TPOP PRACTICAL

ITERATION

PRACTICAL 03 – additional problems

Problem I: *Matrices*

In question 3 we have been working on vector, in this exercise we will be working with matrices. A 3×2 matrix A has the following form:

$$A = \begin{bmatrix} a_{1,1} & a_{1,2} \\ a_{2,1} & a_{2,2} \\ a_{3,1} & a_{3,2} \end{bmatrix}$$

The basic

How could you represent a matrix in Python. Write a program to perform the following operations and print the result (inputs taken from user):

Scalar product:
$$\lambda \cdot A = \begin{bmatrix} \lambda \cdot a_{1,1} & \lambda \cdot a_{1,2} \\ \lambda \cdot a_{2,1} & \lambda \cdot a_{2,2} \\ \lambda \cdot a_{3,1} & \lambda \cdot a_{3,2} \end{bmatrix}$$

Addition:
$$A + B = \begin{bmatrix} a_{1,1} & a_{1,2} \\ a_{2,1} & a_{2,2} \\ a_{3,1} & a_{3,2} \end{bmatrix} + \begin{bmatrix} b_{1,1} & b_{1,2} \\ b_{2,1} & b_{2,2} \\ b_{3,1} & b_{3,2} \end{bmatrix} = \begin{bmatrix} a_{1,1} + b_{1,1} & a_{1,2} + b_{1,2} \\ a_{2,1} + b_{2,1} & a_{2,2} + b_{2,2} \\ a_{3,1} + b_{3,1} & a_{3,2} + b_{3,2} \end{bmatrix}$$

Note: A and B must have the same dimension. Depending on your representation of a matrix, how could you check they have the same dimension?

The advanced bit

Transpose: the transpose of a $m \times n$ matrix is a $n \times m$ matrix. For A, its transpose A^T is a 2×3 matrix.

$$A^t = \begin{bmatrix} a_{1,1} & a_{2,1} & a_{3,1} \\ a_{1,2} & a_{2,2} & a_{3,2} \end{bmatrix}$$

Write a program to perform the transpose operations and print the result (inputs taken from user).

Problem II: *The King and the Wise man*

When the creator of the game of chess showed his invention to the ruler of the country, the ruler was so pleased that he gave the inventor the right to name his prize for the invention. The man, who was very wise, asked the king this: that for the first square of the chess board, he would receive one grain of wheat (in some telling, rice), two for the second one, four on the third one, and so forth, doubling the amount each time. The ruler, arithmetically unaware, quickly accepted the inventor's offer, even getting offended by his perceived notion that the inventor was asking for such a low price, and ordered the treasurer to count and hand over the wheat to the inventor. Given that the chessboard is a 8×8 board, and given the weight of a single grain of rice is about 30 mg, calculate the total weight of rice the king must give to the wise man. The program should print the weight of rice for each chessboard square.

Hints:

To transform an string containing a Python expression, use `eval(my_expression)` as shown below for a list.

```
>>> my_list = eval('[1, 2, 3]')
>>> type(my_list)
<class 'list'>
>>> my_list
[1, 2, 3]
```

To format a number in a print statement use % as shown below:

```
>>> my_number = 125.65
>>> print ("formatted number: %6.2f" %my_number)
formatted number: 125.65
>>> print ("formatted number: %6.1f" %my_number)
formatted number:  125.7
>>> print ("formatted number: %6.0f" %my_number)
formatted number:    126
>>>
```

Note that there is no comma between the string and the %variable. In this case 6 character spaces are used to print the number. The number behind the decimal indicate of many spaces should be used for the decimal part. Notice the rounding of the result.

More about formatting string can be found on the "Python Cheat Sheet".