Teaching and Assessment Plan

Course: Information Technology
Title: Computer Programming
Grade: 12
Topic: Arrays, Files, and Searching

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2022 - 07 - 13
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“Be the one you love, do what you love.”

Here is the assessment plan for students in Grade Twelve in the K-12 system studying Information Technology. According to the plan, one of the modules of the computer programming course created and published by the Ministry of Education, Provincial of British Columbia will be covered.

Arrays, Files, and Searching is a four-week module that will ensure learners can work with “Lists” and “Files” by the end.

During the course, it is necessary to recognize capable students with prior knowledge as teacher assistants and learners unfamiliar with specific topics.

We will also need to repeatedly assess the students' performance during the module to identify any shortcomings in the lesson plan, so we will need an ongoing assessment plan that would allow us to modify the teaching strategy accordingly.

There should be no limit to students' creativity in the lesson or assessment plan. During the lesson, they should be able to use a different method and whichever technique they feel most comfortable with. In addition to evaluating their technique, the final assessment will also assess their creativity and critical thinking skills.

The skill of working with data files from scratch is essential, as is identifying the issues with others' code, fixing them, and making improvements based on their understanding and knowledge.

According to the requirements, the assessment plan should include four weekly assessments. A diagnostic assessment would be the first one, followed by two formative and summative assessments at the end.

During the first session, a diagnostic assessment identifies students with prior knowledge, skills, preconceptions in working with List and Files, and their ability to assist the teacher and other students in a group learning environment. As a result, all groups have relatively sufficient shared knowledge.

We need to ensure that students feel comfortable about the diagnostic assessment results. In other words, students know the assessment results will only be used to adjust the teaching strategy and will not affect their future grades.

During the next two weeks, formative assessments will be held to monitor the learning process and provide feedback. After a formative assessment, students should receive immediate and ongoing feedback on their progress and weaknesses.

In addition to improving knowledge, skills, and understanding, formative feedback motivates students to learn new concepts. Furthermore, they can help students correct misconceptions and reduce their uncertainty about their performance.

Note: You might consider sharing each student's solution so that others in the class can benefit from it.

From a teacher's perspective, they can be used to identify gaps in teaching strategies and adjust the plan accordingly.
The final assessment would be a summative assessment to determine students' knowledge about the Arrays, Files and Search functions. Assessments of learning would occur at the end of a unit.

The content of the summative assessment should be consistent with the formative assessment; no new or complex questions compared to the formative assessments should be asked.
The summative assessment should include a Rubric to inform students what is expected from them and demystify grades by clearly stating. In addition, Rubrics help teachers have measures to monitor a student's learning process and develop and revise a lesson plan.
The final assessment would be 50 percent of the total grade terms of grading. 30 percent would be calculated based on the formative assessments. The final 20 percent would be based on the students' progress and their willingness to learn, their creativity during the formative assessments, and in group activities that their teammates would give.

Course: *Grade 12 - Information Technology - Computer programming* ***Module:*** *Arrays, Files, Search - 4 weeks*	***Date:*** -

Learning Objective:

- *Create programs that apply the use of file techniques*
- *Create programs that use and manipulate array structures to solve problems*
- *Apply structured programming techniques to solve complex problems*
- *Read and make improvement to legacy programs*

Course Delivery

Week	Teacher Activity	Learning Activity	Assessment Type	Timing	Assessment Format
1	Teacher should define different type of List (Array, Map, Set, ...) Define the complexity definition. Also, teachers should explore the use cases of having a "List," and working with files in different types of programs. After the Diagnostic Assessment teacher should be able to make groups of 3 based on the result of the assessment.	Students will name situations where they can use Arrays Or Files and search functions in programs. Also, they will watch a video from Mosh Hamedani that explains the concept in the most convenient way JavaScript Arrays And investigate Space and Time complexity samples from Time Complexity and Space Complexity - GeeksforGeeks	Diagnostic Assessment.	During the session, After exploring the applications	For this assessment, we will use Kahoot! Platform Students will face codes that use arrays and the need to identify the code's complexity (both space and time) and define the type of List. Also, the teacher can ask them verbally to provide a better solution time/space-wise

