##Data Preprocessing in Python

```
import pandas as pd
import numpy as np

# read csv file

df=pd.read_csv("/content/bank.csv", sep=";")

df.head()    #to print first five lines from the dataset
```

```
   age           job  marital  education default  balance housing loan
\
0   30    unemployed  married    primary      no     1787      no   no

1   33      services  married  secondary      no     4789     yes  yes

2   35    management   single   tertiary      no     1350     yes   no

3   30    management  married   tertiary      no     1476     yes  yes

4   59   blue-collar  married  secondary      no        0     yes   no


    contact  day month  duration  campaign  pdays  previous poutcome
y
0  cellular   19   oct        79         1     -1         0  unknown
no
1  cellular   11   may       220         1    339         4  failure
no
2  cellular   16   apr       185         1    330         1  failure
no
3   unknown    3   jun       199         4     -1         0  unknown
no
4   unknown    5   may       226         1     -1         0  unknown
no
```

```
df.tail()    #to print last five lines from the dataset
```

```
      age            job  marital  education default  balance housing
loan  \
4516   33       services  married  secondary      no     -333     yes
no
4517   57  self-employed  married   tertiary     yes    -3313     yes
yes
4518   57     technician  married  secondary      no      295      no
no
4519   28    blue-collar  married  secondary      no     1137      no
no
4520   44   entrepreneur   single   tertiary      no     1136     yes
yes
```

```
       contact  day month  duration  campaign  pdays  previous
poutcome   y
4516  cellular   30   jul       329         5     -1         0
unknown  no
4517   unknown    9   may       153         1     -1         0
unknown  no
4518  cellular   19   aug       151        11     -1         0
unknown  no
4519  cellular    6   feb       129         4    211         3
other  no
4520  cellular    3   apr       345         2    249         7
other  no
```

```
def replace_marital(val):
  if val=="single":
    return 0
  else:
    return 1
df["marital"]=df["marital"].apply(replace_marital,1)

df.head()
```

```
   age           job  marital  education default  balance housing loan
\
0   30   unemployed        1    primary      no     1787      no   no

1   33     services        1  secondary      no     4789     yes  yes

2   35   management        0   tertiary      no     1350     yes   no

3   30   management        1   tertiary      no     1476     yes  yes

4   59  blue-collar        1  secondary      no        0     yes   no


    contact  day month  duration  campaign  pdays  previous poutcome
y
0  cellular   19   oct        79         1     -1         0  unknown
no
1  cellular   11   may       220         1    339         4  failure
no
2  cellular   16   apr       185         1    330         1  failure
no
3   unknown    3   jun       199         4     -1         0  unknown
no
4   unknown    5   may       226         1     -1         0  unknown
no
```

```
df["housing"]=df["housing"].map({
    "no":0,
```

```
    "yes":1
}.get)

df.head()
```

```
   age          job  marital  education default  balance  housing loan
\
0   30   unemployed        1    primary      no     1787        0   no

1   33     services        1  secondary      no     4789        1  yes

2   35   management        0   tertiary      no     1350        1   no

3   30   management        1   tertiary      no     1476        1  yes

4   59  blue-collar        1  secondary      no        0        1   no


    contact  day month  duration  campaign  pdays  previous poutcome
y
0  cellular   19   oct        79         1     -1         0  unknown
no
1  cellular   11   may       220         1    339         4  failure
no
2  cellular   16   apr       185         1    330         1  failure
no
3   unknown    3   jun       199         4     -1         0  unknown
no
4   unknown    5   may       226         1     -1         0  unknown
no
```

```
df["loan"]=df["loan"].replace({
    "no":0,
    "yes":1
})

df.head()
```

```
   age          job  marital  education default  balance  housing
loan  \
0   30   unemployed        1    primary      no     1787        0
0
1   33     services        1  secondary      no     4789        1
1
2   35   management        0   tertiary      no     1350        1
0
3   30   management        1   tertiary      no     1476        1
1
4   59  blue-collar        1  secondary      no        0        1
0
```

```
    contact  day month  duration  campaign  pdays  previous poutcome
y
0  cellular   19   oct        79         1     -1         0  unknown
no
1  cellular   11   may       220         1    339         4  failure
no
2  cellular   16   apr       185         1    330         1  failure
no
3   unknown    3   jun       199         4     -1         0  unknown
no
4   unknown    5   may       226         1     -1         0  unknown
no
```

```
df["job"].unique()   #to find unique value of column job
```

```
array(['unemployed', 'services', 'management', 'blue-collar',
       'self-employed', 'technician', 'entrepreneur', 'admin.',
'student',
       'housemaid', 'retired', 'unknown'], dtype=object)
```

