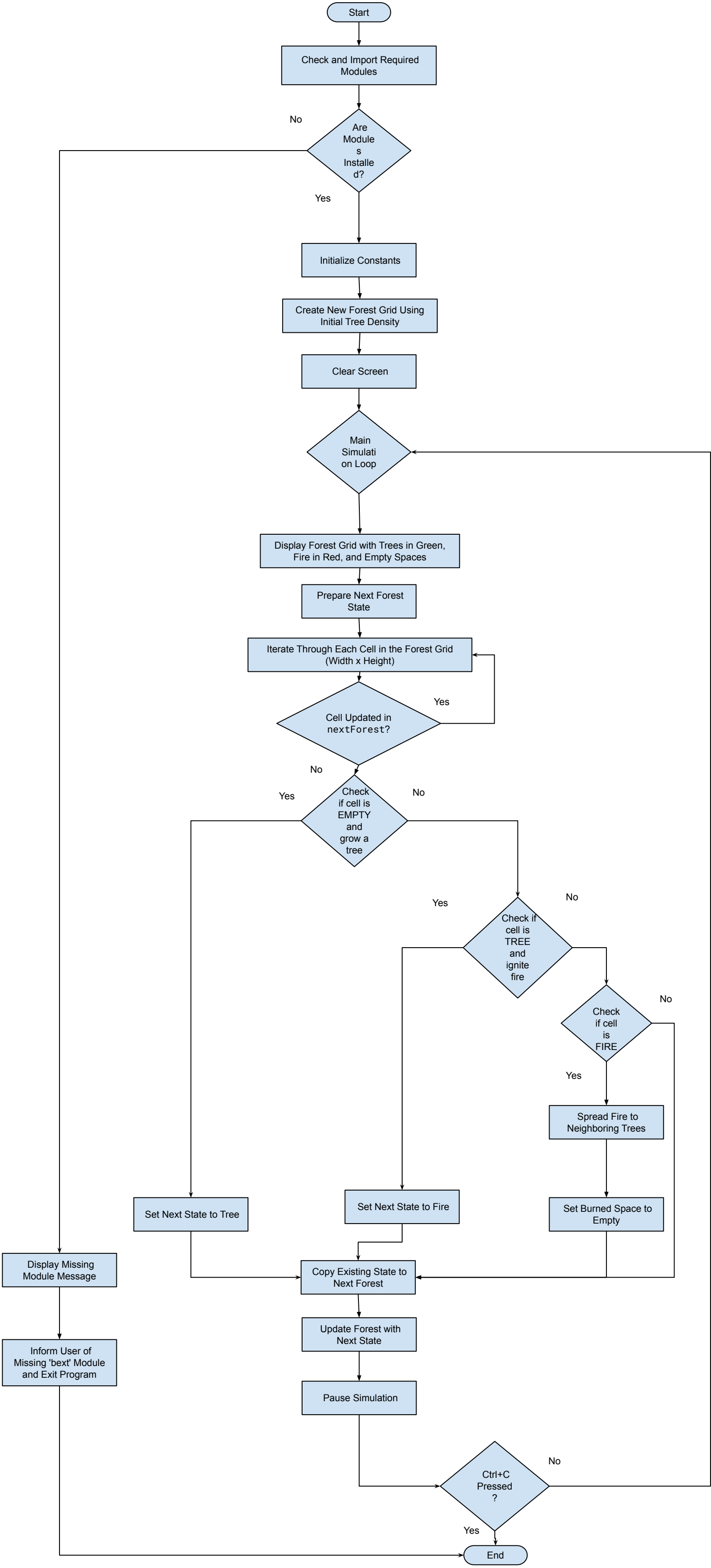Nima Memarzadeh, Arely Gil, Scott Hackett, Brian Preston

