Statistical Mechanics Assignment 1

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1. The rules used to simulate the ant colonies are based on the article Ants and the Art of War by M.W. Moffett. The first of the three rules is:

   An empty cell becomes populated with probability p, majors are f < 1 times as likely to be born as minors, and red and blue births are equally likely

   Allowing red and blue ant births to be equally likely is simply a result of the fact that the article mentions a large number of different ant species, each forming colonies of similar sizes. The scarcity of major ants is mentioned during the article, when the Moffett states "The medias and majors are much scarcer than the minors but far more deadly."

   The second rule is:

   A cell of minors becomes empty when surrounded by at least one enemy minor or major

   The article focuses on the weakness of the smaller "foot soldier" ants, who are able to immobilise enemy ants in order for the large ants to kill them. The article supports the choice to make minors vulnerable to small numbers of other minor ants when it is mentioned that 'a single minor has no more chance against the children then would an equally small scout of a lone hunting species."

   The final rule is:

   A cell of majors becomes empty when surrounded by four minors or at least one major

   Again, this rule refers to the descriptions of multiple minor ants being needed to destroy larger enemy ants. Moffett also mentions that the major ants are 'far more lethal', so they would also have an easier time destroying enemy major ants.

   The rules listed above were the initial rules used for the simulation. However, since a number of people found that the effectiveness of the minors was minimised by rule 2, some alterations were made. Rule 2 was adjusted so that minors can be killed by at least two enemy minors, or at least one major. A second adjustment was to repopulate cells emptied when their occupants are killed. In these cases, a winning minor ant has a $p(1 - f)$ chance of repopulating the cell, while a winning major ant has a pf chance.

2. A set of probability density functions for a 30 by 30 cell

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