inplace instead of creating new dataframe it copies in the old data frame

```
df["job"].replace({
    'unknown':np.nan,
    'unemployed':0, 'services':1, 'management':2, 'blue-collar':3,
       'self-employed':4, 'technician':5, 'entrepreneur':6,
'admin.':7, 'student':8,
       'housemaid':9, 'retired':10
},inplace=True)
```

```
df.head()
```

```
   age  job  marital  education default  balance  housing  loan
contact  \
0   30  0.0        1    primary      no     1787        0     0
cellular
1   33  1.0        1  secondary      no     4789        1     1
cellular
2   35  2.0        0   tertiary      no     1350        1     0
cellular
3   30  2.0        1   tertiary      no     1476        1     1
unknown
4   59  3.0        1  secondary      no        0        1     0
unknown

   day month  duration  campaign  pdays  previous poutcome   y
0   19   oct        79         1     -1         0  unknown  no
1   11   may       220         1    339         4  failure  no
2   16   apr       185         1    330         1  failure  no
```

```
3    3   jun       199         4     -1         0  unknown  no
4    5   may       226         1     -1         0  unknown  no
```

```
df["education"].unique()
```

```
array(['primary', 'secondary', 'tertiary', 'unknown'], dtype=object)
```

```
df["education"].replace({
    'primary':0, 'secondary':1, 'tertiary':2, 'unknown':np.nan

} ,inplace=True)
```

```
df.head()
```

```
   age  job  marital  education default  balance  housing  loan
contact  \
0   30  0.0        1        0.0      no     1787        0     0
cellular
1   33  1.0        1        1.0      no     4789        1     1
cellular
2   35  2.0        0        2.0      no     1350        1     0
cellular
3   30  2.0        1        2.0      no     1476        1     1
unknown
4   59  3.0        1        1.0      no        0        1     0
unknown

   day month  duration  campaign  pdays  previous poutcome   y
0   19   oct        79         1     -1         0  unknown  no
1   11   may       220         1    339         4  failure  no
2   16   apr       185         1    330         1  failure  no
3    3   jun       199         4     -1         0  unknown  no
4    5   may       226         1     -1         0  unknown  no
```

```
df["default"].replace({
    "no":0,
    "yes":1
},inplace=True)
```

```
df.head()
```

```
   age  job  marital  education  default  balance  housing  loan
contact  \
0   30  0.0        1        0.0        0     1787        0     0
cellular
1   33  1.0        1        1.0        0     4789        1     1
cellular
2   35  2.0        0        2.0        0     1350        1     0
cellular
3   30  2.0        1        2.0        0     1476        1     1
unknown
```

```
4   59  3.0        1        1.0        0        0        1     0
unknown

   day month  duration  campaign  pdays  previous poutcome   y
0   19   oct        79         1     -1         0  unknown  no
1   11   may       220         1    339         4  failure  no
2   16   apr       185         1    330         1  failure  no
3    3   jun       199         4     -1         0  unknown  no
4    5   may       226         1     -1         0  unknown  no
```

```
df["balance"].min()
```

```
-3313
```

```
df["balance"].max()
```

```
71188
```

Apply min-max normalization to attribute balance

```
df["balance"]=df["balance"].apply(lambda v: (v-
df["balance"].min()))/(df["balance"].max()-df["balance"].min())

df.head()
```

```
   age  job  marital  education  default   balance  housing  loan
contact  \
0   30  0.0        1        0.0        0  0.068455        0     0
cellular
1   33  1.0        1        1.0        0  0.108750        1     1
cellular
2   35  2.0        0        2.0        0  0.062590        1     0
cellular
3   30  2.0        1        2.0        0  0.064281        1     1
unknown
4   59  3.0        1        1.0        0  0.044469        1     0
unknown

   day month  duration  campaign  pdays  previous poutcome   y
0   19   oct        79         1     -1         0  unknown  no
1   11   may       220         1    339         4  failure  no
2   16   apr       185         1    330         1  failure  no
3    3   jun       199         4     -1         0  unknown  no
4    5   may       226         1     -1         0  unknown  no
```

```
df.contact.replace({"unknown":np.nan, "telephone":0, "cellular":1},
inplace=True)

df.head()
```

```
   age  job  marital  education  default   balance  housing  loan
contact  \
0   30  0.0        1        0.0        0  0.068455        0     0
1.0
1   33  1.0        1        1.0        0  0.108750        1     1
1.0
2   35  2.0        0        2.0        0  0.062590        1     0
1.0
3   30  2.0        1        2.0        0  0.064281        1     1
NaN
4   59  3.0        1        1.0        0  0.044469        1     0
NaN

   day month  duration  campaign  pdays  previous poutcome   y
0   19   oct        79         1     -1         0  unknown  no
1   11   may       220         1    339         4  failure  no
2   16   apr       185         1    330         1  failure  no
3    3   jun       199         4     -1         0  unknown  no
4    5   may       226         1     -1         0  unknown  no
```

```
df.contact.unique()
```

```
array([ 1., nan,  0.])
