

TEAM ID : PNT2022TMD35335

## 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/nprav/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	7.0	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	23.0	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 × 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	Admissi
0	1	8	c	3	Z	3	radiotherapy	R	F	2.0	31397	7.0	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]:
```

	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
318433	318434	6	a	6	X	3	radiotherapy	Q	F	4.0	86499	23.0	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 318325 non-null float64
10 patientid 318438 non-null int64
11 City_Code_Patient 313996 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]: 4645

In [25]: df.isnull()

Out[25]:
```

	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	False
1	False	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	False
3	False	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	False
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
318433	False	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	False
318435	False	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	False
318437	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False

318438 rows × 18 columns

```
In [26]: df.describe()

Out[26]:
```

	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	313996.000000	318438.000000	318438.000000
mean	159219.500000	18.318841	4.771717	3.197627	2.625807	65747.579472	7.251859	3.284099	4880.749392
std	91925.276847	8.633755	3.102535	1.168171	0.873146	37979.936440	4.745266	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	4186.000000
50%	159219.500000	19.000000	5.000000	3.000000	3.000000	65724.000000	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 [11]: df.corr()

Out[11]:
```

	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
Hospital_code	-0.043023	1.000000	0.128294		-0.059638	-0.013739	0.002291	-0.015530	-0.028500
City_Code_Hospital	-0.011352	0.128294	1.000000		-0.045771	-0.049309	0.000750	-0.023988	0.018184
Available Extra Rooms in Hospital	0.042580	-0.059638	-0.045771	1.000000	-0.115868	0.000921	-0.009681	0.096714	-0.143739
Bed Grade	0.013702	-0.013739	-0.049309	-0.115868	1.000000	0.001645	-0.008105	0.088945	0.073833
patientid	-0.004150	0.002291	0.000750	0.000921	0.001645	1.000000	0.002002	0.006889	-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	0.088945	0.006889	-0.012074	1.000000	-0.150358
Admission_Deposit	-0.045972	0.045446	-0.034455	-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.cov()

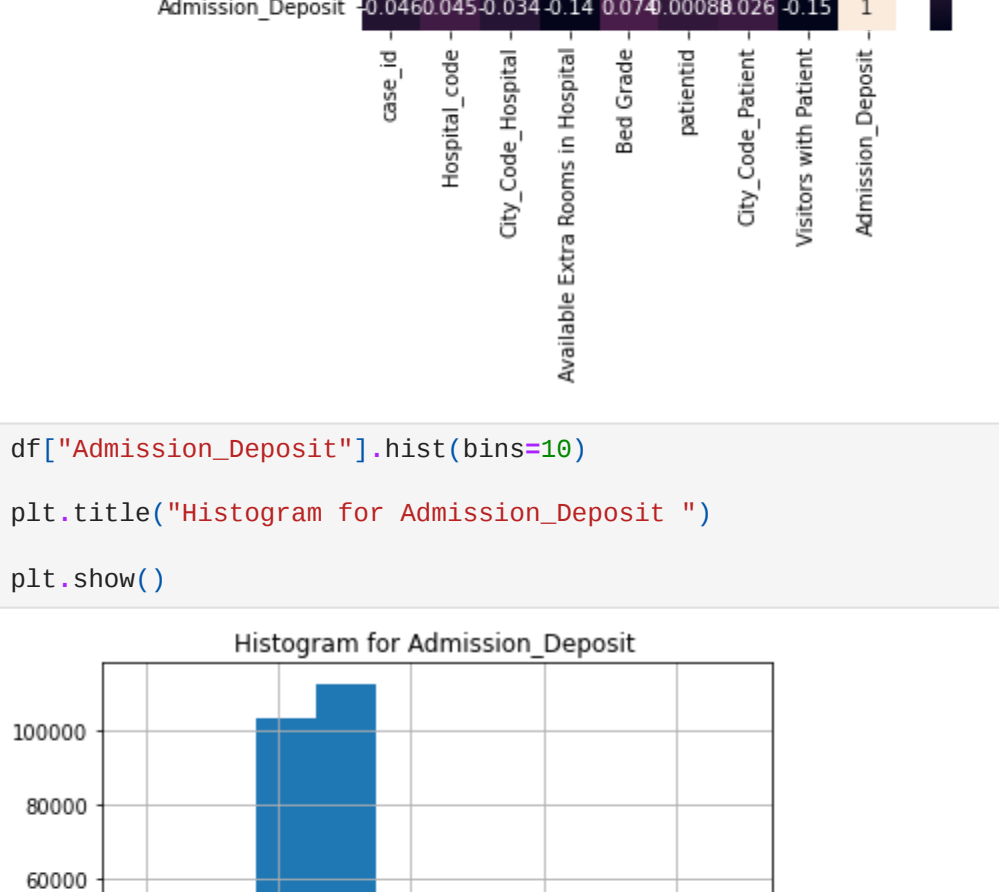
Out[39]:
```

