

Program 1

[35 Marks]

You are given an incomplete program source code named `program1.cpp`. The program is intended to perform array manipulations consisting of adding and removing elements to/from an array. A class named `Array` has been defined in the program for this purpose. The array is specified such that it can only hold up to three elements. The elements are stored in the attribute `data`, whereas the number of elements currently held by the array is kept in the attribute `count`. When an element is added, `count` is increased by 1, and it is decreased by 1 if an element is removed. The class needs to provide a bound-error checking whereby elements cannot be added anymore when the array is already full. Similarly, removing an element cannot be accomplished if the array is empty. Also, accessing an element is allowable only if a valid index is used.

Complete the program according to the tasks stated in the program source code. The tasks are labeled as Task 1 to Task 9.

Figure 1.1 to 1.2 show example runs of the complete program for three types of cases. Note that, the **bold** texts indicate user inputs entered from the keyboard.

```
Number 11 has been added. Current number of element = 1
Number 22 has been added. Current number of element = 2

Enter the index of the element you want to display => 0
Index: 0, Element: 11

Number 33 has been added. Current number of element = 3
The array is full.

An element has been removed. Current number of element = 2
An element has been removed. Current number of element = 1
An element has been removed. Current number of element = 0
The array is empty
```

Figure 1.1: The user has entered a valid index for the element to be displayed. In this case, the value of the corresponding element will be displayed.

```
Number 11 has been added. Current number of element = 1
Number 22 has been added. Current number of element = 2

Enter the index of the element you want to display => -2
Error! You have entered a negative index.

Number 33 has been added. Current number of element = 3
The array is full.

An element has been removed. Current number of element = 2
An element has been removed. Current number of element = 1
An element has been removed. Current number of element = 0
The array is empty
```

Figure 1.2: The user has entered a negative index. In this case, an error occurs as the array should start at the index 0.

```
Number 11 has been added. Current number of element = 1
Number 22 has been added. Current number of element = 2

Enter the index of the element you want to display => 2
Error! You have entered index value of 2
    while the current number of elements is 2

Number 33 has been added. Current number of element = 3
The array is full.

An element has been removed. Current number of element = 2
An element has been removed. Current number of element = 1
An element has been removed. Current number of element = 0
The array is empty
```

Figure 1.3: The user has entered an index that is larger than the valid value the array currently has. In this case, the array is currently holding only two elements. That means, the valid index should be 0 or 1. Thus, an error occurs when the user is trying to access the element at index 2 (i.e., the third element)