```

```
df.month.unique()
```

```
array(['oct', 'may', 'apr', 'jun', 'feb', 'aug', 'jan', 'jul', 'nov',
       'sep', 'mar', 'dec'], dtype=object)
```

```
df.month=df.month.map({'oct':10, 'may':5, 'apr':4, 'jun':6, 'feb':2,
'aug':8, 'jan':1, 'jul':7, 'nov':11,
       'sep':9, 'mar':3, 'dec':12})
```

```
df.head()
```

```
   age  job  marital  education  default   balance  housing  loan
contact  \
0   30  0.0        1        0.0        0  0.068455        0     0
1.0
1   33  1.0        1        1.0        0  0.108750        1     1
1.0
2   35  2.0        0        2.0        0  0.062590        1     0
1.0
3   30  2.0        1        2.0        0  0.064281        1     1
NaN
4   59  3.0        1        1.0        0  0.044469        1     0
NaN

   day  month  duration  campaign  pdays  previous poutcome   y
0   19     10        79         1     -1         0  unknown  no
1   11      5       220         1    339         4  failure  no
```

```
2   16      4       185         1    330         1  failure  no
3    3      6       199         4     -1         0  unknown  no
4    5      5       226         1     -1         0  unknown  no
```

```
df.poutcome.unique()
```

```
array(['unknown', 'failure', 'other', 'success'], dtype=object)
```

```
df.poutcome=df.poutcome.map({'unknown':np.nan, 'failure':0, 'other':1,
'success':2})
```

```
df.head()
```

```
   age  job  marital  education  default   balance  housing  loan
contact  \
0   30  0.0        1        0.0        0  0.068455        0     0
1.0
1   33  1.0        1        1.0        0  0.108750        1     1
1.0
2   35  2.0        0        2.0        0  0.062590        1     0
1.0
3   30  2.0        1        2.0        0  0.064281        1     1
NaN
4   59  3.0        1        1.0        0  0.044469        1     0
NaN

   day  month  duration  campaign  pdays  previous  poutcome   y
0   19     10        79         1     -1         0       NaN  no
1   11      5       220         1    339         4       0.0  no
2   16      4       185         1    330         1       0.0  no
3    3      6       199         4     -1         0       NaN  no
4    5      5       226         1     -1         0       NaN  no
```

```
df.pdays=df.pdays.apply(lambda v:(v-df.pdays.min())/(df.pdays.max()-
df.pdays.min()))
```

```
df.head()
```

```
   age  job  marital  education  default   balance  housing  loan
contact  \
0   30  0.0        1        0.0        0  0.068455        0     0
