

MANISA CELAL BAYAR UNIVERSITY – DEPARTMENT OF COMPUTER ENGINEERING
PROBLEM SET FOR NUMERICAL ANALYSIS FOR COMPUTER ENGINEERS

WEEK 02: DATA STRUCTURES IN PYTHON

1. What is the correct writing of the programming language that we used in this course?

- ☐ () Phyton
- ☐ () Pyhton
- ☐ () Pthyon
- ☐ () Python

2. What is the output of the code below?
`my_name = "Bora Canbula"`

```
print(my_name[2::-1])
```

- ☐ () alu
- ☐ () ula
- ☐ () roB
- ☐ () Bor

3. Which one is not a valid variable name?

- ☐ () for_
- ☐ () Manisa_Celal_Bayar_University
- ☐ () IF
- ☐ () not

4. What is the output of the code below?

```
for i in range(1, 5):  
    print(f"{i:2d} {(i/2):4.2f}", end='')
```

- ☐ () 010.50021.00031.50042.00
- ☐ () 10.50 21.00 31.50 42.00
- ☐ () 1 0.5 2 1.0 3 1.5 4 2.0
- ☐ () 100.5 201.0 301.5 402.0

5. Which one is the correct way to print Bora's age?

```
profs = [  
    {"name": "Yener", "age": 25},  
    {"name": "Bora", "age": 37},  
    {"name": "Ali", "age": 42}  
]
```

- ☐ () profs["Bora"]["age"]
- ☐ () profs[1][1]
- ☐ () profs[1]["age"]
- ☐ () profs.age[name="Bora"]

6. What is the output of the code below?

```
x = set([int(i/2) for i in range(8)])  
print(x)
```

- ☐ () {0, 1, 2, 3, 4, 5, 6, 7}
- ☐ () {0, 1, 2, 3}
- ☐ () {0, 0, 1, 1, 2, 2, 3, 3}
- ☐ () {0.5, 1, 1.5, 2, 2.5, 3, 3.5, 4}

7. What is the output of the code below?

```
x = set(i for i in range(0, 4, 2))  
y = set(i for i in range(1, 5, 2))  
print(x^y)
```

- ☐ () {0, 1, 2, 3}
- ☐ () {}
- ☐ () {0, 8}
- ☐ () SyntaxError: invalid syntax

8. Which of the following sequences is immutable?

- ☐ () List
- ☐ () Set
- ☐ () Dictionary
- ☐ () String

9. What is the output of the code below?

```
print(int(2_999_999.999))
```

- ☐ () 2
- ☐ () 3000000
- ☐ () ValueError: invalid literal
- ☐ () 2999999

10. What is the output of the code below?

```
x = (1, 5, 1)  
print(x, type(x))
```

- ☐ () [1, 2, 3, 4] <class 'list'>
- ☐ () (1, 5, 1) <class 'range'>
- ☐ () (1, 5, 1) <class 'tuple'>
- ☐ () (1, 2, 3, 4) <class 'set'>

WEEK 03: INTRODUCTION TO NUMPY

1. What is the correct way to create a NumPy array?

- ☐ `np.list([1, 2, 3])`
- ☐ `np([1, 2, 3])`
- ☐ `np.array([1, 2, 3])`
- ☐ `np(array([1, 2, 3]))`

2. Which of the following arrays is a 2-D array?

- ☐ `[3, 5]`
- ☐ `[[3], [5]]`
- ☐ `[{1, 3}, {5, 7}]`
- ☐ `[2]`

3. What is the correct way to print 5 from the array given below?

- ```
a = np.array([[1, 2], [3, 4], [5, 6]])
```
- ☐ `print(a[3, 1])`
  - ☐ `print(a[2, 0])`
  - ☐ `print(a[1, 2])`
  - ☐ `print(a[1, 3])`

4. What is the correct way to print every other item from the array given below?

- ```
a = np.arange(5)
```
- ☐ `print(a[1:3:5])`
 - ☐ `print(a[:2])`
 - ☐ `print(a[1:5])`
 - ☐ `print(a[0:2:4])`

5. What does the shape mean of a NumPy array?

- ☐ Number of columns
- ☐ Total number of items
- ☐ Number of items in each dimension
- ☐ Number of rows

6. What is the output of the code below?

```
n_1 = np.array([1, 2, 3])
n_2 = np.array([4, 5, 6])
n_3 = np.array([7, 8, 9])
print(np.array([n_1, n_2, n_3]).ndim)
```

Your answer:

7. What is the output of the code below?

```
n_1 = np.array([1, 2, 3])
n_2 = np.array([4, 5, 6])
n_3 = np.array([7, 8, 9])
print(np.array([n_1 + n_2 + n_3]).shape)
```

Your answer:

8. Which of the following is created with the code given below?

```
np.array([[1, 2, 3], [4, 5, 6]])
```

- ☐ 1-d array of shape 6 x 1
- ☐ 2-d array of shape 2 x 3
- ☐ 3-d array of shape 3 x 2
- ☐ 3-d array of shape 2 x 3

9. What is the output of the code below?

```
print(np.arange(10).reshape(2, -1))
```

10. What is the output of the code below?

```
Print(np.array([0.5, 1.5, 2.5]).dtype)
```

WEEK 04: BINARY REPRESENTATION OF NUMBERS

1. In binary system, which of the following digits are used to represent a number?

- ☐ 1 and 2
- ☐ 0 and 1
- ☐ 0, 1 and 2
- ☐ A and B

2. Which of the following codes gives a binary representation of 97?

- ☐ `binary(97)`
- ☐ `(97).binary()`
- ☐ `f"{97:b}"`
- ☐ `to_binary(97)`

3. What is the name of the NumPy method which converts a number to binary system?

- ☐ `np.binary()`
- ☐ `np.bin()`
- ☐ `np.binary_representation()`
- ☐ `np.binary_repr()`

4. The code given below produces this output:

```
> 0 0 0 0 0 0 0 0 0 1 1 0 0 0 0 1 = 97
```

Complete the code with appropriate statements for the lines given with (1) and (2).

```
n = 16; r = 97; r_0 = r; b = [0]*n
for i in range(n-1, -1, -1):
    x = 2**i
    if r >= x:
        (1)
        (2)
b = b[::-1]
print(*b, end='')
print(f" = {r_0}")
```

5. Modify the code given in question 4 to avoid fixing the number of digits (n). Hint: use `bit_length()` method of integer object.

6. Use the codes given in the question 4 as a starting point and write Python codes which converts the decimal of a base-10 number into binary system.

7. Try to write a general function which converts a base-10 floating point number into any base including the decimal part.

```
def to_any_base(r: float, b: int) -> str:
    '''This function returns the base-b '''
    '''conversion of r, which is a '''
    '''floating-point number. '''
    '''Example: '''
    ''' to_any_base(3.5, 2) -> '11.1' '''
```

WEEK 05: IEEE 754 REPRESENTATION

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| 1. Find the smallest and the largest value that you can represent with 16-bit IEEE 754 standard? | 4. Use a custom IEEE 754 representation as 1-bit for the sign of the number and (4-bit exponent) + (20-bit mantissa). Convert 0.17 into this representation and compare the result with the previous question. |
| 2. Find the 16 bit IEEE 754 representation of -5.875. | |
| 3. Calculate the error if we use 16 bit IEEE 754 representation to store the value 0.17 in memory. | 5. Calculate the bias for the 8 bit exponent part. |