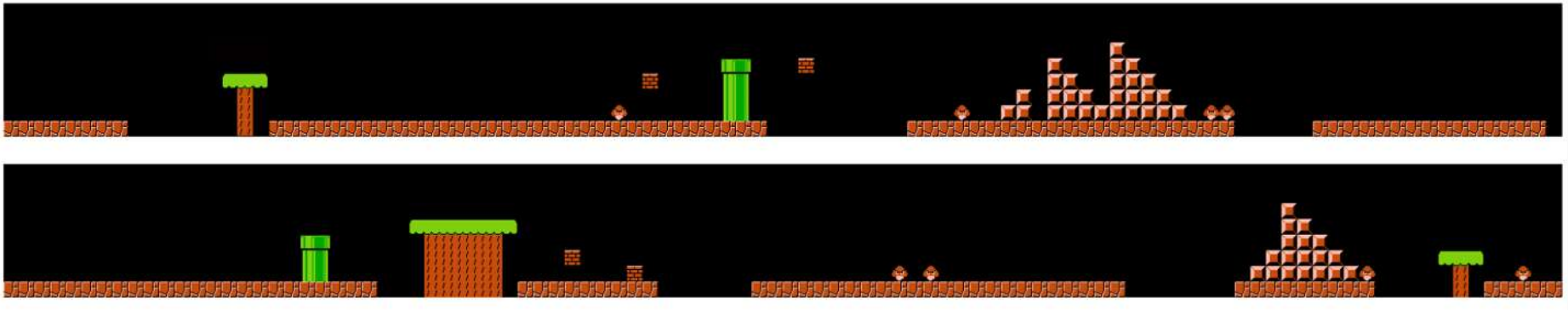
P5 Intro

P5: Evolving Mario Levels

- Using genetic algorithms to design artifacts.
- In this case, we will be generating new Mario levels through evolution.

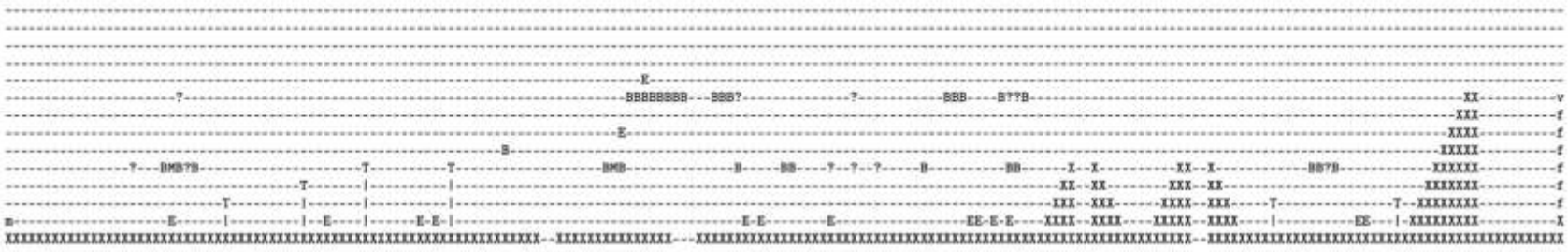


P5: Evolving Mario Levels

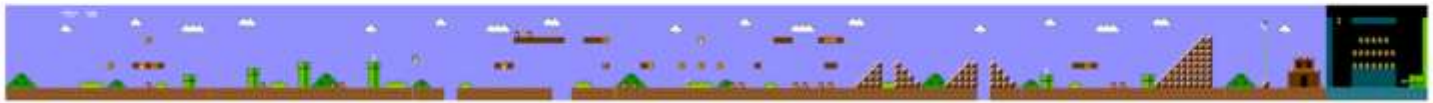
- You will be given two encodings of Mario levels as a genome.
  - Encoding 1: A grid of characters.
  - Encoding 2: Design elements.
- Getting started:
  - Install numpy and scipy using pip (or pip3)
  - Install any version of Unity3D
  - Read this paper:
    - https://www.researchgate.net/profile/Philippe_Pasquier/publication/220867545_Towards_a_Generic_Framework_for_Automated_Video_Game_Level_Creation/links/0912f510ac2bed57d1000000.pdf

Encoding 1. Grid of Characters

- This will just be a txt file. Each unique character refers to an element like a wall, empty space, type of block, etc.



And as a set of tiles (ignore the underground coin room please):

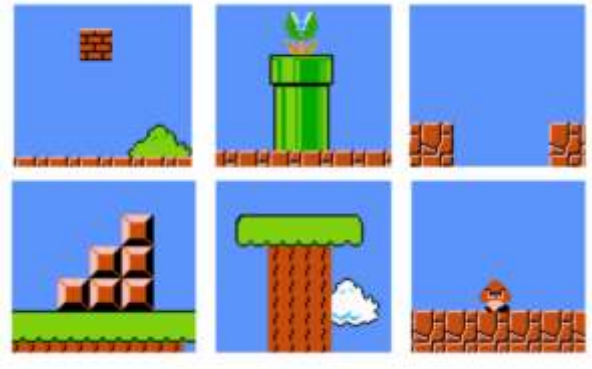


Encoding 1. Grid of Characters

- What you will be doing:
  - Implement the selection, crossover, and mutation.
    - Use at least two selection strategies to build up the next population.
  - You may want to improve the fitness function.
    - You may add new metrics calculations to metrics.py

Encoding 2: A set of design elements

- A set of design elements instead of a grid of characters like before.
  - From the paper mentioned earlier.
  - The genome is implemented with a heap of design elements.
- We will be using 8 different design elements.



Encoding 2: A set of design elements

- What you will be doing
  - You are given an implementation of a variable-point crossover. Explain the implementation and why it effectively produces diverse levels with different design elements and different numbers of design elements.
  - Also, explain how mutation works for this encoding
    - Try to improve it.
  - Try to improve the fitness function for this encoding.
  - You may also want to change the population initialization to encourage biodiversity.

Notes

- Use “python ga.py” to start the genetic algorithm and produce levels, hit ctrl-c when you’re done
- Switch to encoding 2 by changing the line “Individual = Individual_Grid” to “Individual = Individual_DE”
- Do some research on different methods for selection, crossover, etc.
- You will be modifying ga.py. The functions you will be changing or observing will be marked STUDENT.

Team Competition

- If your team wants to compete in the level generation contest, say so in your writeup
- The team with the best level will earn extra credit
- Every competing team must play other team’s games and submit their ratings (in a separate submission on Canvas, later on)