Ontario Engineering Competition 2022

PROGRAMMING | COMPETITION PACKAGE

VERSION 1.1 - 11/28/2021

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Introduction

Contact information

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Rules and Guidelines

1. You may use the internet but copying code will be detected and penalized
2. You may not use a library or open source code to solve everything for you

Competition Schedule

Date	Time	Task	Platform
Saturday, Jan 22	10:00AM - 10:30AM EST	Openning Ceremony	Hopin
	10:20AM EST	Competition Package Released	Email
	10:30AM - 10:45AM EST	Briefing Period	Zoom
	10:45AM - 11:00AM EST	Question Period	Zoom
	11:00AM - 6:30PM EST	Competition Period	
	6:30PM - 7:00PM EST	Final Submission Period	
	7:30PM - 8:00PM EST	Dinner/Break	
	8:00PM - 11:00PM EST	Social	Discord
Sunday, Jan 23	7:30AM - 8:00AM EST	Presentation Schedule Released	
	8:30AM - 9:30AM EST	Team 1-3	Zoom
	9:30AM - 10:30AM EST	Team 4-6	Zoom
	10:30AM - 11:30AM EST	Team 7-9	Zoom
	11:30AM - 12:30PM EST	Team 10-12	Zoom

	12:30PM - 1:30PM EST	Lunch	
	1:30PM - 1:50PM EST	Team 13	Zoom
	1:50PM - 2:50PM EST	Break	Zoom
	3:00PM - 5:00PM EST	Judge Deliberation	Zoom
	5:00PM - 6:00PM EST	Open time	
	6:00PM - 7:30PM EST	Awards Gala	Hopin
	7:30PM - 8:00PM EST	Dinner/Break	
	8:00PM - 11:00PM EST	Social	Discord

Programming competition description

Problem Background

Every year, over 300 million tons of plastic are produced for a wide variety of uses across the globe. Some plastics can be recycled, but most are not. Unfortunately, at least 8 million tons of plastic end up in our oceans every year. This has devastating consequences for marine animals, climate change, and human health. The end of the plastic life cycle is upsetting. It may remain on the ground for hundreds of years, incinerated with producing toxic fumes as a result, in the hands of underpaid workers from developing countries, ingested by sea creatures, or end up in our own bodies. Minimizing plastic waste in the oceans has been a goal for environmentalists for decades. It is still a work in progress today.

Today, we will be simplifying and modeling the end of the plastic life cycle. There are many variables (human and environmental) which dictate where plastic travels. Your goal is to minimize the amount of plastic which ends up in the ocean.

The Challenge

Create a program that designs a plastic transportation and recycling system, and present the final system in a Graphical User Interface. In the final deliverable, your program should be able to calculate an advanced garbage transportation route based on the input parameters provided by users, and show it graphically.

The team would be provided with a set of csv files of the node maps with the following information at each node: locations in lat/lon, types (recycling facilities or plastic dumping point), the amount of plastic recycled or produced at each point, the risk of drops. All maps provided are legal, which means they would have at least one node for each facility type, and all nodes would have legal locations, amount of plastic and risks. The information of each node would be passed in the form of a list:

[ID, [latitude, longitude], type, amount of plastic (recycled or produced), risk%]

The team would also be given a validator function which validates the solution and measures the output of the algorithm quantitatively with a QoR value(quality of result). Please refer to the section “Assessment and Judging” for more information.

The team is expected to provide a csv file containing the solution for each given file. The solution should be an ordered list of nodes, starting with the first node in the given csv file (the first node is guaranteed to be a waste node). Each node should be of the same form as the nodes in the given csv file.

The team is also expected provide a GUI application including:

map	locations of all provided nodes, including recycling facilities, recreational beaches, commercial fishing, etc, should be marked clearly and be distinguishable based on their types
route	the starting, ending and passing nodes should be indicated as well as the directions in each segment of the route
data	these data should be analyzed: total amount of plastic produced, collected, recycled, lost, and ended up in the ocean; the total distance the path takes, and presented to show the performance of the program
interactive components	the GUI should provide interactive panels for users to customize input parameters (furthered explained in section “Assessment and Judging”) and present the results (QoR) with your program

Ideally, the program would provide users with an environment-friendly and economic solution, a route that could minimize the amount of plastic that is dumped into the ocean while keeping the costs needed for the transportation system at a tolerable level.

