

## AUTOMATIC SNAG DISPOSITION USING MACHINE LEARNING ALGORITHMS

Problem Statement : To Design and Develop a Machine Learning Model using Machine Learning Algorithms like Multinomial Naive Bayes, Support Vector Machine, for the prediction of Snag Disposition based on SQMS (SNAG & QUERY MANAGEMENT SYSTEM) dataset. The live Snags taken for the validation of model.

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

import numpy as np
import pandas as pd

import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.naive_bayes import MultinomialNB
from sklearn.naive_bayes import BernoulliNB
from sklearn import model_selection, svm
from sklearn.svm import SVC
from sklearn import metrics
from sklearn.metrics import precision_recall_fscore_support as score
from sklearn.metrics import accuracy_score, precision_score,
recall_score, confusion_matrix, classification_report
from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import KFold, GridSearchCV

df=pd.read_csv("e:\\snag.csv",encoding='ANSI')
pd.set_option('display.max_columns',None)
df.head()
```

	Unnamed: 0	SNAG_ID	ACNO	INSP_NAME
SHOP \				
0	0	009/01009	-	100376 (A A KULKARNI)
9				
1	1	009/01010	-	15530 (RAVINDRA DATTU PAWAR)
9				
2	2	094/01002	SB-188	16528 (ADITYA SANJEEV JOGLEKAR)
94				
3	3	094/01005	SB-187	16364 (SHANKAR BHAUSAHEB DHANAIT)
94				
4	4	009/01026	-	15530 (RAVINDRA DATTU PAWAR)
9				
		INSP_STAGE	SNAG_DATE \	
0		Before Anodising	2-Mar-13	

1	Before Anodising	4-Mar-13
2	Installation	8-Mar-13
3	Injig	9-Mar-13
4	Before Heat Treatment	12-Mar-13

	SNAG_DESC	SNAG_STROKE
\		
0 (I) IN PARTS 11.0790.I.122.900;123.900;124.90...		Operators Fault
1 TOOL MARK NOTICED ON PART NO;11.2010.2.002.002...		Operators Fault
2 During leading edge assembly(11.2010.2.000.901...		Miscellaneous
3 52nd LH wing;DRG.11.2000.2.000.000 After insta...		Miscellaneous
4 As per main view of drg. gap noticed due to la...		Material fault

TASK_NO \	ENGR_FLAG	PART_NO
0 14043 (GAURAV KUMAR SINGH )		R0790.009.002
-		
1 16030 (KESHAVE PRASAD DWIVEDI)		R2010.009.002
-		
2 13304 (ALOK KUMAR SINGH)		- SU30-94-466-
3510401		
3 15028 (RAKESH KUMAR)		- SU30-94-382-
3420401		
4 14044 (HEMANT N SAWANA )		E10.0200.0019.002
-		

SYSTEM	SUB_SYSTEM	PROJECT	CLOSE_DATE	\
0	-	-	-	26-Jun-20
1	-	-	-	15-Apr-13
2	-	-	SU30	-
3	-	-	SU30	10-Jun-13
4	-	-	-	15-Apr-13

Disposition	Forward Date
Disp Date \	
0 acceptable to design	4-Mar-13 12-Mar-13
1 suit the part 11.2010.2.002.002 with 11.2010....	5-Mar-13 25-Mar-13
2 it is allowed to file and merge the step.apply...	13-Mar-13 14-Mar-13
3 install shim between the flanges of wall-3 roo...	13-Mar-13 22-Mar-13
4 not acceptable to design	4-Apr-13 4-

Apr-13

```
          DWG_NO
0          NaN
1  11.2010.2.002.002
2  11.2010.2.000.901
3  11.2000.2.000.000
4          NaN
```

## Inspecting the DataFrame

`df.shape`

```
(10000, 20)
```

`df.describe()`

```
      Unnamed: 0
count  10000.00000
mean    4999.50000
std     2886.89568
min       0.00000
25%    2499.75000
50%    4999.50000
75%    7499.25000
max     9999.00000
```

`df.info()`

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10000 entries, 0 to 9999
Data columns (total 20 columns):
#   Column                Non-Null Count  Dtype
---  -
0   Unnamed: 0            10000 non-null  int64
1   SNAG_ID               10000 non-null  object
2   ACNO                 9995 non-null   object
3   INSP_NAME            10000 non-null  object
4   SHOP                 10000 non-null  object
5   INSP_STAGE           10000 non-null  object
6   SNAG_DATE            10000 non-null  object
7   SNAG_DESC            10000 non-null  object
8   SNAG_STROKE          10000 non-null  object
9   ENGR_FLAG            10000 non-null  object
10  PART_NO              10000 non-null  object
11  TASK_NO              9995 non-null   object
12  SYSTEM              9995 non-null   object
13  SUB_SYSTEM          9995 non-null   object
14  PROJECT              8549 non-null   object
15  CLOSE_DATE          10000 non-null  object
16  DISPOSITION          9999 non-null   object
```

```

17 Forward Date 10000 non-null object
18 Disp Date    10000 non-null object
19 DWG_NO       3200 non-null  object
dtypes: int64(1), object(19)
memory usage: 1.5+ MB