	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	8.450257e+09	-34145.255936	-3237.513037		4572.484177	1089.464209	-1.448858e+07	28036.639476	212.260614
Hospital_code	-3.414526e+04	74.541723	3.436541		-6.001495	-0.103516	7.511144e+02	-0.627298	-0.434073
City_Code_Hospital	-3.237513e+03	3.436541	9.625726		-0.165887	-0.133549	8.841958e+01	-0.348165	0.099525
Available Extra Rooms in Hospital	4.572484e+03	-0.601495	-0.165887	1.364624	-0.116145	4.085939e+01	-0.052868	0.199302	-1.824827e+02
Bed Grade	1.099464e+03	-0.103516	-0.133549	-0.118145	0.782113	5.452883e+01	-0.033075	0.136962	7.004052e+01
patientid	-1.448858e+07	751.114364	88.419578	40.868395	54.528834	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	1.312736e+02
Visitors with Patient	2.122006e+02	-0.434073	0.099525	-0.199302	0.136962	4.615764e+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")

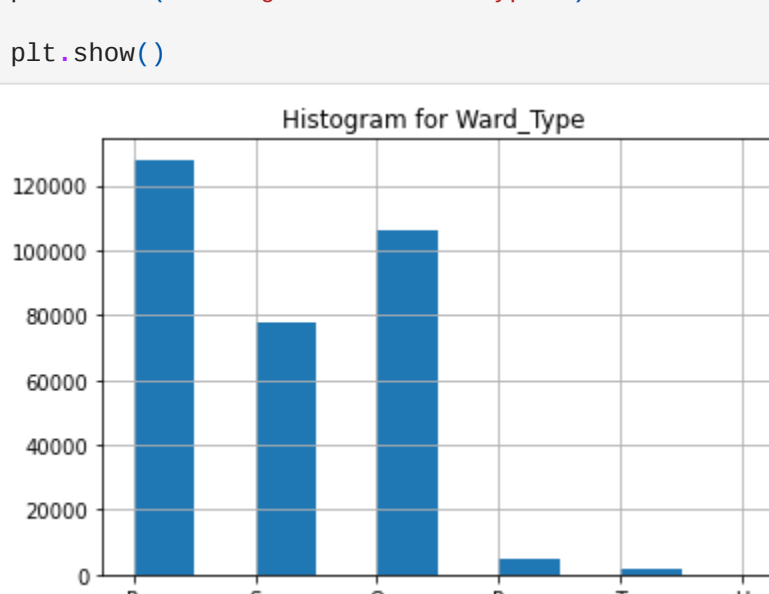
plt.show()
```



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

plt.title("Histogram for Admission_Deposit ")

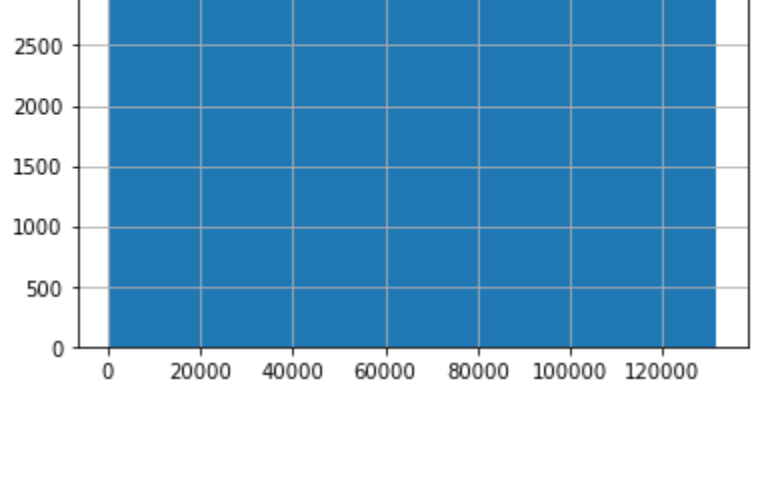
plt.show()
```



```
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()
```

