Thursday Lab #2

Welcome to Lab #2, Thurs, May 9

Goals

- **Learn more details about evolutionary biology**
  - Sexual selection
- **Revisit Monday's examples of evolving systems in light of new information**

- **Understand why Dr. Erik and Dr. Una-May study evolution**
  - I am a Computer Scientist!
- **Practice talking about evolution in English**

Agenda

- **Sexual selection with eye candy!**
- **Lecture on sexual selection**
- **Mating Season exercise**

- **Evolutionary Computation Introduction**
- **Describe evolutionary systems in action**

Eye Candy!

Sexual selection

- **Not all evolutionary variation and change is a result of natural selection**

- **Natural selection is fitness proportional replication**

- **Darwin had to explain why elaborate sexual plumage exists**
  - **To attract mates?**
  - **Hiding fitness?**
  - **Signaling fitness?**

Sexual Selection Examples

- **Elaborate tails of peacocks**
- **Bright plumage**
- **Large racks in moose**
- **Deep voices in men**

- **Circumstances for sexual selection occurs**
  - **Preference shown by one sex (often the females) for individuals of the other sex that exhibit certain traits.**
  - **Increased strength (usually among the males) that yields greater success in securing mates**

The Mating Game

It's BREEDING Season!

1. **Males want to meet as many females as possible and make them pregnant**
    –   Why? To pass their genes on

2. **Females can only mate twice in the season**
    –   They get to pick their mates
    –   So we play the game by males and females meeting each other and trying to decide who to mate with.

3. **When a couple decides to mate, they should "High five" and the female should reveal her number of eggs.**

High Five!

We will mate!

ALFA
ANYSCALE LEARNING FOR ALL

CSAIL

The Mating Game

It's BREEDING Season!

1. **Males want to meet as many females as possible and make them pregnant**
   - **Why? To pass their genes on**

2. **Females can only mate twice in the season**
   - **They get to pick their mates**
   - **So we play the game by males and females meeting each other and trying to decide who to mate with.**

3. **When a couple decides to mate, they should "High five" and the female should reveal her number of eggs.**

4. **Calculate the number of offspring that survive until adulthood using this formula:**
   - **number of offspring = (number of eggs) (male genetic value + female genetic value)**

CSAIL

If You are a Female

Female Traits

- **genetic value: X%**
  - Contribution toward the survivorship until adulthood of her brood.
  - HIDDEN FROM MALES!
    - » Until you decide to mate with a specific male

- **fecundity**
  - the number of eggs produced per cycle
  - HIDDEN FROM MALES!
    - » Until you decide to mate with a specific male

- **X-ray Vision question: yes/no**
  - If you have xray vision, can see a male's genetic value

X-Ray Vision

http://2.bp.blogspot.com/-4XZBdimFZKo/UASfEx4jhyl/
AAAAAAAAAl0/6fy0_enWTew/s1600/IMG_1005.JPG

If you are a male

Male Traits

- **genetic value: Y%**
  - your contribution toward the survivorship until adulthood of each brood you father.
  - HIDDEN FROM FEMALES!
    - » Only reveal if female has X-Ray vision

- **Attractiveness**
  - Behavior that helps you catch desire of female
  - Should be loudly and boldly displayed!!!
  - Finger-snap, hum, clap, foot stamp

- **Fighting ability: # of teeth**
  - Makes you superior to male with less teeth
  - Can be used to dislodge a male at any point in courtship up until a female is actually mating with him, as signaled by "high five".

Teeth Baring!

How Game works

- **Student picks up a role card and HIDES IT!!!**
- **Card states:**
  - **Sex: male or female**
  - **Traits**
- **We start mating season**
  - **Males and Females find partners, mate and females report birth**
    - » **NOTE only 2 broods for females! Any number of matings for males!**
  - **Mating season will continue UNTIL Teacher says STOP! Or all females have finished breeding twice**

The Mating Game Review

Genetic Value / X-ray	No	Yes
Low	12 (10)	4 (12)
High	11 (14)	2 (18)

| Genetic Value / Teeth	3	10
Low	1 (6.3)	5 (4.2)
High	3 (39)	12 (46)

Most Mating	12
Most Offspring	13

What is the connection between Evolution and Computer science?

