

Project Presentation Genetic Shortest Path

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Topic of Project

- Genetic algorithm.
- Find shortest path in graph.
- Weighted, undirected graph.
- Compare genetic algorithm to Dijkstra.
- Graphical user interface.

Three Algorithms

Dijkstra Optimal solution.

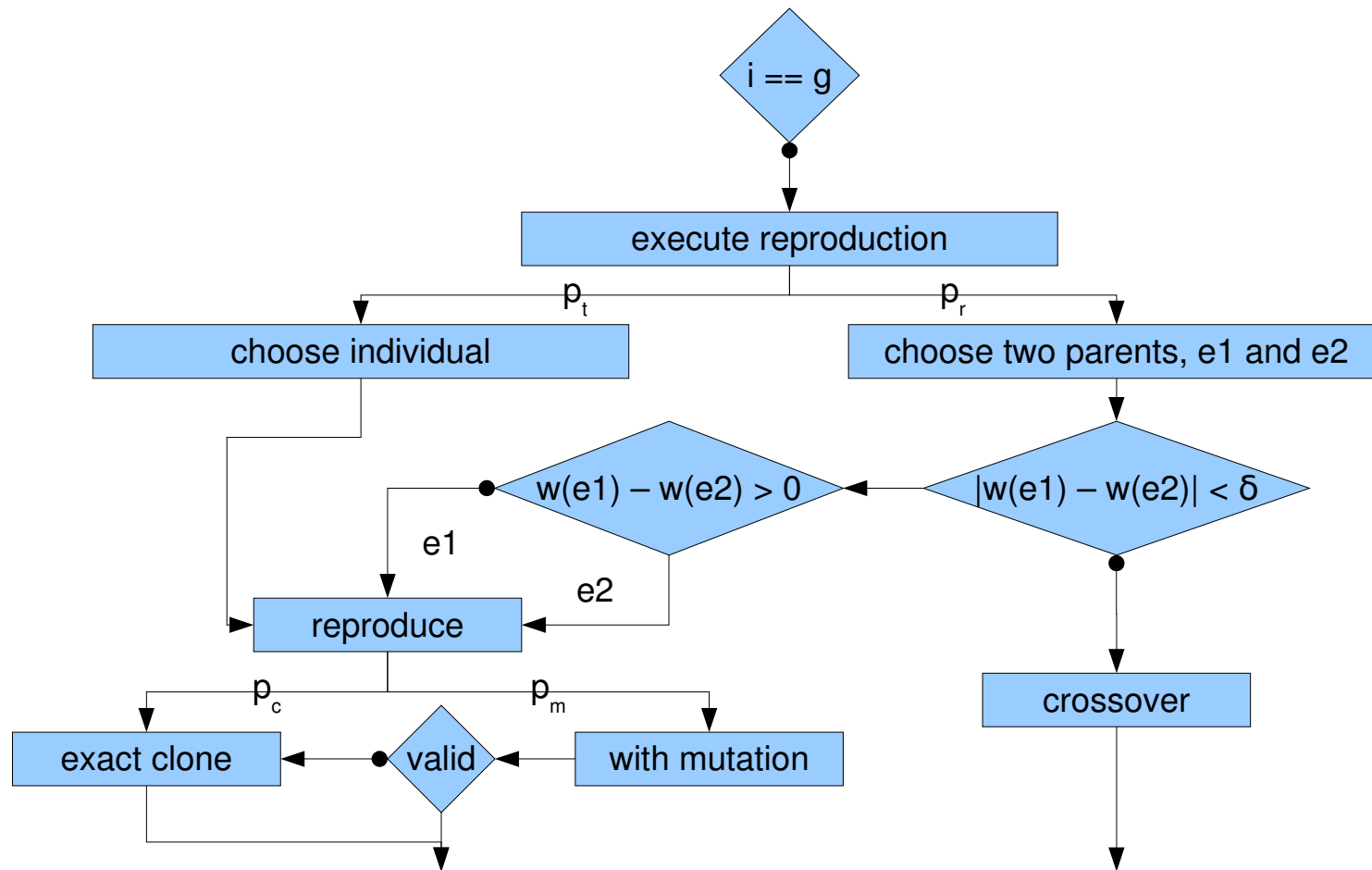
Genetic with constraints Evolutionary algorithm. Only valid genomes.

Genetic without constraints Evolutionary algorithm. Also invalid genomes.

