In [1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import sklearn
from sklearn.linear_model import LogisticRegression
from sklearn.model_selection import train_test_split
from sklearn import metrics

import warnings
warnings.filterwarnings("ignore")
```

In [2]:
```
df=pd.read_csv(r"E:\Linear regression projects\athlete_events.csv")
```

In [3]:
```
df
```

Out[3]:

	ID	Name	Sex	Team	Name Of Country	Games	Year	Season	City	S
0	1	A Dijiang	M	China	CHN	1992 Summer	1992	Summer	Barcelona	Bask
1	2	A Lamusi	M	China	CHN	2012 Summer	2012	Summer	London	
2	3	Gunnar Nielsen Aaby	M	Denmark	DEN	1920 Summer	1920	Summer	Antwerpen	Fo
3	4	Edgar Lindenau Aabye	M	Denmark/Sweden	DEN	1900 Summer	1900	Summer	Paris	Tu
4	5	Christine Jacoba Aaftink	F	Netherlands	NED	1988 Winter	1988	Winter	Calgary	S Sk
...	...	...	...	...	...	...	...	...	...	
271111	135569	Andrzej ya	M	Poland-1	POL	1976 Winter	1976	Winter	Innsbruck	
271112	135570	Piotr ya	M	Poland	POL	2014 Winter	2014	Winter	Sochi	Jun
271113	135570	Piotr ya	M	Poland	POL	2014 Winter	2014	Winter	Sochi	Jun
271114	135571	Tomasz Ireneusz ya	M	Poland	POL	1998 Winter	1998	Winter	Nagano	Bobs
271115	135571	Tomasz Ireneusz ya	M	Poland	POL	2002 Winter	2002	Winter	Salt Lake City	Bobs

271116 rows × 12 columns

In [6]:
```
df.head()
```

Out[6]:

	ID	Name	Sex	Team	Name Of Country	Games	Year	Season	City	Sport	
0	1	A Dijiang	M	China	CHN	1992 Summer	1992	Summer	Barcelona	Basketball	Ba
1	2	A Lamusi	M	China	CHN	2012 Summer	2012	Summer	London	Judo	Ba
2	3	Gunnar Nielsen Aaby	M	Denmark	DEN	1920 Summer	1920	Summer	Antwerpen	Football	Ligh
3	4	Edgar Lindenau Aabye	M	Denmark/Sweden	DEN	1900 Summer	1900	Summer	Paris	Tug-Of-War	Wa
4	5	Christine Jacoba Aaftink	F	Netherlands	NED	1988 Winter	1988	Winter	Calgary	Speed Skating	W 500

In [4]:
```
df.shape
```

Out[4]: (271116, 12)

In [5]:
```
df.size
```

Out[5]: 3253392

In [6]:
```
df.head()
```

Out[6]:

	ID	Name	Sex	Team	Name Of Country	Games	Year	Season	City	Sport	
0	1	A Dijiang	M	China	CHN	1992 Summer	1992	Summer	Barcelona	Basketball	Ba
1	2	A Lamusi	M	China	CHN	2012 Summer	2012	Summer	London	Judo	Ligh
2	3	Gunnar Nielsen Aaby	M	Denmark	DEN	1920 Summer	1920	Summer	Antwerpen	Football	F
3	4	Edgar Lindenau Aabye	M	Denmark/Sweden	DEN	1900 Summer	1900	Summer	Paris	Tug-Of-War	Wa
4	5	Christine Jacoba Aaftink	F	Netherlands	NED	1988 Winter	1988	Winter	Calgary	Speed Skating	W 500

In [4]:
```
df.shape
```

Out[4]: (271116, 12)

In [5]:
```
df.size
```

Out[5]: 3253392

In [7]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 271116 entries, 0 to 271115
Data columns (total 12 columns):
 #   Column           Non-Null Count   Dtype
---  ------           --------------   -----
 0   ID               271116 non-null  int64
 1   Name             271116 non-null  object
 2   Sex              271116 non-null  object
 3   Team             271116 non-null  object
 4   Name Of Country  271116 non-null  object
 5   Games            271116 non-null  object
 6   Year             271116 non-null  int64
 7   Season           271116 non-null  object
 8   City             271116 non-null  object
 9   Sport            271116 non-null  object
 10  Event            271116 non-null  object
 11  Medal            39783 non-null   object
dtypes: int64(2), object(10)
memory usage: 24.8+ MB
```

In [8]:
```
df.tail()
```

Out[8]:

	ID	Name	Sex	Team	Name Of Country	Games	Year	Season	City	Sport	Ev
271111	135569	Andrzej ya	M	Poland-1	POL	1976 Winter	1976	Winter	Innsbruck	Luge	L Mi (Me Dout
271112	135570	Piotr ya	M	Poland	POL	2014 Winter	2014	Winter	Sochi	Ski Jumping	Jump Me La I Indivic
271113	135570	Piotr ya	M	Poland	POL	2014 Winter	2014	Winter	Sochi	Ski Jumping	Jump Me La Hill, Te
271114	135571	Tomasz Ireneusz ya	M	Poland	POL	1998 Winter	1998	Winter	Nagano	Bobsleigh	Bobsle Me F
271115	135571	Tomasz Ireneusz ya	M	Poland	POL	2002 Winter	2002	Winter	Salt Lake City	Bobsleigh	Bobsle Me F

In [9]:
```
df.describe()
```

Out[9]:

	ID	Year
count	271116.000000	271116.000000
mean	68248.954396	1978.378480
std	39022.286345	29.877632
min	1.000000	1896.000000
25%	34643.000000	1960.000000
50%	68205.000000	1988.000000
75%	102097.250000	2002.000000
max	135571.000000	2016.000000

In [10]:
```
df.isnull()
```

Out[10]:

	ID	Name	Sex	Team	Name Of Country	Games	Year	Season	City	Sport	Event	Medal
0	False	False	False	False	False	False	False	False	False	False	False	True
1	False	False	False	False	False	False	False	False	False	False	False	True

In [9]:
```
df.describe()
```

Out[9]:

	ID	Year
count	271116.000000	271116.000000
mean	68248.954396	1978.378480
std	39022.286345	29.877632
min	1.000000	1896.000000
25%	34643.000000	1960.000000
50%	68205.000000	1988.000000
75%	102097.250000	2002.000000
max	135571.000000	2016.000000

In [10]:
```
df.isnull()
```

Out[10]:

