Computational Management Science 1

Final

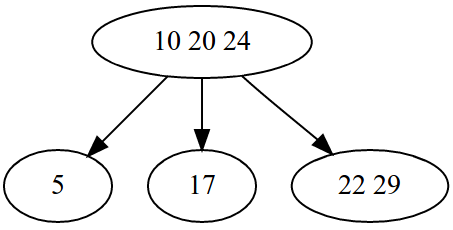
registration number: .....

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

1. (6 points) Writing Code

   (a) (3 points, ≤5 minutes) Functions
   Write a function `product(iterable, start)` in Python that takes a sequence of numbers as first parameter and returns the product of these numbers. A second (optional) parameter denotes a start value and must default to 1. [e.g. `product((1, 3, 4))` ⇒ `12`; `product([3, 5], 2)` ⇒ `30`]. 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 should be able to store trees that can have up to three data members per node and up to three child nodes. Write a **minimalistic** class. You don't need to implement any functionality, just a class that stores the required data and child nodes. Don't forget to write docstrings in order to receive full points. A sample tree is shown in the graph below.



2. (6 points, ≤10 minutes) Python vs. C++
   Name three advantages that Python has over C++ and at least three advantages for the other way around.
   Give at least three concrete examples of when using Python is the better choice and three more for when C++ should be preferred. (*hint: there's nothing particular you're expected to write - rather generic knowledge of which language to select in different situations if a decision between the two has to be made; brief/ to the point answers are preferred*)

3. (6 points, ≤10 minutes) Correct Mistakes
   The following code contains 6 syntax errors/ typos. Clearly mark and correct the mistakes. (*hint: you don't need to understand what the function does to correct the mistakes as there are no logical errors*)

```
import time


def to_json(python object)
    if isinstance(python_object, time.struct_time):
        return {'__class__': 'time.asctime',
                '__value__' time.asctime(python_object)}
    if isinstance(python_object bytes):
        return {'__class__': 'bytes',
                '__value__': lists(python_object)}
    raise TypeError(repr(python_object) . ' is not serializable')
```

4. (12 points) 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 only 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

```
print(10 * 2 ** 2)
```

(b) Loop

```
prices = (4.2, 5.8, 2.9)
total = 0.0
for price in prices:
    print(price)
    total += price
print("Total:", total)
```

(c) Function

```
import math
c1 = 3
c2 = 4
def perimeter_right_triangle(c1, c2):
    print('calculating the hypotenuse')
    return c1 + c2 + math.hypot(c1, c2)
```

(d) List

```
l = [5, 3, 2]
l.pop()
print(sum(l))
```

(e) Statistics

```
l = [5, 3, 2]
print(calc_mean(l))
```

(f) Sorting

```
l = [2, 4, 3]
print(l.sort())
```

5. (5 points, ≤5 minutes) Assignment

   (a) (3 points)
   Briefly explain the difference between call by value and call by reference.

   (b) (1 points)
   Which type of assignment is used by Python?

   (c) (1 points)
   What is the default type of assignment in C++?

6. (6 points, ≤5 minutes) Reading Files
   Write a Python function that takes a filename string as its sole argument. The function should simply print each line of the file with the given filename to stdout. Don't forget to document the function in order to receive full points.

7. (7 points) Testing

   (a) (3 points)
   Describe the purpose of testing software.

   (b) (4 points)
   What is the difference between Python doctests and unit tests? When should each of them be used? What needs to be tested to consider your program comprehensively tested?