

TEAM ID : PNT2022TMD39833

Exploratory Data Analysis:

Required libraries:

```
In [1]: import pandas as pd

import numpy as np

import matplotlib.pyplot as plt

import seaborn as sns

%matplotlib inline

In [2]: df= pd.read_csv("C:/Users/sgaav/OneDrive/Desktop/Healthcare_Data/tesin_data.csv")

In [3]: df

Out[3]:
```

	case_id	Hospital_code	Hospital_type_code	City_Code_Hospital	Hospital_region_code	Available Extra Rooms in Hospital	Department	Ward_Type	Ward_Facility_Code	Bed Grade	patientid	City_Code_Patient	Type of Admission	Severity of Illness	Visitors with Patient	Age	A
	0	1	8	c	3	Z	3 radiotherapy	R	F	2.0	31397		Emergency	Extreme	2	60	
	1	2	2	c	5	Z	2 radiotherapy	S	F	2.0	31397	7.0	Trauma	Extreme	2	51-60	
	2	3	10	e	1	X	2 anesthesia	S	E	2.0	31397	7.0	Trauma	Extreme	2	51-60	
	3	4	26	b	2	Y	2 radiotherapy	R	D	2.0	31397	7.0	Trauma	Extreme	2	51-60	
	4	5	26	b	2	Y	2 radiotherapy	S	D	2.0	31397	7.0	Trauma	Extreme	2	51-60	

	318433	318434	6	a	6	X	3 radiotherapy	Q	F	4.0	86499		Emergency	Moderate	3	41-50	
	318434	318435	24	a	1	X	2 anesthesia	Q	E	4.0	325	8.0	Urgent	Moderate	4	81-90	
	318435	318436	7	a	4	X	3 gynecology	R	F	4.0	125235	10.0	Emergency	Minor	3	71-80	
	318436	318437	11	b	2	Y	3 anesthesia	Q	D	3.0	91081	8.0	Trauma	Minor	5	11-20	
	318437	318438	19	a	7	Y	5 gynecology	Q	C	2.0	21641	8.0	Emergency	Minor	2	11-20	

318438 rows x 18 columns

```
In [4]: df.head()

Out[4]:
```

	case_id	Hospital_code	Hospital_type_code	City_Code_Hospital	Hospital_region_code	Available Extra Rooms in Hospital	Department	Ward_Type	Ward_Facility_Code	Bed Grade	patientid	City_Code_Patient	Type of Admission	Severity of Illness	Visitors with Patient	Age	Admission_Deposit
	0	1	8	c	3	Z	3 radiotherapy	R	F	2.0	31397		Emergency	Extreme	2	51-60	
	1	2	2	c	5	Z	2 radiotherapy	S	F	2.0	31397	7.0	Trauma	Extreme	2	51-60	
	2	3	10	e	1	X	2 anesthesia	S	E	2.0	31397	7.0	Trauma	Extreme	2	51-60	
	3	4	26	b	2	Y	2 radiotherapy	R	D	2.0	31397	7.0	Trauma	Extreme	2	51-60	
	4	5	26	b	2	Y	2 radiotherapy	S	D	2.0	31397	7.0	Trauma	Extreme	2	51-60	

```
In [5]: df.tail()

Out[5]:
```

	318433	318434	6	a	6	X	3 radiotherapy	Q	F	4.0	86499		Emergency	Moderate	3	41-50	
	318434	318435	24	a	1	X	2 anesthesia	Q	E	4.0	325	8.0	Urgent	Moderate	4	81-90	
	318435	318436	7	a	4	X	3 gynecology	R	F	4.0	125235	10.0	Emergency	Minor	3	71-80	
	318436	318437	11	b	2	Y	3 anesthesia	Q	D	3.0	91081	8.0	Trauma	Minor	5	11-20	
	318437	318438	19	a	7	Y	5 gynecology	Q	C	2.0	21641	8.0	Emergency	Minor	2	11-20	

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

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 318438 entries, 0 to 318437
Data columns (total 18 columns):
 # Column Non-Null Count Dtype
---  ---
 0 case_id 318438 non-null int64
 1 Hospital_code 318438 non-null int64
 2 Hospital_type_code 318438 non-null object
 3 City_Code_Hospital 318438 non-null int64
 4 Hospital_region_code 318438 non-null object
 5 Available Extra Rooms in Hospital 318438 non-null int64
 6 Department 318438 non-null object
 7 Ward_Type 318438 non-null object
 8 Ward_Facility_Code 318438 non-null object
 9 Bed Grade 318323 non-null float64
10 patientid 318438 non-null int64
11 City_Code_Patient 313906 non-null float64
12 Type of Admission 318438 non-null object
13 Severity of Illness 318438 non-null object
14 Visitors with Patient 318438 non-null int64
15 Age 318438 non-null object
16 Admission_Deposit 318438 non-null float64
17 Stay 318438 non-null object
dtypes: float64(3), int64(6), object(9)
memory usage: 43.7+ MB
```

