%%javascript Jupyter.keyboard_manager.command_shortcuts.add_shortcut('r', { help : 'run all cells', help_index : 'zz', handler : function (event) { IPython.notebook.execute_all_cells(); return false; }});

In [22]:

```
import numpy as np
import pandas as pd


# for operation 2
df2 = pd.read_csv('diabetes_null.csv', na_values=['#NAME?'])
```

Handling Missing Values

Delete Row

In [23]:

```
df1 = pd.read_csv('diabetes_null.csv', na_values=['#NAME?'])
df1.isnull().sum().sort_values(ascending=False)
df_no_missing = df1.dropna(axis=0)
print(df_no_missing.head(5))
```

```
    Pregnancies  Glucose  BloodPressure  SkinThickness  Insulin   BM
I  \
3             1     89.0           66.0           23.0     94.0  28.
1
4             0    137.0            4.0           35.0    168.0  43.
1
6             3     78.0            5.0           32.0     88.0  31.
0
8             2    197.0            7.0           45.0    543.0   3.
5
13            1    189.0            6.0           23.0    846.0   3.
1

    DiabetesPedigreeFunction  Age  Outcome
3                      0.167   21        0
4                      2.288   33        1
6                      0.248   26        1
8                      0.158   53        1
13                     0.398   59        1
```

Fill with mean

In [24]:

```
from sklearn.preprocessing import Imputer

# Data from excel
df1 = pd.read_csv('diabetes_null.csv', na_values=['#NAME?'])

#Imputer to replace Null with mean
imp = Imputer(missing_values = 'NaN', strategy='mean', axis=0)


imp.fit(df1)
df1 = pd.DataFrame(data=imp.transform(df1), columns=df1.columns)

#print
print(df1.head(5))
```

```
   Pregnancies  Glucose  BloodPressure  SkinThickness     Insulin
BMI  \
0          6.0    148.0           72.0      35.000000  105.659898  3
3.6
1          1.0     85.0           66.0      29.000000  105.659898  2
6.6
2          8.0    183.0           64.0      25.876155  105.659898  2
3.3
3          1.0     89.0           66.0      23.000000   94.000000  2
8.1
4          0.0    137.0            4.0      35.000000  168.000000  4
3.1

   DiabetesPedigreeFunction   Age  Outcome
0                     0.627   5.0      1.0
1                     0.351  31.0      0.0
2                     0.672  32.0      1.0
3                     0.167  21.0      0.0
4                     2.288  33.0      1.0
```

Fill with median

In [25]:

```
from sklearn.preprocessing import Imputer

# Data from excel
df1 = pd.read_csv('diabetes_null.csv', na_values=['#NAME?'])

#Imputer to replace Null with mean
imp = Imputer(missing_values = 'NaN', strategy='median', axis=0)


imp.fit(df1)
df1 = pd.DataFrame(data=imp.transform(df1), columns=df1.columns)

#print
print(df1.head(5))
```

```
   Pregnancies  Glucose  BloodPressure  SkinThickness  Insulin   BMI
  \
0          6.0    148.0           72.0           35.0     71.0  33.6

1          1.0     85.0           66.0           29.0     71.0  26.6

2          8.0    183.0           64.0           27.0     71.0  23.3

3          1.0     89.0           66.0           23.0     94.0  28.1

4          0.0    137.0            4.0           35.0    168.0  43.1


   DiabetesPedigreeFunction   Age  Outcome
0                     0.627   5.0      1.0
1                     0.351  31.0      0.0
2                     0.672  32.0      1.0
3                     0.167  21.0      0.0
4                     2.288  33.0      1.0
```

Handling Noicy Data

Function to find outliers

In [26]:

```
def find_outliers_tukey(x):
    q1 = x.quantile(.25)
    q3 = x.quantile(.75)
    iqr = q3 - q1
    floor = q1 - 1.5*iqr
    ceiling = q3 + 1.5*iqr
    outlier_indices = list(x.index[(x < floor) | (x > ceiling)])
    outlier_values = list(x[outlier_indices])
    return outlier_indices, outlier_values
```

