Comparaison de LOF, OC-SVM et Isolation Forest

Jeu de données

Nous utilisons le jeu de données KDD99CUP

Métriques de comparaison

In [22]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from time import time
from sklearn.ensemble import IsolationForest
from sklearn.svm import OneClassSVM
from sklearn.neighbors import LocalOutlierFactor
from sklearn.metrics import confusion_matrix
from sklearn.metrics import roc_auc_score
from matplotlib.mlab import frange
import statistics
from sklearn.metrics import confusion_matrix
from sklearn.metrics import precision_score, recall_score
from sklearn.metrics import f1_score
from sklearn.metrics import roc_curve
from imblearn.metrics import specificity_score
from imblearn.metrics import sensitivity_score
import matplotlib.cm as cm
from mpl_toolkits import mplot3d
```

```
Using TensorFlow backend.
```

Chargement du jeu de données KDD99-Cup HTTP

KDD99-Cup HTTP contient 30 attributs dont le dernier est la classe à expliquer. Il y a 620098 observations dont 1052 anormales. Avec le dernier attribut, nous avons les classes "o" pour les anomalies et "n" pour les observations normales.

In [23]:
```
data_brut_KDD99CUP = pd.read_csv('/Users/thesard/Doctorat/These2018/ISEP/Developpements/EspaceIntelliJ/LearningAllInPython/Learning_IHM_Features/datasets/imported_datasets/kdd99-unsupervised-ad_2019-06-24 16:08:29.815617.csv', header=None, index_col=None)
#data_brut_Shuttle = pd.read_csv('/Users/thesard/Doctorat/These2018/ISEP/Developpements/EspaceIntelliJ/LearningAllInPython/Learning_IHM_Features/datasets/imported_datasets/shuttle-unsupervised-ad_2019-06-14 17:33:02.493755.csv', header=None, index_col=None)
X_KDD99CUP = data_brut_KDD99CUP[[0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13 ,14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28]]
y_brut_KDD99CUP = data_brut_KDD99CUP[[29]]
data_brut_KDD99CUP.describe()
```

Out[23]:

	0	1	2	3	4	
count	620098.000000	620098.000000	6.200980e+05	620098.000000	620098.000000	620098.
mean	0.627670	280.374673	4.099298e+03	0.005012	0.912428	0.
std	53.972528	1509.901935	2.369388e+04	0.098271	0.282671	0.
min	0.000000	0.000000	0.000000e+00	0.000000	0.000000	0.
25%	0.000000	210.000000	4.580000e+02	0.000000	1.000000	0.
50%	0.000000	240.000000	1.425000e+03	0.000000	1.000000	0.
75%	0.000000	302.000000	3.731000e+03	0.000000	1.000000	0.
max	41065.000000	54540.000000	1.173059e+07	21.000000	1.000000	21.

8 rows × 29 columns

In [24]:
```
# Nombre d'anomalies
n_outliers = data_brut_KDD99CUP[data_brut_KDD99CUP[29] == 'o']
len(n_outliers)/6
```

Out[24]: 175.33333333333334

In [25]:
```
#Pourcentage d'anomalies
pourcentage_anomalies = len(n_outliers)/len(data_brut_KDD99CUP)
pourcentage_anomalies
```

Out[25]: 0.0016965060361426743

In [26]:
```
# Nombre de données normales
n_normals = data_brut_KDD99CUP[data_brut_KDD99CUP[29] == 'n']
len(n_normals)/6
```

Out[26]: 103174.33333333333

In [27]:
```
#Pourcentage de données normales
pourcentage_normales = len(n_normals)/len(data_brut_KDD99CUP)
pourcentage_normales
```

Out[27]:
```
0.9983034939638573
```

In [28]:
```
# Subset the dataset by myself
import math
n_i_min = 0
o_i_min = 0
n_i_max = math.ceil(len(n_normals)/6)
o_i_max = math.ceil(len(n_outliers)/6)
n_sub_dataset_1 = n_normals[n_i_min:n_i_max]
print("Length normals subset 1 = "+str(len(n_sub_dataset_1)))
o_sub_dataset_1 = n_outliers[o_i_min:o_i_max]
print("Length outliers subset 1 = "+str(len(o_sub_dataset_1)))

n_i_min = n_i_max
o_i_min = o_i_max
n_i_max = n_i_max + math.ceil(len(n_normals)/6)
o_i_max = o_i_max + math.ceil(len(n_outliers)/6)
n_sub_dataset_2 = n_normals[n_i_min:n_i_max]
print("Length normals subset 2 = "+str(len(n_sub_dataset_2)))
o_sub_dataset_2 = n_outliers[o_i_min:o_i_max]
print("Length outliers subset 2 = "+str(len(o_sub_dataset_2)))

n_i_min = n_i_max
o_i_min = o_i_max
n_i_max = n_i_max + math.ceil(len(n_normals)/6)
o_i_max = o_i_max + math.ceil(len(n_outliers)/6)
n_sub_dataset_3 = n_normals[n_i_min:n_i_max]
print("Length normals subset 3 = "+str(len(n_sub_dataset_3)))
o_sub_dataset_3 = n_outliers[o_i_min:o_i_max]
print("Length outliers subset 3 = "+str(len(o_sub_dataset_3)))

n_i_min = n_i_max
o_i_min = o_i_max
n_i_max = n_i_max + math.ceil(len(n_normals)/6)
o_i_max = o_i_max + math.ceil(len(n_outliers)/6)
n_sub_dataset_4 = n_normals[n_i_min:n_i_max]
print("Length normals subset 4 = "+str(len(n_sub_dataset_4)))
o_sub_dataset_4 = n_outliers[o_i_min:o_i_max]
print("Length outliers subset 4 = "+str(len(o_sub_dataset_4)))

n_i_min = n_i_max
o_i_min = o_i_max
n_i_max = n_i_max + math.ceil(len(n_normals)/6)
o_i_max = o_i_max + math.ceil(len(n_outliers)/6)
n_sub_dataset_5 = n_normals[n_i_min:n_i_max]
print("Length normals subset 5 = "+str(len(n_sub_dataset_5)))
o_sub_dataset_5 = n_outliers[o_i_min:o_i_max]
print("Length outliers subset 5 = "+str(len(o_sub_dataset_5)))
```

```
n_i_min = n_i_max
o_i_min = o_i_max
n_i_max = n_i_max + math.ceil(len(n_normals)/6)
o_i_max = o_i_max + math.ceil(len(n_outliers)/6)
n_sub_dataset_6 = n_normals[n_i_min:n_i_max]
print("Length normals subset 6 = "+str(len(n_sub_dataset_6)))
o_sub_dataset_6 = n_outliers[o_i_min:o_i_max]
print("Length outliers subset 6 = "+str(len(o_sub_dataset_6)))
```

```
Length normals subset 1 = 103175
Length outliers subset 1 = 176
Length normals subset 2 = 103175
Length outliers subset 2 = 176
Length normals subset 3 = 103175
Length outliers subset 3 = 176
Length normals subset 4 = 103175
Length outliers subset 4 = 176
Length normals subset 5 = 103175
Length outliers subset 5 = 176
Length normals subset 6 = 103171
Length outliers subset 6 = 172
```

Fusion des deux sub_datasets (normales + anomalies)

In [29]:
```
# Fusion of the sub_datasets
sub_dataset_1 = n_sub_dataset_1.append(o_sub_dataset_1, ignore_inde
x=True, sort=False)
sub_dataset_2 = n_sub_dataset_2.append(o_sub_dataset_2, ignore_inde
x=True, sort=False)
sub_dataset_3 = n_sub_dataset_3.append(o_sub_dataset_3, ignore_inde
x=True, sort=False)
sub_dataset_4 = n_sub_dataset_4.append(o_sub_dataset_4, ignore_inde
x=True, sort=False)
sub_dataset_5 = n_sub_dataset_5.append(o_sub_dataset_5, ignore_inde
x=True, sort=False)
sub_dataset_6 = n_sub_dataset_6.append(o_sub_dataset_6, ignore_inde
x=True, sort=False)
#Doubler le nombre d'outlier pour voir l'effet sur les méthodes
sub_dataset_1 = sub_dataset_1.append(o_sub_dataset_2, ignore_index=
True, sort=False)
#sub_dataset_6.describe()
# Détacher la classe à expliquer des autres classes
X_sub_dataset_1 = sub_dataset_1[[0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10,
11, 12, 13 ,14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27,
28]]
y_sub_dataset_1 = sub_dataset_1[[29]]
X_sub_dataset_2 = sub_dataset_2[[0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10,
11, 12, 13 ,14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27,
28]]
y_sub_dataset_2 = sub_dataset_2[[29]]
X_sub_dataset_3 = sub_dataset_3[[0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10,
11, 12, 13 ,14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27,
28]]
y_sub_dataset_3 = sub_dataset_3[[29]]
X_sub_dataset_4 = sub_dataset_4[[0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10,
11, 12, 13 ,14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27,
28]]
y_sub_dataset_4 = sub_dataset_4[[29]]
X_sub_dataset_5 = sub_dataset_5[[0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10,
11, 12, 13 ,14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27,
28]]
y_sub_dataset_5 = sub_dataset_5[[29]]
X_sub_dataset_6 = sub_dataset_6[[0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10,
11, 12, 13 ,14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27,
28]]
y_sub_dataset_6 = sub_dataset_6[[29]]
```

Transformation de la classe à expliquer

L'objectif ici est de remplacer les "o" par -1 et les "n" par 1 afin de faire les matrices de confusion avec la fonction dédiée de scikit-learn.

In [30]:
```
y_transform_KDD99CUP       = y_brut_KDD99CUP
y_transform_KDD99CUP       = np.where(y_transform_KDD99CUP =='o',-1,
1)
#y_transform_KDD99CUP

y_transform_sub_dataset_6 = np.where(y_sub_dataset_6 =='o',-1,1)
y_transform_sub_dataset_5 = np.where(y_sub_dataset_5 =='o',-1,1)
y_transform_sub_dataset_4 = np.where(y_sub_dataset_4 =='o',-1,1)
y_transform_sub_dataset_3 = np.where(y_sub_dataset_3 =='o',-1,1)
y_transform_sub_dataset_2 = np.where(y_sub_dataset_2 =='o',-1,1)
y_transform_sub_dataset_1 = np.where(y_sub_dataset_1 =='o',-1,1)
```

In [31]:
```
X_recomposed_shuttle = dict()
X_recomposed_shuttle[0] = X_sub_dataset_1
X_recomposed_shuttle[1] = X_sub_dataset_2
X_recomposed_shuttle[2] = X_sub_dataset_3
X_recomposed_shuttle[3] = X_sub_dataset_4
X_recomposed_shuttle[4] = X_sub_dataset_5
X_recomposed_shuttle[5] = X_sub_dataset_6

