

Trace Tables

1. Note: A string is an array of characters. For example, in this method the element referred to by STR[9] is the 10th element in the string and STR[0] refers to the first element in the string.

A single space character is represented as " " in the algorithm.

```
double CALC(String STR)
  C = 0
  S = 0
  T = 0
  loop until STR[S] = "."
    if STR[S] = " " then
      C = C + 1
    else
      T = T + 1
    end if
    S = S + 1
  end loop
  return T / (C + 1)
```

- a. Complete the trace table below for the following call to method CALC("it is.").

Note: First line of chart is variable initialization before entering loop.

Loop Iteration	STR	C	S	T	STR[S]
0	it is.	0	0	0	
1	it is.	0	1	1	i

- b. State the value returned by the method.

2. The following is an algorithm for a method named prime.

```
boolean PRIME(int NUMBER)
    FACTOR = 2
    FOUND = false
    P = false
    loop while (FACTOR * FACTOR) <= NUMBER AND NOT FOUND
        if NUMBER mod FACTOR = 0 then
            FOUND = true
        end if
        FACTOR = FACTOR + 1
    end loop
    P = NOT FOUND
    return P
```

- a. Complete the following trace table for the call PRIME(9).

Loop Iteration	Number	FACTOR	FOUND	P

- b. Use trace table to determine the return value when PRIME(20) is called.

Loop Iteration	Number	FACTOR	FOUND	P

- c. Use trace table to determine the return value when PRIME(17) is called.

Loop Iteration	Number	FACTOR	FOUND	P

3. Describe how the algorithm in the PRIME method works.

4.

Given the following array

NAMES

[0]	[1]	[2]	[3]	[4]
Robert	Boris	Brad	George	David

and the following algorithm, which is constructed to reverse the contents of array NAMES

```
N = 5 // the number of elements in the array
K = 0 // this is the first index in the array
```

```

loop while K < N - 1
    TEMP = NAMES[K]
    NAMES [K] = NAMES [N - K - 1]
    NAMES [N - K - 1] = TEMP
    K = K + 1
end loop

```

a. Trace the algorithm, showing contents of the array after each execution of the loop.

NAMES

[illegible]

- b. Explain why the algorithm does not reverse the contents of the array **NAMES**, and how this could be corrected.

5. The names of the members of a cycling club are stored in an array **NAMES** as shown below.

[0]	[1]	[2]	[3]	[4]	[5]
JONES	SMITH	GOMEZ	SINGH	BUTLER	HU

After a competition, an array of positions **POS** is formed as follows.

[0]	[1]	[2]	[3]	[4]	[5]
2	4	2	3	1	5

There was a tie for second place.

Consider the following algorithm fragment. The arrays **NAMES**, **POS**, and **TEMP** are all declared with a size of 6.

```

loop I from 0 to 5
    TEMP[I] = "ZZZ"
end loop
loop I from 0 to 5
    TEMP[POS[I]-1] = NAMES[I]
end loop
loop I from 0 to 5
    NAMES[I] = TEMP[I]
end loop

```

- a. Complete the following trace table for values 0 to 5 in the second loop of the algorithm.

I	POS[I]	TEMP[POS[I]-1]

- b. List the contents of the array **NAMES** after the third loop has been executed.

[0]	[1]	[2]	[3]	[4]	[5]

c. State the purpose of the algorithm.

d. Suggest how the problem with the two competitors who tied could be avoided.

6. Look at the following algorithm.

```

TOTAL = 0
loop I from 0 to 4
  loop J from 0 to I
    TOTAL = TOTAL + 1
  end loop
end loop
output TOTAL

```

a. Construct a trace table for the variables I, J, TOTAL.

b. What is the value of TOTAL when output?