1.0
1   33  1.0        1        1.0        0  0.108750        1     1
1.0
2   35  2.0        0        2.0        0  0.062590        1     0
1.0
3   30  2.0        1        2.0        0  0.064281        1     1
NaN
4   59  3.0        1        1.0        0  0.044469        1     0
NaN
```

```
   day  month  duration  campaign     pdays  previous  poutcome   y
0   19     10        79         1  0.000000         0       NaN  no
1   11      5       220         1  0.389908         4       0.0  no
2   16      4       185         1  0.379587         1       0.0  no
3    3      6       199         4  0.000000         0       NaN  no
4    5      5       226         1  0.000000         0       NaN  no
```

```
df.y.unique()
```

```
array(['no', 'yes'], dtype=object)
```

```
df.y.replace({'no':0, 'yes':1}, inplace=True)
```

```
df.head()
```

```
   age  job  marital  education  default   balance  housing  loan
contact  \
0   30  0.0        1        0.0        0  0.068455        0     0
1.0
1   33  1.0        1        1.0        0  0.108750        1     1
1.0
2   35  2.0        0        2.0        0  0.062590        1     0
1.0
3   30  2.0        1        2.0        0  0.064281        1     1
NaN
4   59  3.0        1        1.0        0  0.044469        1     0
NaN
```

```
   day  month  duration  campaign     pdays  previous  poutcome  y
0   19     10        79         1  0.000000         0       NaN  0
1   11      5       220         1  0.389908         4       0.0  0
2   16      4       185         1  0.379587         1       0.0  0
3    3      6       199         4  0.000000         0       NaN  0
4    5      5       226         1  0.000000         0       NaN  0
```

```
df.duration=df.duration.apply(lambda v:(v-
df.duration.min())/(df.duration.max()-df.duration.min()))
```

```
df.head()
```

```
   age  job  marital  education  default   balance  housing  loan
contact  \
0   30  0.0        1        0.0        0  0.068455        0     0
1.0
1   33  1.0        1        1.0        0  0.108750        1     1
1.0
2   35  2.0        0        2.0        0  0.062590        1     0
1.0
3   30  2.0        1        2.0        0  0.064281        1     1
NaN
4   59  3.0        1        1.0        0  0.044469        1     0
```

```
NaN

   day  month  duration  campaign     pdays  previous  poutcome  y
0   19     10  0.024826         1  0.000000         0       NaN  0
1   11      5  0.071500         1  0.389908         4       0.0  0