	to have balanced groups for future assessments and activities.				
2	Teacher will give each group a set of files containing a list of structured data. Also, they will lecture about the capabilities of arrays and why it is important to have a great understanding of writing optimized code when using arrays (computational cost of working with list). Also, they should introduce the basic functionality, available for arrays and libraries that they need to work with files such as IO libraries or JSON libraries	Students in each group should work on a given file containing an array of data. They should be able to communicate and brainstorm to read the file, manipulate data inside it, and save it as a new file. The activity is a group activity and should be monitored by teachers or teacher assistants.	Formative Assessment (Assessment for learning)	As homework after the second session, students have enough time to practice and find the different solutions for each question.	Students will be provided with a story related to a coffee machine. They need to use their knowledge about working with files and arrays and a search function to write the program for the required questions. The whole assessment include 3 parts of coding and 2 parts of definition understanding. They need to write the code and find the complexity of their code.
3	Teachers should prepare a code with known complexity issues, both	Students will be given a code that is manipulating an array, and they need to discuss the	Formative Assessment (Assessment	At the last part of the session	It is a formative assessment, in the format of the in-class project.

	time and space. For this matter, teachers can use websites such as LeetCode Also, they should prepare different levels of hints for each step during students' trial and error, so in this way, they can provide them with immediate and ongoing feedback.	Complexity issues with the code in their groups and try to write it in a more efficient way.	for learning)	(around 15 minutes).	They will be given a question and an answer related, They have to discuss the solution and identify the problems in the given code at first and then be able to re-write the code and apply any improvement to make it less complex in terms of time AND space.
4	This will be a wrap-up session. Teacher will check the previous formative assessments during the class and discuss the problem students had in each assessment. Teachers should act as mentors and guide students through a brainstorming session.	Student will have a brainstorming session, and everyone will share the knowledge and their solution with other students so all of them can see a different solution to a problem and have a greater Idea.	Summative Assessment (Assessment of learning)	It will take an hour at the end of the session	It will be a given project (story), In addition, a set of definition questions and reading code question, students should do it individually, and they should not share the code to others. The first set of questions is related to their knowledge of basic definitions, such as types of arrays and complexity definitions. The second set of questions is a given story; they should write the code to solve the problem.

					The third part of the assessment would be a given code and students should able to read and understands the code.

Success Criteria

- *Students be able to classify variables requiring an array structure*
- *Students be able to select appropriate searching and reading files techniques*
- *Students be able to extract subsets of data from an array*
- *Students be able to define and calculate time complexity and space complexity*
- *Students be able to understand a written code and make improvements without changing the output*

Array, File, and Search assessment
(Diagnostic Assessment - Week 1)

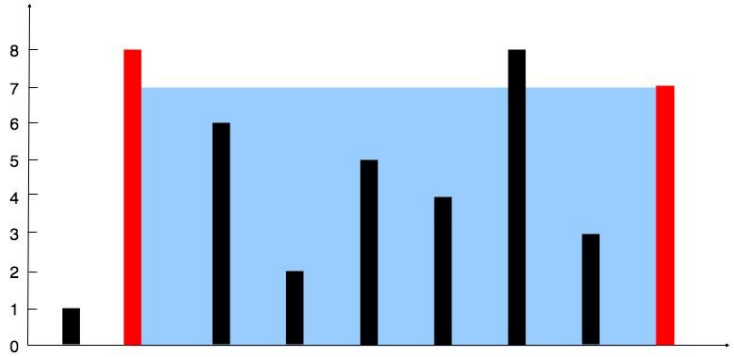
Note:
For this assessment, we will use Kahoot! Because the score at the end would be a big help for the teacher.

A) Which capability of Array should be used for a delete flow?
B) What capability of the Operating System should be used to add a new item to the order list?
C) Which capability of Array should be used for extracting a subset of an array?
C) Which capability of Array should be used to filter data?

Array, File, and Search assessment
(Formative Assessment - Week 2)

Note: Assessment is a shared in-class project

A) Find the maximum amount of water a container can store. (Each line is a side of the imaginary containers)



Source of the question: https://leetcode.com/problems/container-with-most-water

B) How we can improve the answer to have a better performance?

C) Discuss other solutions?

Answer

```
var maxArea = function(H) {
    let ans = 0, i = 0, j = H.length-1
    while (i < j) {
        ans = Math.max(ans, Math.min(H[i], H[j]) * (j - i))
        H[i] <= H[j] ? i++ : j--
    }
    return ans
};
```

Array, File, and Search assessment
(Formative Assessment - Week 3)

A) Write a flow of the below application:

A coffee ordering machine program that stores each customer's data throughout the day, along with their orders. Customers' orders should be processed according to the priority they give as input.