	ID	Name	Sex	Team	Name Of Country	Games	Year	Season	City	Sport	Event	Medal
0	False	False	False	False	False	False	False	False	False	False	False	True
1	False	False	False	False	False	False	False	False	False	False	False	True
2	False	False	False	False	False	False	False	False	False	False	False	True
3	False	False	False	False	False	False	False	False	False	False	False	False
4	False	False	False	False	False	False	False	False	False	False	False	True
...	...	...	...	...	...	...	...	...	...	...	...	...
271111	False	False	False	False	False	False	False	False	False	False	False	True
271112	False	False	False	False	False	False	False	False	False	False	False	True
271113	False	False	False	False	False	False	False	False	False	False	False	True
271114	False	False	False	False	False	False	False	False	False	False	False	True
271115	False	False	False	False	False	False	False	False	False	False	False	True

271116 rows × 12 columns

In [11]:
```
df.isnull().sum()
```

Out[11]:
```
ID                  0
Name                0
Sex                 0
Team                0
Name Of Country     0
Games               0
Year                0
Season              0
City                0
Sport               0
Event               0
Medal          231333
dtype: int64
```

In [13]:
```
df.isna().sum()
```

In [12]:
```
df.notnull()
```

Out[13]:
```
ID                  0
Name                0
Sex                 0
Team                0
Name Of Country     0
Games               0
Year                0
Season              0
City                0
Sport               0
Event               0
Medal          231333
dtype: int64
```

Out[12]:

	ID	Name	Sex	Team	Name Of Country	Games	Year	Season	City	Sport	Event	Medal
0	True	True	True	True	True	True	True	True	True	True	True	False
1	True	True	True	True	True	True	True	True	True	True	True	False
2	True	True	True	True	True	True	True	True	True	True	True	False
3	True	True	True	True	True	True	True	True	True	True	True	True
4	True	True	True	True	True	True	True	True	True	True	True	False
...	...	...	...	...	...	...	...	...	...	...	...	...
271111	True	True	True	True	True	True	True	True	True	True	True	False
271112	True	True	True	True	True	True	True	True	True	True	True	False
271113	True	True	True	True	True	True	True	True	True	True	True	False
271114	True	True	True	True	True	True	True	True	True	True	True	False
271115	True	True	True	True	True	True	True	True	True	True	True	False

271116 rows × 12 columns

In [14]:
```
(df.isnull().sum()/(len(df)))*100
```

Out[14]:
```
ID             0.000000
Name           0.000000
Sex            0.000000
Team           0.000000
Name Of Country    0.000000
Games          0.000000
Year           0.000000
Season         0.000000
```

dtype: int64

In [13]:
```
df.isna().sum()
```

In [12]:
```
df.notnull()
```

Out[13]:
```
ID              0
Name            0
Sex             0
Team            0
Name Of Country 0
Games           0
Year            0
Season          0
City            0
Sport           0
Event           0
Medal      231333
dtype: int64
```

	ID	Name	Sex	Team	Name Of Country	Games	Year	Season	City	Sport	Event	Medal
0	True	True	True	True	True	True	True	True	True	True	True	False
1	True	True	True	True	True	True	True	True	True	True	True	False
2	True	True	True	True	True	True	True	True	True	True	True	False
3	True	True	True	True	True	True	True	True	True	True	True	True
4	True	True	True	True	True	True	True	True	True	True	True	False
...	...	...	...	...	...	...	...	...	...	...	...	...
271111	True	True	True	True	True	True	True	True	True	True	True	False
271112	True	True	True	True	True	True	True	True	True	True	True	False
271113	True	True	True	True	True	True	True	True	True	True	True	False
271114	True	True	True	True	True	True	True	True	True	True	True	False
271115	True	True	True	True	True	True	True	True	True	True	True	False

271116 rows × 12 columns

In [14]:
```
(df.isnull().sum()/(len(df)))*100
```

Out[14]:
```
ID          0.000000
Name        0.000000
Sex         0.000000
Team        0.000000
Name Of Country    0.000000
Games       0.000000
Year        0.000000
Season      0.000000
City        0.000000
Sport       0.000000
Event       0.000000
Medal      85.326207
dtype: float64
```

In [15]:
```
df.drop
```

Out[15]:
```
<bound method DataFrame.drop of             ID                    Name Sex
Team Name Of Country  \
0            1               A Dijiang   M           China             CHN
1            2                A Lamusi   M           China             CHN
2            3      Gunnar Nielsen Aaby   M         Denmark             DEN
3            4     Edgar Lindenau Aabye   M  Denmark/Sweden             DEN
4            5  Christine Jacoba Aaftink   F     Netherlands             NED
...        ...                      ...  ..             ...             ...
271111  135569               Andrzej ya   M        Poland-1             POL
271112  135570                 Piotr ya   M          Poland             POL
271113  135570                 Piotr ya   M          Poland             POL
271114  135571       Tomasz Ireneusz ya   M          Poland             POL
271115  135571       Tomasz Ireneusz ya   M          Poland             POL

              Games  Year  Season            City          Sport  \
0       1992 Summer  1992  Summer       Barcelona     Basketball
1       2012 Summer  2012  Summer          London           Judo
2       1920 Summer  1920  Summer       Antwerpen       Football
3       1900 Summer  1900  Summer           Paris      Tug-Of-War
4       1988 Winter  1988  Winter         Calgary  Speed Skating
...             ...   ...     ...             ...            ...
271111  1976 Winter  1976  Winter       Innsbruck           Luge
271112  2014 Winter  2014  Winter           Sochi    Ski Jumping
271113  2014 Winter  2014  Winter           Sochi    Ski Jumping
271114  1998 Winter  1998  Winter          Nagano      Bobsleigh
271115  2002 Winter  2002  Winter  Salt Lake City      Bobsleigh

                                                Event Medal
0                                  Basketball Men's Basketball    NaN
1                              Judo Men's Extra-Lightweight    NaN
2                                  Football Men's Football    NaN
3                              Tug-Of-War Men's Tug-Of-War   Gold
4                            Speed Skating Women's 500 metres    NaN
...                                                       ...    ...
271111                 Luge Mixed (Men)'s Doubles    NaN
271112  Ski Jumping Men's Large Hill, Individual    NaN
271113       Ski Jumping Men's Large Hill, Team    NaN
271114                  Bobsleigh Men's Four    NaN
271115                  Bobsleigh Men's Four    NaN

[271116 rows x 12 columns]>
```

In [16]:
```
df
```

Out[16]:

