**Cellular Automaton Assignment**

***Eye Colour Dominance***

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| **Model description** | **8.5** | **10** | **Well done. See comments below** |
| **Description of the states of a cell** | **5** | **5** |  |
| **Description of evolution rules** | **10** | **10** |  |
| **Clarity & usefulness of the diagram** | **10** | **10** |  |
| **Creativity of your model idea** | **15** | **15** | **Very interesting idea!** |
| **Coding in Processing** | **49** | **50** | **It would be cool if the initial distribution of brown-blue-green could be easily set by the user at the top of the program. For instance, watch what happens if you start the world with 100% blue. The browns come into being only slowly but then steadily take over.** |
|  |  |  |  |
| **TOTAL** | **97.5** |  |  |

**What it models:**

This automaton models eye colour designation in humans based on genetic dominance. The eye colours of each of the parents determine the probabilities of the eye colour of the child. This model deals with the three most common eye colours: brown, blue, and green. People move search for love nearby, and if they meet someone, they have a child whose eye colour is determined by the eye colours of its parents. The automaton also happens to model population distribution––how people tend to live in groups. A human can only reproduce if it

**States of a cell:**

A cell can be one of 4 colours. **Brown**, **Blue**, and **Green** represent organisms with their respective eye colour. **White** cells are inactive background cells, forming the environment the organisms live in.

In the first generation, 70% of the cells are white, 20% are brown, 8% are blue, and the remaining 2% are green. The coloured cells, representing people, are randomly spread out.

As the automaton runs, lone cells die out and the living cells form clusters, which grow in population and eventually expand to meet.

**Evolution rules:**

The probability of a cell in the next generation having a certain eye colour is determined by the eye colours of its parents.

* **Brown** + **Brown** = 78% **brown**, 16% **blue**, 6% **green**.
* **Brown** + **Blue**  = 72% **brown**, 28% **blue**, 0% **green**.
* **Brown** + **Green** = 60% **brown**, 7% **blue**, 33% **green**.
* **Blue** + **Blue**  = 1% **brown**, 98% **blue**, 1% **green**.
* **Blue**  + **Green** = 0% **brown**, 50% **blue**, 50% **green**.
* **Green** + **Green** = 0% **brown**, 25% **blue**, 75% **green**.
* A child is born within two squares of its parents.
* If an organism has no immediate neighbours, they produce no offspring and their cell does not exist in the next generation.
* Otherwise, an organism breeds with each of its neighbours.

1st generation 2nd generation



1. This cell has no immediate neighbours, so it does not reproduce and its cell becomes blank in the next generation.
2. This breeding pair of cells likely produced #2 in the second generation. The child cell is placed with 2 squares of its parents.
3. Because of the random factor of the automaton, one cannot know for certain exactly which cell a certain breeding pair is responsible for. The breeding pair in the 1st generation labelled #3 could be responsible for any of the 2nd gen cells labelled 3, since they are all within 2 squares of the parent pair (as shown by the rectangles), and are of a possible colour.
4. Even though #4 in the 2nd gen is contained within 2 squares of the #3 parents, it could not have been one of their children, since brown + blue has no chance of a green child.
5. It is possible for child cells to be “born” outside of the visible screen. In this case, the child cell ceases to exist. This is necessary to prevent overpopulation along edges and corners where there is a lack of space, and is akin to real-world populations dying with a lack of resources.