Assignment 5.2 – The Best Group Project

CSD325-A339

15 November 2024

```
                              ( Start )
                                 |
                    Check and Import Required
                           Modules
                                 |
          No                 / Are    \
    +----------------------<  Modules  >
    |                        \Installed?/
    |                             |
    |                            Yes
    |                             |
    |                    Initialize Constants
    |                             |
    |                    Create New Forest Grid Using
    |                       Initial Tree Density
    |                             |
    |                       Clear Screen
    |                             |
    |                          /  Main  \ <-----------------------------+
    |                         < Simulation >                            |
    |                          \  Loop  /                               |
    |                             |                                     |
    |                    Display Forest Grid with Trees in Green,       |
    |                    Fire in Red, and Empty Spaces                  |
    |                             |                                     |
    |                    Prepare Next Forest                            |
    |                          State                                    |
    |                             |                                     |
    |                    Iterate Through Each Cell in the Forest Grid <-+
    |                          (Width x Height)                      |  |
    |                             |                                  |  |
    |                         / Cell    \        Yes                 |  |
    |                        < Updated in >---------------------------  |
    |                         \nextForest?/                             |
    |                             |                                     |
    |                            No                                     |
    |                             |                                     |
    |               Yes       / Check  \       No                       |
    |         +--------------< if cell is >-------------+               |
    |         |               \  EMPTY   /              |               |
    |         |                \ grow a /               |               |
    |         |                 \ tree /                |               |
    |         |                              Yes   / Check  \   No      |
    |         |                          +--------< if cell is >--------+|
    |         |                          |         \  TREE   /          ||
    |         |                          |          \ignite /           ||
    |         |                          |           \fire /            ||
    |         |                          |                  / Check \  No||
    |         |                          |                 < if cell  >--+|
    |         |                          |                  \ is FIRE /   |
    |         |                          |                      |         |
    |         |                          |                     Yes        |
    |         |                          |                      |         |
    |         |                          |           Spread Fire to       |
    |         |                          |          Neighboring Trees     |
    |         |                          |                      |         |
    |    Set Next State          Set Next State          Set Burned Space |
    |      to Tree                  to Fire                 to Empty      |
    |         |                          |                      |         |
    |         +----------+---------------+----------------------+         |
    |                    |                                                |
    |            Copy Existing State to                                   |
    |                 Next Forest                                         |
    |                    |                                                |
    |            Update Forest with                                       |
    |                Next State                                           |
    |                    |                                                |
    |            Pause Simulation                                         |
    |                    |                                                |
    |                / Ctrl+C \     No                                    |
    |               <  Pressed >----------------------------------------+
    |                \   ?    /
    |                    |
    |                   Yes
    |                    |
 Display Missing         |
 Module Message          |
    |                    |
 Inform User of          |
 Missing 'bext' Module   |
 and Exit Program        |
    |                    |
    +--------------->( End )<----+
```

Rules for Pixel
1. **Initial Population of Pixels:**
   a. The forest grid is initialized to a particular tree density (INITIAL_TREE_DENSITY).
   b. Each Pixel has a status of either:
      i. **Tree ('A'):** Pixel is made to be a tree if a random value multiplied by 100 is smaller than or equal to INITIAL_TREE_DENSITY * 100.
      ii. **Empty (' '):** When Pixel is not a tree, it is set to be an empty space.

2. **Growth of Trees in Empty Spaces:**
   a. Each Pixel that is currently Empty has a GROW_CHANCE defined probability of turning into tree ('A').
   b. It is chosen randomly for each simulation run.
3. **Lightning Strikes (Fire Initialization):**
   a. Each pixel that is a Tree currently has a FIRE_CHANCE probability of being struck by lightning and converting to fire ('@').
   b. Lightning strikes are selected randomly at every simulation step.
4. **Spread of Fire:**
   a. Each Pixel on Fire (@) can light its surrounding pixels, which are Trees ('A').
   b. Neighbor pixels are examined in all eight directions (up, down, left, right, and diagonal).
   c. After a tree has been set on Fire, the state of that tree will change to Fire ('@').
5. **Burning Down Trees:**
   a. Pixels that are Fire ('@') get updated to Empty (' ') when they put out Fire to their neighbors.
   b. It makes it look like the being fully burned down.
6. **Copying Existing States:**
   a. Pixels that were not changed during the simulation step are still present.
7. **Randomization of Patterns:**
   a. **Every simulation run is different because of the implementation of randomness in:**
      i. Initial pixel allocation (trees vs empty space).
      ii. Tree growth (GROW_CHANCE).
      iii. Lightning strikes (FIRE_CHANCE).
      iv. Fire spreading dynamics.