	ID	Name	Sex	Team	Name Of Country	Games	Year	Season	City	Sport	Event	Medal
0	1	A Dijiang	M	China	CHN	1992 Summer	1992	Summer	Barcelona	Basketball	Basketball Men's Basketball	NaN
1	2	A Lamusi	M	China	CHN	2012 Summer	2012	Summer	London	Judo	Judo Men's Extra-Lightweight	NaN
2	3	Gunnar Nielsen Aaby	M	Denmark	DEN	1920 Summer	1920	Summer	Antwerpen	Football	Football Men's Football	NaN
3	4	Edgar Lindenau Aabye	M	Denmark/Sweden	DEN	1900 Summer	1900	Summer	Paris	Tug-Of-War	Tug-Of-War Men's Tug-Of-War	Gold
4	5	Christine Jacoba Aaftink	F	Netherlands	NED	1988 Winter	1988	Winter	Calgary	Speed Skating	Speed Skating Women's 500 metres	NaN
...	...	...	...	...	...	...	...	...	...	...	...	...
271111	135569	Andrzej ya	M	Poland-1	POL	1976 Winter	1976	Winter	Innsbruck	Luge	Luge Mixed (Men)'s Doubles	NaN
271112	135570	Piotr ya	M	Poland	POL	2014 Winter	2014	Winter	Sochi	Ski Jumping	Ski Jumping Men's Large Hill, Individual	NaN
271113	135570	Piotr ya	M	Poland	POL	2014 Winter	2014	Winter	Sochi	Ski Jumping	Ski Jumping Men's Large Hill, Team	NaN
271114	135571	Tomasz Ireneusz ya	M	Poland	POL	1998 Winter	1998	Winter	Nagano	Bobsleigh	Bobsleigh Men's Four	NaN
271115	135571	Tomasz Ireneusz ya	M	Poland	POL	2002 Winter	2002	Winter	Salt Lake City	Bobsleigh	Bobsleigh Men's Four	NaN

In [16]:
```
df
```

Out[16]:

	ID	Name	Sex	Team	NOC	Games	Year	Season	City	Sport	Event	Medal
0	1	A Dijiang	M	China	CHN	1992 Summer	1992	Summer	Barcelona	Basketball	Men's Basketball	NaN
1	2	A Lamusi	M	China	CHN	2012 Summer	2012	Summer	London	Judo	Men's Extra-Lightweight	NaN
2	3	Gunnar Nielsen Aaby	M	Denmark	DEN	1920 Summer	1920	Summer	Antwerpen	Football	Men's Football	NaN
3	4	Edgar Lindenau Aabye	M	Denmark/Sweden	DEN	1900 Summer	1900	Summer	Paris	Tug-Of-War	Men's Tug-Of-War	Gold
4	5	Christine Jacoba Aaftink	F	Netherlands	NED	1988 Winter	1988	Winter	Calgary	Speed Skating	Women's 500 metres	NaN
...	...	...	...	...	...	...	...	...	...	...	...	...
271111	135569	Andrzej ya	M	Poland-1	POL	1976 Winter	1976	Winter	Innsbruck	Luge	Mixed (Men)'s Doubles	NaN
271112	135570	Piotr ya	M	Poland	POL	2014 Winter	2014	Winter	Sochi	Ski Jumping	Men's Large Hill, Individual	NaN
271113	135570	Piotr ya	M	Poland	POL	2014 Winter	2014	Winter	Sochi	Ski Jumping	Men's Large Hill, Team	NaN
271114	135571	Tomasz Ireneusz ya	M	Poland	POL	1998 Winter	1998	Winter	Nagano	Bobsleigh	Men's Four	NaN
271115	135571	Tomasz Ireneusz ya	M	Poland	POL	2002 Winter	2002	Winter	Salt Lake City	Bobsleigh	Men's Four	NaN