Y_recomposed_shuttle = dict()
Y_recomposed_shuttle[0] = y_transform_sub_dataset_1
Y_recomposed_shuttle[1] = y_transform_sub_dataset_2
Y_recomposed_shuttle[2] = y_transform_sub_dataset_3
Y_recomposed_shuttle[3] = y_transform_sub_dataset_4
Y_recomposed_shuttle[4] = y_transform_sub_dataset_5
Y_recomposed_shuttle[5] = y_transform_sub_dataset_6
print(X_recomposed_shuttle)
print("**********************************************************
********")
print(Y_recomposed_shuttle)
```

```
{0:          0      1        2    3    4    5    6    7    8    9
...     19  \
0        0.0  215.0  45076.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.    0.0
1        0.0  162.0   4528.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.    1.0
2        0.0  236.0   1228.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.    2.0
3        0.0  233.0   2032.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.    3.0
4        0.0  239.0    486.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.    4.0
5        0.0  238.0   1282.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.    5.0
6        0.0  235.0   1337.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.    6.0
7        0.0  234.0   1364.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.    7.0
8        0.0  239.0   1295.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.    8.0
```

```
9       0.0  181.0   5450.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.    9.0
10      0.0  184.0    124.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.   10.0
11      0.0  185.0   9020.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.   11.0
12      0.0  239.0   1295.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.   12.0
13      0.0  181.0   5450.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.   13.0
14      0.0  236.0   1228.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.   14.0
15      0.0  233.0   2032.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.   15.0
16      0.0  238.0   1282.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.   16.0
17      0.0  235.0   1337.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.   17.0
18      0.0  234.0   1364.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.   18.0
19      0.0  239.0    486.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.   19.0
20      0.0  185.0   9020.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.   20.0
21      0.0  184.0    124.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.   21.0
22      0.0  181.0   5450.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.   22.0
23      0.0  239.0   1295.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.   23.0
24      0.0  236.0   1228.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.   24.0
25      0.0  233.0   2032.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.   25.0
26      0.0  239.0    486.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.   26.0
27      0.0  238.0   1282.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.   27.0
28      0.0  234.0   1364.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.   28.0
29      0.0  235.0   1337.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.   29.0
...     ...    ...      ...  ...  ...  ...  ...  ...  ...  ...  ..
.    ...
103497  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103498  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103499  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103500  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103501  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
```

```
.  255.0
103502  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103503  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103504  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103505  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.   22.0
103506  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103507  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103508  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103509  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103510  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103511  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103512  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103513  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103514  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103515  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103516  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  245.0
103517  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103518  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103519  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103520  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103521  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103522  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103523  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103524  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103525  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.   89.0
103526  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0

          20     21     22     23    24     25    26    27    28
```

0	0.0	0.00	0.00	0.00	0.0	0.00	0.0	0.0	0.0
1	1.0	1.00	0.00	1.00	0.0	0.00	0.0	0.0	0.0
2	2.0	1.00	0.00	0.50	0.0	0.00	0.0	0.0	0.0
3	3.0	1.00	0.00	0.33	0.0	0.00	0.0	0.0	0.0
4	4.0	1.00	0.00	0.25	0.0	0.00	0.0	0.0	0.0
5	5.0	1.00	0.00	0.20	0.0	0.00	0.0	0.0	0.0
6	6.0	1.00	0.00	0.17	0.0	0.00	0.0	0.0	0.0
7	7.0	1.00	0.00	0.14	0.0	0.00	0.0	0.0	0.0
8	8.0	1.00	0.00	0.12	0.0	0.00	0.0	0.0	0.0
9	9.0	1.00	0.00	0.11	0.0	0.00	0.0	0.0	0.0
10	10.0	1.00	0.00	0.10	0.0	0.00	0.0	0.0	0.0
11	11.0	1.00	0.00	0.09	0.0	0.00	0.0	0.0	0.0
12	12.0	1.00	0.00	0.08	0.0	0.00	0.0	0.0	0.0
13	13.0	1.00	0.00	0.08	0.0	0.00	0.0	0.0	0.0
14	14.0	1.00	0.00	0.07	0.0	0.00	0.0	0.0	0.0
15	15.0	1.00	0.00	0.07	0.0	0.00	0.0	0.0	0.0
16	16.0	1.00	0.00	0.06	0.0	0.00	0.0	0.0	0.0
17	17.0	1.00	0.00	0.06	0.0	0.00	0.0	0.0	0.0
18	18.0	1.00	0.00	0.06	0.0	0.00	0.0	0.0	0.0
19	19.0	1.00	0.00	0.05	0.0	0.00	0.0	0.0	0.0
20	20.0	1.00	0.00	0.05	0.0	0.00	0.0	0.0	0.0
21	21.0	1.00	0.00	0.05	0.0	0.00	0.0	0.0	0.0
22	22.0	1.00	0.00	0.05	0.0	0.00	0.0	0.0	0.0
23	23.0	1.00	0.00	0.04	0.0	0.00	0.0	0.0	0.0
24	24.0	1.00	0.00	0.04	0.0	0.00	0.0	0.0	0.0
25	25.0	1.00	0.00	0.04	0.0	0.00	0.0	0.0	0.0
26	26.0	1.00	0.00	0.04	0.0	0.00	0.0	0.0	0.0
27	27.0	1.00	0.00	0.04	0.0	0.00	0.0	0.0	0.0
28	28.0	1.00	0.00	0.04	0.0	0.00	0.0	0.0	0.0
29	29.0	1.00	0.00	0.03	0.0	0.00	0.0	0.0	0.0
...	...	...	...	...	...	...	...	...	...
103497	8.0	0.03	0.05	0.00	0.0	1.00	1.0	0.0	0.0
103498	28.0	0.11	0.07	0.01	0.0	1.00	1.0	0.0	0.0
103499	26.0	0.10	0.07	0.01	0.0	1.00	1.0	0.0	0.0
103500	51.0	0.20	0.03	0.00	0.0	1.00	1.0	0.0	0.0
103501	2.0	0.01	0.07	0.00	0.0	1.00	1.0	0.0	0.0
103502	19.0	0.07	0.07	0.00	0.0	1.00	1.0	0.0	0.0
103503	25.0	0.10	0.07	0.00	0.0	1.00	1.0	0.0	0.0
103504	24.0	0.09	0.05	0.00	0.0	1.00	1.0	0.0	0.0
103505	20.0	0.91	0.09	0.05	0.0	0.91	1.0	0.0	0.0
103506	15.0	0.06	0.09	0.00	0.0	1.00	1.0	0.0	0.0
103507	31.0	0.12	0.05	0.02	0.0	1.00	1.0	0.0	0.0
103508	1.0	0.00	0.07	0.00	0.0	1.00	1.0	0.0	0.0
103509	70.0	0.27	0.02	0.00	0.0	1.00	1.0	0.0	0.0
103510	4.0	0.02	0.08	0.00	0.0	1.00	1.0	0.0	0.0
103511	20.0	0.08	0.07	0.00	0.0	1.00	1.0	0.0	0.0
103512	23.0	0.09	0.07	0.01	0.0	1.00	1.0	0.0	0.0
103513	1.0	0.00	0.07	0.00	0.0	1.00	1.0	0.0	0.0
103514	21.0	0.08	0.06	0.00	0.0	1.00	1.0	0.0	0.0
103515	48.0	0.19	0.04	0.01	0.0	1.00	1.0	0.0	0.0
103516	62.0	0.25	0.02	0.00	0.0	0.99	1.0	0.0	0.0
103517	45.0	0.18	0.05	0.01	0.0	1.00	1.0	0.0	0.0
103518	16.0	0.06	0.06	0.00	0.0	0.00	0.0	1.0	1.0

```
103519  37.0  0.15  0.04  0.02  0.0  1.00  1.0  0.0  0.0
103520  22.0  0.09  0.05  0.00  0.0  1.00  1.0  0.0  0.0
103521  35.0  0.14  0.04  0.01  0.0  1.00  1.0  0.0  0.0
103522  40.0  0.16  0.04  0.01  0.0  1.00  1.0  0.0  0.0
103523  49.0  0.19  0.04  0.02  0.0  1.00  1.0  0.0  0.0
103524  39.0  0.15  0.05  0.02  0.0  1.00  1.0  0.0  0.0
103525  24.0  0.27  0.04  0.01  0.0  1.00  1.0  0.0  0.0
103526   6.0  0.02  0.05  0.00  0.0  1.00  1.0  0.0  0.0

[103527 rows x 29 columns], 1:          0      1        2    3
4    5    6    7    8    9   ...     19  \
0       0.0  323.0   1351.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
1       0.0  336.0   1591.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
2       0.0  319.0   1300.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
3       0.0  323.0   1576.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
4       0.0  322.0   1312.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
5       0.0  263.0  12219.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
6       0.0  320.0   1348.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
7       0.0  320.0   1335.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
8       0.0  318.0   1306.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
9       0.0  321.0   1360.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
10      0.0  322.0   1556.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
11      0.0  320.0   1549.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
12      0.0  320.0   1621.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
13      0.0  323.0   1346.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
14      0.0  321.0   1336.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
15      0.0  321.0   1353.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
16      0.0  321.0   1306.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
17      0.0  320.0   1484.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
18      0.0  260.0   3437.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
19      0.0  339.0   3521.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
20      0.0  262.0   1163.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
```

