Diabetes Analysis

In this file we'll be analyzing Diabetes information for female.

```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt

%matplotlib inline
```

Reading data:

```
pd.read_excel
```

```
<function pandas.io.excel._base.read_excel(io, sheet_name: 'str | int | list[IntStrT] | None' = 0, *, header: 'int | Sequence[int] | None' = 0, names: 'list[str] | None' = None, index_col: 'int | Sequence[int] | None' = None, usecols: 'int | str | Sequence[int] | Sequence[str] | Callable[[str], bool] | None' = None, dtype: 'DtypeArg | None' = None, engine: "Literal['xlrd', 'openpyxl', 'odf', 'pyxlsb'] | None" = None, converters: 'dict[str, Callable] | dict[int, Callable] | None' = None, true_values: 'Iterable[Hashable] | None' = None, false_values: 'Iterable[Hashable] | None' = None, skiprows: 'Sequence[int] | int | Callable[[int], object] | None' = None, nrows: 'int | None' = None, na_values=None, keep_default_na: 'bool' = True, na_filter: 'bool' = True, verbose: 'bool' = False, parse_dates: 'list | dict | bool' = False, date_parser: 'Callable | lib.NoDefault' = <no_default>, date_format: 'dict[Hashable, str] | str | None' = None, thousands: 'str | None' = None, decimal: 'str' = '.', comment: 'str | None' = None, skipfooter: 'int' = 0, storage_options: 'StorageOptions' = None, dtype_backend: 'DtypeBackend | lib.NoDefault' = <no_default>) -> 'DataFrame | dict[IntStrT, DataFrame]'>
```

```
df = pd.read_excel('E:\MeriSkillInternship\Project 2 - Diabetes Data\diabetes_python.xlsx')
```

```
df.head()
```

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction	Age	AgeCategories	Exist Cases	Cases_Num	Preg
0	6	148	72	35	0	33.6	0.627	50	old	Yes	1	
1	1	85	66	29	0	26.6	0.351	31	Middle Age	No	0	
2	8	183	64	0	0	23.3	0.672	32	Middle Age	Yes	1	
3	1	89	66	23	94	28.1	0.167	21	Adolescent	No	0	
4	0	137	40	35	168	43.1	2.288	33	Middle Age	Yes	1	

```
df.shape
```

```
(768, 11)
```

```
df.tail(3)
```

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction	Age	AgeCategories	Exist Cases	Cases_N
765	5	121	72	23	112	26.2	0.245	30	Adolescent	No	
766	1	126	60	0	0	30.1	0.349	47	Middle Age	Yes	
767	1	93	70	31	0	30.4	0.315	23	Adolescent	No	

```
df.head()
```

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

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 768 entries, 0 to 767
Data columns (total 11 columns):
 #   Column                    Non-Null Count  Dtype  
---  ------                    --------------  -----  
 0   Pregnancies               768 non-null    int64  
 1   Glucose                   768 non-null    int64  
 2   BloodPressure             768 non-null    int64  
 3   SkinThickness             768 non-null    int64  
 4   Insulin                   768 non-null    int64  
 5   BMI                       768 non-null    float64
 6   DiabetesPedigreeFunction  768 non-null    float64
 7   Age                       768 non-null    int64  
 8   AgeCategories             768 non-null    object 
 9   Exist Cases               768 non-null    object 
 10  Cases_Num                 768 non-null    int64  
dtypes: float64(2), int64(7), object(2)
memory usage: 66.1+ KB
```

```
df.describe()
```

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction	Age	Cases_Num
count	768.000000	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	0.348958
std	3.369578	31.972618	19.355807	15.952218	115.244002	7.884160	0.331329	11.760232	0.476951
min	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.078000	21.000000	0.000000
25%	1.000000	99.000000	62.000000	0.000000	0.000000	27.300000	0.243750	24.000000	0.000000
50%	3.000000	117.000000	72.000000	23.000000	30.500000	32.000000	0.372500	29.000000	0.000000
75%	6.000000	140.250000	80.000000	32.000000	127.250000	36.600000	0.626250	41.000000	1.000000
max	17.000000	199.000000	122.000000	99.000000	846.000000	67.100000	2.420000	81.000000	1.000000

```
df.columns
```

```
Index(['Pregnancies', 'Glucose', 'BloodPressure', 'SkinThickness', 'Insulin',
       'BMI', 'DiabetesPedigreeFunction', 'Age', 'AgeCategories',
       'Exist Cases', 'Cases_Num'],
      dtype='object')
```

Check Null Values

```
df.isna().sum()
```

```
Pregnancies                 0
Glucose                     0
BloodPressure               0
SkinThickness               0
Insulin                     0
BMI                         0
DiabetesPedigreeFunction    0
Age                         0
AgeCategories               0
Exist Cases                 0
Cases_Num                   0
dtype: int64
```

Check Duplicate Values

```
df.duplicated().sum()
```

```
0
```

Numerical analysis and visualization

We'll analyze the `Glucose` column:

```
df['Glucose'].describe()
```

```
count    768.000000
mean     120.894531
std       31.972618
min        0.000000
25%       99.000000
50%      117.000000
75%      140.250000
max      199.000000
Name: Glucose, dtype: float64
```