Outliers Found in each column

In [27]:

```
glucose_indices, glucose_values = find_outliers_tukey(df1['Glucose'])
print("Outliers for Glucose")
print(np.sort(glucose_values))

print("Outliers for Pregnancies")
pr_indices, pr_values = find_outliers_tukey(df1['Pregnancies'])
print(np.sort(pr_values))

print("Outliers for BloodPressure")
bp_indices, bp_values = find_outliers_tukey(df1['BloodPressure'])
print(np.sort(bp_values))


print("Outliers for SkinThickness")
st_indices, st_values = find_outliers_tukey(df1['SkinThickness'])
print(np.sort(st_values))

print("Outliers for Insulin")
in_indices, in_values = find_outliers_tukey(df1['Insulin'])
print(np.sort(in_values))

print("Outliers for BMI")
bmi_indices, bmi_values = find_outliers_tukey(df1['BMI'])
print(np.sort(bmi_values))

print("Outliers for DiabetesPedigreeFunction")
dpf_indices, dpf_values = find_outliers_tukey(df1['DiabetesPedigreeFunction'])
print(np.sort(dpf_values))

print("Outliers for Age")
age_indices, age_values = find_outliers_tukey(df1['Age'])
print(np.sort(age_values))
```

```
Outliers for Glucose
[]
Outliers for Pregnancies
[ 14.  14.  15.  17.]
Outliers for BloodPressure
[ 122.]
Outliers for SkinThickness
[  1.   1.   1.   1.   1.   2.   2.   2.   2.   2.   2.   2.   2.
2.   2.
   2.   2.   2.   3.   3.   3.   3.   3.   3.   3.   3.   3.   3.
3.   3.
   3.   3.   3.   3.   3.   3.   3.   3.   3.   3.   3.   3.   3.
3.   3.
   4.   4.   4.   4.   4.   4.   4.   4.   4.   4.   4.   4.   4.
4.   4.
   4.   5.   5.   5.   6.  48.  48.  48.  48.  49.  49.  49.  51.  5
2.  52.
  54.  54.  56.  63.  99.]
Outliers for Insulin
[   1.    1.    1.    1.    1.    1.    1.    2.    2.    2.    2.
  3.
    4.    4.    5.    5.    5.    6.    6.    6.    7.    7.    7.
  9.
    9.    9.    9.   11.   11.   11.   11.   11.   11.   12.   12.
12.
   12.   12.   12.   12.   12.   13.   13.   13.   13.   13.   13.
13.
   13.   13.   14.   14.   14.   14.   14.   14.   14.   14.   14.
14.
   15.   15.   15.   15.   15.   15.   15.   15.   15.   15.   15.
15.
   15.   15.   16.   16.   16.   16.   16.   16.   16.   16.   17.
17.
   18.   18.   18.   18.   18.   18.   18.   18.   18.   18.   19.
19.
   19.   19.   21.   21.   21.   21.   21.   22.   22.   22.   23.
23.
   23.   23.   24.   24.   24.   25.   25.   25.   25.   27.   27.
27.
   28.   29.   31.   32.   33.   34.   36.   36.   36.   36.   37.
37.
   37.   38.   41.   42.   42.   43.   44.   44.   44.   44.   45.
45.
   45.   46.   48.   48.   48.   48.   48.   49.   49.   49.   49.
49.
   51.   51.   52.   53.   53.   54.   54.   54.   54.   54.   55.
55.
   56.   56.   56.   56.   56.   84.   85.   85.   86.   87.   87.
88.
   88.   88.   88.   89.   91.   92.   92.   92.   94.   94.   94.
94.
   94.   94.   94.   95.   95.   96.   96.   99.   99.  112.  114.
114.
  115.  115.  115.  115.  115.  115.  116.  116.  119.  122.  122.
125.
  125.  125.  125.  126.  126.  126.  127.  128.  129.  132.  132.
135.
  135.  135.  135.  135.  135.  142.  144.  144.  145.  145.  145.
146.
  148.  148.  152.  152.  155.  155.  155.  155.  156.  156.  156.
158.
```

```
  158.  159.  165.  165.  165.  165.  166.  167.  167.  168.  168.
168.
  168.  171.  175.  175.  175.  176.  176.  176.  178.  182.  182.
182.
  183.  184.  185.  185.  188.  191.  192.  192.  193.  194.  194.
194.
  196.  215.  215.  215.  225.  225.  228.  231.  231.  235.  237.
245.
  249.  255.  258.  265.  265.  271.  272.  274.  275.  277.  278.
284.
  285.  285.  291.  293.  293.  318.  321.  325.  325.  325.  326.
328.
  335.  342.  375.  387.  392.  415.  465.  474.  478.  485.  495.
495.
  543.  545.  579.  744.  846.]
Outliers for BMI
[  2.    2.1   2.4   2.4   2.8   2.8   3.    3.    3.    3.    3.
3.
   3.    3.1   3.1   3.1   3.1   3.1   3.1   3.1   3.1   3.1   3.2
3.3
   3.4   3.4   3.4   3.4   3.4   3.4   3.4   3.5   3.5   3.5   3.5
3.5
   3.5   3.5   3.7   3.8   3.8   3.8   3.8   3.8   3.8   3.8   3.8
3.8
   3.9   3.9   3.9   3.9   3.9   4.    4.    4.1   4.2   4.5   4.5
4.5
   4.6   4.6   4.6   4.6   4.7   4.8   4.9   4.9   5.   52.3  52.3
52.9
  53.2  55.   57.3  59.4  67.1]
Outliers for DiabetesPedigreeFunction
[ 1.251  1.258  1.268  1.282  1.292  1.318  1.321  1.34   1.353  1.3
9
  1.391  1.394  1.4    1.441  1.461  1.476  1.57   1.6    1.698  1.6
99
  1.72   1.731  1.76   1.781  1.893  1.95   1.96   2.137  2.288  2.3
29
  2.42 ]
Outliers for Age
[ 62.  62.  62.  62.  63.  63.  63.  63.  64.  65.  65.  65.  66.  6
6.  66.
  66.  67.  67.  67.  68.  69.  69.  72.  81.]
```

