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

result = np.sum(???)

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

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1.
$$X_1 - X_2 - 5X_3 + X_4 = 9$$

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

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

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

$$\bullet$$
 Y = A*x + b

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

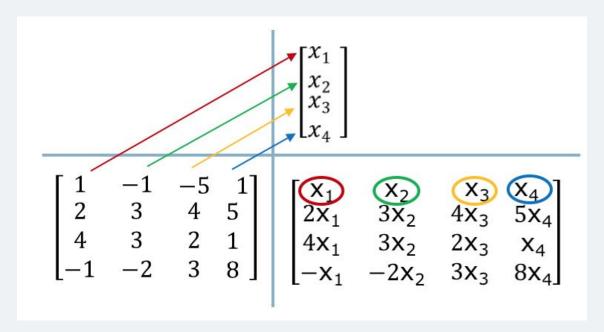
$$\mathbf{x} = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix},$$

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

• 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



$$Ax=b$$

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

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