Name:.....

Student ID:.....

Assignment # 1: Arrays

1. In your own words, describe the definition of an array.

2. Given a 1-D array:
   Start Address is 1000,
   element size is 4,

What is the address of the element at index 10? Also, provide the calculation.

3. Given a 1-D array:
   Start Address is 2000,
   address of the element at index 20 is 2160,

What is the element size of this array? Also, provide the calculation.

4. Given a 2-D array of rank 3 of size 4:
   Start Address is 3000,
   element size is 4,

What is the address of the element at index (2,3)?
Also, provide the calculation.
Reminder: rank index starts at 0.

5. Given an array below:

9	10	5	7	3	1	0	2

5.1 Write the Python operations used and asymptotic running time *O*(?) executed for each operation to obtain the array below.

9	10	5	7	3	1		

5.2 Write the Python operations used and asymptotic running time $O(?)$ executed for each operation to obtain the array below.

9	10	7	3	1			

5.3 Write the Python operations used and asymptotic running time $O(?)$ executed for each operation to obtain the array below.

12	10	7	4	8	3	1	

5.4 Write the Python operations used and asymptotic running time *O*(?) executed for each operation to obtain the array below.

1	3	8	4	7	10	12	

5.5 Write the Python operations used and asymptotic running time O(?) executed for each operation to obtain the array below.

1	3	4	7	8	10	12	

6. Consider a case study, suppose Facebook database keeps a list of usernames. When a user tries to log into Facebook website, a search is queried into the database looking for the entered username. If their username is in the list of usernames, that user can log in.

   In this case, can you use an array to store the list of usernames? And why?

7. Tic-tac-toe is a game played on a 3-by-3 board. This can be represented by a 2-D array of rank 3, size 3. Two players ‘X’ and ‘O’ take turns in placing their marks in the cells on the board. The player who succeeds in placing three of their marks in a horizontal, vertical, or diagonal row or column is the winner.

   A 2-D array of tic-tac-toe call ‘board’ is as follows:

Index	0	1	2
0	(0,0)	(0,1)	(0,2)
1	(1,0)	(1,1)	(1,2)
2	(2,0)	(2,1)	(2,2)

   Write all winning conditions for this game by using 2-D array elements.

For example, board[0][0] == board[0][1] == board[0][2].

8. Using Python or pseudocode, write an algorithm for binary search for a sorted sequence.
   - Parameter low and high should be initialised first outside the loop.
   - Think carefully what should be the condition for the while loop to stop executing (Hint: think about what should occur when low and high have the same index).
   - For if-else condition, it should compare whether target value is less than or more than the data[mid], and then assign new high or low accordingly.

```
def binary_search_iterative(data, target):
  """ Return True if target is found in the given Python list."""
  #Add your code here
  while #Add your code here:
    #Add your code here
    if target == data[mid]:
      return True
    elif #Add your code here:
      #Add your code here
    else:
      #Add your code here
  return False
```