```
df['Glucose'].mean()
```

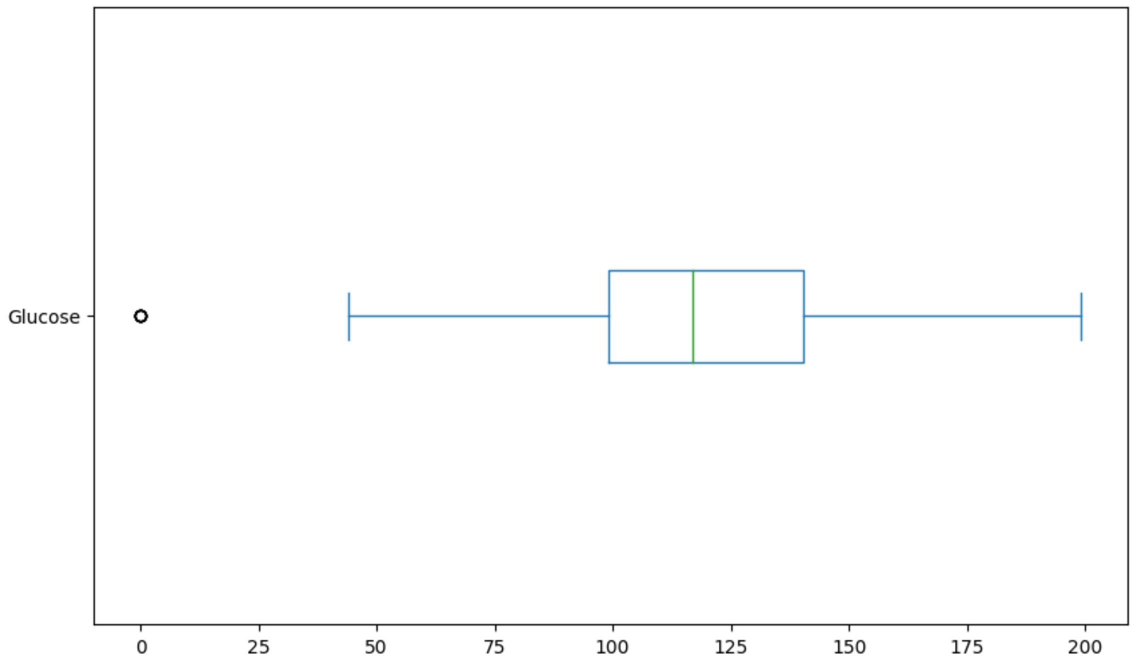
```
120.89453125
```

```
df['Glucose'].median()
```

```
117.0
```

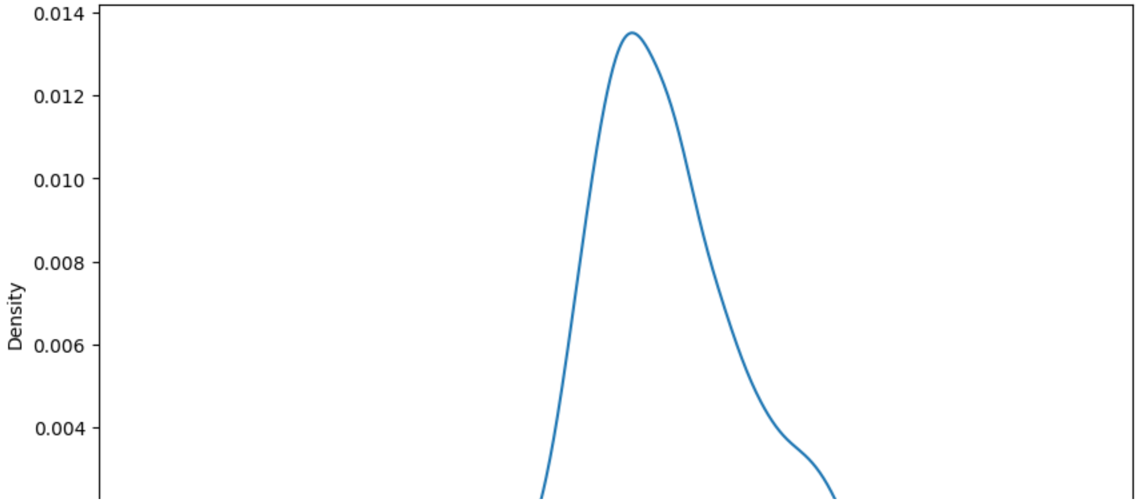
```
df['Glucose'].plot(kind='box', vert=False, figsize=(10,6))
```