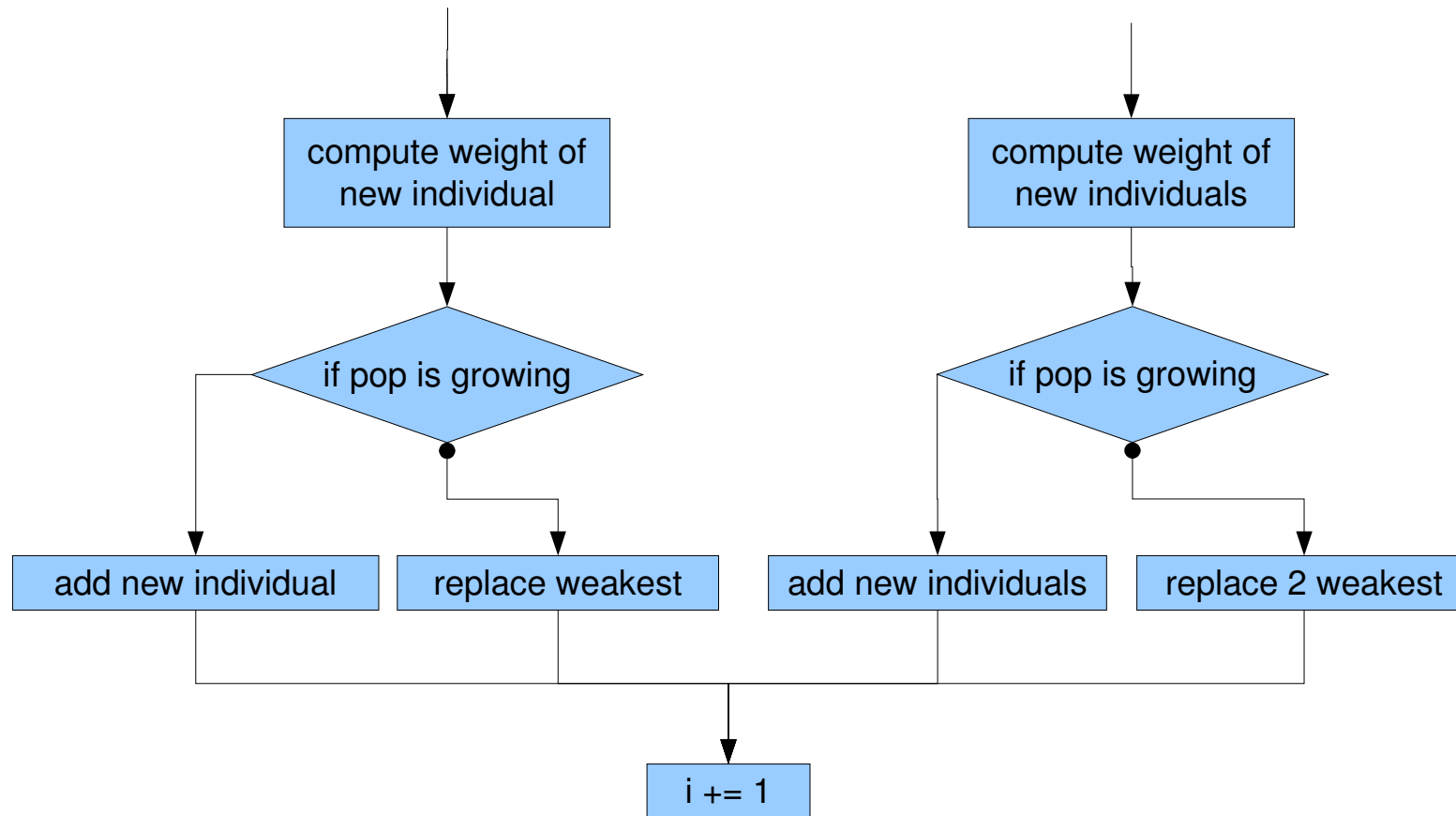
Genome

- List of edges.
- Easier to implement.
- More performant: no search for edge between vertices.
- Valid: path from start to end.

Genetic Algorithm I



Genetic Algorithm II



Initial Population

- Random generation.
- Start from source vertex.
- Limited length.
- Problem: missing edges.

Crossover

- Random selection of father.
- Random selection of splitting point.
- Selection of mother: contains splitting point.
- Check delta: insufficient difference → reproduction.
- Verify direction.
- Take half of each.
- Coupling: put together genes.

Reproduction

- Randomly select individual.
- Randomly swap two edges.
- Verify validity.
- With constraints: return clone if invalid.

Differences With and Without Constraints

With constraints:

- Only valid solutions.
- Initial population: only from start.
- Crossover: delta-value.
- Reproduction: fall back to clone.

Without constraints:

- Also invalid solutions.
- Initial population: from start and end.
- Crossover: delta-value ignored.
- Reproduction: never clone.

Possible Improvements

- Better fitness function for no-constraint.
- Reduce influence of parameters.
- Quality of solutions.

Conclusion

- Rarely optimal, often close.
- Parameters: try and fail.
- Interesting project.

Time for Questions

- Just ask...
- Find everything on `http://bioinsp.zindel.org`

Demonstration

Let's play!