2   16      4  0.059914         1  0.379587         1       0.0  0
3    3      6  0.064548         4  0.000000         0       NaN  0
4    5      5  0.073486         1  0.000000         0       NaN  0

df.describe()

                age           job      marital    education      default
\
count  4521.000000  4483.000000  4521.000000  4334.000000  4521.000000

mean     41.170095     4.037252     0.735457     1.155053     0.016810

std      10.576211     2.534139     0.441138     0.666325     0.128575

min      19.000000     0.000000     0.000000     0.000000     0.000000

25%      33.000000     2.000000     0.000000     1.000000     0.000000

50%      39.000000     3.000000     1.000000     1.000000     0.000000

75%      49.000000     5.000000     1.000000     2.000000     0.000000

max      87.000000    10.000000     1.000000     2.000000     1.000000


            balance      housing         loan      contact          day
\
count  4521.000000  4521.000000  4521.000000  3197.000000  4521.000000

mean      0.063565     0.566025     0.152842     0.905849    15.915284

std       0.040397     0.495676     0.359875     0.292084     8.247667

min       0.000000     0.000000     0.000000     0.000000     1.000000

25%       0.045395     0.000000     0.000000     1.000000     9.000000

50%       0.050429     1.000000     0.000000     1.000000    16.000000

75%       0.064335     1.000000     0.000000     1.000000    21.000000

max       1.000000     1.000000     1.000000     1.000000    31.000000


              month     duration     campaign        pdays     previous
\
```

```
count  4521.000000  4521.000000  4521.000000  4521.000000  4521.000000
mean      6.166777     0.086051     2.793630     0.046751     0.542579
std       2.378380     0.086017     3.109807     0.114818     1.693562
min       1.000000     0.000000     1.000000     0.000000     0.000000
25%       5.000000     0.033102     1.000000     0.000000     0.000000
50%       6.000000     0.059914     2.000000     0.000000     0.000000
75%       8.000000     0.107580     3.000000     0.000000     0.000000
max      12.000000     1.000000    50.000000     1.000000    25.000000


         poutcome            y
count  816.000000  4521.000000
mean     0.557598     0.115240
std      0.750699     0.319347
min      0.000000     0.000000
25%      0.000000     0.000000
50%      0.000000     0.000000
75%      1.000000     0.000000
