Computer Graphics Project Report

### Objective:

To demonstrate and visualize genetic algorithm in a self-created situation. This project is aimed at developing an overall understanding about the working and implementation of the genetic algorithm. Language used: javascript, p5 for visualization.

### What is Genetic Algorithm (GA)?

GA is simple, powerful, general-purpose, derivative-free, stochastic global optimization method inspired by the laws of natural selection and genetics.

These algorithms are derivative-free, which means that they do not need functional derivative information to search for a set of parameters that minimize (or maximize) a given objective function. Instead, they exclusively rely on repeated evaluations of the objective function, and the subsequent search direction after each evaluation follows certain heuristic guidelines. In particular, the optimum solution is obtained by investigating new solutions which incorporate three genetic operations: reproduction, crossover, and mutation in a selective environment where the fittest survive.

There are three main steps for genetic algorithm,  
initialization of population (usually random), evaluation of fitness function and finally generation of new population.

### Situation:

The population consists of agents/rockets that are randomly initialized and have an objective to reach a grey square which can be moved with a mouse click.

### Working:

1. First the population is generated with random agents.rockets. Thier movement is also random (**Initialization Stage**).
2. After some time, the agents that went closest to the square (**Fitness Function**) are selected and their contents are mixed and passed on the next generation (**Crossover Stage**).
3. Some amount of mutation is included in the next generation’s population so that it can explore new possibilities (**Mutation Process**).
4. Then the next population is made with passed on contents (**Reproduction Stage**).
5. This process is repeated till maximum agents are able to reach the square.

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