```
21      0.0  251.0   1306.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
22      0.0  323.0   1353.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
23      0.0  323.0   1627.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
24      0.0  323.0   1340.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
25      0.0  320.0   1316.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
26      0.0  367.0   2406.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
27      0.0  326.0  26491.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
28      0.0  328.0  19660.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
29      0.0  340.0   1448.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
...     ...    ...      ...  ...  ...  ...  ...  ...  ...  ...  ..
.    ...
103321  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103322  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103323  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103324  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103325  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103326  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103327  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103328  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103329  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.   22.0
103330  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103331  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103332  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103333  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103334  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103335  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103336  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103337  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
```

```
.  255.0
103338  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103339  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103340  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  245.0
103341  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103342  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103343  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103344  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103345  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103346  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103347  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103348  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
103349  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.   89.0
103350  0.0    0.0      0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ..
.  255.0
```

	20	21	22	23	24	25	26	27	28
0	255.0	1.00	0.00	0.00	0.0	0.00	0.0	0.0	0.0
1	255.0	1.00	0.00	0.00	0.0	0.00	0.0	0.0	0.0
2	255.0	1.00	0.00	0.00	0.0	0.00	0.0	0.0	0.0
3	255.0	1.00	0.00	0.00	0.0	0.00	0.0	0.0	0.0
4	255.0	1.00	0.00	0.00	0.0	0.00	0.0	0.0	0.0
5	255.0	1.00	0.00	0.00	0.0	0.00	0.0	0.0	0.0
6	255.0	1.00	0.00	0.00	0.0	0.00	0.0	0.0	0.0
7	255.0	1.00	0.00	0.00	0.0	0.00	0.0	0.0	0.0
8	255.0	1.00	0.00	0.00	0.0	0.00	0.0	0.0	0.0
9	255.0	1.00	0.00	0.00	0.0	0.00	0.0	0.0	0.0
10	255.0	1.00	0.00	0.00	0.0	0.00	0.0	0.0	0.0
11	255.0	1.00	0.00	0.00	0.0	0.00	0.0	0.0	0.0
12	255.0	1.00	0.00	0.00	0.0	0.00	0.0	0.0	0.0
13	255.0	1.00	0.00	0.00	0.0	0.00	0.0	0.0	0.0
14	255.0	1.00	0.00	0.00	0.0	0.00	0.0	0.0	0.0
15	255.0	1.00	0.00	0.00	0.0	0.00	0.0	0.0	0.0
16	255.0	1.00	0.00	0.00	0.0	0.00	0.0	0.0	0.0
17	255.0	1.00	0.00	0.00	0.0	0.00	0.0	0.0	0.0
18	255.0	1.00	0.00	0.00	0.0	0.00	0.0	0.0	0.0
19	255.0	1.00	0.00	0.00	0.0	0.00	0.0	0.0	0.0
20	255.0	1.00	0.00	0.00	0.0	0.00	0.0	0.0	0.0
21	255.0	1.00	0.00	0.00	0.0	0.00	0.0	0.0	0.0
22	255.0	1.00	0.00	0.00	0.0	0.00	0.0	0.0	0.0
23	255.0	1.00	0.00	0.00	0.0	0.00	0.0	0.0	0.0

```
24       255.0  1.00  0.00  0.00  0.0  0.00  0.0  0.0  0.0
25       255.0  1.00  0.00  0.00  0.0  0.00  0.0  0.0  0.0
26       255.0  1.00  0.00  0.00  0.0  0.00  0.0  0.0  0.0
27       255.0  1.00  0.00  0.00  0.0  0.00  0.0  0.0  0.0
28       255.0  1.00  0.00  0.00  0.0  0.00  0.0  0.0  0.0
29       255.0  1.00  0.00  0.00  0.0  0.00  0.0  0.0  0.0
...        ...   ...   ...   ...  ...   ...  ...  ...  ...
103321     8.0  0.03  0.05  0.00  0.0  1.00  1.0  0.0  0.0
103322    28.0  0.11  0.07  0.01  0.0  1.00  1.0  0.0  0.0
103323    26.0  0.10  0.07  0.01  0.0  1.00  1.0  0.0  0.0
103324    51.0  0.20  0.03  0.00  0.0  1.00  1.0  0.0  0.0
103325     2.0  0.01  0.07  0.00  0.0  1.00  1.0  0.0  0.0
103326    19.0  0.07  0.07  0.00  0.0  1.00  1.0  0.0  0.0
103327    25.0  0.10  0.07  0.00  0.0  1.00  1.0  0.0  0.0
103328    24.0  0.09  0.05  0.00  0.0  1.00  1.0  0.0  0.0
103329    20.0  0.91  0.09  0.05  0.0  0.91  1.0  0.0  0.0
103330    15.0  0.06  0.09  0.00  0.0  1.00  1.0  0.0  0.0
103331    31.0  0.12  0.05  0.02  0.0  1.00  1.0  0.0  0.0
103332     1.0  0.00  0.07  0.00  0.0  1.00  1.0  0.0  0.0
103333    70.0  0.27  0.02  0.00  0.0  1.00  1.0  0.0  0.0
103334     4.0  0.02  0.08  0.00  0.0  1.00  1.0  0.0  0.0
103335    20.0  0.08  0.07  0.00  0.0  1.00  1.0  0.0  0.0
103336    23.0  0.09  0.07  0.01  0.0  1.00  1.0  0.0  0.0
103337     1.0  0.00  0.07  0.00  0.0  1.00  1.0  0.0  0.0
103338    21.0  0.08  0.06  0.00  0.0  1.00  1.0  0.0  0.0
103339    48.0  0.19  0.04  0.01  0.0  1.00  1.0  0.0  0.0
103340    62.0  0.25  0.02  0.00  0.0  0.99  1.0  0.0  0.0
103341    45.0  0.18  0.05  0.01  0.0  1.00  1.0  0.0  0.0
103342    16.0  0.06  0.06  0.00  0.0  0.00  0.0  1.0  1.0
103343    37.0  0.15  0.04  0.02  0.0  1.00  1.0  0.0  0.0
103344    22.0  0.09  0.05  0.00  0.0  1.00  1.0  0.0  0.0
103345    35.0  0.14  0.04  0.01  0.0  1.00  1.0  0.0  0.0
103346    40.0  0.16  0.04  0.01  0.0  1.00  1.0  0.0  0.0
103347    49.0  0.19  0.04  0.02  0.0  1.00  1.0  0.0  0.0
103348    39.0  0.15  0.05  0.02  0.0  1.00  1.0  0.0  0.0
103349    24.0  0.27  0.04  0.01  0.0  1.00  1.0  0.0  0.0
103350     6.0  0.02  0.05  0.00  0.0  1.00  1.0  0.0  0.0

[103351 rows x 29 columns], 2:          0      1       2    3    4
5    6    7    8    9   ...     19  \
0       0.0  292.0   307.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ...
8.0
1       0.0  300.0   612.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ...
9.0
2       0.0  304.0   443.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ...
10.0
3       0.0  307.0   463.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ...
11.0
4       0.0  304.0   261.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ...
12.0
5       0.0  310.0   597.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ...
13.0
6       0.0  298.0   752.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ...
```

```
14.0
7       0.0  305.0   372.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ...
15.0
8       0.0  295.0  1332.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ...
16.0
9       0.0  296.0   734.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ...
17.0
10      0.0  305.0   387.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ...
18.0
11      0.0  301.0   266.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ...
19.0
12      0.0  305.0   260.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ...
20.0
13      0.0  306.0   410.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ...
21.0
14      0.0  302.0   262.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ...
22.0
15      0.0  302.0   415.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ...
23.0
16      0.0  305.0   266.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ...
24.0
17      0.0  301.0   445.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ...
25.0
18      0.0  303.0   266.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ...
26.0
19      0.0  300.0   634.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ...
27.0
20      0.0  301.0   870.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ...
28.0
21      0.0  302.0   267.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ...
29.0
22      0.0  305.0   263.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ...
30.0
23      0.0  294.0  1080.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ...
31.0
24      0.0  294.0  1027.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ...
32.0
25      0.0  305.0   382.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ...
33.0
26      0.0  305.0   415.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ...
34.0
27      0.0  297.0  2317.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ...
35.0
28      0.0  306.0   261.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ...
36.0
29      0.0  304.0   262.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  ...
37.0
...     ...    ...     ...  ...  ...  ...  ...  ...  ...  ...  ...
...
103321  0.0    0.0     0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ...
255.0
103322  0.0    0.0     0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ...
255.0
```

103323	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...
255.0											
103324	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...
255.0											
103325	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...
255.0											
103326	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...
255.0											
103327	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...
255.0											
103328	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...
255.0											
103329	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...
255.0											
103330	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...
255.0											
103331	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...
255.0											
103332	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...
255.0											
103333	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...
255.0											
103334	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...
255.0											
103335	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...
255.0											
103336	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...
255.0											
103337	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...
255.0											
103338	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...
255.0											
103339	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...
255.0											
103340	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...
255.0											
103341	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...
255.0											
103342	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...
255.0											
103343	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...
255.0											
103344	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...
255.0											
103345	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...
255.0											
103346	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...
255.0											
103347	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...
255.0											
103348	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...
255.0											
103349	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...