```
<Axes: >
```



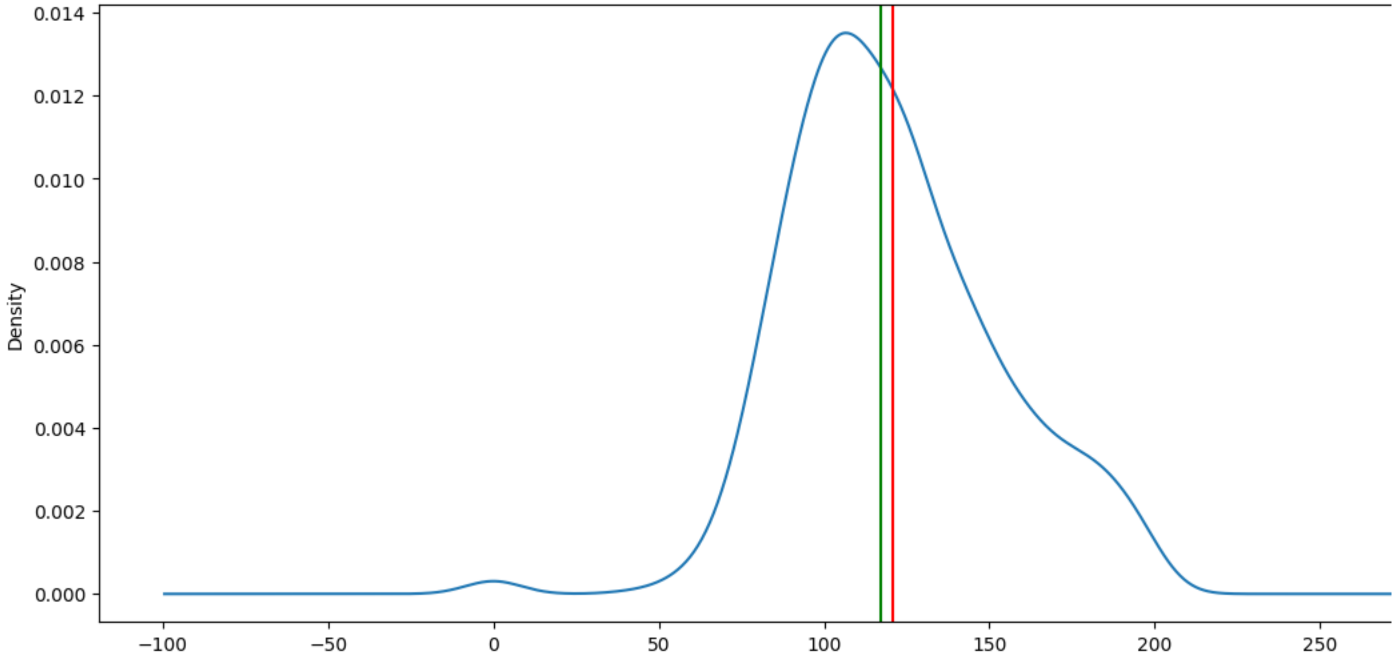
```
df['Glucose'].plot(kind='density', figsize=(10,6))
```

```
<Axes: ylabel='Density'>
```



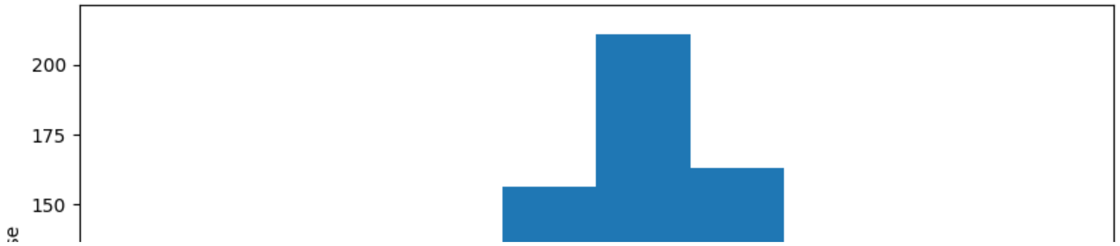
```
ax = df['Glucose'].plot(kind='density', figsize=(14,6)) # kde
ax.axvline(df['Glucose'].mean(), color='red')
ax.axvline(df['Glucose'].median(), color='green')
```

```
<matplotlib.lines.Line2D at 0x1c9b939e2d0>
```



```
ax = df['Glucose'].plot(kind='hist', figsize=(10,6))
ax.set_ylabel('Number of Glucose')
ax.set_xlabel('Glucose')
```

```
Text(0.5, 0, 'Glucose')
```



Categorical analysis and visualization

We'll analyze the `AgeCategories` column:

```
df.head()
```

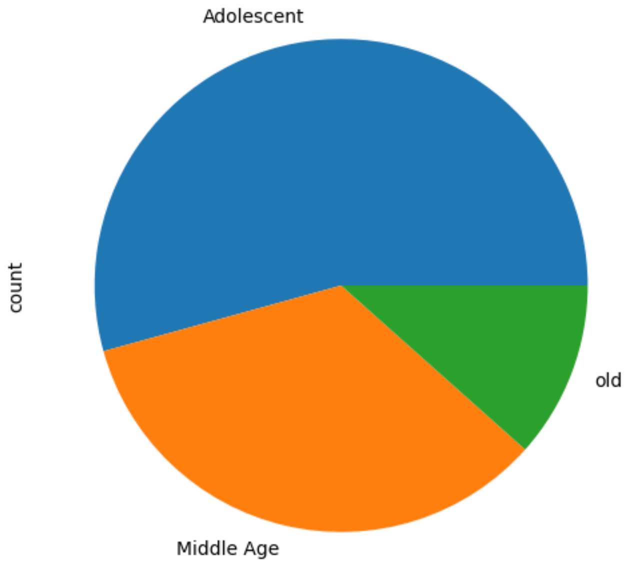
	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction	Age	AgeCategories	Exist Cases	Cases_Num
0	6	148	72	35	0	33.6	0.627	50	old	Yes	1
1	1	85	66	29	0	26.6	0.351	31	Middle Age	No	0
2	8	183	64	0	0	23.3	0.672	32	Middle Age	Yes	1
3	1	89	66	23	94	28.1	0.167	21	Adolescent	No	0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

