100 numpy exercises (Optional)

Source: https://github.com/rougier/numpy-100

How to run this notebook

The recommended way to run this notebook is to click the "Run" button at the top of this page, and select "Run on Binder". This will run the notebook on mybinder.org, a free online service for running Jupyter notebooks.

How to get help

If you are stuck, you can ask for help on the community forum: https://jovian.ml/forum/t/100-numpy-exercises-hints-discussions-help/10561 . You can get help with errors, ask for hints, and share your solutions with others.

If you're new to Numpy, check out this notebook for a quick tutorial: https://jovian.ml/aakashns/python-numerical-computing-with-numpy

Saving your work

Remember to save a snapshot of your work from time to time using to your Jovian.ml account.

```
!pip install jovian --upgrade --quiet
```

```
import jovian
```

```
jovian.commit(project='100-numpy-exercises')
```

```
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```

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`jovian.commit` uploads the notebook to your Jovian.ml account, captures the Python environment and creates a shareable link for your notebook as shown above. You can use this link to share your work and let anyone (including you) run your notebooks and reproduce your work. Learn more: https://jovian.ml/docs/

```
# Ucomment the next line if you need install numpy
# !pip install numpy --upgrade
```

1. Import the numpy package under the name np (★☆☆)

2. Print the numpy version and the configuration (★☆☆)

```
[empty input cell]
```

3. Create a null vector of size 10 (★☆☆)

```
[empty input cell]
```

4. How to find the memory size of any array (★☆☆)

```
[empty input cell]
```

5. How to get the documentation of the numpy add function from the command line? (★☆☆)

```
[empty input cell]
```

6. Create a null vector of size 10 but the fifth value which is 1 (★☆☆)

```
[empty input cell]
```

7. Create a vector with values ranging from 10 to 49 (★☆☆)

```
[empty input cell]
```

8. Reverse a vector (first element becomes last) (★☆☆)

```
[empty input cell]
```

9. Create a 3×3 matrix with values ranging from 0 to 8 (★☆☆)

```
[empty input cell]
```

10. Find indices of non-zero elements from [1,2,0,0,4,0] (★☆☆)

```
[empty input cell]
```

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11. Create a 3×3 identity matrix (★☆☆)

12. Create a 3×3×3 array with random values (★☆☆)

13. Create a 10×10 array with random values and find the minimum and maximum values (★☆☆)

14. Create a random vector of size 30 and find the mean value (★☆☆)

15. Create a 2d array with 1 on the border and 0 inside (★☆☆)

16. How to add a border (filled with 0's) around an existing array? (★☆☆)

17. What is the result of the following expression? (★☆☆)

```
0 * np.nan
np.nan == np.nan
np.inf > np.nan
np.nan - np.nan
np.nan in set([np.nan])
0.3 == 3 * 0.1
```

18. Create a 5×5 matrix with values 1,2,3,4 just below the diagonal (★☆☆)

19. Create a 8×8 matrix and fill it with a checkerboard pattern (★☆☆)

```
```

20. Consider a (6,7,8) shape array, what is the index (x,y,z) of the 100th element?

```
```

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21. Create a checkerboard 8×8 matrix using the tile function (★☆☆)

```
```

22. Normalize a 5×5 random matrix (★☆☆)

```
```

23. Create a custom dtype that describes a color as four unsigned bytes (RGBA) (★☆☆)

```
```

24. Multiply a 5×3 matrix by a 3×2 matrix (real matrix product) (★☆☆)

```
```

25. Given a 1D array, negate all elements which are between 3 and 8, in place. (★☆☆)

```
```

26. What is the output of the following script? (★☆☆)

```
# Author: Jake VanderPlas
```

```
print(sum(range(5),-1))
from numpy import *
print(sum(range(5),-1))
```

---

27. Consider an integer vector Z, which of these expressions are legal? (★☆☆)

```
Z**Z
2 << Z >> 2
Z <- Z
1j*Z
Z/1/1
Z<Z>Z
```

---

28. What are the result of the following expressions?

```
np.array(0) / np.array(0)
np.array(0) // np.array(0)
np.array([np.nan]).astype(int).astype(float)
```

---

29. How to round away from zero a float array ? (★☆☆)

---

30. How to find common values between two arrays? (★☆☆)

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31. How to ignore all numpy warnings (not recommended)? (★☆☆)

32. Is the following expressions true? (★☆☆)

```
np.sqrt(-1) == np.emath.sqrt(-1)
```

33. How to get the dates of yesterday, today and tomorrow? (★☆☆)

34. How to get all the dates corresponding to the month of July 2016? (★★☆)

35. How to compute ((A+B)*(-A/2)) in place (without copy)? (★★☆)

36. Extract the integer part of a random array of positive numbers using 4 different methods (★★☆)

37. Create a 5×5 matrix with row values ranging from 0 to 4 (★★☆)

38. Consider a generator function that generates 10 integers and use it to build an array (★☆☆)

39. Create a vector of size 10 with values ranging from 0 to 1, both excluded (★★☆)

40. Create a random vector of size 10 and sort it (★★☆)

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41. How to sum a small array faster than np.sum? (★★☆)

42. Consider two random array A and B, check if they are equal (★★☆)

43. Make an array immutable (read-only) (★★☆)

44. Consider a random 10×2 matrix representing cartesian coordinates, convert them to polar coordinates (★★☆)

45. Create random vector of size 10 and replace the maximum value by 0 (★★☆)

46. Create a structured array with x and y coordinates covering the [0,1]x[0,1] area (★★☆)

47. Given two arrays, X and Y, construct the Cauchy matrix C (Cij =1/(xi - yj))

48. Print the minimum and maximum representable value for each numpy scalar type (★★☆)

49. How to print all the values of an array? (★★☆)

50. How to find the closest value (to a given scalar) in a vector? (★★☆)

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```

51. Create a structured array representing a position (x,y) and a color (r,g,b) (★★☆)

52. Consider a random vector with shape (100,2) representing coordinates, find point by point distances (★★☆)

53. How to convert a float (32 bits) array into an integer (32 bits) in place?

54. How to read the following file? (★★☆)

