Programming Competition Case

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1. Background

Many minerals and resources can be found in oceanic environments. However, there are also many types of marine life, environments and areas of historical/cultural significance that need to be protected. Obtaining these valuable resources without considering marine health and preservation can be detrimental to the environment. Processes like drilling can disrupt the ocean floor, increase pollution with both noise and waste and have a negative impact on biodiversity. Deep sea mining can also cause major disruptions to ecosystems and even global climate regulation [1].

Given the population spread and easily available resources being mined in excess, searching for resources on land is becoming more time-consuming and expensive. As a result, the areas in which they can be found are becoming more sparse. Not to mention resources which are only available in oceanic environments are even more expensive and difficult to mine.

The (fictitious) island of F.I.N. is known for their rich biodiversity, rare species, and mineral deposits in the ocean surrounding it. Their government has approved external corporations and organizations obtaining the resources surrounding their island. However, all proposals must show that the organization's acquisition of these materials takes into account avoiding at least one of the things on their list of preservation priorities.

2. Competition Challenge

The company WANBIS Corp. has hired you, a group of engineers, to create the interface to be used in the pitch of their resource acquisition plan to the government of F.I.N.. They have provided your team with numerous data sets involving the coastline and environment of the island, the locations of various resources, and the locations of various items on the country's preservation priority list.

You are tasked with using the coastline data, along with a minimum of one resource and one preservation priority dataset to create an algorithm and interface. Your algorithm must provide acquisition locations while avoiding your chosen preservation priorities. Your interface must visualize this prioritization and provide optimal locations for obtaining resources.

You have been given the table below that sorts the datasets into various categories as well as the datasets themselves.

Item	**Obtain, Preserve, or Informational**
Oil	Obtain
Precious metals	Obtain
Helium	Obtain
Shipwrecks	Obtain or Preserve
Coral Reefs	Preserve
Endangered Species	Preserve
Temperature	Informational
Algal blooms	Informational
Wind	Informational

Table 1. Dataset categorization

Each of the datasets is structured according to the example below. Please note that datasets represent a 100 by 100 grid of normalized values, with locations on land having a value of NaN. Also, note that due to data collection errors by WANBIS Corp's scientists, several rows of data are missing for each dataset (and the intern at fault was fired) and the quantity and location of missing data is not consistent between datasets. However, you can assume there is no noise in any of the collected data.

x	y	value
Integer	Integer	Float
…	…	…
Integer	Integer	Float

Table 2: Dataset format

3. Specific Solution Objectives

The problem is divided into multiple components

1. The code phase
    a. Selection of datasets to use
        i. A minimum of 1 acquisition and 1 preservation dataset must be used in conjunction with the coastline data. However, using more datasets in your design may result in a bonus point per extra dataset successfully incorporated into the design up to a maximum of 3 bonus points. Successful incorporation means each used dataset and its prioritization is in some way visualized as a component of the interface.
    b. Algorithm
        i. Your algorithm must find the coordinates of places where WANBIS Corp. can acquire the resource(s) you selected while avoiding preservation priorities.
    c. Interface
        i. The interface must visualize the coordinates output by the algorithm. This can be done as a list, a heat map, etc. Be creative!
        ii. The interface must be understandable to someone who has no knowledge of the algorithm you designed. It should be intuitive and easy for a user to interact with.
2. The presentation phase
    a. Presentation
        i. Your presentation must outline:
            1. The datasets you chose to incorporate and why
            2. The design and implementation of your algorithm
            3. The design choices that went into your interface
    b. Demo
        i. You will be expected to give a short demonstration of how your program works by interacting with your interface.
        ii. The program will be loaded on one of the Director's machines and must run on it. You can assume the Directors have installed any languages and packages you have specified in a README in your submission.

4. Further Expectations/Deliverables

You will have **8 hours** to complete this competition. At the 8 hour mark, all deliverables must be provided. Any changes made to the main branch of your repository after the deadline will not be considered part of your submission.

Code Deliverable:

- All code must be in the provided GitHub repository's "Main" branch before the 8-hour deadline in order for it to be considered for judging.
- Basic instructions must be provided in a README.md on how to compile and run your code. This includes:
    - The language and version your code uses
    - A list of required packages (i.e. Pandas, NumPy)
    - Any specifications of this sort not included in the README cannot be assumed to be on the Directors' machine(s)

Presentation Deliverable:

- Only presentations submitted in the provided GitHub repository's "Main" branch before the 8-hour deadline will be used in presentations to the judging panel. No work may be done on the presentation after the deadline has passed.
- Your presentation must outline:
    - The datasets you chose to incorporate and why
    - The design and implementation of your algorithm
    - The design choices that went into your interface

5. Judging Metrics

Programming Judging Matrix		
Strategy/Algorithm	Simplicity	/10
	Ingenuity	/10
	Ability to Achieve Desired Outcome	/15
		/35
Code	Structure	/10
	Consistency	/5
	Readability	/10
	Efficiency	/10
		/35
User Interface	Ease of Use	/5
	General Aesthetics	/5
		/10
Presentation	Design Process and Justification	/7
	Design Critique	/4
	Voice, Articulation and Timing	/4
	Visual Aids	/2
	Response to Questions	/3
		/20
Deduction Total		
Bonus Total		
Total		**/100**

The judges will use the above table to determine how well your team has met expectations.

The judging metrics, and all competition rules can be found in the CEC 2024 Rule Book.

Please be aware of the actions that can result in point deductions for your team. These are listed below in figure 1.

Programming Point Penalties	
Plagiarism	Elimination
Documents Received After Deadline	-50
Absent Team Member	-25
Entering presentation room before allotted time (after first offense)	-10
Total	

Figure 1. Penalty matrix

6. Sources

[1]
S. Ullas, “Our Impact: What resources do we extract from the Ocean?,” *Ocean Generation*, Aug. 11, 2022. https://oceangeneration.org/what-ocean-resources-we-extract/