```
df['AgeCategories'].value_counts()
```

```
AgeCategories
Adolescent    417
Middle Age    262
old            89
Name: count, dtype: int64
```

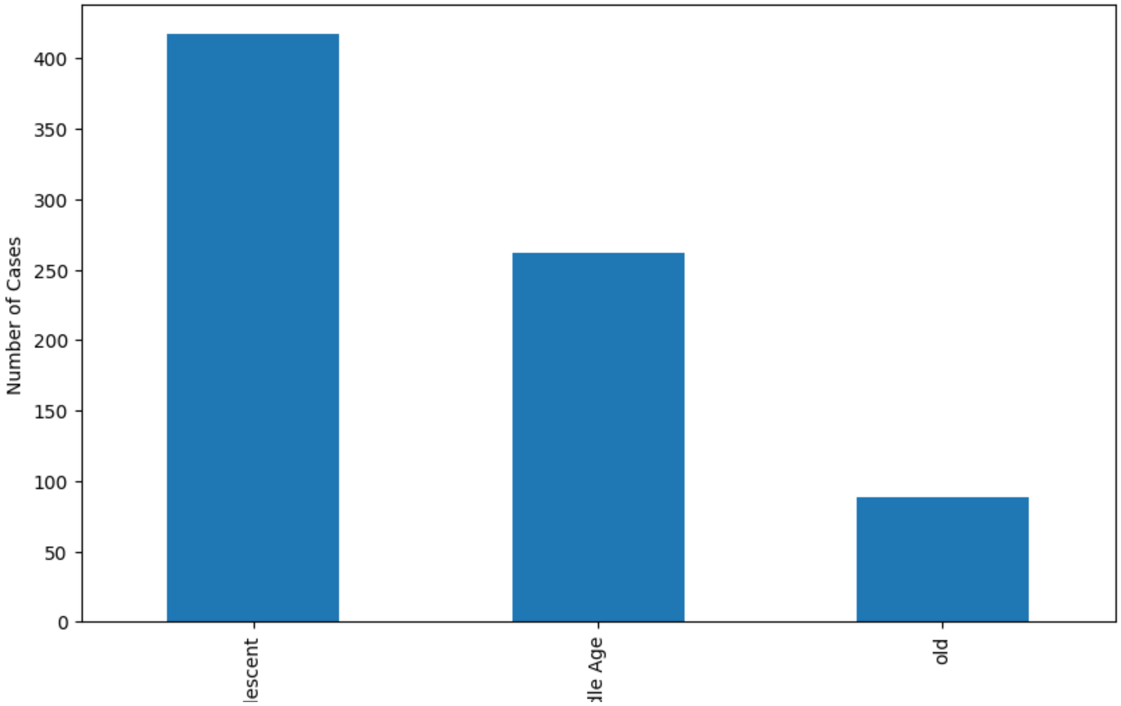
```
df['AgeCategories'].value_counts().plot(kind='pie', figsize=(6,6))
```

```
<Axes: ylabel='count'>
```



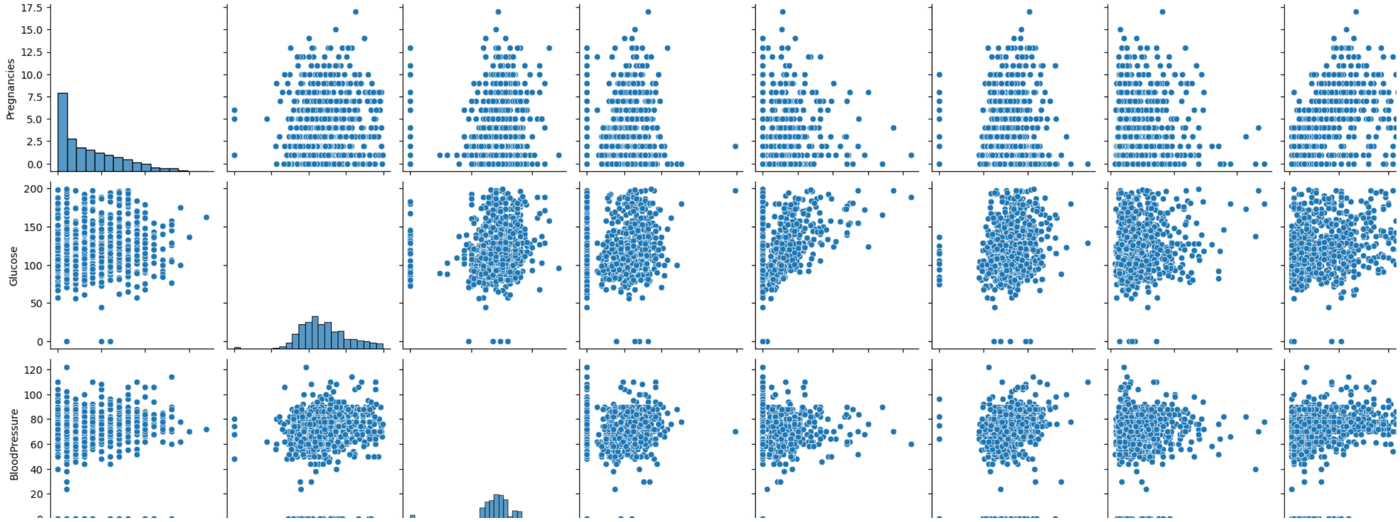
```
ax = df['AgeCategories'].value_counts().plot(kind='bar', figsize=(10,6))
ax.set_ylabel('Number of Cases')
```

