Lab Exercise 4 - Solutions

Task 1: Write a NumPy program to test whether none of the elements of a given array is zero.

```
import numpy as np
x = np.array([10, 2, 30, 45])
print("Original array:")
print(x)
print("Test if NONE of the elements of the array is zero:")
print(np.all(x))
```

Task 2: There are two arrays. The first array, array1 contains the values 45, 67, 23 and array2 contains the values 56, 23, and 89. Write a NumPy program to create an element-wise comparison (greater, greater_equal, less and less_equal) of those two arrays.

```
import numpy as np
array1 = np.array([45, 67, 23])
array2 = np.array([56, 23, 89])
print("Comparison - greater")
print(np.greater(array1, array2))
print("Comparison - greater_equal")
print(np.greater_equal(array1, array2))
print("Comparison - less")
print(np.less(array1, array2))
print("Comparison - less_equal")
print(np.less_equal(array1, array2))
```

Task3 Write a NumPy program to create an array of 8 zeros, 5 ones, 10 fives.

```
import numpy as np
array=np.zeros(8)
print("An array of 10 zeros:")
print(array)
array=np.ones(5)
print("An array of 10 ones:")
print(array)
array=np.ones(10)*5
print("An array of 10 fives:")
print(array)
```

```
An array of 10 zeros:
[0. 0. 0. 0. 0. 0. 0. 0.]
An array of 10 ones:
[1. 1. 1. 1. 1.]
An array of 10 fives:
[5. 5. 5. 5. 5. 5. 5. 5. 5. 5.]
```

Task4: Write a NumPy program to add a vector **v** with values 2, 0, 2 to each row of a matrix **m** with values:

[23 45 11]
[12 23 54]
[29 19 34]
[1 23 10]

```
import numpy as np
m = np.array([[23, 45, 11], [12, 23, 54], [29, 19, 34], [1, 23, 10]])
v = np.array([2, 0, 2])
print("Original vector:")
print(v)
print("Original matrix:")
print(m)
result = np.empty_like(m)
for i in range(4):
  result[i, :] = m[i, :] + v
print("\nAfter adding the vector v to each row of the matrix m:")
print(result)
```

Task 5: Write a NumPy program to create a 5x5 2d array with 1 on the border and 25 inside.

```
import numpy as np
x = np.ones((5,5))
print("Original array:")
print(x)
print("1 on the border and 0 inside in the array")
x[1:-1,1:-1] = 25
print(x)
```

Task 6: Write a NumPy program to find common values between two arrays.

Array1	Array2
[23, 45, 11, 5]	[23, 5, 1]

```
import numpy as np
array1 = np.array([23, 45, 11, 5])
print("Array1: ",array1)
array2 = [23, 5, 1]
print("Array2: ",array2)
print("Common values between two arrays:")
print(np.intersect1d(array1, array2))
```

Task 7: Perform the following manipulation of the two arrays below: horizontal stacking, vertical stacking; divide the individual array horizontally and vertically.

Array1	Array2
[23, 45, 11]	[3, 5, 1]
[12, 23, 54]	[2, 3, 4]
[1, 23, 10]	[9, 1, 5]

Consider the following dataframe for the remaining tasks

Sample DataFrame:
assessment_results = {'name': ['Anastasia', 'Paul', 'Kathe', 'Joseph', 'Linda', 'Michael', 'Matt', 'Laurentine', 'Chirstian', 'Jonas'],
'score': [12.5, 10, 16.5, np.nan, 9, 20, 14.5, np.nan, 8, 19],
'attempts': [1, 3, 2, 3, 2, 3, 1, 1, 2, 1],
'qualify': ['yes', 'no', 'yes', 'no', 'no', 'yes', 'yes', 'no', 'no', 'yes']}
labels = ['a', 'b', 'c', 'd', 'e', 'f', 'g', 'h', 'i', 'j']

Task 8: Write a Pandas program to get the first 3 rows of a given DataFrame.

```
import pandas as pd
import numpy as np

exam_data  = {'name': ['Anastasia', 'Paul', 'Kathe', 'Joseph', 'Linda', 'Michael', 'Matt', 'Laurentine', 'Chirstian', 'Jonas'],
        'score': [12.5, 10, 16.5, np.nan, 9, 20, 14.5, np.nan, 8, 19],
        'attempts': [1, 3, 2, 3, 2, 3, 1, 1, 2, 1],
        'qualify': ['yes', 'no', 'yes', 'no', 'no', 'yes', 'yes', 'no', 'no', 'yes']}
labels = ['a', 'b', 'c', 'd', 'e', 'f', 'g', 'h', 'i', 'j']

df = pd.DataFrame(exam_data , index=labels)
print("First three rows of the data frame:")
print(df.iloc[:3])
```