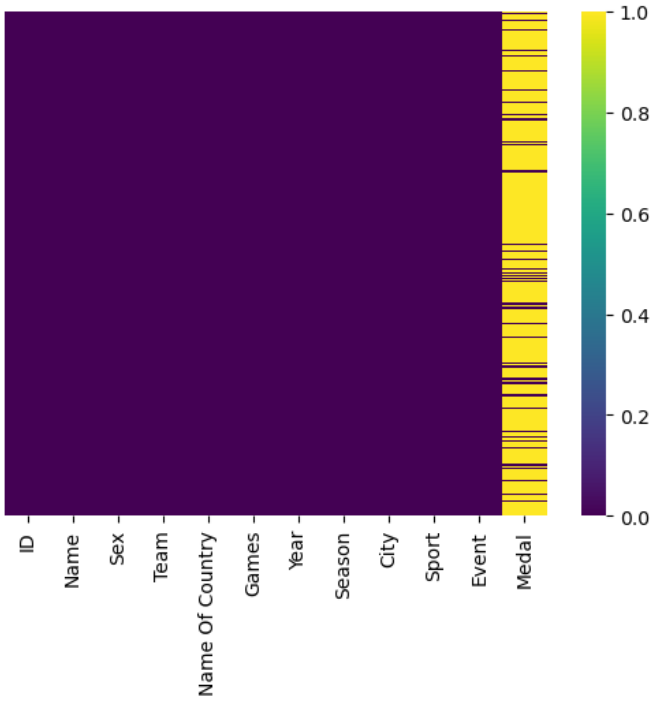
271116 rows × 12 columns

In [17]:
```
sns.heatmap(df.isnull(),yticklabels=False,cmap='viridis')
```

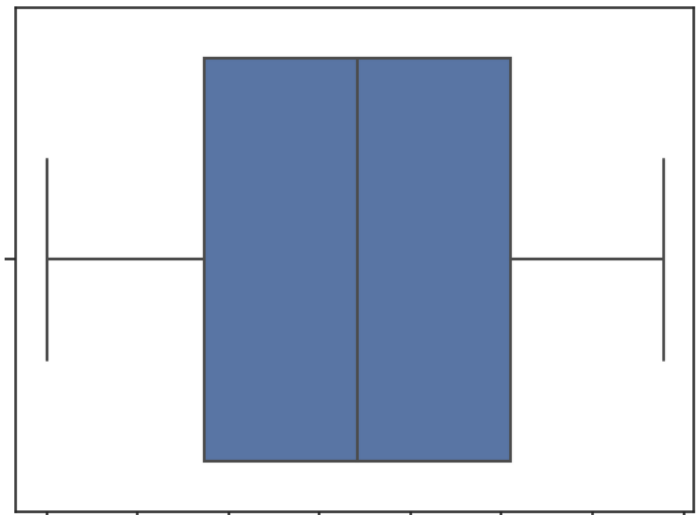
Out[17]: <Axes: >

In [17]:
```
sns.heatmap(df.isnull(),yticklabels=False,cmap='viridis')
```

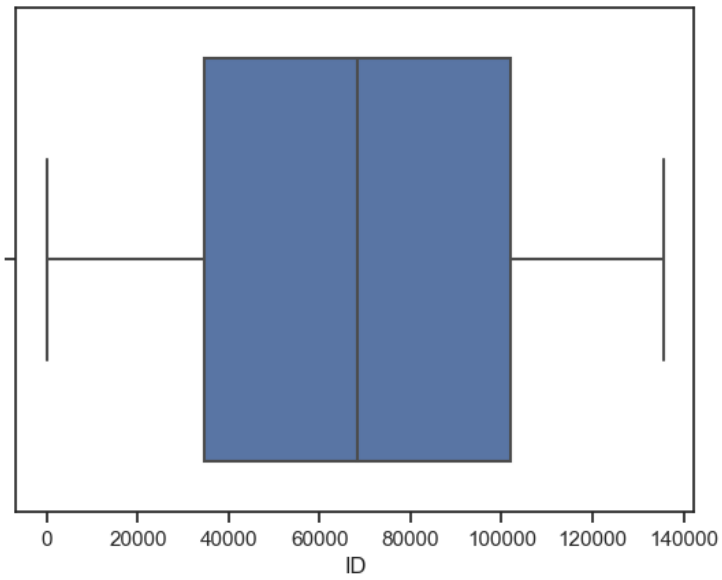
Out[17]: <Axes: >



In [87]:
```
for i in df.columns:
    sns.boxplot(x=df[i])
    plt.show()
```



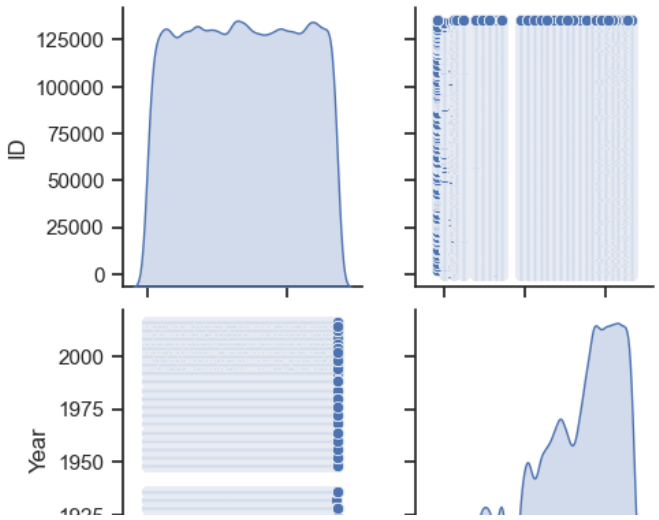
In [87]:
```
for i in df.columns:
    sns.boxplot(x=df[i])
    plt.show()
```



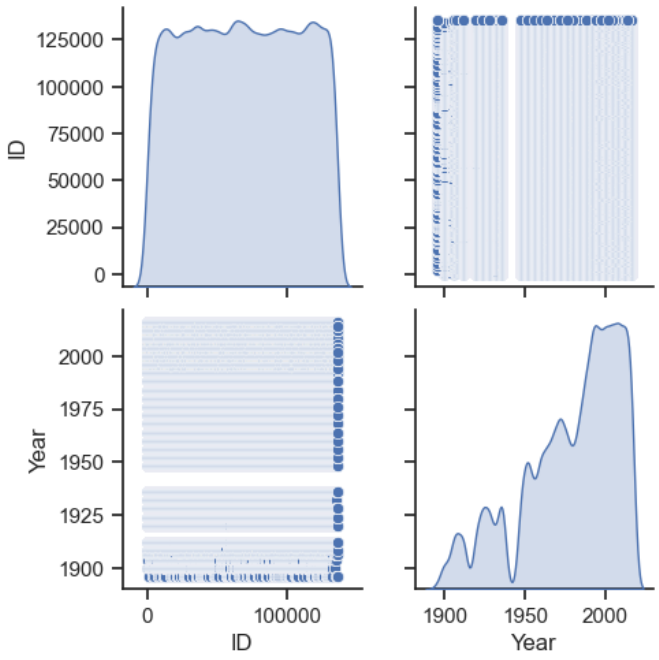

```
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
Cell In[87], line 2
      1 for i in df.columns:
----> 2     sns.boxplot(x=df[i])
      3     plt.show()

File ~\anaconda3\Lib\site-packages\seaborn\categorical.py:2231, in boxplot(dat
a, x, y, hue, order, hue_order, orient, color, palette, saturation, width, dodg
e, fliersize, linewidth, whis, ax, **kwargs)
   2224 def boxplot(
   2225     data=None, *, x=None, y=None, hue=None, order=None, hue_order=None,
   2226     orient=None, color=None, palette=None, saturation=.75, width=.8,
   2227     dodge=True, fliersize=5, linewidth=None, whis=1.5, ax=None,
   2228     **kwargs
   2229 ):
-> 2231     plotter = _BoxPlotter(x, y, hue, data, order, hue_order,
   2232                           orient, color, palette, saturation,
   2233                           width, dodge, fliersize, linewidth)
   2235     if ax is None:
   2236         ax = plt.gca()

File ~\anaconda3\Lib\site-packages\seaborn\categorical.py:785, in _BoxPlotter._
_init__(self, x, y, hue, data, order, hue_order, orient, color, palette, satura
tion, width, dodge, fliersize, linewidth)
    781 def __init__(self, x, y, hue, data, order, hue_order,
```

```
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
Cell In[87], line 2
      1 for i in df.columns:
----> 2     sns.boxplot(x=df[i])
      3     plt.show()

File ~\anaconda3\Lib\site-packages\seaborn\categorical.py:2231, in boxplot(dat
a, x, y, hue, order, hue_order, orient, color, palette, saturation, width, dodg
e, fliersize, linewidth, whis, ax, **kwargs)
   2224 def boxplot(
   2225     data=None, *, x=None, y=None, hue=None, order=None, hue_order=None,
   2226     orient=None, color=None, palette=None, saturation=.75, width=.8,
   2227     dodge=True, fliersize=5, linewidth=None, whis=1.5, ax=None,
   2228     **kwargs
   2229 ):
-> 2231     plotter = _BoxPlotter(x, y, hue, data, order, hue_order,
   2232                           orient, color, palette, saturation,
   2233                           width, dodge, fliersize, linewidth)
   2235     if ax is None:
   2236         ax = plt.gca()

File ~\anaconda3\Lib\site-packages\seaborn\categorical.py:785, in _BoxPlotter._
_init__(self, x, y, hue, data, order, hue_order, orient, color, palette, satura
tion, width, dodge, fliersize, linewidth)
    781 def __init__(self, x, y, hue, data, order, hue_order,
    782              orient, color, palette, saturation,
    783              width, dodge, fliersize, linewidth):
--> 785     self.establish_variables(x, y, hue, data, orient, order, hue_order)
    786     self.establish_colors(color, palette, saturation)
    788     self.dodge = dodge

File ~\anaconda3\Lib\site-packages\seaborn\categorical.py:544, in _CategoricalP
lotter.establish_variables(self, x, y, hue, data, orient, order, hue_order, uni
ts)
    541         raise ValueError(err)
    543 # Figure out the plotting orientation
--> 544 orient = infer_orient(
    545     x, y, orient, require_numeric=self.require_numeric
    546 )
    548 # Option 2a:
    549 # We are plotting a single set of data
    550 # ------------------------------------
    551 if x is None or y is None:
    552
    553     # Determine where the data are

File ~\anaconda3\Lib\site-packages\seaborn\_oldcore.py:1601, in infer_orient(x,
y, orient, require_numeric)
   1599         warnings.warn(single_var_warning.format("Vertical", "x"))
   1600     if require_numeric and x_type != "numeric":
-> 1601         raise TypeError(nonnumeric_dv_error.format("Horizontal", "x"))
   1602     return "h"
   1604 elif str(orient).startswith("v"):

TypeError: Horizontal orientation requires numeric `x` variable.
```

