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Silverfish Simulation
dkand12 - Project Specification

Introduction

The subject that we have decided to write about is the Silverfish Simulation. We chose the subject because both of us loved the idea of modelling evolution **that takes place in a bathroom** and has a span of thousands of years.

This subject also opens up a window of possibility when it comes to the way we will program our simulation. We have a very fond interest in MATLAB and we feel that this subject and MATLAB fits perfectly and this programming language will, therefore, be used to create the simulation.

Problem statement

When the lights are on, silverfishes demonstrate different behaviours. One type of silverfish will feign death to avoid detection, while another will make a run for it and hope to escape before getting stomped to death. There will, most likely, exist some sort of inheritance system where children of two silverfishes will inherit their parents' behavior. The question that we want to answer is:

After thousands of years of evolution in a bathroom, what kind of silverfish will prevail? The bold one that feigns death or the cowardly one that flees to the hideout? Perhaps one is not better than the other and both survive equally well.

Factors such as how far the silverfish has gone from its hide-out or how long the light is switched on may or may not be factors when deciding the likelihood of the silverfishes detection.

Approach

The main approach to this problem will be to make the creation of the simulation as simple as possible while it should still give pleasing results. We believe that if one starts incorporating complicating factors, that might not even lead to remarkable results, the entire model will be much harder to implement in the limited time-span that we have available.

As we mentioned earlier, the modelling will take place in a MATLAB environment, which means that the model will rely heavily on different calculations and such. We know that projects similar to ours are usually modelled with the help of differential equations. If we decide to do so with our project, MATLAB will prove to be a wise choice in programming language.

Our supervisor, Henrik Eriksson, spoke to us about the differences in using event-based or time-based simulation, that is, if our model will be based on a chronological sequence of events where operations are made once an event is initiated or if the model will be based on

events spread across a time-interval, where an event is initiated depending on current position in the time-interval. Before we start to model the problem on the computer, a choice will be made between these different simulation techniques.

References

The web page http://www.simulatedevolution.com/ is very similar to our project and it is possible that this web page will inspire us during the process of modelling.

Another reference we will most likely be using is the book *Differential equations with boundary-value problems,* by Zill and Dennis G since it, thoroughly and comprehensively, educates the reader in different kinds of differential equations, which will probably be used extensively in our project.

Time plan

Firstly, we need to decide the rules of the world we are trying to model. These include, but are not limited to, the following:

- The rules of how the silverfish dies of a natural death.
- How the silverfish inherits the characteristics of its parents (feign or flee) and how often the silverfishes reproduce.
- How the time that the light is turned on will affect silverfishes that are feigning.
- How the distance between silverfish and hideout will affect its chances of escape should it flee.
- If the distance from the hideout affects the silverfish's decision to feign or flee.

When these rules have been set, it would be wise to see if growth and decay of the silverfish population can be presented with an already existing mathematical model and use this model.

When this is accomplished, modelling can start in MATLAB and we will work with the essay and model in parallel. One of the project highlights will be to present the simulation. We have decided that visual aspects of the simulation will be covered when the actual simulation is working.