Hands-on Activity 6.1 Introduction to Data Analysis and Tools

CPE311 Computational Thinking with Python

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6.1 Intended Learning Outcome

1. Use pandas and numpy data analysis tools.
2. Demonstrate how to analyze data using numpy and pandas

6.2 Resources:

Personal Computer

Jupyter Notebook

Internet Connection

# 6.3 Supplementary Activities:

Exercise 1

Run the given code below for exercises 1 and 2, perform the given tasks without using any Python modules

```
import random
random.seed(0)
salaries = [round(random.random()*1000000, -3) for _ in range(100)]
```

Using the data generated above, calculate the following statistics without importing anything from the statistics module in the standard library (https://docs.python.org/3/library/statistics.html) and then confirm your results match up to those that are obtained when using the statistics module (where possible):

Mean

Median

Mode (hint: check out the Counter in the collections module of the standard library at https://docs.python.org/3/library/collections.html#collections.Counter)

Sample variance

Sample standard deviation

```
import statistics as stats
from collections import Counter
from math import isnan
from itertools import filterfalse
import math
data=salaries
meanSal= stats.mean(data)
print("Mean using statisctics module:",meanSal)

total_sum = 0
length= len(data)
for num in data:
    total_sum += num
    mean=total_sum/length
print("Mean without using Statistics Module:", mean)

med=stats.median(data)
print("\nMedian Using stats module:", med)

def getMedian(lst):
    sorted_list = sorted(lst)
    mid = len(sorted_list) // 2
    if len(sorted_list) % 2 == 0:
        median = (sorted_list[mid] + sorted_list[-mid-1]) / 2
    else:
        median = sorted_list[mid]
    return median
result = getMedian(data)
print(f"Median without using Stats module: {result}")


mode=stats.mode(data)
print("\nMode using stats module:", mode)

from collections import Counter
n_num = salaries
n = len(n_num)

data = Counter(n_num)
get_mode = dict(data)
mode = [k for k, v in get_mode.items() if v == max(list(data.values()))]

if len(mode) == n:
    get_mode = "No mode found"
else:
    get_mode = "Mode without stats library is / are: " + ', '.join(map(str, mode))

print(get_mode)

sv=stats.variance(data)
print("\nSample Variance using stats module:", sv)

meanSqred= [(x-meanSal) ** 2 for x in data]
sumOfMeanSqred=sum(meanSqred)
sampVar= sumOfMeanSqred/ (len(data)-1)
print("Variance using stats module:", sampVar)

stanDev= stats.stdev(data)
print(f"\nStandard Deviation using stats module: {stanDev:.2f}")

devData = data
variance = sum((x - mean) ** 2 for x in devData) / len(devData)
std_dev = math.sqrt(sv)

print(f"Sample Standard Deviation without python modules: {std_dev:.2f}")
```

```
Mean using statisctics module: 585690.0
Mean without using Statistics Module: 585690.0

Median Using stats module: 589000.0
Median without using Stats module: 589000.0

Mode using stats module: 477000.0
Mode without stats library is / are: 477000.0

Sample Variance using stats module: 72625796640.53752
Variance using stats module: 72637231377.65958

Standard Deviation using stats module: 269491.74
Sample Standard Deviation without python modules: 269491.74
```

Exercise 2

Using the same data, calculate the following statistics using the functions in the statistics module where appropriate:

Range

Coefficient of variation Interquartile range

Quartile coefficient of dispersion

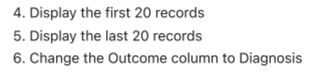
```
range = max(salaries) - min(salaries)

mean = meanSal
standardDev = stanDev
COV = (standardDev / mean) * 100

def cal_iqr(data):
    sorted_data = sorted(data)
    q1 = getMedian(data)
    q3 = getMedian(sorted_data[(len(sorted_data) + 1) // 2:])
    return q3 - q1

iqr = cal_iqr(salaries)

def cal_qd(data):
    sorted_data = sorted(data)
    q1 = getMedian(data)
    q3 = getMedian(sorted_data[(len(sorted_data) + 1) // 2:])
    return (q3 - q1) / (q3 + q1)

qd = cal_qd(salaries)

# output
print(f"Range:", range)
print(f"Coefficient of Variation:", COV,"%")
print(f"Interquartile Range:", iqr)
print(f"Quartile Coefficient of Dispersion:", qd)
```

```
Range: 995000.0
Coefficient of Variation: 46.01269231349201 %
Interquartile Range: 230500.0
Quartile Coefficient of Dispersion: 0.16364927227547035
```

