B2.2

Data structures

CHAPTER ASSIGNMENT

Name _____ Class _____ No. _____ Date _____

Answer every question in the space given. Show your working. You may use the chapter page to help you.

Questions from *Computer Science for the IB Diploma*, 1st edition (2025), Paul Baumgarten, Ioana Ganea, Carl Turland (Hachette Learning), for classroom use.

Programming Exercises — 1D Arrays and Lists (p. 346)

1. Construct a program that creates a 1D array or list that stores six integer values. Output true if the first element in the array is the same as the last element in the array.

2. Construct code that requires the user to enter a number. Use that number as the size of an array or list of integers to be inputted from the keyboard. Calculate the sum of all even numbers in the array or list; calculate the average of all its elements; and count how many of those elements are odd numbers. Display those values.

3. Construct a program that creates an array or list that stores five names. Copy those elements in a second array or list in reverse order. Display the second array or list.

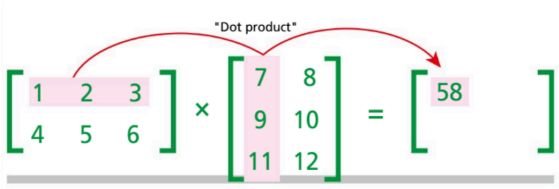
Programming Exercises — 2D Arrays and Lists (p. 349)

1. Construct code that creates a two-dimensional array or list with three rows and three columns. Fill it with values read from the keyboard. Calculate the sum of all values and their average, and display the results.

2. Construct a program that creates a two-dimensional array or list with three rows and three columns. Display the sum of all elements per column. Display the average of all elements per row.

3. Construct code that creates a two-dimensional array or list with three rows and three columns that stores random numbers. Display the array and output the sum of all the elements on the principal diagonal. Calculate the sum of the elements on the secondary diagonal and display this value as well.

4 Matrix calculations are used extensively in machine learning within Computer Science. The following constraints exist to calculate a dot product: width of matrix A must match height of matrix B. Given two 2D arrays (lists) of integers that represent matrices, construct a program to calculate and solve the dot product of those two matrices.



Programming Exercises — ArrayLists and Dynamic Lists (p. 352)

1 Construct programming code to create an ArrayList in Java or a dynamic list in Python that stores five colours.

(a) Construct code to insert a sixth colour after the third.

(b) Change the element at the second position to a different colour.

(c) Delete the last element.

(d) Display the new data structure.

2. Construct a program that creates an ArrayList in Java or a dynamic list in Python that stores three numbers.

(a) Append three more values to the end of the data structure.

(b) Display the size of the data structure.

(c) Display the first element.

(d) Store the first element into a variable.

(e) Replace all the other elements with this value.

(f) Display the new values.

3. Construct a program that creates an ArrayList in Java or a dynamic list in Python that stores three different numbers.

(a) Store the second value into a variable and insert it into the data structure at the end.

(b) Display the index of the first occurrence of that value.

4. Construct programming code that creates an ArrayList in Java or a dynamic list in Python that stores four different values.

   (a) Display all the elements.

   (b) Swap the values of the second and third elements.

   (c) Display the new data structure.

Review Questions — Stacks and Queues (pp. 356–357)

1. Define the term "stack".

2. Define the term "queue".

3. Identify the main operations of a stack.

4. Identify the main operations of a queue.

5. Explain the FIFO and the LIFO principles and how they apply to stacks and queues.

6. Identify a real-life scenario where you could use a stack.

7. Identify a real-life scenario where you could use a queue.

8. Outline a situation where the use of a stack might be more efficient than the use of a queue.

9. Outline a situation where the use of a queue might be more efficient than the use of a stack.

10. Identify a scenario where you might combine a stack and a queue within the same program.

11. You must store a list of numbers in a particular sequence and then retrieve them in reverse order. Identify the data structure that is most suitable for this task and explain your reasoning.

12. Outline three uses of a stack.

13. Outline three uses of a queue.

14 Describe two characteristics of a stack.

15 Describe two characteristics of a queue.

16 Compare the use of a stack with arrays or lists.

17 Compare static and dynamic data structures in terms of data storage and data access.

18 Explain the meaning of stack overflow and stack underflow and describe when they occur.

19 Use a stack to evaluate the following arithmetic expression: `5 2 * 3 2 + -`

Programming Exercises — Stacks and Queues (p. 357)

1. Construct a program that creates a stack that has a maximum size of seven elements. Push five words into the stack. Display the top element. Pop two words from the stack and display the top element.

2. Construct a program to reverse the elements from a given queue using a stack.

End of assignment · Check your answers against the chapter at gurujazzy.com/subjects/ib-computer-science/b2-2-data-structures/