CIS 607 EC
Graduate Seminar on Evolutionary Computation

Programming Assignment 1
Genetic Algorithms

Due date: Oct. 16th, 2012
GA Implementation

• Implement Genetic Algorithms in your language of choice

• Implement variations, according to different directions

• Solve an example problem

• Perform experiments and compare results

• Report results
Example Problem
Double Pendulum Equilibrium

- Two uniform bars are connected by pins at A and B, and supported at A. Let a horizontal force $P$ act at C.
- Given Force $P=2$, length of bars $l_1=l_2=2$, and bar weights $w_1=w_2=2$.
- Find the equilibrium configuration of the system (friction is neglected). That is, the values for angles, where $0 \leq \theta_1, \theta_2 \leq 90$. 

Example Problem
Double Pendulum Equilibrium

Diagram with labeled points A, B, C, and P, with angles $\theta_1$, $\theta_2$, lengths $l_1$ and $l_2$, and weights $W_1$ and $W_2$. The diagram shows the system in equilibrium.
Example Problem
Double Pendulum Equilibrium

• The total potential for the pendulum is

\[ \Pi = - P[(\ell_1 \sin \theta_1 + \ell_2 \sin \theta_2)] - (W_1 \ell_1 / 2)\cos \theta_1 - W_2 [((\ell_2 / 2) \cos \theta_2 + \ell_1 \cos \theta_1)] \]
Population Model

• Implement Generational GA
• Implement Steady State GA
Representation

• Implement fitness functions that understand the following representations:
  – Binary coded reals
  – Real numbers
Crossover

- Implement the following reproduction schemes:
  - One-point
  - N-point
  - Uniform
  - Multiple parents
Experiments

• Perform (30) independent runs for each version (combination of variants)

• Record performance
  – Time
  – No. Evaluations
  – Convergence (best individual of each generation) for best run

• Draw conclusions
Report

• Report:
  – implementation details
  – Experiment details
  – Results
  – Comparisons
  – Conclusions
• Write in journal/conference paper format
• Send to juan@cs.uoregon.edu by Oct. 16th
• May work on teams (0 < |team| <= 4)