```
255.0
103350  0.0    0.0     0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ...
255.0
```

	20	21	22	23	24	25	26	27	28
0	255.0	1.00	0.00	0.12	0.03	0.0	0.0	0.0	0.0
1	255.0	1.00	0.00	0.11	0.03	0.0	0.0	0.0	0.0
2	255.0	1.00	0.00	0.10	0.03	0.0	0.0	0.0	0.0
3	255.0	1.00	0.00	0.09	0.03	0.0	0.0	0.0	0.0
4	255.0	1.00	0.00	0.08	0.03	0.0	0.0	0.0	0.0
5	255.0	1.00	0.00	0.08	0.03	0.0	0.0	0.0	0.0
6	255.0	1.00	0.00	0.07	0.03	0.0	0.0	0.0	0.0
7	255.0	1.00	0.00	0.07	0.03	0.0	0.0	0.0	0.0
8	255.0	1.00	0.00	0.06	0.03	0.0	0.0	0.0	0.0
9	255.0	1.00	0.00	0.06	0.03	0.0	0.0	0.0	0.0
10	255.0	1.00	0.00	0.06	0.03	0.0	0.0	0.0	0.0
11	255.0	1.00	0.00	0.05	0.03	0.0	0.0	0.0	0.0
12	255.0	1.00	0.00	0.05	0.03	0.0	0.0	0.0	0.0
13	255.0	1.00	0.00	0.05	0.03	0.0	0.0	0.0	0.0
14	255.0	1.00	0.00	0.05	0.03	0.0	0.0	0.0	0.0
15	255.0	1.00	0.00	0.04	0.03	0.0	0.0	0.0	0.0
16	255.0	1.00	0.00	0.04	0.03	0.0	0.0	0.0	0.0
17	255.0	1.00	0.00	0.04	0.03	0.0	0.0	0.0	0.0
18	255.0	1.00	0.00	0.04	0.03	0.0	0.0	0.0	0.0
19	255.0	1.00	0.00	0.04	0.03	0.0	0.0	0.0	0.0
20	255.0	1.00	0.00	0.04	0.03	0.0	0.0	0.0	0.0
21	255.0	1.00	0.00	0.03	0.03	0.0	0.0	0.0	0.0
22	255.0	1.00	0.00	0.03	0.03	0.0	0.0	0.0	0.0
23	255.0	1.00	0.00	0.03	0.03	0.0	0.0	0.0	0.0
24	255.0	1.00	0.00	0.03	0.03	0.0	0.0	0.0	0.0
25	255.0	1.00	0.00	0.03	0.03	0.0	0.0	0.0	0.0
26	255.0	1.00	0.00	0.03	0.03	0.0	0.0	0.0	0.0
27	255.0	1.00	0.00	0.03	0.03	0.0	0.0	0.0	0.0
28	255.0	1.00	0.00	0.03	0.03	0.0	0.0	0.0	0.0
29	255.0	1.00	0.00	0.03	0.03	0.0	0.0	0.0	0.0
...	...	...	...	...	...	...	...	...	...
103321	9.0	0.04	0.07	0.00	0.00	1.0	1.0	0.0	0.0
103322	3.0	0.01	0.07	0.00	0.00	1.0	1.0	0.0	0.0
103323	11.0	0.04	0.05	0.00	0.00	1.0	1.0	0.0	0.0
103324	56.0	0.22	0.03	0.00	0.00	1.0	1.0	0.0	0.0
103325	43.0	0.17	0.04	0.00	0.00	1.0	1.0	0.0	0.0
103326	37.0	0.15	0.04	0.01	0.00	1.0	1.0	0.0	0.0
103327	5.0	0.02	0.08	0.00	0.00	1.0	1.0	0.0	0.0
103328	54.0	0.21	0.04	0.00	0.00	1.0	1.0	0.0	0.0
103329	58.0	0.23	0.04	0.01	0.00	1.0	1.0	0.0	0.0
103330	2.0	0.01	0.07	0.00	0.00	1.0	1.0	0.0	0.0
103331	2.0	0.01	0.07	0.00	0.00	1.0	1.0	0.0	0.0
103332	24.0	0.09	0.05	0.00	0.00	1.0	1.0	0.0	0.0
103333	55.0	0.22	0.04	0.00	0.00	1.0	1.0	0.0	0.0
103334	48.0	0.19	0.05	0.01	0.00	1.0	1.0	0.0	0.0
103335	13.0	0.05	0.06	0.00	0.00	1.0	1.0	0.0	0.0
103336	23.0	0.09	0.05	0.00	0.00	1.0	1.0	0.0	0.0
103337	5.0	0.02	0.06	0.00	0.00	1.0	1.0	0.0	0.0

```
103338   20.0  0.08  0.06  0.00  0.00  1.0  1.0  0.0  0.0
103339   44.0  0.17  0.04  0.01  0.00  1.0  1.0  0.0  0.0
103340   14.0  0.05  0.07  0.00  0.00  1.0  1.0  0.0  0.0
103341    3.0  0.01  0.07  0.00  0.00  1.0  1.0  0.0  0.0
103342    3.0  0.01  0.07  0.00  0.00  1.0  1.0  0.0  0.0
103343   19.0  0.07  0.05  0.00  0.00  1.0  1.0  0.0  0.0
103344   33.0  0.13  0.05  0.02  0.00  1.0  1.0  0.0  0.0
103345   15.0  0.06  0.08  0.00  0.00  1.0  1.0  0.0  0.0
103346    4.0  0.02  0.07  0.00  0.00  1.0  1.0  0.0  0.0
103347   19.0  0.07  0.07  0.00  0.00  1.0  1.0  0.0  0.0
103348   12.0  0.05  0.05  0.00  0.00  1.0  1.0  0.0  0.0
103349   50.0  0.20  0.03  0.00  0.00  1.0  1.0  0.0  0.0
103350    3.0  0.01  0.06  0.00  0.00  1.0  1.0  0.0  0.0

[103351 rows x 29 columns], 3:          0        1        2    3
4    5    6    7    8    9   ...     19  \
0       0.0    150.0  18730.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0
...  116.0
1       0.0    228.0  16917.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0
...  117.0
2       0.0    238.0   2959.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0
...  118.0
3       0.0    201.0  16449.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0
...  119.0
4       0.0    207.0  14532.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0
...  120.0
5       0.0    202.0    306.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0
...  121.0
6       0.0    239.0  10233.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0
...  122.0
7       0.0    239.0    437.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0
...  123.0
8       0.0    203.0   9805.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0
...  124.0
9       0.0    200.0   9878.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0
...  125.0
10      0.0    205.0   2472.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0
...  126.0
11      0.0    225.0   1540.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0
...  127.0
12      0.0    228.0   2474.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0
...  128.0
13      0.0    214.0  19067.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0
...  129.0
14      0.0    203.0  17757.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0
...  130.0
15      0.0    200.0  19271.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0
...  131.0
16      0.0    227.0   1164.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0
...  132.0
17      0.0    226.0   1262.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0
...  133.0
18      0.0    176.0   8804.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0
```

```
...  134.0
19      0.0    240.0  19067.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0
...  135.0
20      0.0    254.0  16917.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0
...  136.0
21      0.0    252.0   1262.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0
...  137.0
22      0.0    251.0   1540.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0
...  138.0
23      0.0    254.0   2474.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0
...  139.0
24      0.0    253.0   1164.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0
...  140.0
25      0.0    234.0    674.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0
...    1.0
26      0.0    235.0    504.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0
...    2.0
27      0.0    237.0    460.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0
...    3.0
28      0.0    238.0   1556.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0
...    4.0
29      0.0    235.0    560.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0
...    5.0
...     ...      ...      ...  ...  ...  ...  ...  ...  ...  ...
...    ...
103321  0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...  172.0
103322  0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...  247.0
103323  0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...  117.0
103324  0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...  160.0
103325  0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...  153.0
103326  0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...  231.0
103327  0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...  146.0
103328  0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...  116.0
103329  0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...  161.0
103330  0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...  217.0
103331  0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...  199.0
103332  0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...  251.0
103333  0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...   58.0
103334  0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...  232.0
```

```
103335  0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...  135.0
103336  0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...  216.0
103337  0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...  220.0
103338  0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...   29.0
103339  0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...  215.0
103340  0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...  244.0
103341  0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...  154.0
103342  0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...  135.0
103343  0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...  117.0
103344  0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...  169.0
103345  0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...  175.0
103346  0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...  220.0
103347  0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...  154.0
103348  0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...  123.0
103349  0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...  114.0
103350  0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...  111.0
```

	20	21	22	23	24	25	26	27	28
0	255.0	1.0	0.0	0.01	0.05	0.00	0.00	0.00	0.00
1	255.0	1.0	0.0	0.01	0.05	0.00	0.00	0.00	0.00
2	255.0	1.0	0.0	0.01	0.05	0.00	0.00	0.00	0.00
3	255.0	1.0	0.0	0.01	0.05	0.00	0.00	0.00	0.00
4	255.0	1.0	0.0	0.01	0.05	0.00	0.00	0.00	0.00
5	255.0	1.0	0.0	0.01	0.05	0.00	0.00	0.00	0.00
6	255.0	1.0	0.0	0.01	0.05	0.00	0.00	0.00	0.00
7	255.0	1.0	0.0	0.01	0.05	0.00	0.00	0.00	0.00
8	255.0	1.0	0.0	0.01	0.05	0.00	0.00	0.00	0.00
9	255.0	1.0	0.0	0.01	0.05	0.00	0.00	0.00	0.00
10	255.0	1.0	0.0	0.01	0.05	0.00	0.00	0.00	0.00
11	255.0	1.0	0.0	0.01	0.05	0.00	0.00	0.00	0.00
12	255.0	1.0	0.0	0.01	0.04	0.00	0.00	0.00	0.00
13	255.0	1.0	0.0	0.01	0.04	0.00	0.00	0.00	0.00
14	255.0	1.0	0.0	0.01	0.04	0.00	0.00	0.00	0.00
15	255.0	1.0	0.0	0.01	0.04	0.00	0.00	0.00	0.00
16	255.0	1.0	0.0	0.01	0.04	0.00	0.00	0.00	0.00
17	255.0	1.0	0.0	0.01	0.04	0.00	0.00	0.00	0.00
18	255.0	1.0	0.0	0.01	0.04	0.00	0.00	0.00	0.00