```
In [7]: df.dtypes

Out[7]:
case_id          int64
Hospital_code     int64
Hospital_type_code object
City_Code_Hospital int64
Hospital_region_code object
Available Extra Rooms in Hospital int64
Department        object
Ward_Type          object
Ward_Facility_Code object
Bed Grade          float64
patientid          int64
City_Code_Patient float64
Type of Admission  object
Severity of Illness object
Visitors with Patient int64
Age                object
Admission_Deposit float64
Stay               object
dtype: object

In [8]: df.shape

Out[8]:
(318438, 18)
```

Before Null Values checking :

```
In [22]: df.isnull().sum().sum()

Out[22]:
6465

In [23]: df.isnull()

Out[23]:
```

	case_id	Hospital_code	Hospital_type_code	City_Code_Hospital	Hospital_region_code	Available Extra Rooms in Hospital	Department	Ward_Type	Ward_Facility_Code	Bed Grade	patientid	City_Code_Patient	Type of Admission	Severity of Illness	Visitors with Patient	Age	A
	0	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False
	1	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False
	2	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False
	3	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False
	4	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False

	318433	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False
	318434	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False
	318435	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False
	318436	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False
	318437	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False

318438 rows x 18 columns

```
In [24]: df.describe()

Out[24]:
```

	case_id	Hospital_code	City_Code_Hospital	Available Extra Rooms in Hospital	Bed Grade	patientid	City_Code_Patient	Visitors with Patient	Admission_Deposit
count	318438.000000	318438.000000	318438.000000	318438.000000	318325.000000	318438.000000	313906.000000	318438.000000	318438.000000
mean	159219.500000	18.318841	4.777177	3.197627	2.629807	65747.579472	7.251569	3.284099	4880.749992
std	91825.278947	8.633755	3.102636	1.168171	0.873146	37979.936440	4.746266	1.764081	1086.776254
min	1.000000	1.000000	1.000000	0.000000	1.000000	1.000000	1.000000	0.000000	1880.000000
25%	79610.250000	11.000000	2.000000	2.000000	2.000000	32847.000000	4.000000	2.000000	4186.000000
50%	159219.500000	19.000000	5.000000	3.000000	3.000000	65724.500000	8.000000	3.000000	4741.000000
75%	238828.750000	26.000000	7.000000	4.000000	3.000000	98470.000000	8.000000	4.000000	5409.000000
max	318438.000000	32.000000	13.000000	24.000000	4.000000	131624.000000	38.000000	32.000000	11008.000000

```
In [27]: df.isnull().sum()

Out[27]:
case_id          0
Hospital_code     0
Hospital_type_code 0
City_Code_Hospital 0
Hospital_region_code 0
Available Extra Rooms in Hospital 0
Department        0
Ward_Type          0
Ward_Facility_Code 0
Bed Grade         113
patientid         4532
City_Code_Patient 0
Type of Admission 0
Severity of Illness 0
Visitors with Patient 0
Age                0
Admission_Deposit 0
Stay               0
dtype: int64

In [31]: df.corr()

Out[31]:
```

	case_id	Hospital_code	City_Code_Hospital	Available Extra Rooms in Hospital	Bed Grade	patientid	City_Code_Patient	Visitors with Patient	Admission_Deposit
case_id	1.000000	-0.043023	-0.011352	0.042580	0.013702	-0.004150	0.065196	0.001309	-0.045972
Hospital_code	-0.043023	1.000000	0.128294	-0.059638	-0.013739	0.002291	-0.015530	-0.028500	0.045446
City_Code_Hospital	-0.011352	0.128294	1.000000	-0.045771	-0.049309	0.000750	-0.023988	0.018194	-0.034465
Available Extra Rooms in Hospital	0.042580	-0.059638	-0.045771	1.000000	-0.115888	0.000921	-0.009681	0.096714	-0.143739
Bed Grade	0.013702	-0.013739	-0.049309	-0.115888	1.000000	0.001645	-0.008105	0.088945	0.073893
patientid	-0.004150	0.002291	0.000750	0.000921	0.001645	1.000000	0.002002	-0.002689	-0.000877
City_Code_Patient	0.065196	-0.015530	-0.023988	-0.009681	-0.008105	0.002002	1.000000	-0.012074	0.025837
Visitors with Patient	0.001309	-0.028500	0.018194	0.096714	0.088945	0.006889	-0.012074	1.000000	-0.150358
Admission_Deposit	-0.045972	0.045446	-0.034465	-0.143739	0.073893	-0.000877	0.025837	-0.150358	1.000000