```
Text(0, 0.5, 'Number of Cases')
```



```
sns.pairplot(df)
plt.show()
```

```
c:\Users\USER\AppData\Local\Programs\Python\Python311\Lib\site-packages\seaborn\axisgrid.py:118: UserWarning: The figure layout has chang
  self._figure.tight_layout(*args, **kwargs)
```



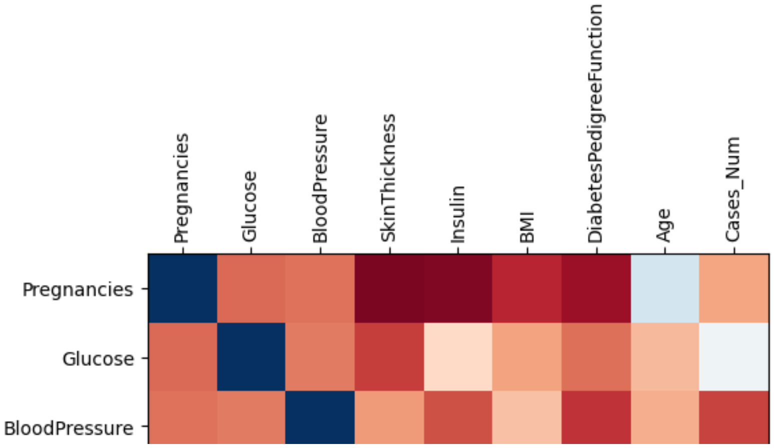
Relationship between the columns?

We will find any significant relationship

```
columns = ['Pregnancies', 'Glucose', 'BloodPressure', 'SkinThickness',
       'Insulin', 'BMI', 'DiabetesPedigreeFunction', 'Age', 'Cases_Num']
corr=df[columns].corr()
corr
```

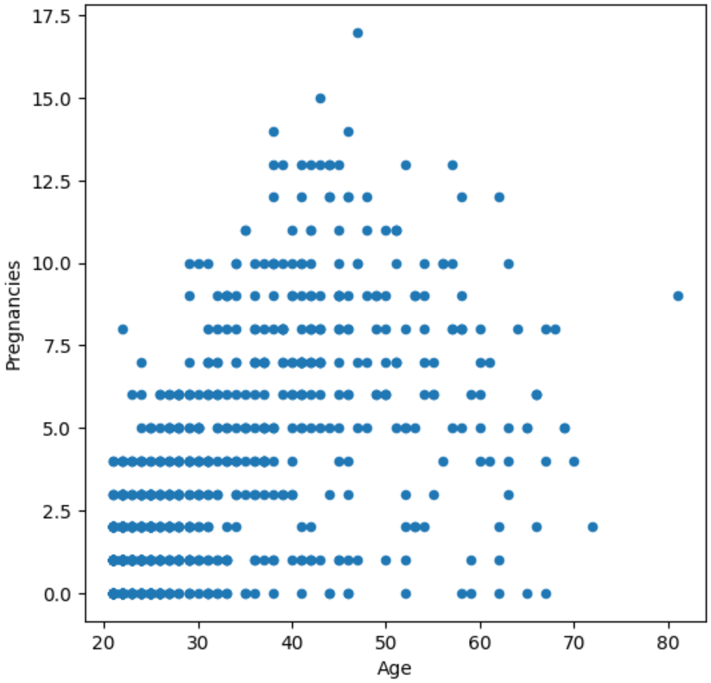
	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction	Age	Cas
Pregnancies	1.000000	0.129459	0.141282	-0.081672	-0.073535	0.017683	-0.033523	0.544341	0.2
Glucose	0.129459	1.000000	0.152590	0.057328	0.331357	0.221071	0.137337	0.263514	0.4
BloodPressure	0.141282	0.152590	1.000000	0.207371	0.088933	0.281805	0.041265	0.239528	0.0
SkinThickness	-0.081672	0.057328	0.207371	1.000000	0.436783	0.392573	0.183928	-0.113970	0.0
Insulin	-0.073535	0.331357	0.088933	0.436783	1.000000	0.197859	0.185071	-0.042163	0.1
BMI	0.017683	0.221071	0.281805	0.392573	0.197859	1.000000	0.140647	0.036242	0.2
DiabetesPedigreeFunction	-0.033523	0.137337	0.041265	0.183928	0.185071	0.140647	1.000000	0.033561	0.1
Age	0.544341	0.263514	0.239528	-0.113970	-0.042163	0.036242	0.033561	1.000000	0.2
Cases_Num	0.221898	0.466581	0.065068	0.074752	0.130548	0.292695	0.173844	0.238356	1.0

