In this thesis is presented design and implementation of a system performing genetic programming in simply typed lambda calculus. Population initialization method based on term generating technique producing typed lambda terms in long normal form is introduced. This method is parameterized by simple search strategy. Several search strategies are presented, such as strategy for systematic generation or strategy corresponding to standard ramped half-and-half method. Another such a strategies called \textit{geometric} strategy is further examined in experiments and shown to have various desirable effects such as improved success rate, lesser time consumption and smaller average term size in comparison with standard ramped half-and-half generating method. Other performance enhancements are proposed and supported by experiments such as eta-normalization of generated individuals and @-tree representation of individuals. Abstraction elimination is utilized to enable use of simple tree-swapping crossover.