1. Design the model and properties for each order.
2. Use files, arrays and sorting functions to solve the problem.

Hints:

1. You can use one or multiple files to store the order data, and the flow would be different depending on the way you choose. The flow would be different.

Array, File, and Search assessment
(Summative Assessment - Week 4)

INSTRUCTIONS

- Students should not communicate or pair programs with other students.
- Students shall not share the answers before the end of the exam
- Students are free to use any IDE they prefer
- Students are allowed to leave the class if they finish the exam before the time ends.

PART 1

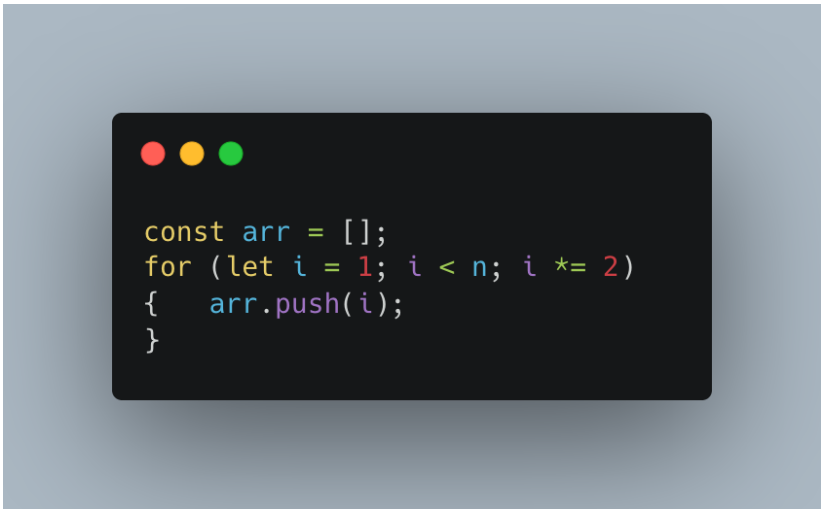
Definitions and concepts

1. What is the difference between Map, Set, and List?

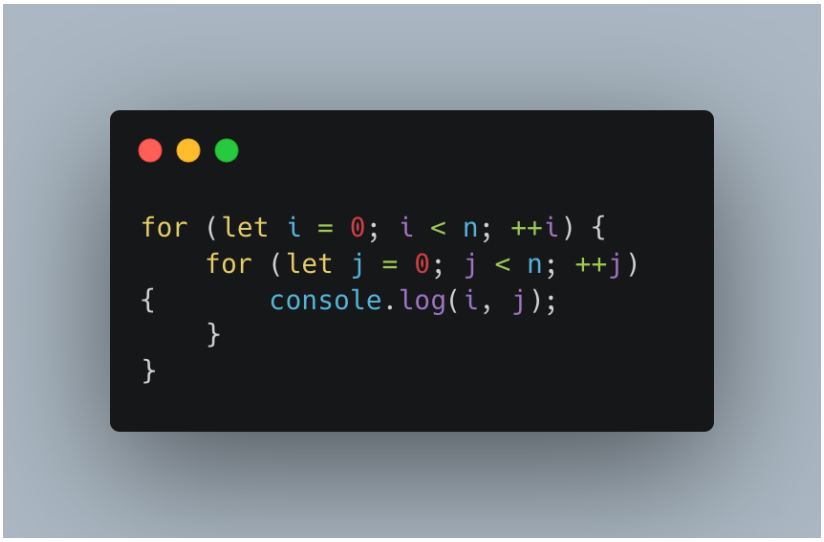
2. What is time complexity? Why should we care about time complexity?

3. What is space complexity? Why should we care about space complexity?

4. Calculate the time complexity for the given code?



5. Calculate the space complexity of the given code?



PART 2

Write an application that is described below:

A coffee machine that is able to get the name of a person and their order (including the name of the order, ingredient, time, and number) and store them in a human-readable file.

Coffee machine specialists would be able to search for a specific person and see the history of the order, and also should be able to search orders based on the coffee name. Moreover, they should be able to get analytics data based on the order.

Analytical data should cover

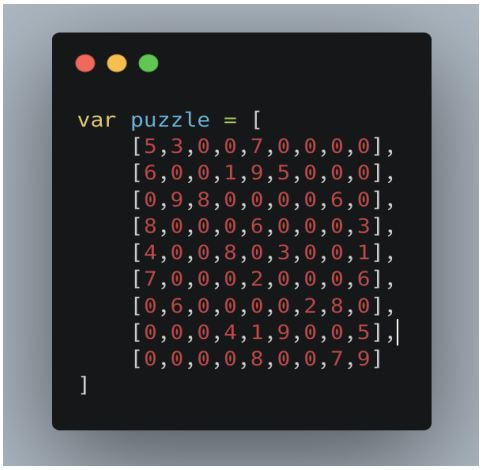
a. How many orders are served during the day
b. How much money has been spent on this coffee machine
c. Which day had been the most successful day in terms of the number of orders or income of the orders

Note: Consider finding write best possible code in terms of time and space complexity.