```
fig = plt.figure(figsize=(6,6))
plt.matshow(corr, cmap='RdBu', fignum=fig.number)
plt.xticks(range(len(corr.columns)), corr.columns, rotation='vertical');
plt.yticks(range(len(corr.columns)), corr.columns);
```



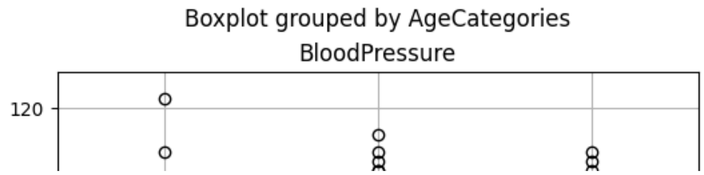
```
df.plot(kind='scatter', x='Age', y='Pregnancies', figsize=(6,6))
```

```
<Axes: xlabel='Age', ylabel='Pregnancies'>
```



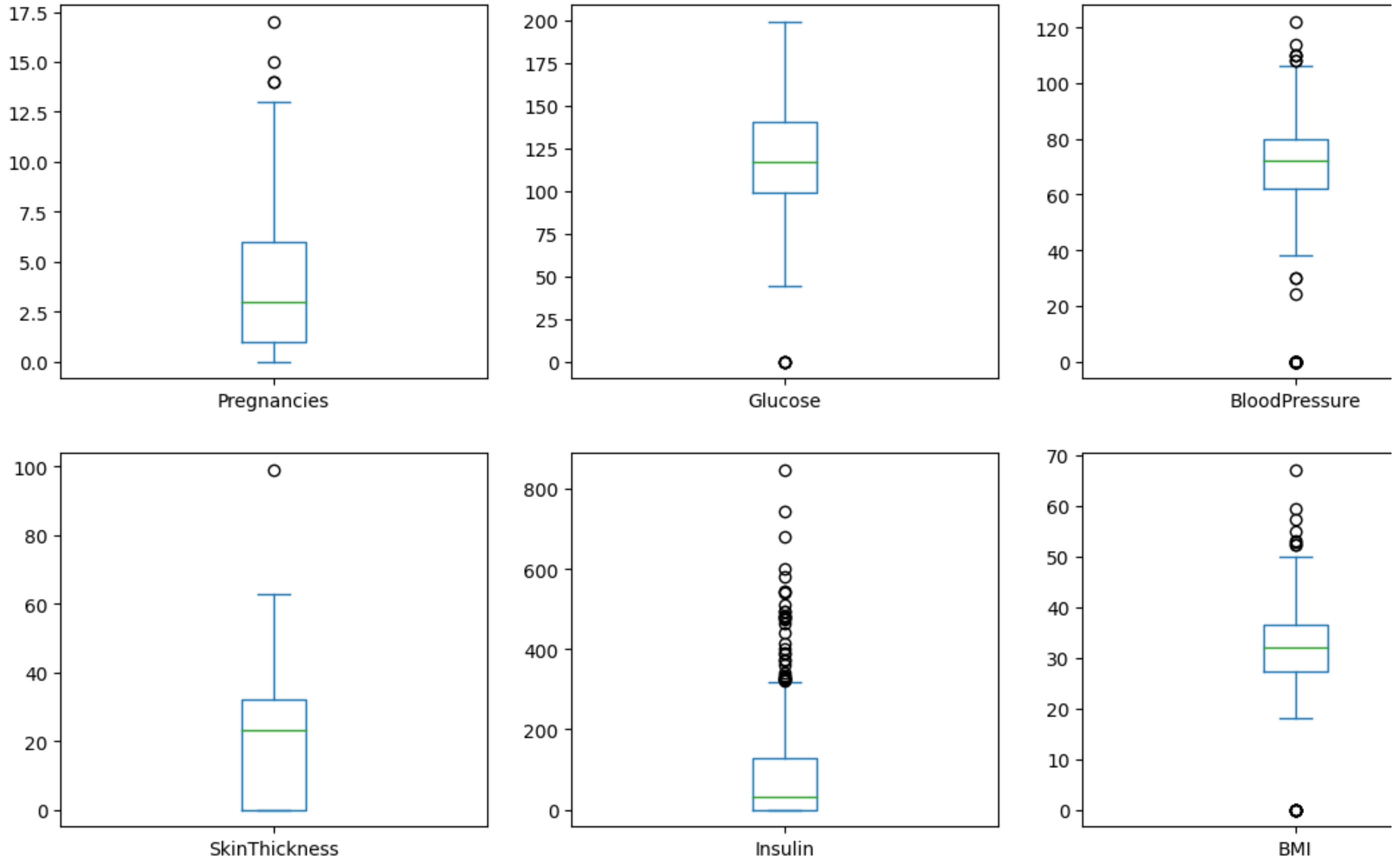
```
ax = df[['BloodPressure', 'AgeCategories']].boxplot(by='AgeCategories', figsize=(6,6))
ax.set_ylabel('BloodPressure')
```