```
1, 2, 3, 4, 5
6,  ,  , 7, 8
 ,  , 9,10,11
```

55. What is the equivalent of enumerate for numpy arrays? (★★☆)

56. Generate a generic 2D Gaussian-like array (★★☆)

57. How to randomly place p elements in a 2D array? (★★☆)

58. Subtract the mean of each row of a matrix (★★☆)

59. How to sort an array by the nth column? (★★☆)

60. How to tell if a given 2D array has null columns? (★★☆)

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61. Find the nearest value from a given value in an array (★★☆)

62. Considering two arrays with shape (1,3) and (3,1), how to compute their sum using an iterator? (★★☆)

63. Create an array class that has a name attribute (★★☆)

64. Consider a given vector, how to add 1 to each element indexed by a second vector (be careful with repeated indices)? (★★★)

65. How to accumulate elements of a vector (X) to an array (F) based on an index list (I)? (★★★)

66. Considering a (w,h,3) image of (dtype=ubyte), compute the number of unique colors (★★★)

67. Considering a four dimensions array, how to get sum over the last two axis at once? (★★★)

68. Considering a one-dimensional vector D, how to compute means of subsets of D using a vector S of same size describing subset indices? (★★★)

69. How to get the diagonal of a dot product? (★★★)

70. Consider the vector [1, 2, 3, 4, 5], how to build a new vector with 3 consecutive zeros interleaved between each value? (★★★)

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71. Consider an array of dimension (5,5,3), how to mulitply it by an array with dimensions (5,5)? (★★★)

72. How to swap two rows of an array? (★★★)

73. Consider a set of 10 triplets describing 10 triangles (with shared vertices), find the set of unique line segments composing all the triangles (★★★)

74. Given an array C that is a bincount, how to produce an array A such that np.bincount(A) == C? (★★★)

75. How to compute averages using a sliding window over an array? (★★★)

76. Consider a one-dimensional array Z, build a two-dimensional array whose first row is (Z[0],Z[1],Z[2]) and each subsequent row is shifted by 1 (last row should be (Z[-3],Z[-2],Z[-1]) (★★★)

77. How to negate a boolean, or to change the sign of a float inplace? (★★★)

78. Consider 2 sets of points P0,P1 describing lines (2d) and a point p, how to compute distance from p to each line i (P0[i],P1[i])? (★★★)

79. Consider 2 sets of points P0,P1 describing lines (2d) and a set of points P, how to compute distance from each point j (P[j]) to each line i (P0[i],P1[i])? (★★★)

80. Consider an arbitrary array, write a function that extract a subpart with a fixed shape and centered on a given element (pad with a `fill` value when necessary) (★★★)

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81. Consider an array Z = [1,2,3,4,5,6,7,8,9,10,11,12,13,14], how to generate an array R = [[1,2,3,4], [2,3,4,5], [3,4,5,6], ..., [11,12,13,14]]? (★★★)

82. Compute a matrix rank (★★★)

83. How to find the most frequent value in an array?

84. Extract all the contiguous 3×3 blocks from a random 10×10 matrix (★★★)

85. Create a 2D array subclass such that Z[i,j] == Z[j,i] (★★★)

86. Consider a set of p matrices wich shape (n,n) and a set of p vectors with shape (n,1). How to compute the sum of of the p matrix products at once? (result has shape (n,1)) (★★★)

87. Consider a 16×16 array, how to get the block-sum (block size is 4×4)? (★★★)

88. How to implement the Game of Life using numpy arrays? (★★★)

89. How to get the n largest values of an array (★★★)

90. Given an arbitrary number of vectors, build the cartesian product (every combinations of every item) (★★★)

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91. How to create a record array from a regular array? (★★★)

92. Consider a large vector Z, compute Z to the power of 3 using 3 different methods (★★★)

93. Consider two arrays A and B of shape (8,3) and (2,2). How to find rows of A that contain elements of each row of B regardless of the order of the elements in B? (★★★)

94. Considering a 10×3 matrix, extract rows with unequal values (e.g. [2,2,3]) (★★★)

95. Convert a vector of ints into a matrix binary representation (★★★)

96. Given a two dimensional array, how to extract unique rows? (★★★)

97. Considering 2 vectors A & B, write the einsum equivalent of inner, outer, sum, and mul function (★★★)

98. Considering a path described by two vectors (X,Y), how to sample it using equidistant samples (★★★)?

99. Given an integer n and a 2D array X, select from X the rows which can be interpreted as draws from a multinomial distribution with n degrees, i.e., the rows which only contain integers and which sum to n. (★★★)

100. Compute bootstrapped 95% confidence intervals for the mean of a 1D array X (i.e., resample the elements of an array with replacement N times, compute the mean of each sample, and then compute percentiles over the means). (★★★)

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Congratulations on completing the 100 exercises, well done!

What to do next?

- Share your completed notebook on Facebook, LinkedIn or Twitter and challenge your friends.

- Share your solutions and help others on the forum: https://jovian.ml/forum/t/100-numpy-exercises-hints-discussions-help/10561

- Check out our course on "Data Analysis with Python: Zero to Pandas" - https://jovian.ml/learn/data-analysis-with-python-zero-to-pandas

- Star this repository to show your appreciation for the original author of this notebook: https://github.com/rougier/numpy-100