

Computational Management Science 1

Fall 2019 Final

registration number:
(Do not write your name on the test - just the 7 digit student id number.)

All examples are evaluated using the Python programming language, version 3.6.

1. (6 points) Writing Code

(a) (3 points, ≤ 5 minutes) Functions

The Fibonacci numbers F_n are defined as follows: $F_0 = 0$, $F_1 = 1$, and $F_n = F_{n-2} + F_{n-1}$ for all $n \geq 2$. I.e. we get the following sequence $0, 1, 1, 2, 3, 5, 8, \dots$. Write a function `fibonacci(n)`, which returns the n th Fibonacci number. Add a proper docstring to receive full points.

(b) (3 points, ≤ 5 minutes) Classes and data structures

Implement a simple data structure in Python. The data structure must be capable of storing a triangle in a two dimensional drawing application (e.g. the coordinates of three points). Write a **minimalistic** class (`__init__(.)`). You don't need to implement any functionality, just a class that stores the required data. Note that your implementation must be self-contained and must not rely on any third party functionality not provided by you. Don't forget to write docstrings in order to receive full points.

2. (6 points, ≤10 minutes) Correct Mistakes

The following code contains 6 syntax errors/typos. Clearly mark and correct the mistakes. The code must run self-contained (that is without any import statements that are not included). The output should be:

The person "name: Genius, age: 22" is an adult.

```
import sys

class Person:
    '''Class containing the name and the age of one person.'''

    def __init__(name, age):
        self.name = name
        self.age = age

    def __str__(self):
        return (f'name: {self.name}, '
                f'age: {self.age}')

int main():
    me = Person('Genius', 22)
    if 18 <= me.age <= 65
        print(f'The person "{me}" is an adult.')
    return 0

if __name__ == 'main':
    exit(main())
```

3. (9 points, ≤ 10 minutes) Libraries

(a) (2 points)

What is the purpose of profiling? Which library helps with doing so?

(b) (2 points)

What is an ndarray? Which 3rd party package provides them?

(c) (3 points)

What is the purpose of unit tests? What is the purpose doctests? Is it sufficient to have one or the other? If you need both, which test cases should be covered by unit tests and which ones by doctests?

(d) Finally, name one thing you like about this course and one thing that should be improved in the future (be honest!) (2p).

4. (12 points, ≤10 minutes) Reading and Understanding Code

What is the output of the following code snippets? Write exactly what the output of each snippet is if the snippet is the sole content of a Python file. If the output is an error message, it is enough to write "ERROR". If there is no output, write "-"

(a) Simple calculation

```
x = 5
y = 3 * x**2 + 2 * x - 7
print(y)
```

(b) Loop

```
p = 13
result = True
for i in range(2, p):
    if p % i == 0:
        result = False
        break

print(result)
```

(c) Function

```
def swap(a, b):
    c = a
    a = b
    b = c
    return a, b

a = 5
b = 10
c, d = swap(a, b)
print(a, b, c, d)
```

(d) Lists and tuples

```
values = (-5, 4, 3)
values[0] = 5
```

(e) String operations

```
s = "Everyone wants to get the grade 1 in CMS."
print(s.find("Everyone"))
print(s[2])
```

(f) List comprehension

```
integers = [i for i in range(10)]
print(sum(integers))
```

5. (9 points, ≤ 10 minutes) Various

(a) (3 points)

What is a generator expression (PEP 289)? Which key advantage does it have? Provide at least one example.

(b) (3 points)

What is inheritance? What is composition? Which relationship types does each of them model?

(c) (3 points)

When passing a list to a function, can the list be changed? Why was that implementation decision taken (what are the advantages)? What could you do to avoid that behavior?

6. (6 points, ≤ 5 minutes) Writing Files

In one of your Python programs, the central results are stored in a special object which cannot easily be represented as text.. Your employer asks you to design and implement a function that stores that object permanently. Explain how you approach the problem and why you decide to do so. Implement the function

`save(filename: str, result_object) -> None` that takes a filename string and the resulting object. The function should write the object to a file with the given name. Any representation of the data is ok as long as it allows to easily read the data back in from the file (but you don't need to implement the reading function, just the writing function). Don't forget to document the function in order to receive full points.