```
    Text(0, 0.5, 'BloodPressure')
```



```
boxplot_cols = ['Pregnancies', 'Glucose', 'BloodPressure', 'SkinThickness','Insulin', 'BMI']
df[boxplot_cols].plot(kind='box', subplots=True, layout=(2,3), figsize=(14,8))
```

```
    Pregnancies       Axes(0.125,0.53;0.227941x0.35)
    Glucose        Axes(0.398529,0.53;0.227941x0.35)
    BloodPressure  Axes(0.672059,0.53;0.227941x0.35)
    SkinThickness     Axes(0.125,0.11;0.227941x0.35)
    Insulin        Axes(0.398529,0.11;0.227941x0.35)
    BMI            Axes(0.672059,0.11;0.227941x0.35)
    dtype: object
```



Column wrangling

Add and calculate a new `Pregnancies_per_Age` column

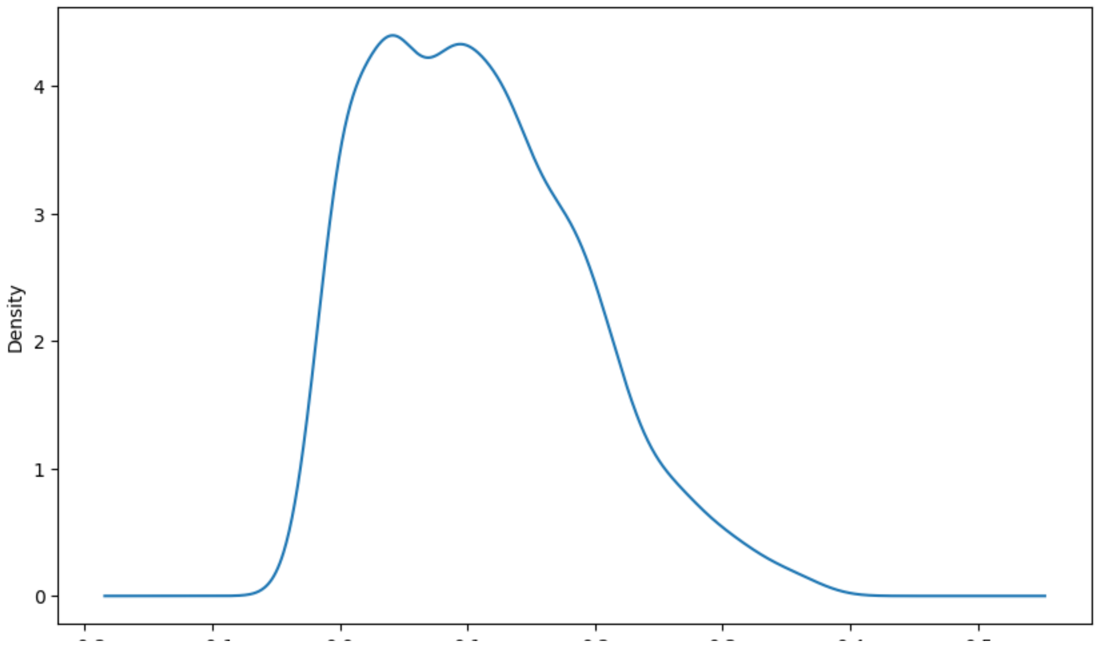
```
df['Pregnancies_per_Age'] = df['Pregnancies'] / df['Age']
```

```
df['Pregnancies_per_Age'].head()
```

```
    0    0.120000
    1    0.032258
    2    0.250000
    3    0.047619
    4    0.000000
    Name: Pregnancies_per_Age, dtype: float64
```

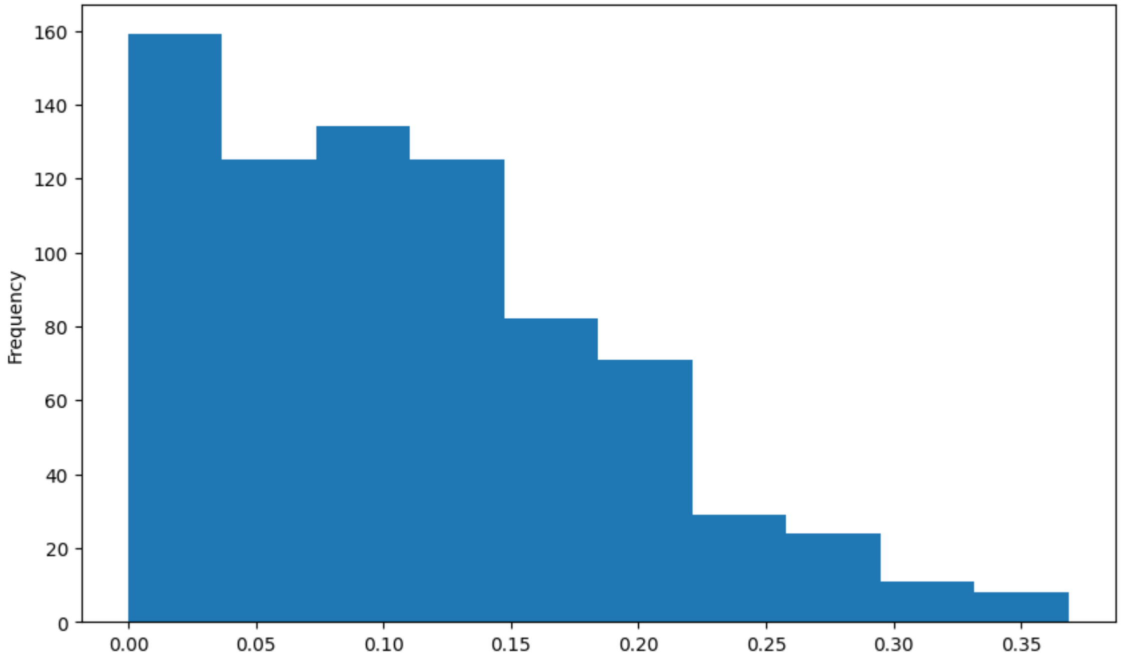
```
df['Pregnancies_per_Age'].plot(kind='density', figsize=(10,6))
```

