



UNIVERSITY OF AGDER



Numpy

Lecture 6



Agenda

- Info
- Exercise recap
- Numpy - Sum
- System of linear equations



Exercise review - 4

4 Numpy Helper Functions

- Create a function which takes in one argument (numpy array).
- Find the **index** of the maximum value in the numpy array. *Hint: np.argmax()*
- Find the maximum **value** in the numpy array. *Hint: max() and np.max() is not the same*
- Let the function return both the index and the value. *Hint: return a,b*
- Download the file *exercise_5_numbers.txt* from Canvas and generate a numpy array from the values. *Hint: np.genfromtxt()*
- Use your function and find the greatest value in the numpy array, as well as it's index.

Exercise - 5

5 Numpy Slicing

Try to solve each task with a single slice/selection. E.g. `a[:, -1]`.

- Create a numpy array as shown in Figure 1.
- Select the values marked in green.
- Select the values with a blue outline.
- Select the values with a red outline.

Hint: lecture notes

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	32	33	34	35
36	37	38	39	40	41	42
43	44	45	46	47	48	49

Figure 1: 7×7 array

Summation of columns

```
a = np.arange(1, 50).reshape(7,7)
```

```
result = np.sum(???)
```

1	2	3	4	5	6	7
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System of linear equations

$$1. \quad x_1 - x_2 - 5x_3 + x_4 = 9$$

$$2. \quad 2x_1 + 3x_2 + 4x_3 + 5x_4 = 2$$

$$3. \quad 4x_1 + 3x_2 + 2x_3 + x_4 = -2$$

$$4. \quad -x_1 + -2x_2 + 3x_3 + 8x_4 = 1$$

System of linear equations

- $Y = A*x + b$

$$A = \begin{bmatrix} 1 & -1 & -5 & 1 \\ 2 & 3 & 4 & 5 \\ 4 & 3 & 2 & 1 \\ -1 & -2 & 3 & 8 \end{bmatrix},$$

$$x = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix},$$

$$b = \begin{bmatrix} 9 \\ 2 \\ -2 \\ 1 \end{bmatrix}$$

System of linear equations

- To solve it, we need it on this form

$$Ax=b$$

$$\begin{bmatrix} 1 & -1 & -5 & 1 \\ 2 & 3 & 4 & 5 \\ 4 & 3 & 2 & 1 \\ -1 & -2 & 3 & 8 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = \begin{bmatrix} 9 \\ 2 \\ -2 \\ 1 \end{bmatrix}$$

System of linear equations - matrix multiplication

$$\begin{bmatrix} 1 & -1 & -5 & 1 \\ 2 & 3 & 4 & 5 \\ 4 & 3 & 2 & 1 \\ -1 & -2 & 3 & 8 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = \begin{bmatrix} 2x_1 & 3x_2 & 4x_3 & 5x_4 \\ 4x_1 & 3x_2 & 2x_3 & x_4 \\ -x_1 & -2x_2 & 3x_3 & 8x_4 \end{bmatrix}$$

Slides borrowed from Morten Rudolfson

System of linear equations

$$Ax=b$$

$$x=A^{-1}*b$$

$$\begin{bmatrix} 1 & -1 & -5 & 1 \\ 2 & 3 & 4 & 5 \\ 4 & 3 & 2 & 1 \\ -1 & -2 & 3 & 8 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = \begin{bmatrix} 9 \\ 2 \\ -2 \\ 1 \end{bmatrix}$$

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