```
In [28]: df.isnull().sum().sum()

Out[28]:
6465
```

Work With Null Values :

```
In [32]: df["Bed Grade"].fillna(df["Bed Grade"].mean(),inplace=True)

In [33]: df["Bed Grade"].isnull().sum()

Out[33]:
0

In [34]: df.isnull().sum()

Out[34]:
case_id          0
Hospital_code     0
Hospital_type_code 0
City_Code_Hospital 0
Hospital_region_code 0
Available Extra Rooms in Hospital 0
Department        0
Ward_Type          0
Ward_Facility_Code 0
Bed Grade         0
patientid         0
City_Code_Patient 4532
Type of Admission 0
Severity of Illness 0
Visitors with Patient 0
Age                0
Admission_Deposit 0
Stay               0
dtype: int64

In [35]: df["City_Code_Patient"].fillna(df["City_Code_Patient"].mean(),inplace=True)

In [36]: df["City_Code_Patient"].isnull().sum()

Out[36]:
0
```

After Cleaning Process :

Total Null Values Checking :

```
In [37]: df.isnull().sum()

Out[37]:
case_id          0
Hospital_code     0
Hospital_type_code 0
City_Code_Hospital 0
Hospital_region_code 0
Available Extra Rooms in Hospital 0
Department        0
Ward_Type          0
Ward_Facility_Code 0
Bed Grade         0
patientid         0
City_Code_Patient 0
Type of Admission 0
Severity of Illness 0
Visitors with Patient 0
Age                0
Admission_Deposit 0
Stay               0
dtype: int64

In [38]: df.isnull().sum().sum()

Out[38]:
0

In [39]: df.corr()

Out[39]:
```

	case_id	Hospital_code	City_Code_Hospital	Available Extra Rooms in Hospital	Bed Grade	patientid	City_Code_Patient	Visitors with Patient	Admission_Deposit
case_id	8.460257e+00	-3.414525e-06	-3.237513e+03	3.436541	9.625726	-0.165887	-0.133549	8.841959e+01	-0.348165
Hospital_code	-3.414525e-06	74.541723	3.436541	9.625726	-0.165887	-0.133549	8.841959e+01	-0.348165	0.099525
City_Code_Hospital	-3.237513e+03	3.436541	9.625726	-0.165887	-0.133549	8.841959e+01	-0.348165	0.099525	-1.161750e+02
Available Extra Rooms in Hospital	4.572484e+03	-0.801495	-0.165887	1.364624	-0.118145	4.085839e+01	-0.052888	0.199302	-1.824827e+02
Bed Grade	1.099464e+03	-0.103516	-0.133549	-0.118145	0.762113	5.462883e+01	-0.033075	0.136962	7.004052e+01
patientid	-1.448856e+07	751.114364	88.419578	40.858395	54.28834	1.442476e+09	355.729931	461.576369	-3.620715e+04
City_Code_Patient	2.803664e+04	-0.627298	-0.348165	-0.052888	-0.033075	3.557299e+02	22.197075	-0.099496	1.312739e+02
Visitors with Patient	2.122606e+02	-0.434073	0.099525	0.199302	0.136962	4.615794e+02	-0.099496	3.111913	-2.882567e+02
Admission_Deposit	-4.592730e+06	426.413524	-116.175038	-182.482676	70.040518	-3.620715e+04	131.273639	-288.256679	1.181083e+06

```
In [40]: sns.heatmap(df.corr(),annot=True)

plt.title("Correlation Matrix")

plt.show()
```

```
In [41]: df["Admission_Deposit"].hist(bins=10)

plt.title("Histogram for Admission_Deposit ")

plt.show()
```

```
In [42]: df["Ward_Type"].hist(bins=10)

plt.title("Histogram for Ward_Type ")

plt.show()
```

```
In [43]: df["patientid"].hist(bins=100)

plt.title("Histogram for patientid ")

plt.show()
```