- **Look around you!**
  - **Nature is efficient**
  - **Nature is ingenious**
  - **Nature solves complex problems**
  - **Nature adapts**
- **Why not look at nature when you try to solve problems?**
  - **What process has created all the variation and adaptation in nature?**
  - **Can we use this process ourselves?**
  - **Can we imitate the behavior in nature to create efficient algorithms?**

Evolutionary Algorithms
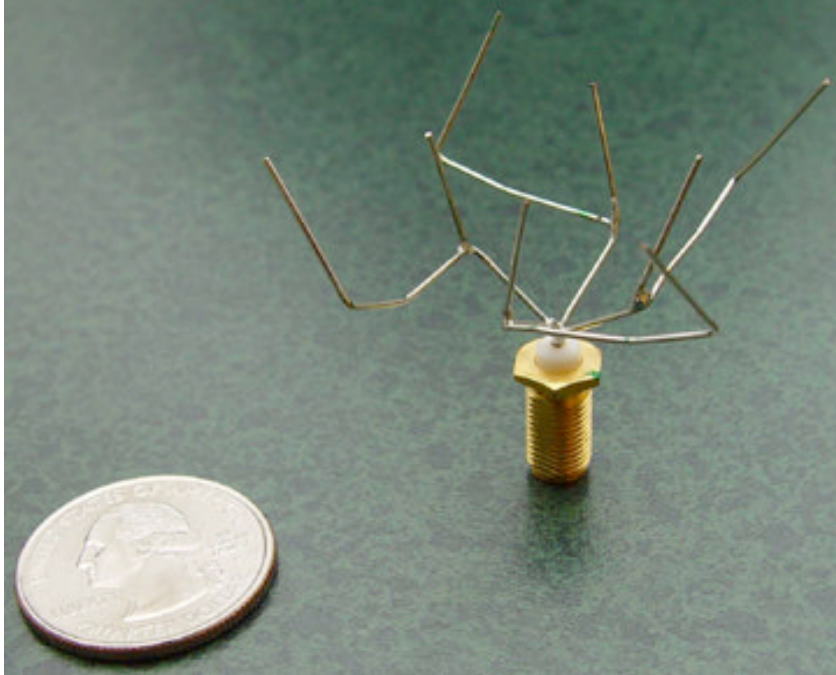
- **Create random designs**
- **Evaluate the designs**
- **Select the fit designs**
- **Vary the selected designs**
- **Replace the old designs with the new designs**

Checklist for Evolutionary System

- **Refer to Monday's examples of systems or new ones you think of**
- **Think: For each, answer the following**
  - **What is the population**
  - **What is the organism**
  - **What traits do organisms carry?**
  - **Which traits are adaptive or not?**
  - **What makes an organism fit?**
  - **What competition for selection is there?**
  - **Is there one or more species in the population?**
  - **Give examples of ancestors**
- **Pair**
- **Share**

Lab #2 Learning Outcomes

- **More nuanced view of fitness in evolution**
- **Make the connection between CS and Evolution**
- **Improvement at seeing differences between evolutionary systems and non-evolutionary systems**

Lab #2 Journal Entry

Use these questions to guide today's journal entry

- **Be brief**
- **Sketch or bullets**
- **Reflect!**
- **A journal is a DIARY**
- **Make your final entry**
- **Print and bring the journal to class**

- **Question of the day:**
  - **What questions do you have?**
- **Question of the week**
  - **What new relationships between CS, evolution and learning do you see?**

ALFA
ANYSCALE LEARNING FOR ALL

CSAIL

TODO

- Print and bring journal to class on Friday morning
- Send Power Point presentation of Evolutionary Gems to Meijuan **mjyan@stu.edu.cn**

- Submit the output from their PD_skeleton.py program to Meijuan **mjyan@stu.edu.cn** before 0800 on Friday the 10th of May
- The PD_skeleton.py was the assignment that you got on _Monday_ morning. (Some students have shown it to me in class, but I need to get all the names)
- The output should look like (but the years should be correct)

```
START Prisoners Dilemma
THE SENTENCE IS:
Alice: Cooperate and got -1 years
Bob: Cooperate and got 1 years
THE SENTENCE IS:
Alice: Cooperate and got -1 years
Bob: Defect and got 1 years
THE SENTENCE IS:
Alice: Defect and got -1 years
Bob: Cooperate and got 1 years
THE SENTENCE IS:
Alice: Defect and got -1 years
Bob: Defect and got 1 years
END Prisoners Dilemma
```

ALFA
ANYSCALE LEARNING FOR ALL

CSAIL