max      2.000000     1.000000
```

```
df.to_csv("/content/bank_preprocessed.csv",index=False)
```

```
new_df=pd.read_csv("/content/bank_preprocessed.csv")
```

```
new_df.head()
```

```
   age  job  marital  education  default   balance  housing  loan
contact  \
0   30  0.0        1        0.0        0  0.068455        0     0
1.0
1   33  1.0        1        1.0        0  0.108750        1     1
1.0
2   35  2.0        0        2.0        0  0.062590        1     0
1.0
3   30  2.0        1        2.0        0  0.064281        1     1
NaN
4   59  3.0        1        1.0        0  0.044469        1     0
NaN

   day  month  duration  campaign     pdays  previous  poutcome  y
0   19     10  0.024826         1  0.000000         0       NaN  0
1   11      5  0.071500         1  0.389908         4       0.0  0
2   16      4  0.059914         1  0.379587         1       0.0  0
```

```
3    3      6  0.064548          4  0.000000          0       NaN  0
4    5      5  0.073486          1  0.000000          0       NaN  0

new_df.corr()

                 age       job   marital  education   default   balance
\
age         1.000000  0.246948  0.410768  -0.190484 -0.017885  0.083820

job         0.246948  1.000000  0.022194  -0.159257  0.000797  0.046488

marital     0.410768  0.022194  1.000000  -0.169967 -0.007391 -0.007525

education -0.190484 -0.159257 -0.169967   1.000000 -0.011623  0.056585

default   -0.017885  0.000797 -0.007391  -0.011623  1.000000 -0.070886

balance    0.083820  0.046488 -0.007525   0.056585 -0.070886  1.000000

housing   -0.193888 -0.140553  0.041449  -0.072716  0.006881 -0.050227

loan      -0.011250  0.009586  0.048496  -0.024752  0.063994 -0.071349

contact   -0.204200 -0.084848 -0.056938   0.117748  0.023372 -0.036326

day       -0.017853  0.000524 -0.006769   0.017107 -0.013261 -0.008677

month      0.073764  0.026193  0.061882   0.083234  0.008917  0.099872

duration  -0.002367 -0.009160 -0.024560  -0.011193 -0.011615 -0.015950

campaign  -0.005148 -0.041718  0.008093   0.009714 -0.012348 -0.009976

pdays     -0.008894  0.001408 -0.020693   0.011531 -0.026317  0.009437

previous  -0.003511  0.022125 -0.035558   0.030396 -0.026656  0.026196

poutcome   0.048548  0.073736 -0.009813   0.023715  0.025369  0.020393

y          0.045092  0.066550 -0.045815   0.055368  0.001303  0.017905


             housing      loan   contact       day     month  duration
\
