Universität Konstanz

Introduction to Computation for the Social Sciences

Assignment 3

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Please solve the exercises below and commit your solutions to our GitHub Classroom until Nov, 19th midnight. Submit all your code in executable files (*py* / *ipynb*) and your text in one text file (*txt* / *md* / *pdf*). You can score up to 10 points in this assignment. You will get individual feedback in your repository.

Exercise 1: Python Basics (2 Points)

a) Complete Course "Python Unit Testing"
Please complete the course "Python Unit Testing" in the *PyCharm Edu IDE*[1].

b) Give Feedback
In your private repository, navigate to *assignment03* > *solution*. If you cannot find the folder of the current assignment, then fetch and merge your repository with the remote branch *assignments*. See *Assignment 02 Exercise 1*. There, create a text file, in which you describe challenges and problems you encountered while completing the course.

Exercise 2: Algorithms for Number Conversion (3 Points)

In the lecture, we discussed an algorithm that converts integer numbers in decimal representation to binary representation.

a) Write a corresponding algorithm `decimal_int_to_octal()` in Python to convert non-negative integer numbers in decimal representation to octal.

b) Develop a more general algorithm `decimal_to_octal()` that also converts numbers that include decimal places from decimal representation to octal.

Exercise 3: Unit Testing (3 Points)

The following algorithm in Python converts numbers in decimal representation to binary.

```
1 import math
2 def decimal2binary(n):
3    # function to convert decimal integers to binary
4    x = []
```

```
5    while n > 0:
6        x.append(n % 2)
7        n = math.floor(n/2)
8    return x[::-1]
```

a) Develop a unit test that checks for values in the interval [-1,3] whether the algorithm returns the expected results.

b) Adjust the algorithm so it passes the unit test developed in a). Rename the function to `decimal_to_binary_correct()`.

Exercise 4: Theoretical Question (2 Points)

Briefly explain the defining characteristics of the following three data structures: array, linked list, dictionary. Provide a simple example / illustration for each of the data structures. For each of the three data structures explain how to find a specific element within the data structure.

[1] https://www.jetbrains.com/education/