```
19       255.0  1.0  0.0  0.01  0.03  0.00  0.00  0.00  0.00
20       255.0  1.0  0.0  0.01  0.03  0.00  0.00  0.00  0.00
21       255.0  1.0  0.0  0.01  0.03  0.00  0.00  0.00  0.00
22       255.0  1.0  0.0  0.01  0.03  0.00  0.00  0.00  0.00
23       255.0  1.0  0.0  0.01  0.03  0.00  0.00  0.00  0.00
24       255.0  1.0  0.0  0.01  0.03  0.00  0.00  0.00  0.00
25       255.0  1.0  0.0  1.00  0.04  0.00  0.00  0.00  0.00
26       255.0  1.0  0.0  0.50  0.04  0.00  0.00  0.00  0.00
27       255.0  1.0  0.0  0.33  0.04  0.00  0.00  0.00  0.00
28       255.0  1.0  0.0  0.25  0.04  0.00  0.00  0.00  0.00
29       255.0  1.0  0.0  0.20  0.04  0.00  0.00  0.00  0.00
...        ...  ...  ...   ...   ...   ...   ...   ...   ...
103321   172.0  1.0  0.0  0.01  0.00  0.00  0.00  0.06  0.06
103322   247.0  1.0  0.0  0.00  0.00  0.00  0.00  0.05  0.05
103323   117.0  1.0  0.0  0.01  0.00  0.00  0.00  0.02  0.02
103324   160.0  1.0  0.0  0.01  0.00  0.00  0.00  0.06  0.06
103325   153.0  1.0  0.0  0.01  0.00  0.00  0.00  0.06  0.06
103326   231.0  1.0  0.0  0.00  0.00  0.00  0.00  0.02  0.02
103327   146.0  1.0  0.0  0.01  0.00  0.00  0.00  0.01  0.01
103328   116.0  1.0  0.0  0.01  0.00  0.00  0.00  0.04  0.04
103329   161.0  1.0  0.0  0.01  0.00  0.00  0.00  0.01  0.01
103330   217.0  1.0  0.0  0.00  0.00  0.00  0.00  0.06  0.06
103331   199.0  1.0  0.0  0.01  0.00  0.00  0.00  0.06  0.06
103332   251.0  1.0  0.0  0.00  0.00  0.00  0.00  0.02  0.02
103333    58.0  1.0  0.0  0.02  0.00  0.02  0.02  0.02  0.02
103334   232.0  1.0  0.0  0.00  0.00  0.00  0.00  0.02  0.02
103335   135.0  1.0  0.0  0.01  0.00  0.00  0.00  0.01  0.01
103336   216.0  1.0  0.0  0.00  0.00  0.00  0.00  0.01  0.01
103337   220.0  1.0  0.0  0.00  0.00  0.00  0.00  0.01  0.01
103338    29.0  1.0  0.0  0.03  0.00  0.00  0.00  0.00  0.00
103339   215.0  1.0  0.0  0.00  0.00  0.00  0.00  0.06  0.06
103340   244.0  1.0  0.0  0.00  0.00  0.00  0.00  0.05  0.05
103341   154.0  1.0  0.0  0.01  0.00  0.00  0.00  0.06  0.06
103342   135.0  1.0  0.0  0.01  0.00  0.00  0.00  0.05  0.05
103343   117.0  1.0  0.0  0.01  0.00  0.00  0.00  0.04  0.04
103344   169.0  1.0  0.0  0.01  0.00  0.00  0.00  0.01  0.01
103345   175.0  1.0  0.0  0.01  0.00  0.00  0.00  0.01  0.01
103346   220.0  1.0  0.0  0.00  0.00  0.00  0.00  0.06  0.06
103347   154.0  1.0  0.0  0.01  0.00  0.00  0.00  0.01  0.01
103348   123.0  1.0  0.0  0.01  0.00  0.00  0.00  0.05  0.05
103349   114.0  1.0  0.0  0.01  0.00  0.00  0.00  0.02  0.02
103350   111.0  1.0  0.0  0.01  0.00  0.00  0.00  0.01  0.01

[103351 rows x 29 columns], 4:            0        1        2    3
4    5    6    7    8    9   ...  \
0         0.0    320.0   7458.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0
...
1         0.0    261.0  32540.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0
...
2         0.0    325.0    186.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0
...
3         0.0    326.0  15925.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0
...
```

4	0.0	335.0	14497.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
...										
5	0.0	317.0	280.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
...										
6	0.0	330.0	8753.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
...										
7	0.0	318.0	179.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
...										
8	0.0	323.0	10970.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
...										
9	0.0	324.0	2302.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
...										
10	0.0	320.0	2828.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
...										
11	0.0	319.0	454.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
...										
12	0.0	323.0	7509.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
...										
13	0.0	321.0	743.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
...										
14	192.0	328.0	189.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
...										
15	0.0	315.0	791.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
...										
16	0.0	321.0	3682.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
...										
17	0.0	319.0	261.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
...										
18	0.0	315.0	1616.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
...										
19	0.0	321.0	538.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
...										
20	0.0	319.0	983.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
...										
21	0.0	325.0	753.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
...										
22	0.0	317.0	7384.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
...										
23	0.0	326.0	8894.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
...										
24	0.0	325.0	544.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
...										
25	0.0	327.0	883.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
...										
26	0.0	327.0	2006.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
...										
27	0.0	324.0	971.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
...										
28	0.0	324.0	14947.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
...										
29	0.0	264.0	11425.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
...										
...	...	...	...	...	...	...	...	...	...	...

```
...
103321    0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...
103322    0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...
103323    0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...
103324    0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...
103325    0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...
103326    0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...
103327    0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...
103328    0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...
103329    0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...
103330    0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...
103331    0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...
103332    0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...
103333    0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...
103334    0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...
103335    0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...
103336    0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...
103337    0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...
103338    0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...
103339    0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...
103340    0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...
103341    0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...
103342    0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...
103343    0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...
103344    0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...
103345    0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...
103346    0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...
```

```
103347    0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...
103348    0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...
103349    0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...
103350    0.0  54540.0   8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0
...
```

	19	20	21	22	23	24	25	26	27	28
0	255.0	255.0	1.0	0.0	0.00	0.0	0.01	0.01	0.00	0.00
1	255.0	255.0	1.0	0.0	0.00	0.0	0.01	0.01	0.00	0.00
2	255.0	255.0	1.0	0.0	0.00	0.0	0.01	0.01	0.00	0.00
3	255.0	255.0	1.0	0.0	0.00	0.0	0.01	0.01	0.00	0.00
4	255.0	255.0	1.0	0.0	0.00	0.0	0.01	0.01	0.00	0.00
5	255.0	255.0	1.0	0.0	0.00	0.0	0.01	0.01	0.00	0.00
6	255.0	255.0	1.0	0.0	0.00	0.0	0.01	0.01	0.00	0.00
7	255.0	255.0	1.0	0.0	0.00	0.0	0.01	0.01	0.00	0.00
8	255.0	255.0	1.0	0.0	0.00	0.0	0.01	0.01	0.00	0.00
9	255.0	255.0	1.0	0.0	0.00	0.0	0.01	0.01	0.00	0.00
10	255.0	255.0	1.0	0.0	0.00	0.0	0.01	0.01	0.00	0.00
11	255.0	255.0	1.0	0.0	0.00	0.0	0.01	0.01	0.00	0.00
12	255.0	255.0	1.0	0.0	0.00	0.0	0.01	0.01	0.00	0.00
13	255.0	255.0	1.0	0.0	0.00	0.0	0.01	0.01	0.00	0.00
14	255.0	255.0	1.0	0.0	0.00	0.0	0.01	0.01	0.00	0.00
15	255.0	255.0	1.0	0.0	0.00	0.0	0.01	0.01	0.00	0.00
16	255.0	255.0	1.0	0.0	0.00	0.0	0.01	0.01	0.00	0.00
17	255.0	255.0	1.0	0.0	0.00	0.0	0.01	0.01	0.00	0.00
18	255.0	255.0	1.0	0.0	0.00	0.0	0.01	0.01	0.00	0.00
19	255.0	255.0	1.0	0.0	0.00	0.0	0.01	0.01	0.00	0.00
20	255.0	255.0	1.0	0.0	0.00	0.0	0.01	0.01	0.00	0.00
21	255.0	255.0	1.0	0.0	0.00	0.0	0.01	0.01	0.00	0.00
22	255.0	255.0	1.0	0.0	0.00	0.0	0.01	0.01	0.00	0.00
23	255.0	255.0	1.0	0.0	0.00	0.0	0.01	0.01	0.00	0.00
24	255.0	255.0	1.0	0.0	0.00	0.0	0.01	0.01	0.00	0.00
25	255.0	255.0	1.0	0.0	0.00	0.0	0.01	0.01	0.00	0.00
26	255.0	255.0	1.0	0.0	0.00	0.0	0.01	0.01	0.00	0.00
27	255.0	255.0	1.0	0.0	0.00	0.0	0.00	0.00	0.00	0.00
28	255.0	255.0	1.0	0.0	0.00	0.0	0.00	0.00	0.00	0.00
29	255.0	255.0	1.0	0.0	0.00	0.0	0.00	0.00	0.00	0.00
...	...	...	...	...	...	...	...	...	...	...
103321	145.0	145.0	1.0	0.0	0.01	0.0	0.00	0.00	0.01	0.01
103322	195.0	195.0	1.0	0.0	0.01	0.0	0.00	0.00	0.05	0.05
103323	136.0	136.0	1.0	0.0	0.01	0.0	0.00	0.00	0.05	0.05
103324	239.0	239.0	1.0	0.0	0.00	0.0	0.00	0.00	0.05	0.05
103325	164.0	164.0	1.0	0.0	0.01	0.0	0.00	0.00	0.01	0.01
103326	106.0	106.0	1.0	0.0	0.01	0.0	0.00	0.00	0.01	0.01
103327	136.0	136.0	1.0	0.0	0.01	0.0	0.00	0.00	0.01	0.01
103328	235.0	235.0	1.0	0.0	0.00	0.0	0.00	0.00	0.06	0.06
103329	180.0	180.0	1.0	0.0	0.01	0.0	0.00	0.00	0.06	0.06
103330	125.0	125.0	1.0	0.0	0.01	0.0	0.00	0.00	0.02	0.02
103331	224.0	224.0	1.0	0.0	0.00	0.0	0.00	0.00	0.06	0.06
103332	165.0	165.0	1.0	0.0	0.01	0.0	0.00	0.00	0.05	0.05