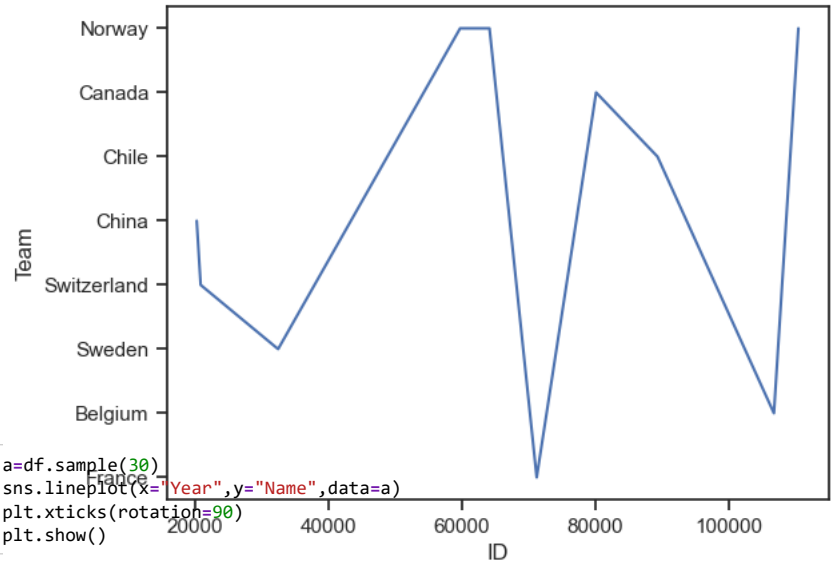
In [80]:
```
sns.set(style="ticks")
sns.pairplot(df,diag_kind="kde",markers="o")
plt.show()
```



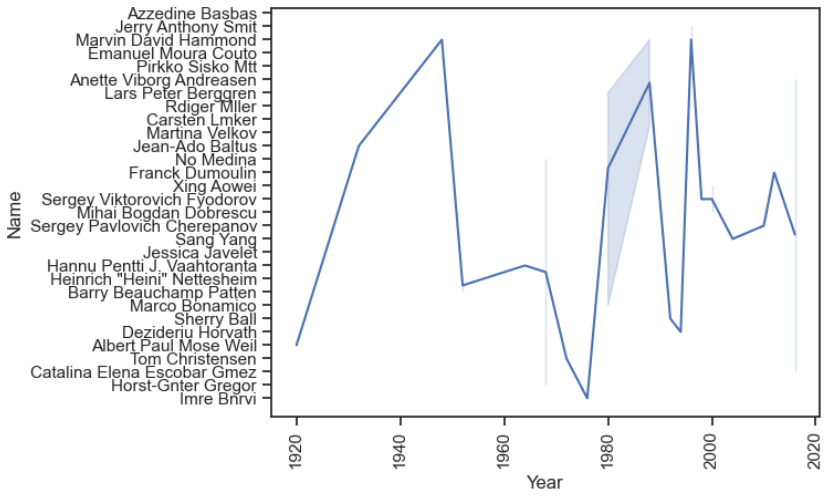
In [80]:
```
sns.set(style="ticks")
sns.pairplot(df,diag_kind="kde",markers="o")
plt.show()
```



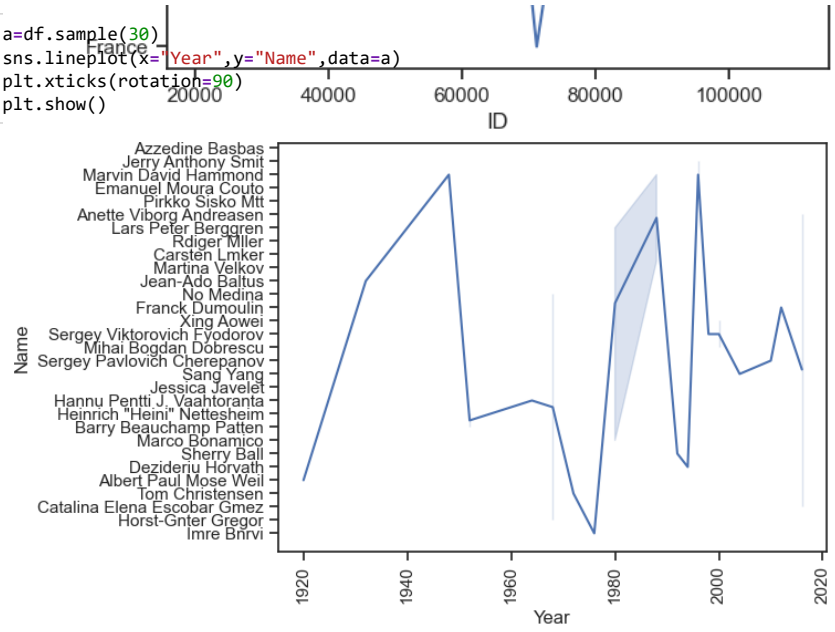
In [82]:
```
a=df.sample(10)
sns.lineplot(x="ID",y="Team",data=a)
plt.show()
```



In [83]:
```
a=df.sample(30)
sns.lineplot(x="Year",y="Name",data=a)
plt.xticks(rotation=90)
plt.show()
```

