of 1000 healthy students, 1 sick student, and no recovered students. Click on each box variable and set the initial condition. Notice that as you complete each variable, the items are no longer highlighted.

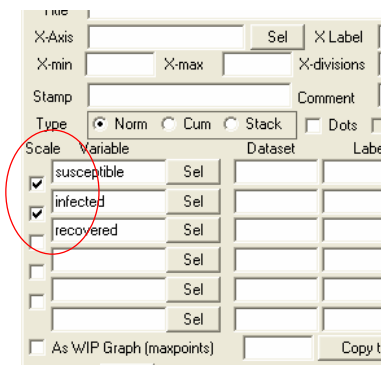
- Set your flows. Getting sick occurs when people interact, so some fraction of interactions ($\text{infection rate} * \text{susceptible} * \text{infected}$) should lead to infection. For recovery, on a given day, some fraction of infected people will get better ($\text{recovery rate} * \text{infected}$).



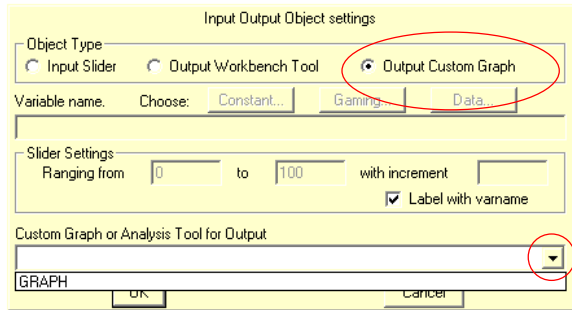
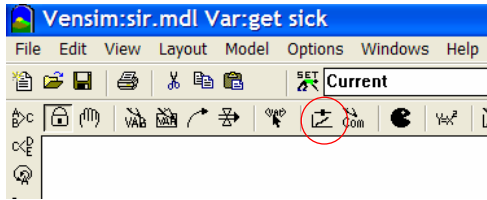
11. Set your constants. For recovery rate, if this is a 2 day (48 hour) flu, roughly half of the infected people will get better each day, so set the constant to 0.5. For the infection rate, this will be smaller as it is a rate “per interaction” and not per person. Enter an infection rate of 0.002 infections per interaction per day. Notice that this constant represents quite a bit. Maybe some of the infected people are quarantined. Maybe some of the susceptible people never come into contact with infected people. Maybe some interactions do not lead to the spreading of the flu.
12. You have a model, but no way to display the results when you run it, so create a graph object. Start with the control panel (press the speedometer button in the upper right portion of the window) and press the graphs tab. Create a new graph. When creating a new graph you can get very fancy with setting many of the labels and setting graph limits, but you can get a minimal graph simply by selecting the variables to be graphed. Create a graph of infected, susceptible, and recovered.



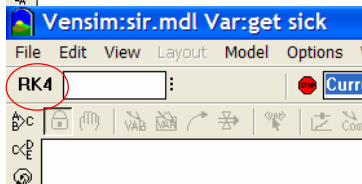
Be sure after entering in your plot variables to select the checkboxes between them that will ensure that they are all plotted on the same scale.



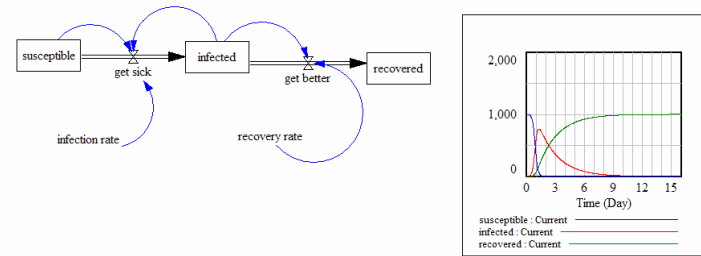
13. Place the graph object on the screen using the input/output object button (looks like a slider bar on top of a graph, next to the delete button that looks like a Pac-Man®). Click on the screen to place an I/O object, and choose to output a custom graph. From the pulldown menu at the bottom of the dialog box, select the graph you created.



14. The default method for running models is the Euler method. Never, Never, Never use the Euler method. Click on the "Set" button, and click on the word Euler that appears so that it changes to RK4. Consider this the "run better button".



15. Run the model using the "run once" button, which looks like a running person. Notice that you now see the results of the model displayed in the graph.



16. Run the model again using the "run trials" button, which looks like a running person with lots of lines behind him or her. Notice that the constant have turned into sliders, and by changing those sliders you can rerun the model for different parameters. Changing those parameters may give you unexpected results, particularly if you enter rates which are extremely large or negative. Double clicking on the slider will allow you to set the range and increment of the sliders. Press the stop button when you are done running trials.

