Math 140 Herding Model Calculations

Today you should incorporate at least two sets of calculations into your NetLogo model: speed of the animals and distance to herd centroid.

Helpful tip on plots in NetLogo: Edit a plot and look at the plot pen area. Clicking on the button with the yellow pencil lets you choose options for the pen properties. The Mode menu lets you choose Line for the usual graph, Bar for nicer histograms, and Point for scatter plots.

Speed graphs

We need to calculate distance moved per tick, to yield speed in meters per second. This implies that you need to know the previous position of the sheep or dog, in order to determine how far it moved. One way to accomplish this is to add variables like previous_x and previous_y to sheeps-own and dogs-own and then calculate the speed *after* moving the animals. Or add variables next_x and next_y and calculate the distance between the current position and the next position *before* moving each animal.

Mean sheep speed over time can be graphed as a regular plot over time (and you should plot the dog's speed as well, to get an idea of how fast the dog can move).

A histogram of sheep speeds at each tick can also be useful, to get an idea of the range of speeds.

Distance to centroid graph

A good strategy here is to let the x and y coordinates of the herd centroid be global variables calculated at each tick once the animals have moved. The centroid coordinates are the mean *xcor* and mean *ycor* of the sheep, so is easy to calculate in NetLogo. You can then use *distancexy* to calculate the distance of each sheep and the dog from the herd centroid.

To create a graph like Figure 1a of the original article, set the pen mode to Point as described above. Use *plotxy* to plot the dog's distance from the herd centroid along the horizontal axis and the mean sheep distance from the herd centroid along the vertical axis. Time is not explicitly shown in the plot, but over time the plot will accumulate more and more points to fill out the curve. You may want to make the distances from herd centroid variables owned by the sheep and the dog (and calculated for each animal after it moves for each tick), to simplify the plot commands.