MAT2440, Classwork26, Spring2025

ID:_____ Name:_____

1. The definition of an **Algorithm**:

   An algorithm is a finite sequence of precise instructions for performing a computation or for solving a problem.

2. The introduction of **Pseudocode**:

   Algorithms in English - - → Pseudocode - - → Programming language

3. The structure of a pseudocode (procedure, statements, and return):

   procedure: Name of the code (input: description of input(s))

   statements: Assignments

   Conditional statement (**if** condition **then** statement)

   Loop Constructions (**for** loop, **while** loop)

   return: Variable which is the output(s)

4. A pseudocode of summation:

procedure *summation*($a_1, a_2, \cdots, a_n$: a list of n numbers)
$n :=$ the length of $\{a_i\}$
sum := 0 (which is a variable to store the summation)
for $i := 1$ **to** n (a **for** loop)
    $sum := sum + a_i$ (adding each number to *sum*)
return sum

How does this pseudocode work?

Initialization: sum = 0

i	*sum*
$i = 1$	$= sum + a_1 = 0 + a_1 = a_1$ (sum=0 ⇒ sum=a_1)
$i = 2$	$= sum + a_2 = a_1 + a_2$ (sum = a_1 ⇒ sum=a_1+a_2)
⋮	⋮
$i = n$	$sum + a_n = a_1 + a_2 + a_3 + \cdots + a_{n-1} + a_n$

Return: $sum = a_1 + a_2 + \cdots + a_n$

5. Algorithm and Pseudocode of **Finding the Maximum Element in a Finite Sequence**.

Problem: Let $a_1, a_2, \cdots, a_n$ be a list of n numbers. Find the largest value of them.

Algorithm:

(1) Set temporary maximum *tempMax* equals the first element a_1

(2) Compare a_2 to *tempMax:*

if $a_2 >$ *tempMax* , then *tempMax* = a_2.

if $a_2 <$ *tempMax* , then do nothing.

(3) Repeat the previous step for a_3, a_4, ⋯, a_n.

(4) The variable *tempMax* at this point contains the largest value in the sequence.

Pseudocode:

procedure *max*($a_1, a_2, \cdots, a_n$: a list of n numbers)
$n :=$ the length of $\{a_i\}$
tempMax := a_1
for $i :=$ 2 **to** n
    if *tempMax* $< a_i$ **then** *tempMax* := a_i
return tempMax { *tempMax* is the largest element}

6. An example of finding the maximum element in a finite sequence:

Let the sequence be {3, 1, 5, 6, 4}.

Initialization: *tempMax* = 3 and n = 5. ← the length of the sequence

i	a_i	*tempMax* $< a_i$ (T or F?)	*tempMax*
$i = 2$	1	3 < 1 (F)	3
$i = 3$	5	3 < 5 (T)	5
$i = 4$	6	5 < 6 (T)	6
$i = 5$	4	6 < 4 (F)	6

Return: *tempMax* = 6.

7. Write down an algorithm of **finding the Minimum Element in a Finite Sequence**.