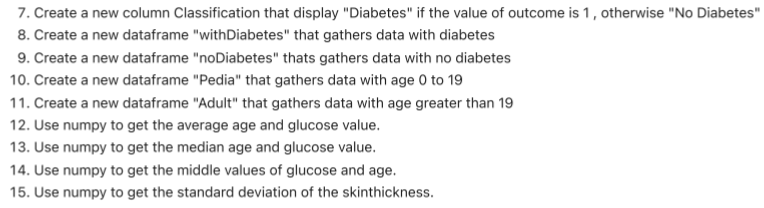
Exercise 3: Pandas for Data Analysis

Load the diabetes.csv file. Convert the diabetes.csv into dataframe Perform the following tasks in the diabetes dataframe:

1. Identify the column names
2. Identify the data types of the data
3. Display the total number of records



4. Display the first 20 records
5. Display the last 20 records
6. Change the Outcome column to Diagnosis



7. Create a new column Classification that display "Diabetes" if the value of outcome is 1 , otherwise "No Diabetes"
8. Create a new dataframe "withDiabetes" that gathers data with diabetes
9. Create a new dataframe "noDiabetes" thats gathers data with no diabetes
10. Create a new dataframe "Pedia" that gathers data with age 0 to 19
11. Create a new dataframe "Adult" that gathers data with age greater than 19
12. Use numpy to get the average age and glucose value.
13. Use numpy to get the median age and glucose value.
14. Use numpy to get the middle values of glucose and age.
15. Use numpy to get the standard deviation of the skinthickness.

```
import pandas as pd
filepath= '/content/diabetes.csv'
data= pd.read_csv(filepath)
data
```

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction	Age	Outcome
0	6	148	72	35	0	33.6	0.627	50	1
1	1	85	66	29	0	26.6	0.351	31	0
2	8	183	64	0	0	23.3	0.672	32	1
3	1	89	66	23	94	28.1	0.167	21	0
4	0	137	40	35	168	43.1	2.288	33	1
...	...	...	...	...	...	...	...	...	...
763	10	101	76	48	180	32.9	0.171	63	0
764	2	122	70	27	0	36.8	0.340	27	0
765	5	121	72	23	112	26.2	0.245	30	0
766	1	126	60	0	0	30.1	0.349	47	1
767	1	93	70	31	0	30.4	0.315	23	0

768 rows × 9 columns

Next steps: Generate code with data   View recommended plots

```
data.columns

# display columns
```

```
Index(['Pregnancies', 'Glucose', 'BloodPressure', 'SkinThickness', 'Insulin',
       'BMI', 'DiabetesPedigreeFunction', 'Age', 'Outcome'],
      dtype='object')
```

```
data.describe()
# indentify data types
```

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction	Age
count	768.000000	768.000000	768.000000	768.000000	768.000000	768.000000	768.000000	768.000000
mean	3.845052	120.894531	69.105469	20.536458	79.799479	31.992578	0.471876	33.240885
std	3.369578	31.972618	19.355807	15.952218	115.244002	7.884160	0.331329	11.760232
min	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.078000	21.000000
25%	1.000000	99.000000	62.000000	0.000000	0.000000	27.300000	0.243750	24.000000
50%	3.000000	117.000000	72.000000	23.000000	30.500000	32.000000	0.372500	29.000000
75%	6.000000	140.250000	80.000000	32.000000	127.250000	36.600000	0.626250	41.000000
max	17.000000	199.000000	122.000000	99.000000	846.000000	67.100000	2.420000	81.000000

```
print(f"Total number of records: {len(data)}")
# total number of records using pandas
```

```
Total number of records: 768
```

```
data.head(20)
# display the first 20 records
```