```
103333   43.0   43.0  1.0  0.0  0.02  0.0  0.00  0.00  0.00  0.00
103334   97.0   97.0  1.0  0.0  0.01  0.0  0.00  0.00  0.01  0.01
103335  205.0  205.0  1.0  0.0  0.00  0.0  0.00  0.00  0.05  0.05
103336  183.0  183.0  1.0  0.0  0.01  0.0  0.00  0.00  0.05  0.05
103337   71.0   71.0  1.0  0.0  0.01  0.0  0.00  0.00  0.01  0.01
103338  124.0  124.0  1.0  0.0  0.01  0.0  0.00  0.00  0.05  0.05
103339  224.0  224.0  1.0  0.0  0.00  0.0  0.00  0.00  0.01  0.01
103340  110.0  110.0  1.0  0.0  0.01  0.0  0.00  0.00  0.05  0.05
103341  166.0  166.0  1.0  0.0  0.01  0.0  0.00  0.00  0.01  0.01
103342  167.0  167.0  1.0  0.0  0.01  0.0  0.00  0.00  0.01  0.01
103343  243.0  243.0  1.0  0.0  0.00  0.0  0.00  0.00  0.02  0.02
103344    1.0    1.0  1.0  0.0  1.00  0.0  0.00  0.00  0.00  0.00
103345   20.0   20.0  1.0  0.0  0.05  0.0  0.00  0.00  0.10  0.10
103346  185.0  185.0  1.0  0.0  0.01  0.0  0.00  0.00  0.01  0.01
103347  144.0  144.0  1.0  0.0  0.01  0.0  0.00  0.00  0.06  0.06
103348  156.0  156.0  1.0  0.0  0.01  0.0  0.00  0.00  0.01  0.01
103349  180.0  180.0  1.0  0.0  0.01  0.0  0.00  0.00  0.01  0.01
103350  173.0  173.0  1.0  0.0  0.01  0.0  0.00  0.00  0.06  0.06

[103351 rows x 29 columns], 5:          0        1       2    3
4    5    6    7    8    9   ...     19  \
0       0.0      0.0     0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  .
..    1.0
1       0.0      0.0     0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  .
..    2.0
2       0.0      0.0     0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  .
..    3.0
3       0.0      0.0     0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  .
..    4.0
4       0.0      0.0     0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  .
..    1.0
5       0.0      0.0     0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  .
..    2.0
6       0.0      0.0     0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  .
..    3.0
7       0.0      0.0     0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  .
..    4.0
8       0.0      0.0     0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  .
..    1.0
9       0.0      0.0     0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  .
..    2.0
10      0.0      0.0     0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  .
..    1.0
11      0.0      0.0     0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  .
..    2.0
12      0.0      0.0     0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  .
..    1.0
13      0.0      0.0     0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  .
..    2.0
14      0.0      0.0     0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  .
..    3.0
15      0.0      0.0     0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  .
..    4.0
```

```
16       0.0       0.0      0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0  .
..     1.0
17       0.0       0.0      0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0  .
..     2.0
18       0.0       0.0      0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0  .
..     3.0
19       0.0       0.0      0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0  .
..     4.0
20       0.0       0.0      0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0  .
..     1.0
21       0.0       0.0      0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0  .
..     2.0
22       0.0       0.0      0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0  .
..     1.0
23       0.0       0.0      0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0  .
..     2.0
24       0.0       0.0      0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0  .
..     1.0
25       0.0       0.0      0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0  .
..     2.0
26       0.0       0.0      0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0  .
..     3.0
27       0.0       0.0      0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0  .
..     1.0
28       0.0       0.0      0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0  .
..     2.0
29       0.0       0.0      0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0  .
..     3.0
...      ...       ...      ...   ...   ...   ...   ...   ...   ...   ...  .
..     ...
103313   0.0   54540.0   8314.0   2.0   1.0   1.0   0.0   0.0   0.0   0.0  .
..    82.0
103314   0.0   54540.0   8314.0   2.0   1.0   1.0   0.0   0.0   0.0   0.0  .
..   193.0
103315   0.0   54540.0   8314.0   2.0   1.0   1.0   0.0   0.0   0.0   0.0  .
..    31.0
103316   0.0   54540.0   8314.0   2.0   1.0   1.0   0.0   0.0   0.0   0.0  .
..     6.0
103317   0.0   54540.0   8314.0   2.0   1.0   1.0   0.0   0.0   0.0   0.0  .
..    22.0
103318   0.0   54540.0   8314.0   2.0   1.0   1.0   0.0   0.0   0.0   0.0  .
..   190.0
103319   0.0   54540.0   8314.0   2.0   1.0   1.0   0.0   0.0   0.0   0.0  .
..    10.0
103320   0.0   54540.0   8314.0   2.0   1.0   1.0   0.0   0.0   0.0   0.0  .
..    92.0
103321   0.0   54540.0   8314.0   2.0   1.0   1.0   0.0   0.0   0.0   0.0  .
..    58.0
103322   0.0   54540.0   8314.0   2.0   1.0   1.0   0.0   0.0   0.0   0.0  .
..   191.0
103323   0.0   54540.0   8314.0   2.0   1.0   1.0   0.0   0.0   0.0   0.0  .
..   101.0
103324   0.0   54540.0   8314.0   2.0   1.0   1.0   0.0   0.0   0.0   0.0  .
```

```
..   27.0
103325  0.0  54540.0  8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0  .
..   32.0
103326  0.0  54540.0  8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0  .
..   75.0
103327  0.0  54540.0  8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0  .
..   55.0
103328  0.0  54540.0  8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0  .
..   28.0
103329  0.0  54540.0  8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0  .
..   23.0
103330  0.0  54540.0  8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0  .
..   56.0
103331  0.0  54540.0  8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0  .
..  203.0
103332  0.0  54540.0  8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0  .
..   40.0
103333  0.0  54540.0  8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0  .
..   91.0
103334  0.0  54540.0  8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0  .
..  202.0
103335  0.0  54540.0  8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0  .
..  202.0
103336  0.0  54540.0  8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0  .
..    7.0
103337  0.0  54540.0  8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0  .
..   20.0
103338  0.0  54540.0  8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0  .
..    9.0
103339  2.0  54540.0  8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0  .
..   34.0
103340  0.0  54540.0  8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0  .
..   18.0
103341  0.0  54540.0  8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0  .
..   98.0
103342  0.0  54540.0  8314.0  2.0  1.0  1.0  0.0  0.0  0.0  0.0  .
..   41.0

            20   21   22    23    24   25   26    27    28
0       249.0  1.0  0.0  1.00  0.12  0.0  0.0  1.00  0.94
1       249.0  1.0  0.0  0.50  0.12  0.0  0.0  1.00  0.94
2       249.0  1.0  0.0  0.33  0.12  0.0  0.0  1.00  0.94
3       249.0  1.0  0.0  0.25  0.12  0.0  0.0  1.00  0.94
4       249.0  1.0  0.0  1.00  0.12  0.0  0.0  1.00  0.94
5       249.0  1.0  0.0  0.50  0.12  0.0  0.0  1.00  0.94
6       249.0  1.0  0.0  0.33  0.12  0.0  0.0  1.00  0.94
7       249.0  1.0  0.0  0.25  0.12  0.0  0.0  1.00  0.94
8       249.0  1.0  0.0  1.00  0.12  0.0  0.0  1.00  0.94
9       249.0  1.0  0.0  0.50  0.12  0.0  0.0  1.00  0.94
10      249.0  1.0  0.0  1.00  0.12  0.0  0.0  1.00  0.94
11      249.0  1.0  0.0  0.50  0.12  0.0  0.0  1.00  0.94
12      249.0  1.0  0.0  1.00  0.13  0.0  0.0  1.00  0.94
13      249.0  1.0  0.0  0.50  0.12  0.0  0.0  1.00  0.94
```

```
14       249.0  1.0  0.0  0.33  0.12  0.0  0.0  1.00  0.94
15       249.0  1.0  0.0  0.25  0.12  0.0  0.0  1.00  0.94
16       249.0  1.0  0.0  1.00  0.12  0.0  0.0  1.00  0.94
17       249.0  1.0  0.0  0.50  0.12  0.0  0.0  1.00  0.94
18       249.0  1.0  0.0  0.33  0.12  0.0  0.0  1.00  0.94
19       249.0  1.0  0.0  0.25  0.12  0.0  0.0  1.00  0.94
20       249.0  1.0  0.0  1.00  0.12  0.0  0.0  1.00  0.94
21       249.0  1.0  0.0  0.50  0.12  0.0  0.0  1.00  0.94
22       249.0  1.0  0.0  1.00  0.13  0.0  0.0  1.00  0.94
23       249.0  1.0  0.0  0.50  0.13  0.0  0.0  1.00  0.94
24       249.0  1.0  0.0  1.00  0.13  0.0  0.0  1.00  0.94
25       249.0  1.0  0.0  0.50  0.13  0.0  0.0  1.00  0.94
26       249.0  1.0  0.0  0.33  0.13  0.0  0.0  1.00  0.94
27       249.0  1.0  0.0  1.00  0.14  0.0  0.0  1.00  0.94
28       249.0  1.0  0.0  0.50  0.14  0.0  0.0  1.00  0.94
29       249.0  1.0  0.0  0.33  0.14  0.0  0.0  1.00  0.94
...        ...  ...  ...   ...   ...  ...  ...   ...   ...
103313    82.0  1.0  0.0  0.01  0.00  0.0  0.0  0.04  0.04
103314   193.0  1.0  0.0  0.01  0.00  0.0  0.0  0.05  0.05
103315    31.0  1.0  0.0  0.03  0.00  0.0  0.0  0.00  0.00
103316     6.0  1.0  0.0  0.17  0.00  0.0  0.0  0.17  0.17
103317    22.0  1.0  0.0  0.05  0.00  0.0  0.0  0.00  0.00
103318   190.0  1.0  0.0  0.01  0.00  0.0  0.0  0.05  0.05
103319    10.0  1.0  0.0  0.10  0.00  0.0  0.0  0.10  0.10
103320    92.0  1.0  0.0  0.01  0.00  0.0  0.0  0.01  0.01
103321    58.0  1.0  0.0  0.02  0.00  0.0  0.0  0.02  0.02
103322   191.0  1.0  0.0  0.01  0.00  0.0  0.0  0.05  0.05
103323   101.0  1.0  0.0  0.01  0.00  0.0  0.0  0.05  0.05
103324    27.0  1.0  0.0  0.04  0.00  0.0  0.0  0.00  0.00
103325    32.0  1.0  0.0  0.03  0.00  0.0  0.0  0.06  0.06
103326    75.0  1.0  0.0  0.01  0.00  0.0  0.0  0.01  0.01
103327    55.0  1.0  0.0  0.02  0.00  0.0  0.0  0.04  0.04
103328    28.0  1.0  0.0  0.04  0.00  0.0  0.0  0.07  0.07
103329    23.0  1.0  0.0  0.04  0.00  0.0  0.0  0.00  0.00
103330    56.0  1.0  0.0  0.02  0.00  0.0  0.0  0.02  0.02
103331   203.0  1.0  0.0  0.00  0.00  0.0  0.0  0.05  0.05
103332    40.0  1.0  0.0  0.03  0.00  0.0  0.0  0.00  0.00
103333    91.0  1.0  0.0  0.01  0.00  0.0  0.0  0.15  0.15
103334   202.0  1.0  0.0  0.00  0.00  0.0  0.0  0.05  0.05
103335   202.0  1.0  0.0  0.00  0.00  0.0  0.0  0.01  0.01
103336     7.0  1.0  0.0  0.14  0.00  0.0  0.0  0.14  0.14
103337    20.0  1.0  0.0  0.05  0.00  0.0  0.0  0.00  0.00
103338     9.0  1.0  0.0  0.11  0.00  0.0  0.0  0.11  0.11
103339    34.0  1.0  0.0  0.03  0.00  0.0  0.0  0.32  0.32
103340    18.0  1.0  0.0  0.06  0.00  0.0  0.0  0.00  0.00
103341    98.0  1.0  0.0  0.01  0.00  0.0  0.0  0.05  0.05
103342    41.0  1.0  0.0  0.02  0.00  0.0  0.0  0.00  0.00

