Session 3 - Fundamental Data Structures

September 3, 2018

1 Python Training: Day 1 Session 3

References (more or less):

- https://docs.python.org/3/tutorial/
- https://realpython.com/
- https://www.learnpython.org/en/
- https://www.tutorialspoint.com/
- https://stackoverflow.com/questions/43211296/pgadmin4-postgresql-application-server-could-not-be-contacted
- https://stackoverflow.com/questions/12562928/psql-exe-password-authentication-failed-in-windows
- https://en.wikipedia.org/wiki/Bulls_and_Cows
- https://en.wikipedia.org/wiki/Fibonacci_number

1.1 List and Tuple

Both are array like structure: a sequential data structure containing a series of values.

In contrast to array, list and tuple can contain item with various data types.

The difference between both: list is mutable while tuple is not.

1.1.1 List initialization

```
In [ ]: list_a = [1, 2, 3, 4, 5, 6, 7]

In [ ]: print(list_a)
        print(len(list_a))
```

1.1.2 List indexing

```
In [ ]: list_a[3] # zero index based

In [ ]: list_a[-1]

In [ ]: list_a[2] = -3
        print(list_a)
```

1.1.3 List concatenation

```
In [ ]: list_b = [-1, 0.5, -3]

In [ ]: list_c = list_a + list_b

In [ ]: list_c
```

1.1.4 List: inserting and removing item

```
In [ ]: list_c.insert(3, 99)

In [ ]: list_c

In [ ]: list_c.append(10)

In [ ]: list_c

In [ ]: list_c.remove(4)

In [ ]: list_c
```

1.1.5 List slicing

```
In [ ]: list_d = list_c[4:9]

In [ ]: list_d

In [ ]: list_d[1:-2]
```

1.1.6 List copying

By assigning a list x to other list y, x references the same object as y.

```
In [ ]: list_e = list_c
        print(list_e, list_c)
        list_c[3] = -20
        print(list_e, list_c)
        del list_e[2]
        print(list_e, list_c)
```

By copying, only the value is considered.

```
In [ ]: list_f = list_c.copy()
        # or
        # list_f = list_c[:]
        print(list_f, list_c)
        del list_f[1]
        print(list_f, list_c)
        list_c[3] = 200
        print(list_f, list_c)
```

1.1.7 Tuple initialization

```
In [ ]: tuple_a = (1,2,3,4)
        tuple_a[0:2]

In [ ]: tuple_a[2] = 10 # nope, you can't do this with tuple. Tuple is read only.
```

1.1.8 Iterating list

It is understandable to put the discussion of for loop here, as you should understand list, tuple, and iterator before using for loop.

```
In [ ]: for item in list_c: # iterating list
            print(item, type(item))

In [ ]: for i in (1,2,3): # iterating tuple
            print(i, end='')

In [ ]: it = iter(['a','b','c','d','e'])

In [ ]: print(it)

In [ ]: it.__next__() # up to the number of elements

In [ ]: for i in iter([1,2,3,4,5]):
            print(i, end=' ')
```

Two lists can be iterated at once.

```
In [ ]: a = [1,2,3]
        b = ['a','b','c']

        for x,y in zip(a,b):
            print(x, y)
```

1.1.9 Inline list

To make our life easier, list could be created inline with for loop.

```
In [ ]: nums = range(0, 20)
        print(nums)

In [ ]: num_list = list(nums)
        print(num_list)

In [ ]: list(range(150,100,-5))

In [ ]: even_numbers = [x for x in range(0,20) if x % 2 == 0]

In [ ]: print(even_numbers)
```

1.1.10 Enumerating with index

Sometimes iterating with index is required. Function 'enumerate' enumerates a list and return the index for each item.

```
In [ ]: dino_pasaran = ['kliwon', 'legi', 'pahing', 'pon', 'wage']
        for i, dino in enumerate(dino_pasaran):
            print(i, dino)
```

1.1.11 Some useful string operation

For indexing, treat strings as list

```
In [ ]: kalimat = ' Ini Ibu Budi '
```

```
In [ ]: kalimat[2:8]
```

Other useful operation

1. trim
2. upper and lower
3. split

```
In [ ]: kalimat.strip()
```

```
In [ ]: print(kalimat.upper(), kalimat.lower())
```

```
In [ ]: kalimat.split('i')
```

1.1.12 Assignment 1.3.1

Reverse the string ' Ini Ibu Budi ' into ' iduB ubI inI '