age       -0.193888 -0.011250 -0.204200 -0.017853  0.073764 -0.002367

job       -0.140553  0.009586 -0.084848  0.000524  0.026193 -0.009160

marital    0.041449  0.048496 -0.056938 -0.006769  0.061882 -0.024560

education -0.072716 -0.024752  0.117748  0.017107  0.083234 -0.011193
```

```
default    0.006881  0.063994  0.023372 -0.013261  0.008917 -0.011615
balance   -0.050227 -0.071349 -0.036326 -0.008677  0.099872 -0.015950
housing    1.000000  0.018451  0.046484 -0.031291 -0.170922  0.015740
loan       0.018451  1.000000  0.007166 -0.004879  0.039226 -0.004997
contact    0.046484  0.007166  1.000000 -0.055509  0.014321  0.027292
day       -0.031291 -0.004879 -0.055509  1.000000  0.080436 -0.024629
month     -0.170922  0.039226  0.014321  0.080436  1.000000 -0.000282
duration   0.015740 -0.004997  0.027292 -0.024629 -0.000282  1.000000
campaign  -0.003574  0.017120 -0.033973  0.160706  0.059214 -0.068382
pdays      0.116893 -0.031086  0.024204 -0.094352 -0.112003  0.010380
previous   0.038621 -0.022115  0.001642 -0.059114 -0.037410  0.018080
poutcome  -0.253137 -0.096067 -0.037807  0.019975  0.080557  0.115722
y         -0.104683 -0.070517 -0.002108 -0.011244  0.023335  0.401118
```

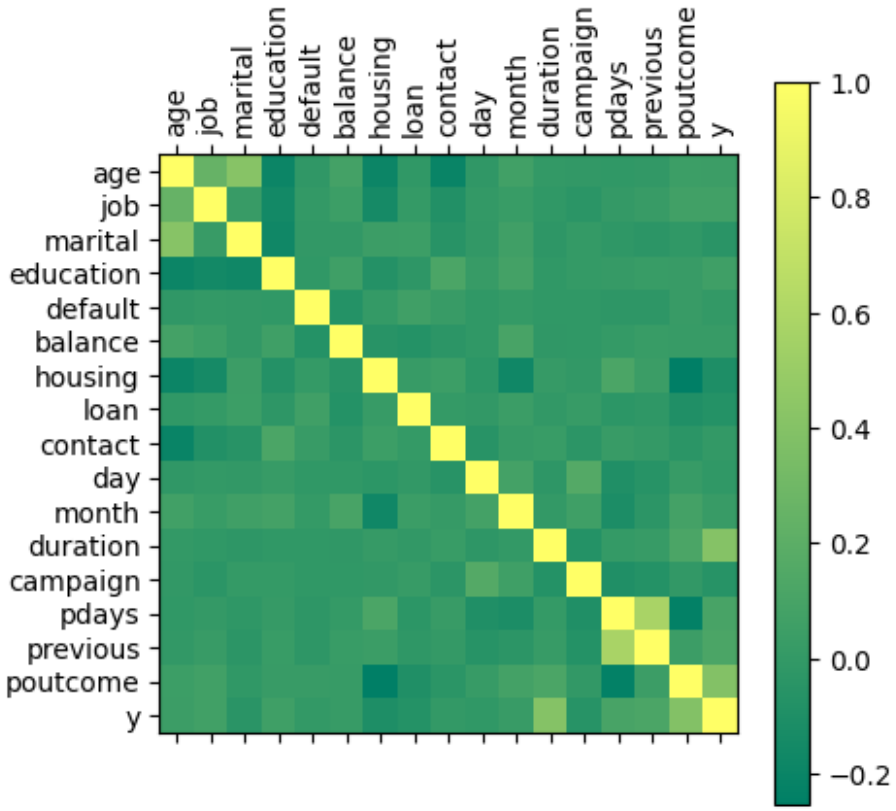
```
           campaign     pdays  previous  poutcome         y
age       -0.005148 -0.008894 -0.003511  0.048548  0.045092
job       -0.041718  0.001408  0.022125  0.073736  0.066550
marital    0.008093 -0.020693 -0.035558 -0.009813 -0.045815
education  0.009714  0.011531  0.030396  0.023715  0.055368
default   -0.012348 -0.026317 -0.026656  0.025369  0.001303
balance   -0.009976  0.009437  0.026196  0.020393  0.017905
housing   -0.003574  0.116893  0.038621 -0.253137 -0.104683
loan       0.017120 -0.031086 -0.022115 -0.096067 -0.070517
contact   -0.033973  0.024204  0.001642 -0.037807 -0.002108
day        0.160706 -0.094352 -0.059114  0.019975 -0.011244
month      0.059214 -0.112003 -0.037410  0.080557  0.023335
duration  -0.068382  0.010380  0.018080  0.115722  0.401118
campaign   1.000000 -0.093137 -0.067833 -0.006457 -0.061147
pdays     -0.093137  1.000000  0.577562 -0.235082  0.104087
previous  -0.067833  0.577562  1.000000  0.043307  0.116714
poutcome  -0.006457 -0.235082  0.043307  1.000000  0.396350
y         -0.061147  0.104087  0.116714  0.396350  1.000000
```

```
import matplotlib.pyplot as plt
%matplotlib inline

plt.matshow(new_df.corr(), cmap='summer')
plt.colorbar()
```

```