Task 9: Write a Pandas program to select the rows where the number of attempts in the examination is greater than 2.

```
import pandas as pd
import numpy as np

exam_data  = {'name': ['Anastasia', 'Paul', 'Kathe', 'Joseph', 'Linda', 'Michael', 'Matt', 'Laurentine', 'Chirstian', 'Jonas'],
        'score': [12.5, 10, 16.5, np.nan, 9, 20, 14.5, np.nan, 8, 19],
        'attempts': [1, 3, 2, 3, 2, 3, 1, 1, 2, 1],
        'qualify': ['yes', 'no', 'yes', 'no', 'no', 'yes', 'yes', 'no', 'no', 'yes']}
labels = ['a', 'b', 'c', 'd', 'e', 'f', 'g', 'h', 'i', 'j']

df = pd.DataFrame(exam_data , index=labels)
print("First three rows of the data frame:")
print(df[df['attempts'] > 2])
```

Task 10: Write a Pandas program to count the number of rows and columns of a DataFrame.

```
import pandas as pd
import numpy as np

exam_data  = {'name': ['Anastasia', 'Paul', 'Kathe', 'Joseph', 'Linda', 'Michael', 'Matt', 'Laurentine', 'Chirstian', 'Jonas'],
        'score': [12.5, 10, 16.5, np.nan, 9, 20, 14.5, np.nan, 8, 19],
        'attempts': [1, 3, 2, 3, 2, 3, 1, 1, 2, 1],
        'qualify': ['yes', 'no', 'yes', 'no', 'no', 'yes', 'yes', 'no', 'no', 'yes']}
labels = ['a', 'b', 'c', 'd', 'e', 'f', 'g', 'h', 'i', 'j']

df = pd.DataFrame(exam_data , index=labels)
print("First three rows of the data frame:")
total_rows=len(df.axes[0])
total_cols=len(df.axes[1])
print("Number of Rows: "+str(total_rows))
print("Number of Columns: "+str(total_cols))
```

Task 11: Write a Pandas program to select the rows the score is between 14 and 20 (inclusive).

```
import pandas as pd
import numpy as np

exam_data  = {'name': ['Anastasia', 'Paul', 'Kathe', 'Joseph', 'Linda', 'Michael', 'Matt', 'Laurentine', 'Chirstian', 'Jonas'],
        'score': [12.5, 10, 16.5, np.nan, 9, 20, 14.5, np.nan, 8, 19],
        'attempts': [1, 3, 2, 3, 2, 3, 1, 1, 2, 1],
        'qualify': ['yes', 'no', 'yes', 'no', 'no', 'yes', 'yes', 'no', 'no', 'yes']}
labels = ['a', 'b', 'c', 'd', 'e', 'f', 'g', 'h', 'i', 'j']

df = pd.DataFrame(exam_data , index=labels)
print("Rows where score between 14 and 20 (inclusive):")
print(df[df['score'].between(14, 20)])
```

Task 12: Write a Pandas program to change the score in row 'c' to 11.5

```
import pandas as pd
import numpy as np

exam_data  = {'name': ['Anastasia', 'Paul', 'Kathe', 'Joseph', 'Linda', 'Michael', 'Matt', 'Laurentine', 'Chirstian', 'Jonas'],
        'score': [12.5, 10, 16.5, np.nan, 9, 20, 14.5, np.nan, 8, 19],
        'attempts': [1, 3, 2, 3, 2, 3, 1, 1, 2, 1],
        'qualify': ['yes', 'no', 'yes', 'no', 'no', 'yes', 'yes', 'no', 'no', 'yes']}
labels = ['a', 'b', 'c', 'd', 'e', 'f', 'g', 'h', 'i', 'j']

df = pd.DataFrame(exam_data , index=labels)
print("\nOriginal data frame:")
print(df)
print("\nChange the score in row 'c' to 11.5:")
df.loc['c', 'score'] = 11.5
print(df)
```

Task 13: Write a Pandas program to calculate the mean score for each different student in DataFrame

```
import pandas as pd
import numpy as np

exam_data  = {'name': ['Anastasia', 'Paul', 'Kathe', 'Joseph', 'Linda', 'Michael', 'Matt', 'Laurentine', 'Chirstian', 'Jonas'],
        'score': [12.5, 10, 16.5, np.nan, 9, 20, 14.5, np.nan, 8, 19],
        'attempts': [1, 3, 2, 3, 2, 3, 1, 1, 2, 1],
        'qualify': ['yes', 'no', 'yes', 'no', 'no', 'yes', 'yes', 'no', 'no', 'yes']}
labels = ['a', 'b', 'c', 'd', 'e', 'f', 'g', 'h', 'i', 'j']

df = pd.DataFrame(exam_data , index=labels)
print("\nMean score for each different student in data frame:")
print(df['score'].mean())
```