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**Project Topic Area:** Instrumented biological simulation

**Project Name:** coral-reef-simulation

**Github repository:** <https://github.com/arlysswest/coral-reef-simulation>

The repo will have a `README.md` describing the project.

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## Project Vision

This project would model a coral reef and coral reef restoration. It would include problems that coral reefs face and how they negatively affect the health of the reef. Additionally, it would include restoration efforts and how they positively affect the health of the reef. In this program time is going to be discrete. I am going to build a text-based version first. I will research giving it a visual representation and implement a visual version if I have the resources to do so.

## Key Aspects

### Messages:

- It would display congratulatory messages when the coral reef improves
- It would display problem messages when a problem randomly occurs

### Tools:

- User chooses tools
- Improve coral reef health
- artificial substrates / 3D printed modules
  - coral cover: inc
  - algae cover: no change
  - temp (c): no change
  - ph: no change
- coral gardening
  - coral cover: inc
  - algae cover: dec
  - temp (c): no change
  - ph: no change
- Micro-fragmentation
  - coral cover: inc
  - algae cover: dec
  - temp (c): no change
  - ph: no change

- Removing pollution
  - Removing pollution
  - coral cover: inc
  - algae cover: dec
  - temp (c): no change
  - ph: inc

Statistics:

- Improve when tools are applied
- Suffer when problems occur
- Outputs current statistics
- *Coral Cover % (int):*
  - Improve=increase
  - suffer=decrease
  - range= 0-100% (healthy Indo-Pacific reefs can be 25–50%; >40% now is considered quite good in 2020s)
  - starting point: 30–40%
- *Algae cover % (int):*
  - improve=decrease
  - suffer=increase
  - range=0–100% (really sick reefs go 40–70% algae)
  - starting point: 10%
- *Water PH (float):*
  - improve= increase
  - suffer= decrease
  - range=0–14 (ocean acidification is moving surface ocean toward 8.0 and lower)
  - starting point: 8.1
- *Water Temperature (C) (float).*
  - starting point: 26–28°C
  - improve=stays here
  - suffer= increase >30–31°C
  - range= 0–40°C

Problems:

- Randomly chosen
- Would make coral reef health suffer
- Pollution
  - coral cover: dec
  - algae cover: inc
  - temp (c): no change

- ph: dec
- Invasive species
  - coral cover: dec
  - algae cover: inc
  - temp (c): no change
  - ph: no change
- Co2 emissions
  - coral cover: dec
  - algea cover: inc
  - temp (c): inc
  - ph: dec
- Storm or physical damage
  - coral cover: dec
  - algae cover: inc
  - temp (c): no change
  - ph: no change
- Over fishing
  - coral cover: dec
  - algae cover: inc
  - temp (c): no change
  - ph: no change

### **Text Based Version**

- The program would loop through the following steps:
  1. Display current statistics
  2. Ask user if they would like to apply one of the tools or quit
    - > if they choose to quit end the simulation
    - > if they choose a tool continue to next step
  3. Adjust statistics based off selected tool
  4. Output updates statistics
  5. Output a congratulatory message
  6. Have program select a random problem to occur
  7. Update statistics based off random problem
  8. Repeat steps 1-7

### **Visual Version**

- Complete only if I have time
- I would need to do additional research for how I might implement this
- Map:
  - The user could click on the map to expand the map

- The user can click an exit button to leave the expanded map
  - The user can click on a different area of the map to focus on restoring a different area
- Image:
  - an image of a portion the coral reef
  - It would have more corals the higher the coral coverage % is
- Messages:
  - Would display the most recent message from the system including:
    - Congratulatory messages when reef improves
    - Problems
- Statistics:
  - Display updated statistics in real time
- Tools:
  - Display different tools at all times
- Example image:
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