PART 3

```
function sodukuSolver(puzzle) {
    var nonPossibilities  = {},impossibleNumbers,emptySpaces = 81;
    while(emptySpaces>0){
        emptySpaces = 0;
        for (var vert =0; vert < puzzle.length; vert++) {
            for (var horz = 0; horz<puzzle.length; horz++) {
                nonPossibilities = {};
                if (puzzle[vert][horz] === 0) {
                    for (var i = 0; i < 9; i++) {
                        if (puzzle[vert][i]>0) {
                            nonPossibilities[puzzle[vert][i]] = true;
                        }
                        if (puzzle[i][horz] >0) {
                            nonPossibilities[puzzle[i][horz]] = true;
                        }
                    }
                    for (var vertBox = Math.floor(vert/3)*3; vertBox<Math.floor(vert/3)*3+3; vertBox++)
{
                        for (var horzBox = Math.floor(horz/3)*3; horzBox<Math.floor(horz/3)*3+3;
horzBox++) {
                            if (puzzle[vertBox][horzBox]) {
                                nonPossibilities[puzzle[vertBox][horzBox]] = true;
                            }
                        }
                    }
                    for(i = 0; i<10; i++){
                        // console.log('new-nonPossibilities',nonPossibilities[i],i);

                    }
                    console.log();
                        let ID = String(vert+1)+String(horz+1);

                    impossibleNumbers = Object.keys(nonPossibilities);

                    if (impossibleNumbers.length === 8) {
                        for(var i =1; i<10; i++){
                            if (impossibleNumbers.indexOf(i.toString()) < 0) {
                                document.getElementById(ID).innerHTML = i;
                                document.getElementById(ID).classList.add("current");

                                puzzle[vert][horz] = i;
                            }
                        }
                    }else{
                        emptySpaces++;
                    }
                }
            }
        }
    }

    for(var vert = 0; vert<puzzle.length; vert++){
        var row = '';
        var n = 2;
        for(var horz = 0; horz<puzzle.length; horz++){
            row +=(puzzle[vert][horz]);
            if (horz == n && n < 8) {
                row += '|';
                n = n + 3;
            }
        }
    }
    return print(puzzle);
}
```

1. Calculate the time and space complexity of the given code.
2. Re-write the code with lower time complexity
3. Re-write the code with lower space complexity



```
var puzzle = [
    [5,3,0,0,7,0,0,0,0],
    [6,0,0,1,9,5,0,0,0],
    [0,9,8,0,0,0,0,6,0],
    [8,0,0,0,6,0,0,0,3],
    [4,0,0,8,0,3,0,0,1],
    [7,0,0,0,2,0,0,0,6],
    [0,6,0,0,0,0,2,8,0],
    [0,0,0,4,1,9,0,0,5],
    [0,0,0,0,8,0,0,7,9]
]
```

