

TEAM ID : PNT2022TMD27917

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/npaw/OneDrive/Desktop/Healthcare_Data/train_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	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	

	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		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		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                           318325 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(4), 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]: 4645

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	159219.000000	18.318841	4.777177	3.197627	2.825807	65747.579472	7.251959	3.284099	4880.748992
std	91925.276847	8.633755	3.102536	1.168171	0.873146	37979.936440	4.745366	1.764061	1086.776254
min	1.000000	1.000000	1.000000	0.000000	1.000000	1.000000	1.000000	0.000000	1800.000000
25%	79610.250000	11.000000	2.000000	2.000000	2.000000	32847.000000	4.000000	2.000000	4196.000000
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	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 [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	0.018184	-0.034465
Available Extra Rooms in Hospital	0.042580	-0.059638	-0.045771	1.000000	-0.115868	0.001645	-0.009681	0.096714	-0.143739
Bed Grade	0.013702	-0.013739	-0.049309	-0.115868	1.000000	0.001645	-0.008105	0.068895	-0.073833
patientid	-0.004150	0.002291	0.000750	0.000921	0.001645	1.000000	0.002002	0.006890	-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	0.018184	0.096714	0.068895	0.006890	-0.012074	1.000000	-0.150358
Admission_Deposit	-0.045972	0.045446	-0.034465	-0.143739	-0.073833	-0.000877	0.025837	-0.150358	1.000000

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

Out[28]: 4645
```

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

Total Null Values :

```
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	0.042580	0.013702	-0.004150	0.065196	0.001309	-0.045972
Hospital_code	-3.414525e-06	74.541723	3.436541	-0.059638	-0.013739	0.002291	-0.015530	-0.028500	0.045446
City_Code_Hospital	-3.237513e+03	3.436541	9.025726	-0.045771	-0.049309	0.000750	-0.023988	0.018184	-0.034465
Available Extra Rooms in Hospital	0.042580e+03	-0.059638	-0.045771	1.364624	-0.118145	0.001645	-0.009681	0.096714	-0.143739
Bed Grade	1.099464e+03	-0.103516	-0.133549	-0.118145	0.762113	0.001645	-0.008105	0.068895	-0.073833
patientid	-1.448856e+07	751.114364	88.419578	0.000921	0.001645	1.000000	0.002002	0.006890	-0.000877
City_Code_Patient	2.803664e+04	-0.027298	-0.348165	-0.009681	-0.008105	0.002002	1.000000	-0.012074	0.025837
Visitors with Patient	2.122606e+02	-0.434073	0.099525	0.199302	0.136962	0.006890	-0.012074	1.000000	-0.150358
Admission_Deposit	-4.592730e+06	426.413524	-116.175038	-0.143739	-0.073833	-0.000877	0.025837	-0.150358	1.000000

```
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.show()
```