Competition deliverables

Output Files

You must submit a file named “*team_number*_*test_map_name*_output.csv” which provides the path the garbage will be processed in for each test case. Nodes in the csv file should take in the following format (same as the node in given maps):

- [ID, [latitude, longitude], type, amount of plastic (recycled or produced), risk%]

You must also submit a GUI application that can show the path solution with a given map.

readme.txt

Include in the submission folder readme.txt, with the following information:

- Administrative information such as names, emails of team members, group number, and project title
- Location of all code used for the project with directories
- Instructions to compile and run the project for the judges

Report

Include in the submission folder a brief, 2-page report outlining the engineering problem to be solved:

- Identify the stakeholders and the problem, explaining why the problem is relevant to stakeholders
- Identify the chosen solution and how it addresses the chosen problem
- Identify the target users
- Give a high-level overview of the solution design, including the algorithm and GUI
- Shortly summarize the design process, management process, and development process
- If there were required components that could not be constructed in the time given, highlight the mistakes made and provide an explanation on how the problem could be solved in the future
- If the solution included any open-source libraries, highlight the components that contain the code and if there is an alternative library that should have been used
- Indicate the core functions of the software and how the program's components work from a development standpoint
- Clearly mention the installation method, and any unique components of the solution that were not suggested in the problem.

Presentation

Include in the submission folder your final presentation for the judges demonstrating the solution and how it works. Oral presentations should:

- Be no more than 12 minutes in length, NOT including an 8-minute Q & A period
- Briefly summarize the contents of the report
- Walk the judges through the implementation, including technologies used and any difficult technical challenges the team has faced
- Demonstrate the solution with given test cases
- A set of hidden cases will be provided for all groups
- Include all team members
- Do not wear anything with your school name or logo

Assessment and Judging

Quality of Results

The Quality of Results is calculated in this formula: QoR = (a*amount of plastic in ocean + b*distance). The two parameters (a and b) are input parameters which would reflect the quality of

the result with a larger emphasis on the loss or the distance. It is positively related to the amount of plastic and distance and negatively related to run time. The smaller the QoR is, the better the application performs. The two parameters should be two decimals ranging from 0 to 1 and add up to 1.
QoRs of each algorithm would be compared with that of the naive solution provided by the leads as well as within all groups.

Time Limit

Participants would be given testing maps with three sizes: small, medium and large. Hidden maps with these three sizes would be used to test their program later. It is expected that the algorithm could satisfy the given time limit for both testing maps and hidden maps:

- Small maps: 0.5 seconds
- Medium maps: 6 seconds
- Large maps: 40 seconds

Marking rubric

OEC 2022 Programming Design Competition Rubrics			Team Name
1	Performance & Code/30	Able to generate solutions for given testing maps: QoR value will be evaluated against other teams	/5
		GUI is visually appealing and not distracting	/5
		Facilities are clear and labeled; Route is easy to see and follow	/5
		Solutions are found within given time limit	/5
		Required data is present and easy to find	/5
		Interaction is seamless with no lag	/5
		Performance Total Score	-
2	Strategy & Algorithm/20	How well the design meets the requirements	/5
		Appropriate user documents	/5
		Simplicity	/5
		Extra, relevant features and components	

			/5
		Strategy Total Score	-
3	Presentation /30	Design Process	/3
		Design Justification	/3
		Design Critique	/3
		Flow and Logic	/3
		Time allocation	/2
		Visual Aids	/1
		Team member participation	/3
		Response to Questions	/2
		Presentation Total Score	-
3	Demo & Testing /20	Able to generate solutions for hidden tests	/5
		Solutions are found within given time limit	/5
		Gui could function properly with hidden tests	/5
		Close QoR values for hidden tests as for the given tests	/5
		Demo & Testing Total Score	-
4	Penalties	Plagiarism	-50
		Insufficient Citation	-50
		Deliverables Received After Deadline	-50
		Absent Team Member	-25
		Disclosure of School in Presentation/Files/Documents	-10
		Program cannot compile/run	

			-50
		Program cannot respond to user input/give incorrect solutions/fail test cases	-20
		Presentation under/over time by more than 1 minutes	-10
		Penalties Total Subtracted	-
5	TOTAL /100		-