Genevieve Grivas and Adela Habib
Parallel Computing Project Description

The final project will consist of a parallel discrete event simulation (PDES) using Rensselaer's Optimistic Simulation System (ROSS). The PDES will be based off of a basic predator-prey model using a 2D world grid system. An example of the basic state variables and events for this model are described below, the values and equations are arbitrary and may change as the project progresses.

State Variables	**Description**
Predator	the number of predators (integer)
Prey	the number of prey (integer)
Grass	the number of grass (integer)

Events	**Description**
Prey Die	if there are more predator than prey, one prey dies $Predator > Prey \Rightarrow Prey -= 1$
Predator Die	if there are no prey, one predator dies $Prey == 0 \Rightarrow Predator -= 1$
Update Method	this even occurs every time tick within the model, for us, this includes growing the grass $Grass += 50$

ROSS uses a Time Warp, a detection-and-recovery synchronization mechanism, which "rolls back" events and re-executes them in the correct order. To implement this, ROSS uses Reverse Computation (RC). If an event is received out of order, ROSS will reverse all computation done on that processor until it is in the "correct state" for the unexecuted event. Therefore, our project will also require RC Events in order to undo the events previously described. Following the model above, the RC Events are described below.

RC Events	**Description**
Prey Die	$Prey += 1$
Predator Die	$Predator += 1$
Update Method	$Grass -= 50$

The 2D world grid consists of multiple cells, each of which house the variables and events. However, each cell is independent of one another and can be *programmed in parallel*. This is how our project will use a MPI parallel system. Each cell on the grid will run on an entire MPI rank, thus events that take place on each cell happen in parallel during the same "time tick." This model will be able to be strongly scaled by running it on the Blue/Gene Q and increasing the number of MPI ranks (i.e. the size of the 2D grid).

Lastly, the predators and prey will be able to "move" throughout the grid. These events will use communication between MPI ranks to describe the movement of each predator/prey as they travel to neighboring MPI ranks.