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction	Age	Outcome
0	6	148	72	35	0	33.6	0.627	50	1
1	1	85	66	29	0	26.6	0.351	31	0
2	8	183	64	0	0	23.3	0.672	32	1
3	1	89	66	23	94	28.1	0.167	21	0
4	0	137	40	35	168	43.1	2.288	33	1
5	5	116	74	0	0	25.6	0.201	30	0
6	3	78	50	32	88	31.0	0.248	26	1
7	10	115	0	0	0	35.3	0.134	29	0
8	2	197	70	45	543	30.5	0.158	53	1
9	8	125	96	0	0	0.0	0.232	54	1
10	4	110	92	0	0	37.6	0.191	30	0
11	10	168	74	0	0	38.0	0.537	34	1
12	10	139	80	0	0	27.1	1.441	57	0
13	1	189	60	23	846	30.1	0.398	59	1
14	5	166	72	19	175	25.8	0.587	51	1
15	7	100	0	0	0	30.0	0.484	32	1
16	0	118	84	47	230	45.8	0.551	31	1
17	7	107	74	0	0	29.6	0.254	31	1
18	1	103	30	38	83	43.3	0.183	33	0
19	1	115	70	30	96	34.6	0.529	32	1

```
data.tail(20)
# display the last 20 records
```

```
     Pregnancies  Glucose  BloodPressure  SkinThickness  Insulin   BMI  DiabetesPedigreeFunction  Age  Outcome
748            3      187             70             22      200  36.4                     0.408   36        1
749            6      162             62              0        0  24.3                     0.178   50        1
750            4      136             70              0        0  31.2                     1.182   22        1
751            1      121             78             39       74  39.0                     0.261   28        0
752            3      108             62             24        0  26.0                     0.223   25        0
753            0      181             88             44      510  43.3                     0.222   26        1
754            8      154             78             32        0  32.4                     0.443   45        1
755            1      128             88             39      110  36.5                     1.057   37        1
756            7      137             90             41        0  32.0                     0.391   39        0
757            0      123             72              0        0  36.3                     0.258   52        1
758            1      106             76              0        0  37.5                     0.197   26        0
759            6      190             92              0        0  35.5                     0.278   66        1
760            2       88             58             26       16  28.4                     0.766   22        0
761            9      170             74             31        0  44.0                     0.403   43        1
762            9       89             62              0        0  22.5                     0.142   33        0
763           10      101             76             48      180  32.9                     0.171   63        0
764            2      122             70             27        0  36.8                     0.340   27        0
765            5      121             72             23      112  26.2                     0.245   30        0
766            1      126             60              0        0  30.1                     0.349   47        1
767            1       93             70             31        0  30.4                     0.315   23        0
```

```
data
```

```
     Pregnancies  Glucose  BloodPressure  SkinThickness  Insulin   BMI  DiabetesPedigreeFunction  Age  Outcome
0              6      148             72             35        0  33.6                     0.627   50        1
1              1       85             66             29        0  26.6                     0.351   31        0
2              8      183             64              0        0  23.3                     0.672   32        1
3              1       89             66             23       94  28.1                     0.167   21        0
4              0      137             40             35      168  43.1                     2.288   33        1
...          ...      ...            ...            ...      ...   ...                       ...  ...      ...
763           10      101             76             48      180  32.9                     0.171   63        0
764            2      122             70             27        0  36.8                     0.340   27        0
765            5      121             72             23      112  26.2                     0.245   30        0
766            1      126             60              0        0  30.1                     0.349   47        1
767            1       93             70             31        0  30.4                     0.315   23        0

768 rows × 9 columns
```

Next steps: Generate code with data View recommended plots

```
data = data.rename(columns={'Outcome': 'Diagnosis'})
# rename outcomes to Diagnosis
data
```

```
     Pregnancies  Glucose  BloodPressure  SkinThickness  Insulin   BMI  DiabetesPedigreeFunction  Age  Diagnosis
0              6      148             72             35        0  33.6                     0.627   50          1
1              1       85             66             29        0  26.6                     0.351   31          0
2              8      183             64              0        0  23.3                     0.672   32          1
3              1       89             66             23       94  28.1                     0.167   21          0
4              0      137             40             35      168  43.1                     2.288   33          1
...          ...      ...            ...            ...      ...   ...                       ...  ...        ...
763           10      101             76             48      180  32.9                     0.171   63          0
764            2      122             70             27        0  36.8                     0.340   27          0
765            5      121             72             23      112  26.2                     0.245   30          0
766            1      126             60              0        0  30.1                     0.349   47          1
767            1       93             70             31        0  30.4                     0.315   23          0

768 rows × 9 columns
```

Next steps: Generate code with data View recommended plots

```
data['Classification'] = data['Diagnosis'].apply(lambda x: 'Diabetes' if x == 1 else 'No Diabetes')
data.head()
# Create a new column Classification that display
# "Diabetes" if the value of outcome is 1 , otherwise "No Diabetes"
```

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction	Age	Diagnosis	Classification
0	6	148	72	35	0	33.6	0.627	50	1	Diabetes
1	1	85	66	29	0	26.6	0.351	31	0	No Diabetes
2	8	183	64	0	0	23.3	0.672	32	1	Diabetes
3	1	89	66	23	94	28.1	0.167	21	0	No Diabetes
4	0	137	40	35	168	43.1	2.288	33	1	Diabetes

```
withDiabetes= data[data['Diagnosis'] == 1]
withDiabetes.head(20)
# Create a new dataframe "withDiabetes" that gathers data with diabetes
```

