Zurich University
of Applied Sciences

School of
Engineering

P02 – String literals / Conditionals

1. Master complexity (on-site week 3)

Solve the following three exercises individually and in this particular order. Please make sure you just use your current understanding of Python programming as well as your cogitation; refrain from googling the assumed “correct” solution or getting help from your class mates this time. Call on your advisor for questions.

1.1 Text-based graphics with Python

Mind the following output of some short Python script:

```
$ python lab_2-1.py
  *
  *  *
  *  *  *
  *  *
  *
```

Develop a Python script on your own that produces this output. Use at most 5 “print” statements and 5 string literals (literal := a constant / “hard-coded” value inside your code).

1.2 Enhancement

What would the outputted figure look like with a height of 11 lines instead of just 5? Draw it manually on a sheet of paper:

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

1.3 Abstraction
Describe in a most compact form and with natural language the “construction rule” that produces this kind of figure: What is its blueprint? Consider the general case with a height of any number of lines.

Are there any special cases to be considered?

Is there a difference between your construction rule and the procedure you used when drawing the figure in exercise 1.2?

➔ *Discuss your results and findings with your advisor.*

2. Conditionals

2.1a TOM calculation (selective: AV&VS)

Write a program that computes the TOM (take-off mass) of your DA 40 aircraft by asking the user for the weights needed. Based on that the program should decide if take-off is allowed or not.

Background: For aircrafts, take-off is only allowed when their TOM is below the maximum structural take-off mass (MTOM). The TOM can be computed by adding the

- empty mass of the aircraft,
- weight of the pilot/passengers in the front seats,
- weight of the passengers in the rear seats,
- weight of the standard baggage compartment,
- weight of the baggage tube and
- weight of the usable fuel.

For a Diamond Aircraft DA 40 the empty mass of the aircraft is *900kg* and the MTOM is *1280kg*.

An example:

- Pilot 75kg
- Passenger (front) 75kg
- Standard compartment 20kg
- Usable fuel 89kg

➔ This aircraft is allowed to take-off, since the sum of the empty plane and the above weights is just 1159kg, which is less than the MTOM (1280kg).

2.1b Cost calculation (selective: WI)

Write a program that calculates the labour hours within a project based on a given budget and time frame. In this simple example you need to calculate the machine, the material and the labour costs together and check if the total costs are not over the budget.

Following facts are known:

- Machine A needs 47 units of material a1 and 119 units of material a2
- Machine B needs 159 units of material b1
- The machine and the materials needs only to be bought and used once
- Cost for the machines and material:
    - machine_a = 25000
    - machine_b = 40000
    - material_a1 = 335 / unit
    - material_a2 = 1520 / unit
    - material_b1 = 865 / unit
- To realize the project you need at least machine A or B
- Labour costs of specialist A for machine A is 150 / hour
- Labour costs of specialist B for machine B is 175 / hour

- Labour costs of a project manager is 200 / hour
- There is only one project manager involved which works 42h per month
- Project management cost needs to be between 8 and 12% of the total labour cost
- The machine and material costs together needs to be below 25% of the budget

The program needs to check all the constraints and tell the user invalid entries. It also reports the machine plus material costs, labour costs, the labour hours and the project management costs in percentage of the labour costs. The user needs to input the machine type, the budget and the duration of the project in month. Plan as many hours as possible for the given budget.

2.2 Rock Paper Scissors

Write a program for the rock-paper-scissors game where one person is simulated by the computer and the other is the actual user.

Rock-paper-scissors is usually played by two people, where players simultaneously form one of three shapes with an outstretched hand. The rules are

- the "rock" beats scissors
- the "scissors" beat paper and
- the "paper" beats rock;
- if both players throw the same shape, the game is tied.

Hints:

- Just simulating one round of the game is enough; optionally, you can of course enhance your implementation to play until one party has, say, 3 wins.
- Generate a random number to simulate the computers choice.
- To generate a random number use:

```
import random

random_number = int(random.uniform(lower_bound, upper_bound))
```