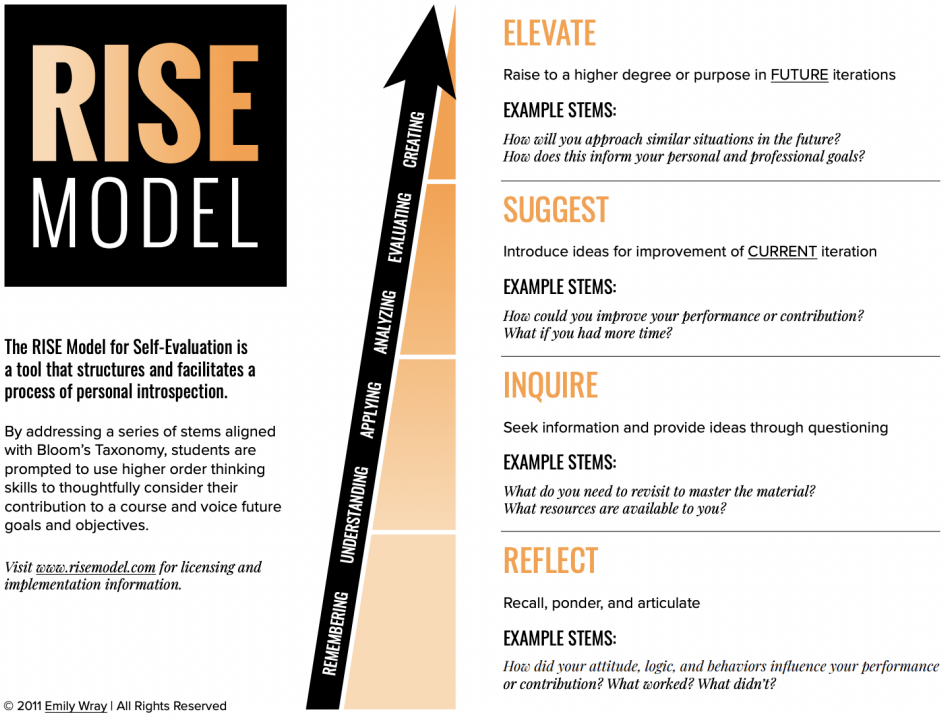
Rubric

Part 1 (25 pts)	(Excellent)	(Good)	(Fair)	(Poor)
Definitions	All definitions answered completely (14-15)	All definitions answered but has some minor misconception (10-14)	Not all questions answered and have minor misconceptions in answers (2-10)	Not all questions answered and have major misconceptions in answers (0-1)
Time and Space complexity calculation	Both answers are correct (10	Only one is correct (5)	-	No correct answer (0)
Part 2 (45 pts)	**(Excellent)**	**(Good)**	**(Fair)**	**(Poor)**
Program execution	Program executes correctly with no syntax or runtime errors (18-20)	Program executes with a minor (easily fixed error) (12-18)	Program executes with more than one error (easily fixed error) (4-12)	Program does not execute (0-4)
Design of logic	Program is logically well designed (14-15)	Program has no error but run with higher that expected time and space complexity (10-14)	Program has significant logic errors, but still can result the expected output (4-10)	Program is incorrect, wrong output and wrong choose of libraries or type of List (0-4)
Standards	Program is stylistically well designed, well documented and explains the reason behind each logic (7-10)	Few inappropriate design choices (i.e. poor variable names, improper indentation) (4-6)	Several inappropriate design choices (i.e. poor variable names, improper indentation) (2-3)	Program is poorly written (0-1)

Part 3 (35 pts)	(Excellent)	(Good)	(Fair)	(Poor)
Understanding the code	Calculate the time and space complexity of the code correctly and explain each step of the calculation (13-15)	Calculate the time and space complexity the have lack of explanation for each step (8-13)	Not able to calculate the code complexities correctly and have incorrect explanation (2-8)	Not able to calculate or explanation any of the complexities (0-1)
Re-write with less time complexity	Be able to re-write the code in the optimum time complexity (9-10)	Be able to re-write the code in a lower but not the optimum time complexity (5-9)	Not able to re-write the code completely or have a broken result at the end (0-5)	-
Re-write with less space complexity	Be able to re-write the code in the optimum space complexity (9-10)	Be able to re-write the code in a lower but not the optimum space complexity (5-9)	Not able to re-write the code completely or have a broken result at the end (0-5)	-

Feedback note

In order to provide more effective feedback, I suggest using the RISE model. With the RISE model, feedback can be given and received in a structured and meaningful way. [https://www.risemodel.com].



The following characteristics should be considered when providing feedback: [https://www.queensu.ca/teachingandlearning/modules/assessments/13_s2_05_characteristics_of_feedback.html]

Timely

Feedback needs to come when students are still mindful of the topic or assignment. To be effective, it has to come while they are still working towards their learning goal.

Goal-directed

Firstly, formative feedback must clearly communicate the desired learning goals, followed by the criteria for successfully reaching these goals.

Encourages Self-Assessment

Successful formative feedback entails a high level of self-assessment. Student self-assessment is a process in which students monitor and evaluate their own performance and identify strategies necessary to reach their desired learning goal.

Descriptive

Feedback is more effective when it provides details on how to improve, rather than simply to verify whether or not the answer was correct. Feedback should be evidence-based and linked to the intended learning outcomes.

Ongoing

The more feedback students receive during the learning process, the more opportunities they have to adjust their current performance to achieve their desired outcome.

Collaborative

The formative feedback process must be collaborative between the instructor and students. Apart from providing the learning goals and outlining the criteria required for success, the instructor must also support students as they monitor and control their learning procedure.

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