Deleting Row

In [28]:

```
df_del = df1.drop(bp_indices)
print(df_del.head(5))
```

```
   Pregnancies  Glucose  BloodPressure  SkinThickness  Insulin   BMI
  \
0          6.0    148.0           72.0           35.0     71.0  33.6

1          1.0     85.0           66.0           29.0     71.0  26.6

2          8.0    183.0           64.0           27.0     71.0  23.3

3          1.0     89.0           66.0           23.0     94.0  28.1

4          0.0    137.0            4.0           35.0    168.0  43.1


   DiabetesPedigreeFunction   Age  Outcome
0                     0.627   5.0      1.0
1                     0.351  31.0      0.0
2                     0.672  32.0      1.0
3                     0.167  21.0      0.0
4                     2.288  33.0      1.0
```

Replace with min

In [29]:

```
min_in = np.min(df_del['Insulin'])
df_del['Insulin'] = np.where(df_del['Insulin'] > 321, min_in, df_del['Insulin'])
print(df_del.head(5))
```

```
   Pregnancies  Glucose  BloodPressure  SkinThickness  Insulin   BMI
  \
0          6.0    148.0           72.0           35.0     71.0  33.6

1          1.0     85.0           66.0           29.0     71.0  26.6

2          8.0    183.0           64.0           27.0     71.0  23.3

3          1.0     89.0           66.0           23.0     94.0  28.1

4          0.0    137.0            4.0           35.0    168.0  43.1


   DiabetesPedigreeFunction   Age  Outcome
0                     0.627   5.0      1.0
1                     0.351  31.0      0.0
2                     0.672  32.0      1.0
3                     0.167  21.0      0.0
4                     2.288  33.0      1.0
```

Normalization and Reduction

In [30]:

```
from sklearn.decomposition import PCA
pca = PCA(n_components = 2)
pca.fit(df_del)

PCA(copy=True, n_components=2, whiten=False)

df = pca.transform(df_del)

df_2d = pd.DataFrame(df)

df_2d.index = df_del.index

df_2d.columns = ['PC1', 'PC2']

df_2d.head(5)
```

Out[30]:

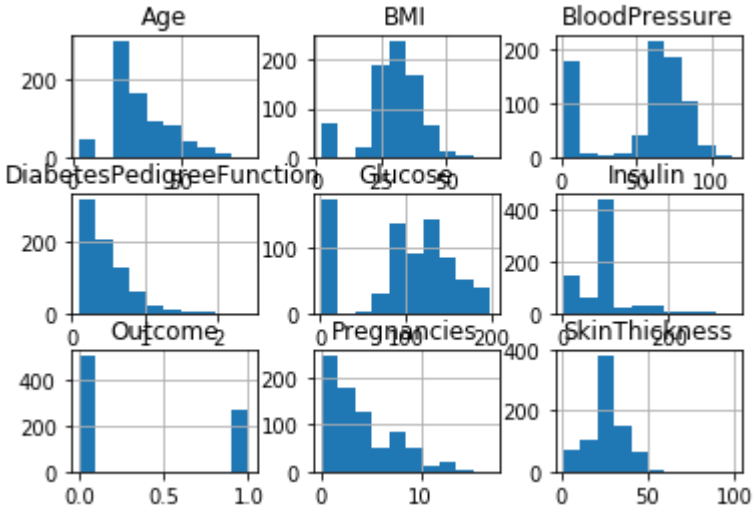
	PC1	PC2
0	33.055249	-35.671449
1	-13.762445	6.138142
2	58.976048	-59.330959
3	4.351620	20.820122
4	89.453205	42.851607

