

Computational Thinking and Problem Solving (COMP1002) and Problem Solving Methodology in Information Technology (COMP1001)

Assignment 1 Sample Solutions (Due on 30 September 2021 at 12:00 noon)

1. [10 marks] Suppose you are given a positive integer. Write down the pseudocode of finding its binary representation. Also write down the *input* and *output* specifications.

Input: a positive integer

Output: a binary representation of the positive integer

Set x as the input positive integer

Set L as an empty list

Repeat

Divide x by 2 and obtain the remainder, b

Prepend b to L

Set x as $x / 2$

Until x is 0

Return L

2. [20 marks] Suppose you are given the following the text string.

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Write down the pseudocode, in details, how you can systematically count the number of each English word in the text, which has 5 or more letters, in the word. Note that there are punctuations in the text string and your pseudocode should mention how you deal with them.

Set x as the text string

Set count = 0 as the number of words having 5 or more letters

Repeat

Get a sequence of characters, w, before a whitespace

If there is a punctuation mark at the end of w

Remove the punctuation mark

If number of letters in w ≥ 5

Add 1 to count

Until the end of the text

Return count

3. [20 marks] In Lecture 2, the difference between function and procedure is mentioned. Suppose there are two persons, Alice and Bob. One day, Alice asks Bob to complete a task for her. That is, Bob has to buy 3 oranges, 2 apples and 6 eggs, using the money collected from Alice. Bob has to put the items on a table. Before that, Bob has to clean the table first.

Does Bob act like a function or a procedure? What are the input(s) and output(s), if any? Justify your claim.

A procedure. This is because some of the outcomes are not to be modelled as data/objects. Having the table cleaned and the items put on the table is a change of the “system state”, but not to be returned to Alice directly from Bob.

Input: Money from Alice

Output: Nothing

4. [12 marks] Use the Python command line console to show the steps for the conversion of an integer, 17, to its binary representation. Screen-capture your steps and outputs. What is the binary representation of 17?

```
>>> 17 // 2
8
>>> 17 % 2
1
>>> 8 // 2
4
>>> 8 % 2
0
>>> 4 // 2
2
>>> 4 % 2
0
>>> 2 // 2
1
>>> 2 % 2
0
>>> 1 // 2
0
>>> 1 % 2
1
```

10001

5. [20 marks] Based on the conversion problem in Q.4, create a Python program that a user enters a valid positive integer in base 10, and the system will display the corresponding binary number. You need to provide three test cases (i.e., input and output) to verify your program. One of the cases should be the one in Q.4. Type the test cases in terms of *comment* at the beginning of your program. Other than those for data input and output, no built-in/external functions can be used.

```
num = int(input("Please enter an integer Number >>"))
quotient = num
answer = 0
while num != 0:
    quotient = num // 2
    remainder = num % 2
    print("quotient", quotient)
    print("remainder", remainder)
    answer = answer * 10 + remainder
    num = quotient
```

```
Please enter an integer Number >> 17
quotient 8
remainder 1
quotient 4
remainder 0
quotient 2
remainder 0
quotient 1
remainder 0
quotient 0
remainder 1

answer: 10001
```

<code>print("\nanswer:", answer)</code>	
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6. [18 marks] Write a Python program to calculate the area of a triangle as below:

- A user is asked to provide the lengths of 3 sides of a triangle;
- The program will calculate and display the triangle area using Heron's formula; otherwise, if the calculation result is not valid, the program will display an error message.

You may assume the user always input numbers to the program.

Other than those for data input and output, no built-in/external functions can be used.

(Hints: You may refer to https://en.wikipedia.org/wiki/Heron%27s_formula or other sources for more information.)

```
1 a,b,c = eval(input("Input the lengths of 3 sides of triangle, which are sperated by ',': "))
2
3 s = (a + b + c) / 2
4 A_square = s * (s - a) * (s - b) * (s - c)
5
6 if A_square > 0:
7     A = A_square ** 0.5
8     print("The area is ", A)
9 else:
10    print(f"The inputs {sides} cannot form a triangle.")
11
```

Input the lengths of 3 sides of triangle, which are sperated by ',': 4,13,15
The area is 24.0