plt.xticks(list(range(len(new_df.columns))), new_df.columns,
rotation='vertical')
plt.yticks(list(range(len(new_df.columns))), new_df.columns,
rotation='horizontal')

plt.show()
```



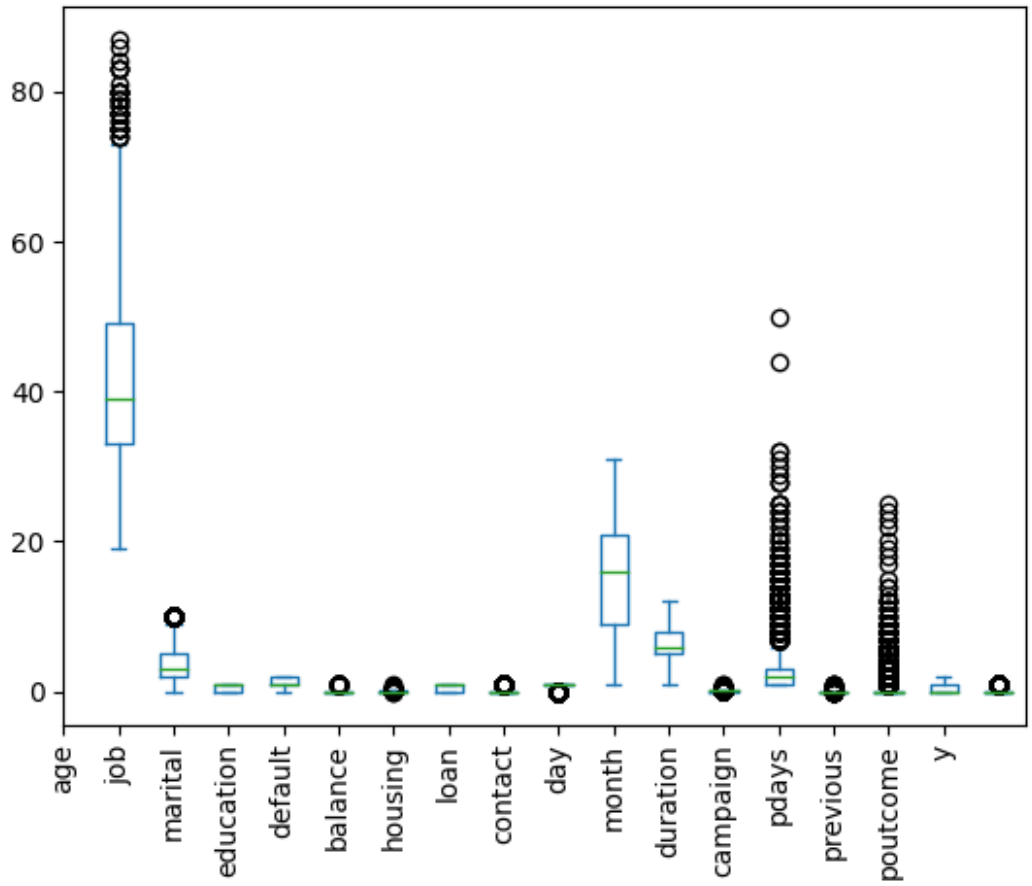

```
new_df.corr()["y"].sort_values(ascending=False)
```

```
y            1.000000
duration     0.401118
poutcome     0.396350
previous     0.116714
pdays        0.104087
job          0.066550
education    0.055368
age          0.045092
month        0.023335
balance      0.017905
default      0.001303
contact     -0.002108
day         -0.011244
marital     -0.045815
```

```
campaign    -0.061147
loan        -0.070517
housing     -0.104683
Name: y, dtype: float64
```

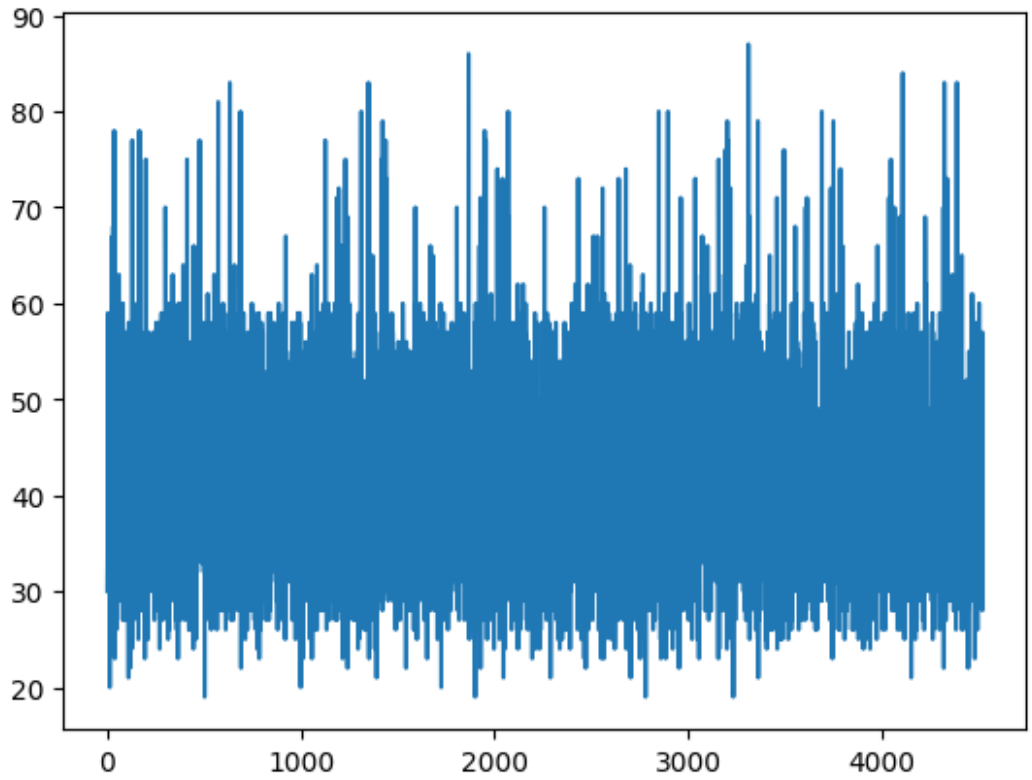
```
new_df.plot.box()
plt.xticks(list(range(len(new_df.columns))), new_df.columns,
rotation='vertical')
```

```
([<matplotlib.axis.XTick at 0x7960190e8670>,
  <matplotlib.axis.XTick at 0x7960190e8640>,
  <matplotlib.axis.XTick at 0x79601a01e290>,
  <matplotlib.axis.XTick at 0x7960191eb6a0>,
  <matplotlib.axis.XTick at 0x7960191e9540>,
  <matplotlib.axis.XTick at 0x7960191ea110>,
  <matplotlib.axis.XTick at 0x7960191ebfd0>,
  <matplotlib.axis.XTick at 0x7960191eb3d0>,
  <matplotlib.axis.XTick at 0x796018ec74f0>,
  <matplotlib.axis.XTick at 0x796018ec5f90>,
  <matplotlib.axis.XTick at 0x796018ec7be0>,
  <matplotlib.axis.XTick at 0x796018ec52d0>,
  <matplotlib.axis.XTick at 0x796018ec6650>,
  <matplotlib.axis.XTick at 0x796018ec4e20>,
  <matplotlib.axis.XTick at 0x796018ec4670>,
  <matplotlib.axis.XTick at 0x79601d487460>,
  <matplotlib.axis.XTick at 0x7960190e9b70>],
 [Text(0, 0, 'age'),
  Text(1, 0, 'job'),
  Text(2, 0, 'marital'),
  Text(3, 0, 'education'),
  Text(4, 0, 'default'),
  Text(5, 0, 'balance'),
  Text(6, 0, 'housing'),
  Text(7, 0, 'loan'),
  Text(8, 0, 'contact'),
  Text(9, 0, 'day'),
  Text(10, 0, 'month'),
  Text(11, 0, 'duration'),
  Text(12, 0, 'campaign'),
  Text(13, 0, 'pdays'),
  Text(14, 0, 'previous'),
  Text(15, 0, 'poutcome'),
  Text(16, 0, 'y')])
```



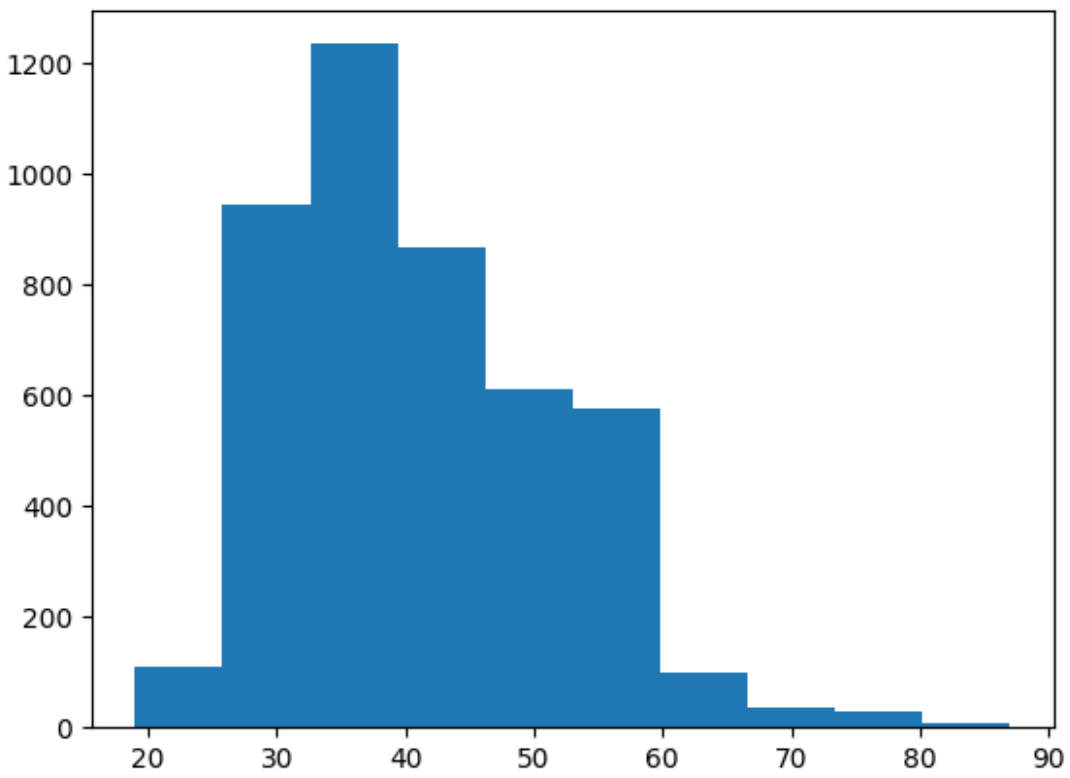

```
plt.plot(df.age.values)
```

```
[<matplotlib.lines.Line2D at 0x796018f40340>]
```




```
plt.hist(df.age.values)
```

```
(array([ 111.,  944., 1235.,  869.,  612.,  576.,  100.,   36.,   30.,
          8.]),
 array([19. , 25.8, 32.6, 39.4, 46.2, 53. , 59.8, 66.6, 73.4, 80.2,
87. ]),
 <BarContainer object of 10 artists>)
```


1200
1000
800
600
400
200
0
20
30
40
50
60
70
80
90