1.1.13 Assignment 1.3.2

The following is a list of fish names:

nama_nama_ikan = ["Ayam-ayam", "Alu-alu", "Bandeng", "Barakuda", "Baronang", "Belanak", "Buntal", "Cakalang", "Cucut", "Cupang", "Discus","Hiu", "Gatul", "Giru", "Guppy", "Gabus", "Haring", "Hilsa", "Injel", "Iwak pitik", "Iwak tempe", "Iwak peyek", "Julung-julung", "Kembung", "Kod", "Koki", "Koi", "Kepe-kepe", "Layur", "Lemadang", "Lepu", "Lele", "Louhan", "Mas", "Makarel", "Mujahir", "Molly", "Nila", "Neon", "Platy", "Pari", "Pindang", "Sepat", "Salmon", "Sarden", "Kakap", "Kedukang", "Kerapu", "Terubuk", "Tenggiri", "Teri", "Tongkol", "Tuna"]

Copy and use the following list to write a program that 1. Prompt and ask the user to mention 5 example of fish 2. Examine user answer one by one 3. For every correct answer, tell the user how many left 4. Finish after 5 correct answers

1.2 Dictionary

Dictionary = associative array, unordered key value pairs

1.2.1 Dictionary initialization

```
In [ ]: a_dict = {}

In [ ]: a_dict['spring'] = 'musim semi'
        a_dict['summer'] = 'musim panas'
        a_dict['fall'] = 'musim gugur'
        a_dict['winter'] = 'musim salju'

In [ ]: a_dict['summer']
```

1.2.2 Iterating dictionary

```
In [ ]: a_dict.keys()

In [ ]: a_dict.values()

In [ ]: print(list(a_dict.keys()))
        print(list(a_dict.values()))

In [ ]: for k, v in a_dict.items():
            print(k, ':', v)
```

1.2.3 Assignment 1.3.3

List all word and its count in Pembukaan UUD 1945. The test is provided in the following variable.

pembukaan_uud = "Bahwa sesungguhnya kemerdekaan itu ialah hak segala bangsa dan oleh sebab itu, maka penjajahan diatas dunia harus dihapuskan karena tidak sesuai dengan perikemanusiaan dan perikeadilan. Dan perjuangan pergerakan kemerdekaan Indonesia telah sampailah kepada saat yang berbahagia dengan selamat sentosa mengantarkan rakyat Indonesia ke depan pintu gerbang kemerdekaan negara Indonesia, yang merdeka, bersatu, berdaulat, adil dan makmur. Atas berkat rahmat Allah Yang Maha Kuasa dan dengan didorongkan oleh keinginan luhur, supaya berkehidupan kebangsaan yang bebas, maka rakyat Indonesia menyatakan dengan ini kemerdekaannya. Kemudian daripada itu untuk membentuk suatu pemerintah negara Indonesia yang melindungi segenap bangsa Indonesia dan seluruh tumpah darah Indonesia dan untuk memajukan kesejahteraan umum, mencerdaskan kehidupan bangsa, dan ikut melaksanakan ketertiban dunia yang berdasarkan kemerdekaan, perdamaian abadi dan keadilan sosial, maka disusunlah kemerdekaan kebangsaan Indonesia itu dalam suatu Undang-Undang Dasar negara Indonesia, yang terbentuk dalam suatu susunan negara Republik Indonesia yang berkedaulatan rakyat dengan berdasar kepada : Ketuhanan Yang Maha Esa, kemanusiaan yang adil dan beradab, persatuan Indonesia, dan kerakyatan yang dipimpin oleh hikmat kebijaksanaan dalam permusyawaratan/perwakilan, serta dengan mewujudkan suatu keadilan sosial bagi seluruh rakyat Indonesia."

1.3 Sets

```
In [ ]: A = {'a', 'b', 'c'}

In [ ]: A.add('d')
```

```
In [ ]: print(A)

In [ ]: for i in A:
            print(i)

In [ ]: A.remove('c')

In [ ]: A

In [ ]: len(A)

In [ ]: 'b' in A

In [ ]: 'z' in A
```

1.3.1 Assignment 1.3.4

M = {the first 30 multiple of 3} N = {the first 30 multiple of 2}
   Find (from set M and N)

1. Elements that are multiple of 2 or 3
2. Elements that are multiple of 2 and 3
3. Elements that are multiple of 2 only
4. Elements that are multiple of 3 only

1.3.2 Assignment 1.3.5

Number guessing game: Ask the user to input four digit number, each number must only appear once. Then output how many numbers are correct and are in the right position.