Visualization

Histogram

In [31]:

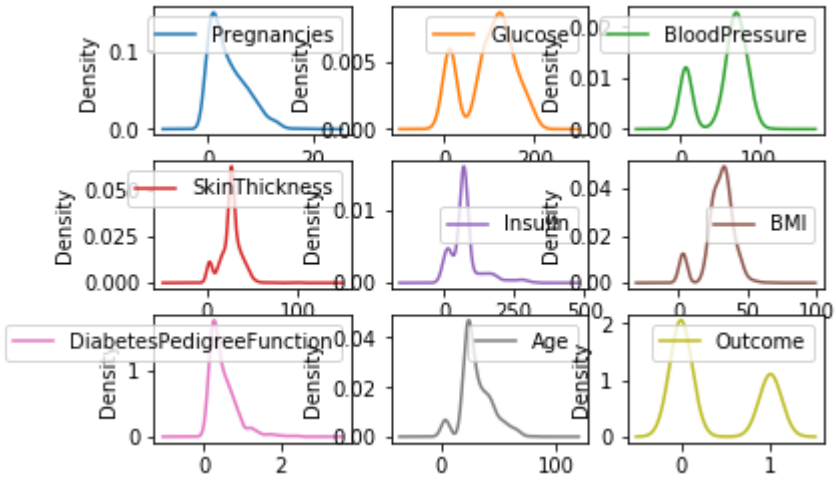
```
import matplotlib.pyplot as plt
df_del.hist()
plt.show()
```



Density Plot

In [32]:

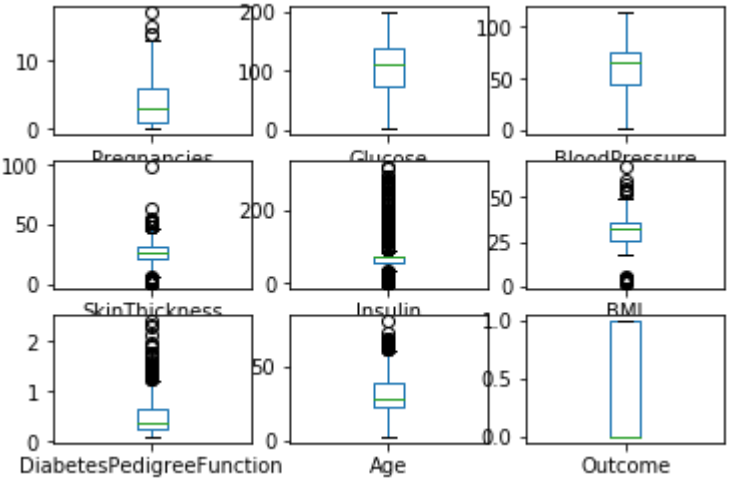
```
df_del.plot(kind='density', subplots=True, layout=(3,3), sharex=False)
plt.show()
```



Box Plot

In [33]:

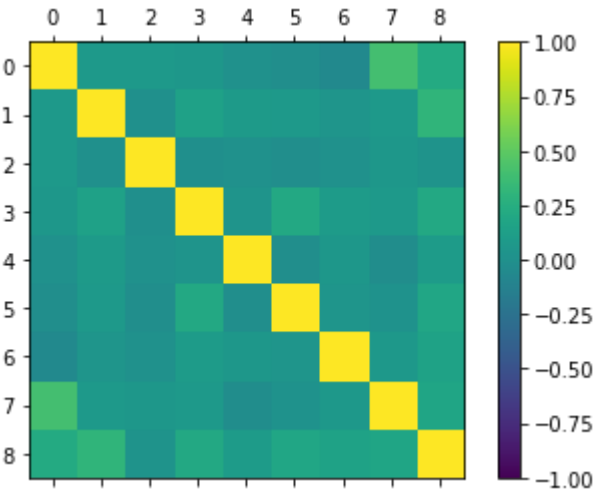
```
df_del.plot(kind='box', subplots=True, layout=(3,3), sharex=False, sharey=False)
plt.show()
```



Correlation Matrix ¶

In [34]:

```
cor = df_del.corr()
fig = plt.figure()
ax = fig.add_subplot(111)
cax = ax.matshow(cor, vmin=-1, vmax =1)
fig.colorbar(cax)
ticks=np.arange(0,9,1)
ax.set_xticks(ticks)
ax.set_yticks(ticks)
plt.show()
```



Scatter Plot

In [35]:

```
from pandas.plotting import scatter_matrix
scatter_matrix(df_del)
plt.show()
```