

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:/Data/np/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	12535		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	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
	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	12535		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                  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]: 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 [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	313906.000000	318438.000000	318438.000000
mean	155219.500000	18.318481	4.777117	3.197627	2.825807	65747.579472	7.251859	3.284099	4880.746392
std	91925.276847	8.633956	3.102636	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%	79910.250000	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	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 [32]: df.isnull()

Out[32]:
```

	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	0.065198	0.001309	-0.045972
	Hospital_code	-0.043023	1.000000	0.128294	-0.059638	-0.037309	0.002291	-0.015530	-0.028500	-0.034546
	City_Code_Hospital	-0.011352	0.128294	1.000000	-0.045771	-0.040309	0.000750	-0.023988	0.018184	-0.034455
	Available Extra Rooms in Hospital	0.042580	-0.059638	-0.045771	1.000000	-0.115868	0.000021	-0.009681	0.006714	-0.143739
	Bed Grade	0.013702	-0.037309	-0.040309	-0.115868	1.000000	0.001645	-0.008105	0.086945	-0.073833
	patientid	-0.004150	0.002291	0.000750	0.000921	0.001645	1.000000	0.002002	0.006889	-0.000877
	City_Code_Patient	0.065198	-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	0.006714	0.006945	0.006889	-0.012074	1.000000	-0.150358
	Admission_Deposit	-0.045972	0.034455	-0.034455	-0.143739	0.075833	-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 [39]: 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	8.460252e+00	-3.645259e+00	-3.237513e+03	4.572484177	1099.466209	-1.448898e+07	28036.639476	-4.592730e+08
	Hospital_code	-3.645260e+04	74.541723	3.436541	-0.601495	-0.103518	7.511446e+02	-0.627298	-0.434073
	City_Code_Hospital	-3.237513e+03	3.436541	9.625728	-0.165887	-0.133549	8.841959e+01	-0.348165	0.099525
	Available Extra Rooms in Hospital	4.572484e+03	-0.601495	-0.165887	1.364824	-0.118145	4.085839e+01	-0.052888	0.199302
	Bed Grade	1.099486e+03	-0.103518	-0.133549	-0.118145	0.762113	5.462883e+01	-0.033075	0.156962
	patientid	-1.448898e+07	7.5114364	88.419578	40.858395	54.528834	1.482478e+09	355.72931	-3.620715e+04
	City_Code_Patient	2.803686e+04	-0.627298	-0.348165	-0.052888	-0.033075	3.557299e+02	22.197075	-0.099496
	Visitors with Patient	2.122606e+02	-0.434073	0.099525	0.199302	0.136982	4.815764e+02	-0.099496	3.111913
	Admission_Deposit	-4.592730e+08	4.26413524	-116.175038	-182.482676	70.040518	-3.620715e+04	131.273639	-288.256879

```
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()
```