Ho Chi Minh University of Technology
Department of Computer Science and Engineering

Programming Technique

Test 2

Duration: 120 minutes.

Note: Do not copy. If any hint of plagiarism is found, both students will receive 0.

Problem 1 (2 points).

Given two N-dimensional vectors of type float:

$$x = [x_0, x_1, \ldots, x_{N-1}]$$

$$y = [y_0, y_1, \ldots, y_{N-1}]$$

Compute their dot product:

$$x \cdot y = \sum_{i=0}^{N-1} x_i y_i$$

Note: N is input from user, values of x and y are randomly generated.

Problem 2 (2 points).

Write a function that receives a Math score and an English score. Return the average value of them **and** the bigger score between the two.

Problem 3 (2 points).

a) Define a new class called Vehicle with the following protected properties (0.5):
- Integer NumberOfWheel
- Float MaxFuel
- Float MaxVelocity

b) Define two new classes of your own (car, motorbike, truck, van, etc.), inherited from the above class. Implement their constructors so that a user can initialize NumberOfWheel, MaxFuel and MaxVelocity when he creates a new instance of the class.

c) Add another static member into the base class Vehicle called NumVehicle. This variable is 0 at the start of the program. Rework on your previous codes so

that each time you create a new instance (of car, motorbike, truck, van, etc.), NumVehicle **automatically** increases by one (0.5).

Problem 4 (2 points).

Given an 8 x 8 character array:

Allow the user to enter the position of the Queen (denoted 'Q'), the King (denoted 'K'), and the Bishop ('B'). The rest of the empty tiles are 'X' (but they are not drawn in the above picture for clarity). Check if the Queen can eliminate the King, knowing that a Queen can freely move in the following directions:

- Horizontally.
- Vertically.
- Diagonally.

If the King is on one of the possible paths of the Queen, the King is eliminated. Print "Checkmate" if the King is eliminated. Otherwise, print "Stalemate".
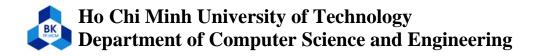
However, if the Bishop lies between the King and the Queen, the King survives. Print "Stalemate". Example:

Problem 5 (1 points).

Capitalize a string. For example:

"abDe" -> "ABDE".

"Xm10o" - > "XM10O".

Problem 6 (1 points).

Write a recursive function to convert a number from decimal to binary. You must use the following prototype:

```
bool isSymmetric(int n)
```

Do not use loop structure. A single digit is always symmetric.

Hint: you can use math library.