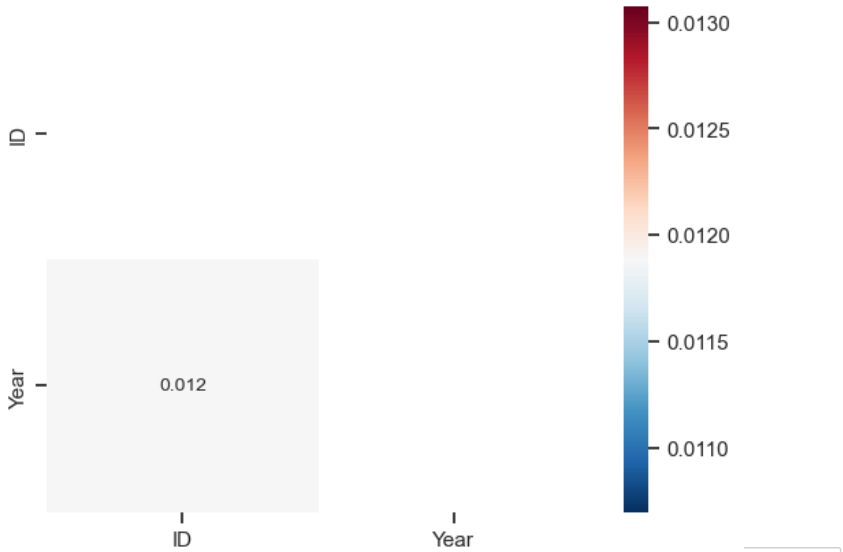


In [83]:
```
a=df.sample(30)
sns.lineplot(x="Year",y="Name",data=a)
plt.xticks(rotation=90)
plt.show()
```



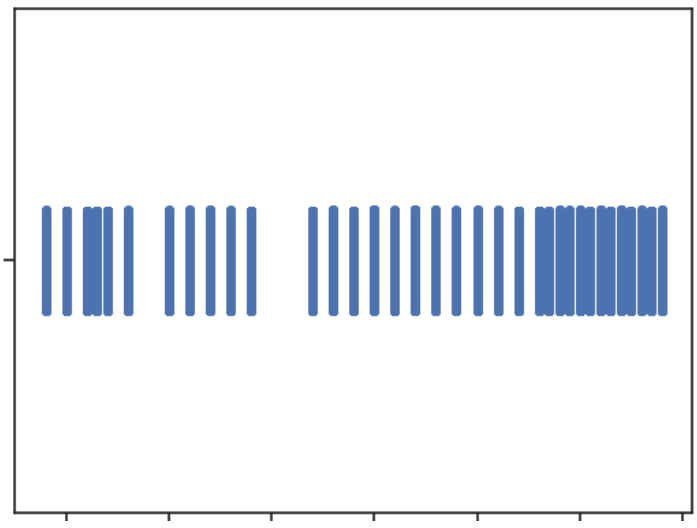
In [85]:
```
corr=df.corr()
msk=np.triu(np.ones_like(corr))
sns.heatmap(corr,cmap=plt.cm.RdBu_r,annot=True,annot_kws={'size':10},mask=msk)
```

Out[85]: <Axes: >



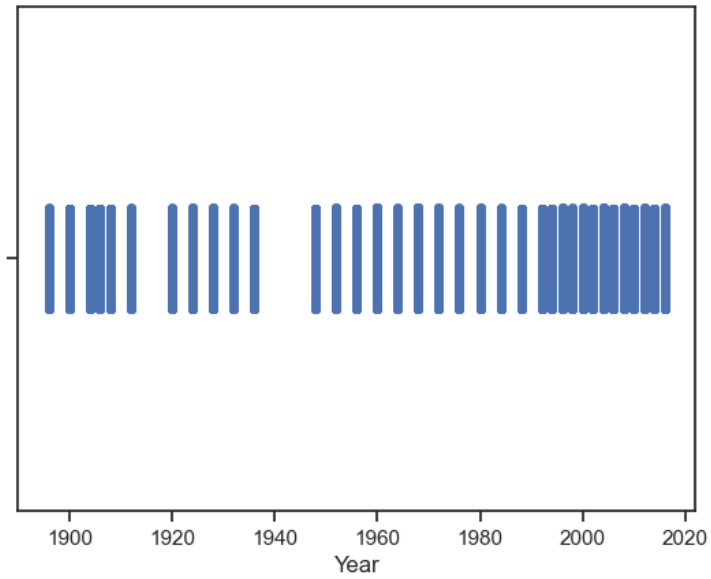
In [88]:
```
sns.stripplot(x="Year",data=df)
```

Out[88]: <Axes: xlabel='Year'>

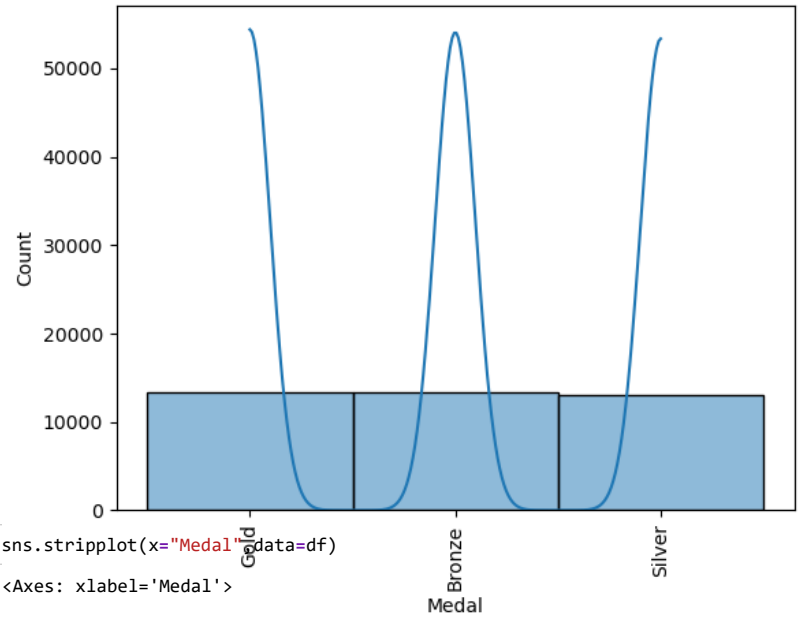


In [88]:
```
sns.stripplot(x="Year",data=df)
```

Out[88]: <Axes: xlabel='Year'>

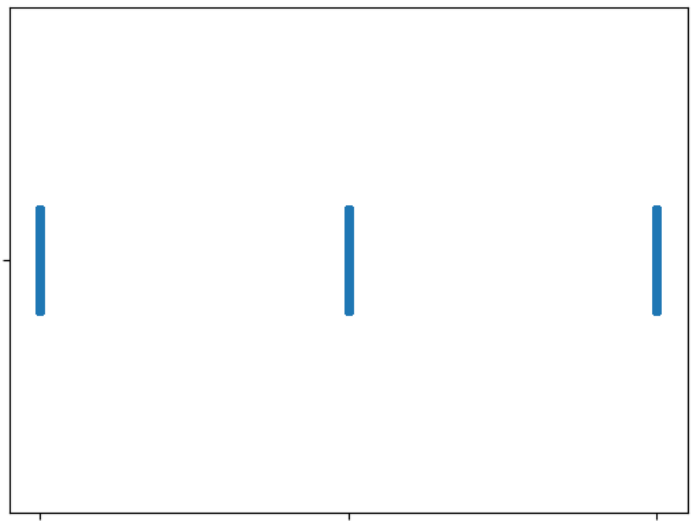


In [18]:
```
sns.histplot(df["Medal"],bins=10,kde=True)
plt.xticks(rotation=90)
plt.show()
```