```
<Axes: ylabel='Density'>
```



```
df['Pregnancies_per_Age'].plot(kind='hist', figsize=(10,6))
```

```
<Axes: ylabel='Frequency'>
```



Add and calculate a new `Calculated_Insulin` column

Use this formula

$$Calculated_Insulin = Insulin * DiabetesPedigreeFunction$$

```
df['Calculated_Insulin'] = df['Insulin'] * df['DiabetesPedigreeFunction']
```

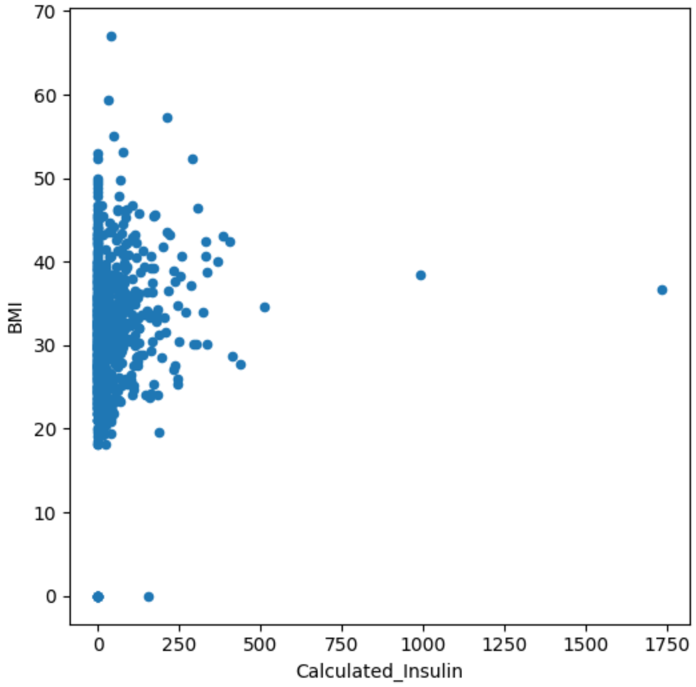
```
df['Calculated_Insulin'].head()
```

```
0      0.000
1      0.000
2      0.000
3     15.698
4    384.384
Name: Calculated_Insulin, dtype: float64
```

We can see the relationship between `Cost` and `Profit` using a scatter plot:

```
df.plot(kind='scatter', x='Calculated_Insulin', y='BMI', figsize=(6,6))
```

```
<Axes: xlabel='Calculated_Insulin', ylabel='BMI'>
```



Selection & Indexing:

Get all the data which related to age category `old`

```
df.loc[df['AgeCategories'] == 'old']
```

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction	Age	AgeCategories	Exist Cases	Cases_Num	Pr
0	6	148	72	35	0	33.6	0.627	50	old	Yes	1	
8	2	197	70	45	543	30.5	0.158	53	old	Yes	1	
9	8	125	96	0	0	0.0	0.232	54	old	Yes	1	
12	10	139	80	0	0	27.1	1.441	57	old	No	0	
13	1	189	60	23	846	30.1	0.398	59	old	Yes	1	
...	...	...	...	...	...	...	...	...	...	...	...	
734	2	105	75	0	0	23.3	0.560	53	old	No	0	
749	6	162	62	0	0	24.3	0.178	50	old	Yes	1	
757	0	123	72	0	0	36.3	0.258	52	old	Yes	1	
759	6	190	92	0	0	35.5	0.278	66	old	Yes	1	
763	10	101	76	48	180	32.9	0.171	63	old	No	0	

89 rows × 13 columns

Get the mean SkinThickness of the `Middle 1age (31-49)`

```
df.loc[df['AgeCategories'] == 'Middle Age', 'SkinThickness'].mean()
```

```
    20.18320610687023
```

How many records belong to Age Group `Adolescent (<31)` or `Middle Age (31-49)`?

```
df.loc[(df['AgeCategories'] == 'Adolescent') | (df['AgeCategories'] == 'Middle Age')].shape[0]
```

```
    679
```

Get the mean BMI for `Adolescent (<31)` which is injured in diabete `Exist Cases = yes`

```
df.loc[(df['AgeCategories'] == 'Adolescent') & (df['Exist Cases'] == 'Yes'), 'BMI'].mean()
```

```
    36.455555555555556
```