[103343 rows x 29 columns]}
**************************************************************
**
{0: array([[ 1],
       [ 1],
```

```
       [ 1],
       ...,
       [-1],
       [-1],
       [-1]]), 1: array([[ 1],
       [ 1],
       [ 1],
       ...,
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       [ 1],
       ...,
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       [-1],
       [-1]]), 5: array([[ 1],
       [ 1],
       [ 1],
       ...,
       [-1],
       [-1],
       [-1]])}
```

In [36]:

```
MS_executions_time_IF_Shuttle = []
MS_roc_auc_IF_Shuttle = []
MS_precisions_IF_Shuttle = []
MS_recalls_IF_Shuttle = []
MS_f1_scores_IF_Shuttle = []
MS_tn_IF_Shuttle = []
MS_fp_IF_Shuttle = []
MS_fn_IF_Shuttle = []
MS_tp_IF_Shuttle = []
MS_specificity_IF_Shuttle = []
MS_max_samples_IF_Shuttle = []

X_data = X_recomposed_shuttle[0]
Y_data = Y_recomposed_shuttle[0]

for j in range(0, len(X_recomposed_shuttle), 1):
    if(j > 0):
```

```
        #X_data = X_data.append(X_recomposed_shuttle[j], ignore_ind
ex=True, sort=False)
        #Y_data = Y_data.append(Y_recomposed_shuttle[j], ignore_ind
ex=True, sort=False)
        X_data = np.concatenate((X_data , X_recomposed_shuttle[j]))
        Y_data = np.concatenate((Y_data , Y_recomposed_shuttle[j]))
    MS_max_samples_IF_Shuttle.append(len(X_data))
    print("Taille: ")
    print(MS_max_samples_IF_Shuttle)

    start_IF_Shuttle = time()

    # Instanciation, fit and predict on Shuttle
    MS_func_IF_Shuttle = IsolationForest(behaviour="new")
    MS_func_IF_Shuttle.fit(X_data)
    MS_y_pred_IF_Shuttle = MS_func_IF_Shuttle.predict(X_data)

    # Calcul du temps d'exécution
    MS_exec_time_IF_Shuttle = time() - start_IF_Shuttle
    MS_executions_time_IF_Shuttle.append(MS_exec_time_IF_Shuttle)
    print("Temps d'exécution: ")
    print(MS_executions_time_IF_Shuttle)

    # Precision
    MS_precisions_IF_Shuttle.append(precision_score(Y_data, MS_y_pr
ed_IF_Shuttle))
    print("Precision: ")
    print(MS_precisions_IF_Shuttle)

    # Recall
    MS_recalls_IF_Shuttle.append(recall_score(Y_data, MS_y_pred_IF_
Shuttle))
    print("Recall: ")
    print(MS_recalls_IF_Shuttle)

    # f1_score
    MS_f1_scores_IF_Shuttle.append(f1_score(Y_data, MS_y_pred_IF_Sh
uttle))
    print("f1_score: ")
    print(MS_f1_scores_IF_Shuttle)

    # Specificity
    MS_specificity_IF_Shuttle.append(specificity_score(Y_data, MS_y
_pred_IF_Shuttle))
    print("Specificity: ")
    print(MS_specificity_IF_Shuttle)

    # Matrice de confusion
    print("Matrice de confusion: ")
    print(confusion_matrix(Y_data, MS_y_pred_IF_Shuttle))
    ttn, tfp, tfn, ttp = confusion_matrix(Y_data, MS_y_pred_IF_Shut
tle).ravel()
    tn = ttp
```

```
    fp = tfn
    fn = tfp
    tp = ttn
    MS_tn_IF_Shuttle.append(tn)
    MS_fp_IF_Shuttle.append(fp)
    MS_fn_IF_Shuttle.append(fn)
    MS_tp_IF_Shuttle.append(tp)

    # Calcul de l'aire sous la courbe ROC
    MS_y_DF_IF_Shuttle = MS_func_IF_Shuttle.decision_function(X_dat
a)
    MS_auc_IF_Shuttle = roc_auc_score(Y_data, MS_y_DF_IF_Shuttle)
    MS_roc_auc_IF_Shuttle.append(MS_auc_IF_Shuttle)
    print("ROC AUC: ")
    print(MS_roc_auc_IF_Shuttle)
```

```
Taille:
[103527]

/Users/thesard/anaconda3/lib/python3.7/site-packages/sklearn/ensem
ble/iforest.py:213: FutureWarning: default contamination parameter
0.1 will change in version 0.22 to "auto". This will change the pr
edict method behavior.
  FutureWarning)

Temps d'exécution:
[9.811700105667114]
Precision:
[1.0]
Recall:
[0.90306760358614]
f1_score:
[0.9490651849512857]
Specificity:
[1.0]
Matrice de confusion:
[[  352     0]
 [10001 93174]]
ROC AUC:
[0.9992024803401105]
Taille:
[103527, 206878]

/Users/thesard/anaconda3/lib/python3.7/site-packages/sklearn/ensem
ble/iforest.py:213: FutureWarning: default contamination parameter
0.1 will change in version 0.22 to "auto". This will change the pr
edict method behavior.
  FutureWarning)
```

```
Temps d'exécution:
[9.811700105667114, 18.64274787902832]
Precision:
[1.0, 1.0]
Recall:
[0.90306760358614, 0.9023019142234069]
f1_score:
[0.9490651849512857, 0.9486421765934683]
Specificity:
[1.0, 1.0]
Matrice de confusion:
[[   528      0]
 [ 20160 186190]]
ROC AUC:
[0.9992024803401105, 0.9992184964498388]
Taille:
[103527, 206878, 310229]
```

```
/Users/thesard/anaconda3/lib/python3.7/site-packages/sklearn/ensem
ble/iforest.py:213: FutureWarning: default contamination parameter
0.1 will change in version 0.22 to "auto". This will change the pr
edict method behavior.
  FutureWarning)
```

```
Temps d'exécution:
[9.811700105667114, 18.64274787902832, 27.14884901046753]
Precision:
[1.0, 1.0, 1.0]
Recall:
[0.90306760358614, 0.9023019142234069, 0.9020466844358291]
f1_score:
[0.9490651849512857, 0.9486421765934683, 0.9485010981246104]
Specificity:
[1.0, 1.0, 1.0]
Matrice de confusion:
[[   704      0]
 [ 30319 279206]]
ROC AUC:
[0.9992024803401105, 0.9992184964498388, 0.9999270096775851]
Taille:
[103527, 206878, 310229, 413580]
```

```
/Users/thesard/anaconda3/lib/python3.7/site-packages/sklearn/ensem
ble/iforest.py:213: FutureWarning: default contamination parameter
0.1 will change in version 0.22 to "auto". This will change the pr
edict method behavior.
  FutureWarning)
```

```
Temps d'exécution:
[9.811700105667114, 18.64274787902832, 27.14884901046753, 47.61349
391937256]
Precision:
[1.0, 1.0, 1.0, 1.0]
Recall:
[0.90306760358614, 0.9023019142234069, 0.9020466844358291, 0.90191
90695420403]
f1_score:
[0.9490651849512857, 0.9486421765934683, 0.9485010981246104, 0.948
4305446910649]
Specificity:
[1.0, 1.0, 1.0, 1.0]
Matrice de confusion:
[[   880      0]
 [ 40478 372222]]
ROC AUC:
[0.9992024803401105, 0.9992184964498388, 0.9999270096775851, 0.993
200563913915]
Taille:
[103527, 206878, 310229, 413580, 516931]

/Users/thesard/anaconda3/lib/python3.7/site-packages/sklearn/ensem
ble/iforest.py:213: FutureWarning: default contamination parameter
0.1 will change in version 0.22 to "auto". This will change the pr
edict method behavior.
  FutureWarning)

Temps d'exécution:
[9.811700105667114, 18.64274787902832, 27.14884901046753, 47.61349
391937256, 51.398707151412964]
Precision:
[1.0, 1.0, 1.0, 1.0, 1.0]
Recall:
[0.90306760358614, 0.9023019142234069, 0.9020466844358291, 0.90191
90695420403, 0.9018425006057669]
f1_score:
[0.9490651849512857, 0.9486421765934683, 0.9485010981246104, 0.948
4305446910649, 0.9483882080861226]
Specificity:
[1.0, 1.0, 1.0, 1.0, 1.0]
Matrice de confusion:
[[  1056      0]
 [ 50637 465238]]
ROC AUC:
[0.9992024803401105, 0.9992184964498388, 0.9999270096775851, 0.993
200563913915, 0.9881881438567894]
Taille:
[103527, 206878, 310229, 413580, 516931, 620274]
```

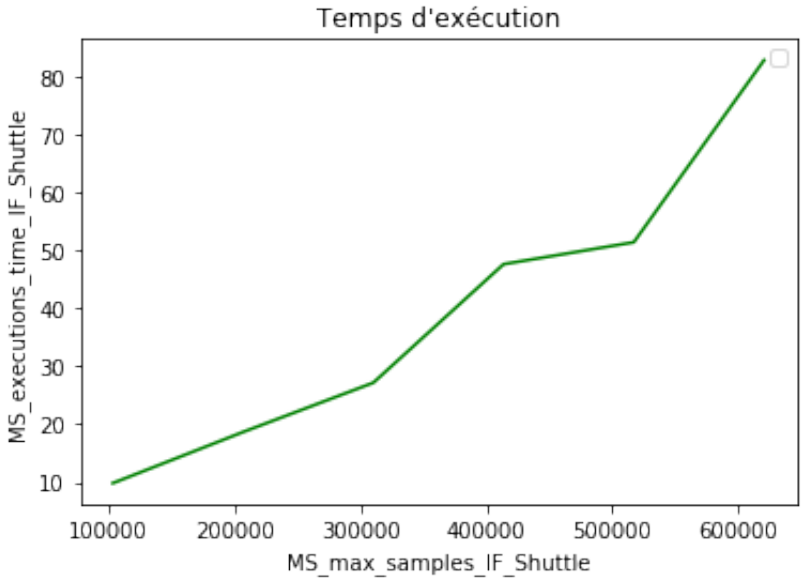
```
/Users/thesard/anaconda3/lib/python3.7/site-packages/sklearn/ensem
ble/iforest.py:213: FutureWarning: default contamination parameter
0.1 will change in version 0.22 to "auto". This will change the pr
edict method behavior.
  FutureWarning)

Temps d'exécution:
[9.811700105667114, 18.64274787902832, 27.14884901046753, 47.61349
391937256, 51.398707151412964, 82.8274712562561]
Precision:
[1.0, 1.0, 1.0, 1.0, 1.0, 0.9996309949879805]
Recall:
[0.90306760358614, 0.9023019142234069, 0.9020466844358291, 0.90191
90695420403, 0.9018425006057669, 0.9014709730779296]
f1_score:
[0.9490651849512857, 0.9486421765934683, 0.9485010981246104, 0.948
4305446910649, 0.9483882080861226, 0.948016824881254]
Specificity:
[1.0, 1.0, 1.0, 1.0, 1.0, 0.8322475570032574]
Matrice de confusion:
[[  1022    206]
 [ 60994 558052]]
ROC AUC:
[0.9992024803401105, 0.9992184964498388, 0.9999270096775851, 0.993
200563913915, 0.9881881438567894, 0.9685776496525951]
```

In [37]:
```
# Evolution du temps d'exécution
plt.plot(MS_max_samples_IF_Shuttle, MS_executions_time_IF_Shuttle,
"g-")
plt.title("Temps d'exécution")
#plt.axis([0, 1, 0, 1])
plt.xlabel('MS_max_samples_IF_Shuttle')
plt.ylabel('MS_executions_time_IF_Shuttle')
plt.legend(loc="best")

plt.show()
```

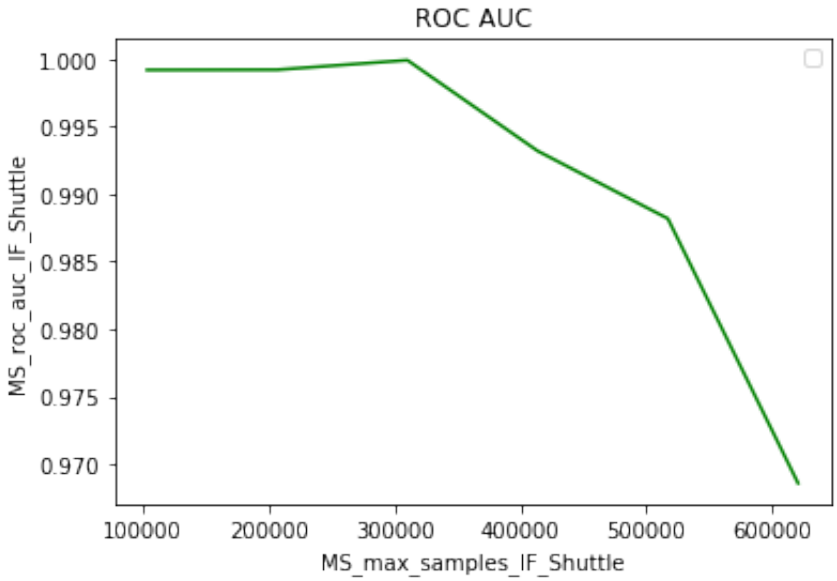
```
No handles with labels found to put in legend.
```



In [38]:
```
# Evolution de l'aire sous la courbe ROC
plt.plot(MS_max_samples_IF_Shuttle, MS_roc_auc_IF_Shuttle, "g-")
plt.title("ROC AUC")
#plt.axis([0, 1, 0, 1])
plt.xlabel('MS_max_samples_IF_Shuttle')
plt.ylabel('MS_roc_auc_IF_Shuttle')
plt.legend(loc="best")

plt.show()
```

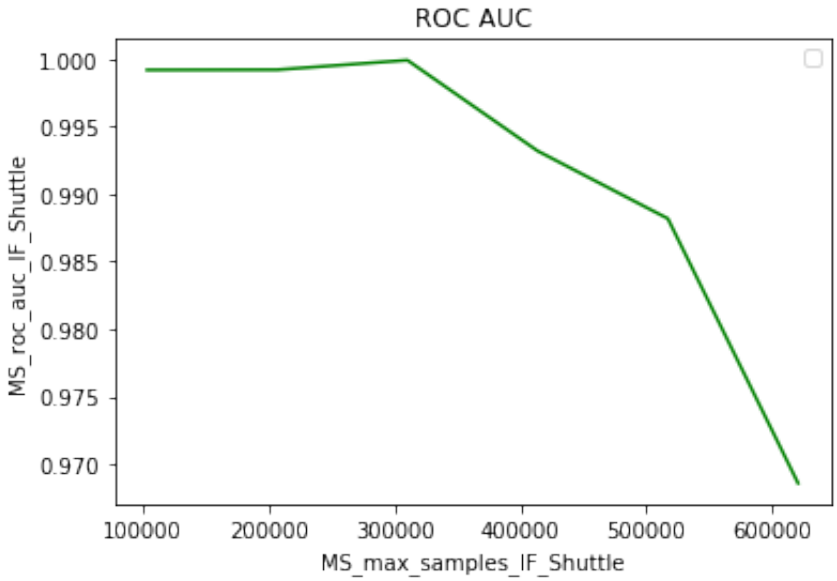
```
No handles with labels found to put in legend.
```



In [38]:
```
# Evolution du rappel
plt.plot(MS_max_samples_IF_Shuttle, MS_recalls_IF_Shuttle, "g-")
plt.title("Rappel")
#plt.axis([0, 1, 0, 1])
plt.xlabel('MS_max_samples_IF_Shuttle')
plt.ylabel('MS_recalls_IF_Shuttle')
plt.legend(loc="best")

plt.show()
```

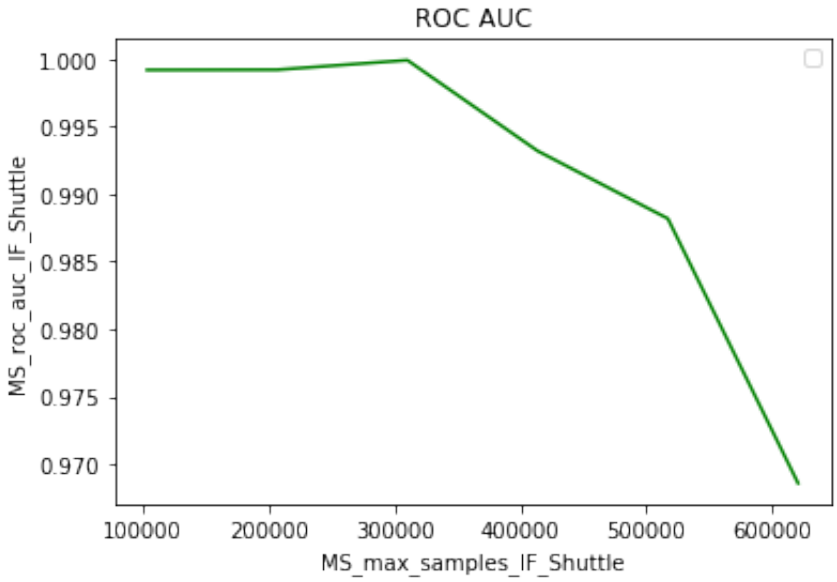
```
No handles with labels found to put in legend.
```



In [38]:
```
# Evolution de la spécificité
plt.plot(MS_max_samples_IF_Shuttle, MS_specificity_IF_Shuttle, "g-"
)
plt.title("Specificité")
#plt.axis([0, 1, 0, 1])
plt.xlabel('MS_max_samples_IF_Shuttle')
plt.ylabel('MS_specificity_IF_Shuttle')
plt.legend(loc="best")

plt.show()
```

```
No handles with labels found to put in legend.
```



In [ ]:
```
fig = plt.figure()
ax = plt.axes(projection='3d')
ax.scatter3D(MS_recalls_IF_Shuttle, MS_specificity_IF_Shuttle, MS_m
ax_samples_IF_Shuttle, c=MS_max_samples_IF_Shuttle, cmap='Greens')
ax.xlabel('MS_recalls_IF_Shuttle')
ax.ylabel('MS_specificity_IF_Shuttle')
ax.zlabel('MS_max_samples_IF_Shuttle')
```