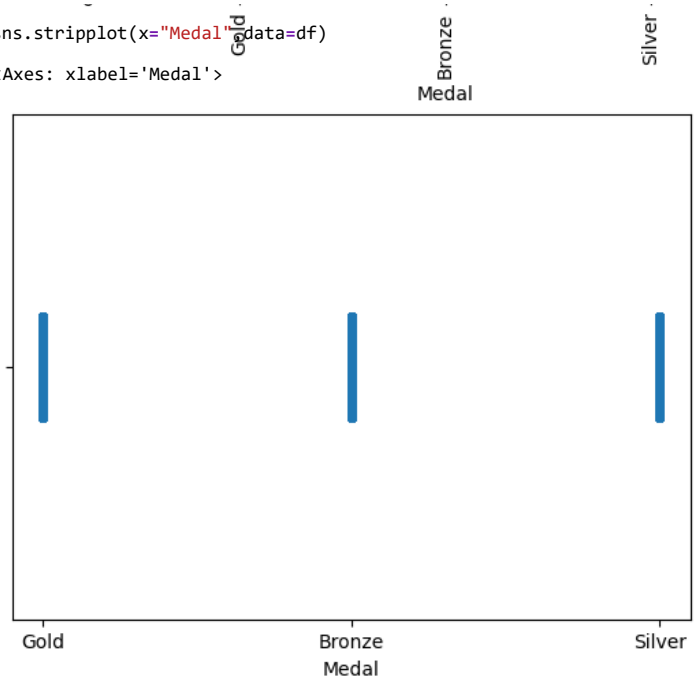
In [19]:
```
sns.stripplot(x="Medal",data=df)
```

Out[19]: <Axes: xlabel='Medal'>

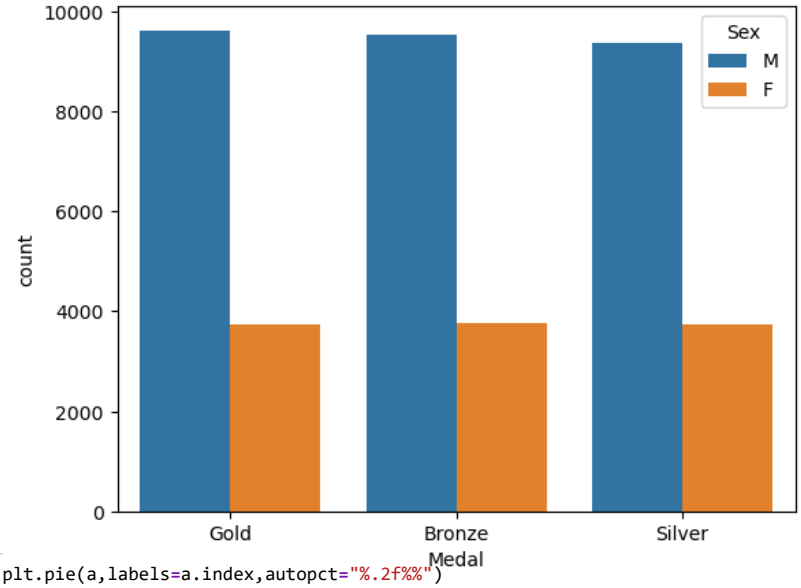


In [19]:
```
sns.stripplot(x="Medal",data=df)
```

Out[19]: <Axes: xlabel='Medal'>

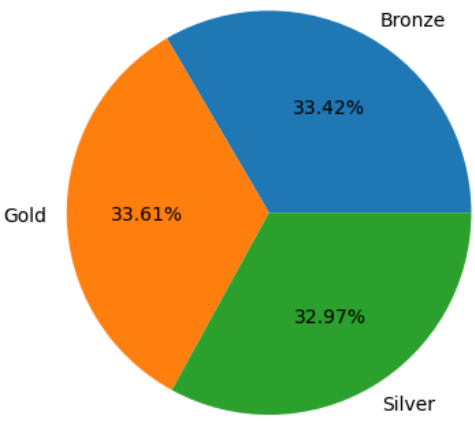


In [20]:
```
sns.countplot(x=df['Medal'],hue=df['Sex'])
plt.show()
```



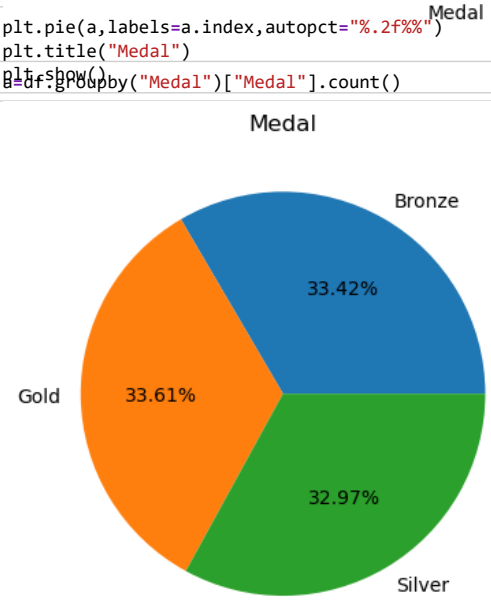
In [22]:
```
plt.pie(a,labels=a.index,autopct="%.2f%%")
plt.title("Medal")
plt.show()
```

In [21]:
```
a=df.groupby("Medal")["Medal"].count()
```



In [22]:
```
plt.pie(a,labels=a.index,autopct="%.2f%%")
plt.title("Medal")
plt.show()
```

In [21]:
```
a=df.groupby("Medal")["Medal"].count()
```



In [23]:
```
from sklearn.preprocessing import OneHotEncoder,StandardScaler
categorical_cols=["Year","City"]
encoder=OneHotEncoder(drop='first',sparse=False)
encoder_cols=pd.DataFrame(encoder.fit_transform(df[categorical_cols]),columns=enc
```

