



## Checkpoint 4 -- Selection and Fitness

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## What you will be doing

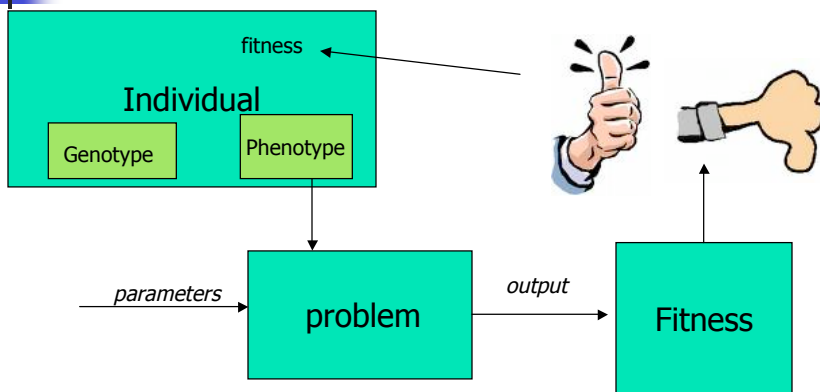
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- Goals:
  - Define and implement fitness measure
  - Experiment with a variety of selection mechanisms
  - More statistics gathering.
  
- Reminder: all checkpoints to contribute to what eventually will be reported in your final report / presentation.

## Deliverables

- Report and Code

## Fitness





## Fitness

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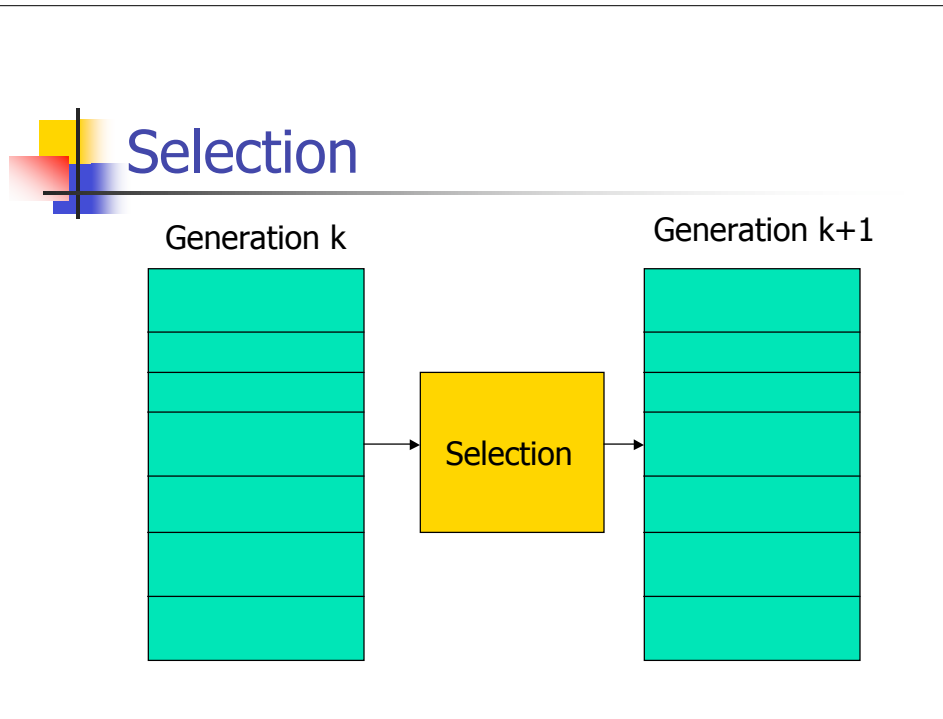
- Report
  - Description of fitness measure
    - What gets evaluated (output, not phenotype)
    - What is the evaluation criteria
    - What scaling or penalties (if any) are applied.
    - Pseudocode (if needed)
- Code
  - Implementation of above



## Fitness

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- If you have a complex fitness function...
  - Fully describe in report
  - Try to code up as much as you can
    - Expectation that you will continue to develop past CP4.



- ## Selection
- Process of determining individuals of generation  $i+1$  from generation  $i$ .
  - Basic process
    - Choose parents from generation  $i$ .
    - Have chosen parents produce offspring
      - Add these offspring to population
    - Choose individuals from population to survive in generation  $i+1$ .



## Selection

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- In choosing a selection scheme
  - Overlapping or non-overlapping?
  - Selection mechanism for parents
  - Selection mechanisms for survival
  - Determine rates for crossover / mutation.



## Selection

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- Tasks
  - Compare results of EA based on different selection strategies.
    - Overlapping vs. non-overlapping
    - Choice of parent selection mechanisms
    - Choice of survivor selection mechanisms
    - Mutation Rate.
    - Crossover rate.
  - Goal: to gain insight into best parameters for your problem.



## Selections

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- EA test runs
  - For all runs of your EA
    - Maintain constant population size / generation.
    - Use same genotype, genetic mapping, genetic operators
    - Keep all parameters constant except parameter under study
    - suggested values...your mileage may vary
      - 25% elitism
      - Fitness Proportional / Roulette Wheel Selection for both parents and survival
      - 75% crossover rate
      - 0.001 mutation rate.
    - Run until you "detect convergence"



## Selection

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- Overlapping vs. non-overlapping.
  - Compare levels of overlap:
    - 0% -- no overlap (parents live only 1 generation)
    - 25% elitism -- 25% of parents will be placed in survival pool
    - 50% elitism -- 50% of parents will be placed in survival pool
    - 75% elitism -- 75% of parents will be placed in survival pool
    - 100% elitism -- all parents will be placed in survival pool



## Selection

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- Parent Selection
  - Compare:
    - Fitness Proportional / Roulette Wheel
    - Tournament (binary)
    - Linear Ranking / Roulette Wheel
  
  - Feel free to replace any of the above with your own.



## Selection

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- Survival Selection
  - Compare:
    - Fitness Proportional / Roulette Wheel
    - Tournament (binary)
    - Linear Ranking / Roulette Wheel
  
  - Feel free to replace any of the above with your own.



## Selection

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- Crossover
  - Compare:
    - Crossover rate: 0
    - Crossover rate = 0.25
    - Crossover rate = 0.50
    - Crossover rate = 0.75
    - Crossover rate = 1.0
  - Maintain 0.001 mutation rate



## Selection

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- Mutation
  - Compare:
    - Mutation rate: 0.001
    - Mutation rate 0.01
    - Mutation rate 0.05
  - Maintain 75% crossover rate.





## Selection

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- Feel free to run additional test with combinations that seem promising.



## Selection

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- Statistics to be collected
- For each generation:
  - Best fit individual
  - Worst fit individual
  - Avg fitness



## Selection

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- Report
  - Parameters of each comparison
  - Statistic plots for each comparison
  - Conclusions
    - What worked, what didn't
    - What you might be inspired to try.
    - Other observations.
- Code
  - Implement different selection mechanisms
  - Collect and deliver statistics.



## Questions?

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## Ground rules

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- To be done in your teams.
- Report submission in PDF, Word, or plain text.
- Code submission as zip, tar, etc.
  - Include instructions for building/running.
  - Include platform as mycourses comment when submitting.
- Electronic submission via mycourses.



## Submission

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- Due Tuesday, January 30.
  - Note new date.
- Any trouble, see me sooner rather than later.