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction	Age	Diagnosis	Classification
0	6	148	72	35	0	33.6	0.627	50	1	Diabetes
2	8	183	64	0	0	23.3	0.672	32	1	Diabetes
4	0	137	40	35	168	43.1	2.288	33	1	Diabetes
6	3	78	50	32	88	31.0	0.248	26	1	Diabetes
8	2	197	70	45	543	30.5	0.158	53	1	Diabetes
9	8	125	96	0	0	0.0	0.232	54	1	Diabetes
11	10	168	74	0	0	38.0	0.537	34	1	Diabetes
13	1	189	60	23	846	30.1	0.398	59	1	Diabetes
14	5	166	72	19	175	25.8	0.587	51	1	Diabetes
15	7	100	0	0	0	30.0	0.484	32	1	Diabetes
16	0	118	84	47	230	45.8	0.551	31	1	Diabetes
17	7	107	74	0	0	29.6	0.254	31	1	Diabetes
19	1	115	70	30	96	34.6	0.529	32	1	Diabetes
22	7	196	90	0	0	39.8	0.451	41	1	Diabetes
23	9	119	80	35	0	29.0	0.263	29	1	Diabetes
24	11	143	94	33	146	36.6	0.254	51	1	Diabetes
25	10	125	70	26	115	31.1	0.205	41	1	Diabetes
26	7	147	76	0	0	39.4	0.257	43	1	Diabetes
31	3	158	76	36	245	31.6	0.851	28	1	Diabetes
37	9	102	76	37	0	32.9	0.665	46	1	Diabetes

Next steps: Generate code with withDiabetes View recommended plots

```
noDiabetes= data[data['Diagnosis'] == 0]
noDiabetes.head(20)
#  Create a new dataframe "noDiabetes" thats gathers data with no diabetes
```

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction	Age	Diagnosis	Classifi
1	1	85	66	29	0	26.6	0.351	31	0	No D
3	1	89	66	23	94	28.1	0.167	21	0	No D
5	5	116	74	0	0	25.6	0.201	30	0	No D
7	10	115	0	0	0	35.3	0.134	29	0	No D
10	4	110	92	0	0	37.6	0.191	30	0	No D
12	10	139	80	0	0	27.1	1.441	57	0	No D
18	1	103	30	38	83	43.3	0.183	33	0	No D
20	3	126	88	41	235	39.3	0.704	27	0	No D
21	8	99	84	0	0	35.4	0.388	50	0	No D
27	1	97	66	15	140	23.2	0.487	22	0	No D
28	13	145	82	19	110	22.2	0.245	57	0	No D
29	5	117	92	0	0	34.1	0.337	38	0	No D
30	5	109	75	26	0	36.0	0.546	60	0	No D
32	3	88	58	11	54	24.8	0.267	22	0	No D
33	6	92	92	0	0	19.9	0.188	28	0	No D
34	10	122	78	31	0	27.6	0.512	45	0	No D
35	4	103	60	33	192	24.0	0.966	33	0	No D
36	11	138	76	0	0	33.2	0.420	35	0	No D
40	3	180	64	25	70	34.0	0.271	26	0	No D
41	7	133	84	0	0	40.2	0.696	37	0	No D

```
Pedia= data[data['Age'] <= 19]
Pedia.head(20)

# Create a new DataFrame "Pedia" that gathers data with age 0 to 19

# current data set has no data with ages < 20
```

```
   Pregnancies  Glucose  BloodPressure  SkinThickness  Insulin  BMI  DiabetesPedigreeFunction  Age  Diagnosis  Classificat
```

```
Adult= data[data['Age'] > 19]
Adult.head(20)

# Create a new DataFrame "Adult" that gathers data with age greater than 19
```

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction	Age	Diagnosis	Classifi
0	6	148	72	35	0	33.6	0.627	50	1	D
1	1	85	66	29	0	26.6	0.351	31	0	No D
2	8	183	64	0	0	23.3	0.672	32	1	D
3	1	89	66	23	94	28.1	0.167	21	0	No D
4	0	137	40	35	168	43.1	2.288	33	1	D
5	5	116	74	0	0	25.6	0.201	30	0	No D
6	3	78	50	32	88	31.0	0.248	26	1	D
7	10	115	0	0	0	35.3	0.134	29	0	No D
8	2	197	70	45	543	30.5	0.158	53	1	D
9	8	125	96	0	0	0.0	0.232	54	1	D
10	4	110	92	0	0	37.6	0.191	30	0	No D
11	10	168	74	0	0	38.0	0.537	34	1	D
12	10	139	80	0	0	27.1	1.441	57	0	No D
13	1	189	60	23	846	30.1	0.398	59	1	D
14	5	166	72	19	175	25.8	0.587	51	1	D
15	7	100	0	0	0	30.0	0.484	32	1	D
16	0	118	84	47	230	45.8	0.551	31	1	D