In [24]:
```
numerical_cols=["ID","Year"]
scaler=StandardScaler()
scaled_cols=pd.DataFrame(scaler.fit_transform(df[numerical_cols]),columns=scaler.
```

In [113]:
```
x=pd.concat([encoder_cols,scaled_cols],axis=1)
y=df['Sex']
```

In [114]:
```
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.2,random_state=42)
```

In [115]:
```
log=LogisticRegression()
```

In [116]:
```
log.fit(x_train,y_train)
```

Out[116]:
```
LogisticRegression()
```

In [117]:
```
print('Train Score:',log.score(x_train,y_train))
```

```
Train Score: 0.7248031278239861
```

In [121]:
```
print(metrics.classification_report(y_test,pred_test))
```

In [118]:
```
print('Test Score:',log.score(x_test,y_test))
```

```
              precision    recall  f1-score   support

Test Score: 0.7264311006196518
           F       0.00      0.00      0.00     14834
           M       0.73      1.00      0.84     39390

    accuracy                           0.73     54224
   macro avg       0.36      0.50      0.42     54224
weighted avg       0.53      0.73      0.61     54224
```

In [119]:
```
pred_train=log.predict(x_train)
pred_test=log.predict(x_test)
```

In [120]:
```
print(metrics.classification_report(y_train,pred_train))
```

```
              precision    recall  f1-score   support

           F       0.00      0.00      0.00     55088
           M       0.72      1.00      0.84    157204

    accuracy                           0.72    216892
   macro avg       0.36      0.50      0.42    216892
weighted avg       0.52      0.72      0.61    216892
```

In [122]:
```
from sklearn.metrics import matthews_corrcoef, accuracy_score, precision_score, r
```

In [123]:
```
y_train_binary = label_binarize(y_train, classes=['F', 'M'])
fpr, tpr, threshold = metrics.roc_curve(y_train_binary[:, 0],roc)
plt.plot([0, 1], [0, 1], "k--")
plt.plot(fpr, tpr, label='logistic')
plt.show()
```

In [121]:
```
print(metrics.classification_report(y_test,pred_test))
```

In [118]:
```
print('Test Score:',log.score(x_test,y_test))
```

```
              precision    recall  f1-score   support

Test Score: 0.7264311006196518
           F       0.00      0.00      0.00     14834
           M       0.73      1.00      0.84     39390

    accuracy                           0.73     54224
   macro avg       0.36      0.50      0.42     54224
weighted avg       0.53      0.73      0.61     54224
```

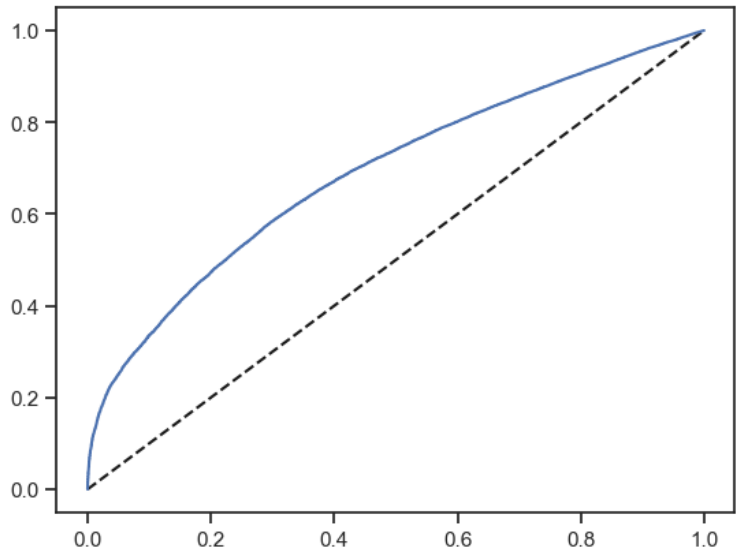
In [119]:
```
pred_train=log.predict(x_train)
pred_test=log.predict(x_test)
```

In [120]:
```
print(metrics.classification_report(y_train,pred_train))
```

```
              precision    recall  f1-score   support

           F       0.00      0.00      0.00     59888
           M       0.72      1.00      0.84    157204

    accuracy                           0.72    216892
   macro avg       0.36      0.50      0.42    216892
weighted avg       0.52      0.72      0.61    216892
```

In [122]:
```
from sklearn.metrics import matthews_corrcoef, accuracy_score, precision_score, r
```

In [123]:
```
y_train_binary = label_binarize(y_train, classes=['F', 'M'])
fpr, tpr, threshold = metrics.roc_curve(y_train_binary[:, 0],roc)
plt.plot([0, 1], [0, 1], "k--")
plt.plot(fpr, tpr, label='logistic')
plt.show()
```



In [124]:
```
metrics.roc_auc_score(y_train,roc)
```

Out[124]:
```
0.6901432210989167
```

In [125]:
```
from sklearn.metrics import matthews_corrcoef

mcc=matthews_corrcoef(y_test,pred_test)
print('MCC:',mcc)
```

```
MCC: 0.0
```

In [57]:
```
best_param = grid.best_params_
best_model = grid.best_estimator_
```

In [126]:
```
param_grid={
    'penalty':['l1','l2'],
    'C':[0.1,0.5,1,5,10]
}
```

In [58]:
```
y_pred = best_model.predict(x_test)
```

In [157]:
```
from sklearn.metrics import accuracy_score , precision_score,recall_score,f1_scor
```

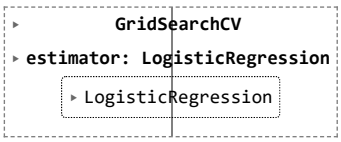
In [127]:
```
from sklearn.model_selection import GridSearchCV
```

In [ ]:

In [128]:
```
grid=GridSearchCV(estimator=log, param_grid=param_grid, cv= 5)
```

In [129]:
```
grid.fit(x_train,y_train)
```

Out[129]:



MCC: 0.0

In [57]:
```
best_param = grid.best_params_
best_model = grid.best_estimator_
```

In [126]:
```
param_grid={
    'penalty':['l1','l2'],
    'C':[0.1,0.5,1,5,10]
}
```

In [58]:
```
y_pred = best_model.predict(x_test)
```

In [157]:
```
from sklearn.metrics import accuracy_score , precision_score,recall_score,f1_scor
```

In [127]:
```
from sklearn.model_selection import GridSearchCV
```

In [ ]:

In [128]:
```
grid=GridSearchCV(estimator=log, param_grid=param_grid, cv= 5)
```

In [129]:
```
grid.fit(x_train,y_train)
```

Out[129]: