

33 September 2022

1. **Warm up:** Answer the following True / False questions.

- (a) The enumeration type `enum` is an ordered list of any other data type.
- (b) Both array and enumeration types can have repeated elements.
- (c) Arrays are always allocated a fixed size.

2. This question is about operations on arrays.

- (a) Create a function that takes in two arrays and returns their inner product (considering the arrays as vectors):

$$\begin{bmatrix} x_1 & x_2 & \cdots & x_n \end{bmatrix} \begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{bmatrix} = x_1y_1 + x_2y_2 + \cdots + x_ny_n.$$

Do not use the `vector` header. If the arrays are not of the same length, a message should be printed to the user.

- (b) Create a function that takes in two arrays and returns their outer product (considering the arrays as vectors), as a two dimensional array:

$$\begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{bmatrix} \begin{bmatrix} y_1 & y_2 & \cdots & y_m \end{bmatrix} = \begin{bmatrix} x_1y_1 & x_1y_2 & \cdots & x_1y_m \\ x_2y_1 & x_2y_2 & \cdots & x_2y_m \\ \vdots & \vdots & \ddots & \vdots \\ x_ny_1 & x_ny_2 & \cdots & x_ny_m \end{bmatrix}$$

Do not use the `vector` header. In this case, the arrays could be different lengths.

3. Create a function that takes as input a positive integer `size`, and prints out a two dimensional array with as many rows and columns as the integer, and a specific placement of 1's and 0's. For example:

$$\text{size} = 5 : \begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 & 1 \end{bmatrix} \quad \text{size} = 6 : \begin{bmatrix} 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 0 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \quad \text{and so on.}$$

4. Create a function that asks the user for an input string, and prints out how many vowels, consonants, and punctuation marks (all symbols that are not letters) the string has. For example, if the user input `Hello, world!`, then the function should print

```
vowels: 3
consonants: 7
punctuation marks: 3
```