```

```
df.isnull().sum()
```

```

Unnamed: 0      0
SNAG_ID         0
ACNO            5
INSP_NAME       0
SHOP            0
INSP_STAGE      0
SNAG_DATE       0
SNAG_DESC       0
SNAG_STROKE     0
ENGR_FLAG       0
PART_NO         0
TASK_NO         5
SYSTEM          5
SUB_SYSTEM      5
PROJECT        1451
CLOSE_DATE      0
DISPOSITION     1
Forward Date    0
Disp Date       0
DWG_NO          6800
dtype: int64

```

The Above Analysis Porovides the Idea about the missing values in the DataFrame

```
df.isnull()
```

```

      Unnamed: 0  SNAG_ID  ACNO  INSP_NAME  SHOP  INSP_STAGE
SNAG_DATE \
0      False      False  False      False  False      False
False
1      False      False  False      False  False      False
False
2      False      False  False      False  False      False
False
3      False      False  False      False  False      False
False
4      False      False  False      False  False      False
False
...           ...      ...      ...      ...      ...
...
9995      False      False  False      False  False      False
False
9996      False      False  False      False  False      False

```

False						
9997	False	False	False	False	False	False
False						
9998	False	False	False	False	False	False
False						
9999	False	False	False	False	False	False
False						

	SNAG_DESC	SNAG_STROKE	ENGR_FLAG	PART_NO	TASK_NO	SYSTEM
SUB_SYSTEM \						
0	False	False	False	False	False	False
False						
1	False	False	False	False	False	False
False						
2	False	False	False	False	False	False
False						
3	False	False	False	False	False	False
False						
4	False	False	False	False	False	False
False						
...	...	...	...	...	...	...
...						
9995	False	False	False	False	False	False
False						
9996	False	False	False	False	False	False
False						
9997	False	False	False	False	False	False
False						
9998	False	False	False	False	False	False
False						
9999	False	False	False	False	False	False
False						

	PROJECT	CLOSE_DATE	DISPOSITION	Forward Date	Disp Date
DWG_NO					
0	False	False	False	False	False
True					
1	False	False	False	False	False
False					
2	False	False	False	False	False
False					
3	False	False	False	False	False
False					
4	False	False	False	False	False
True					
...	...	...	...	...	...
.					..
9995	True	False	False	False	False
True					
9996	True	False	False	False	False

True					
9997	False	False	False	False	False
True					
9998	False	False	False	False	False
True					
9999	False	False	False	False	False
True					

[10000 rows x 20 columns]

## Analysing the Given Data

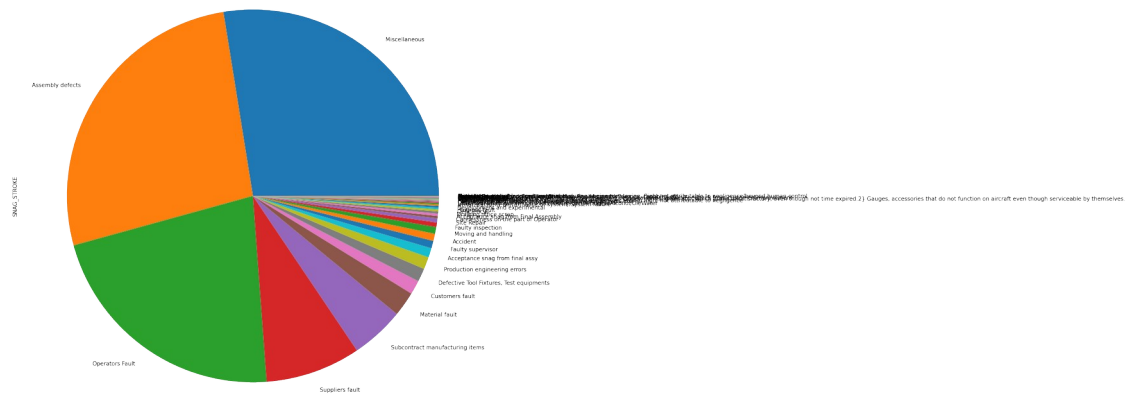
```
df_categorical=df.select_dtypes(include=['object'])
print("This Shows the data which is not known or not given ")
df_categorical.apply(lambda x:x=='-',axis=0).sum()
```

This Shows the data which is not known or not given

```
SNAG_ID          0
ACNO             3348
INSP_NAME        28
SHOP             0
INSP_STAGE       273
SNAG_DATE        0
SNAG_DESC        0
SNAG_STROKE      13
ENGR_FLAG        962
PART_NO          6886
TASK_NO          4494
SYSTEM           9632
SUB_SYSTEM       9635
PROJECT          1608
CLOSE_DATE       3447
DISPOSITION      112
Forward Date     997
Disp Date        123
DWG_NO           0
dtype: int64
```

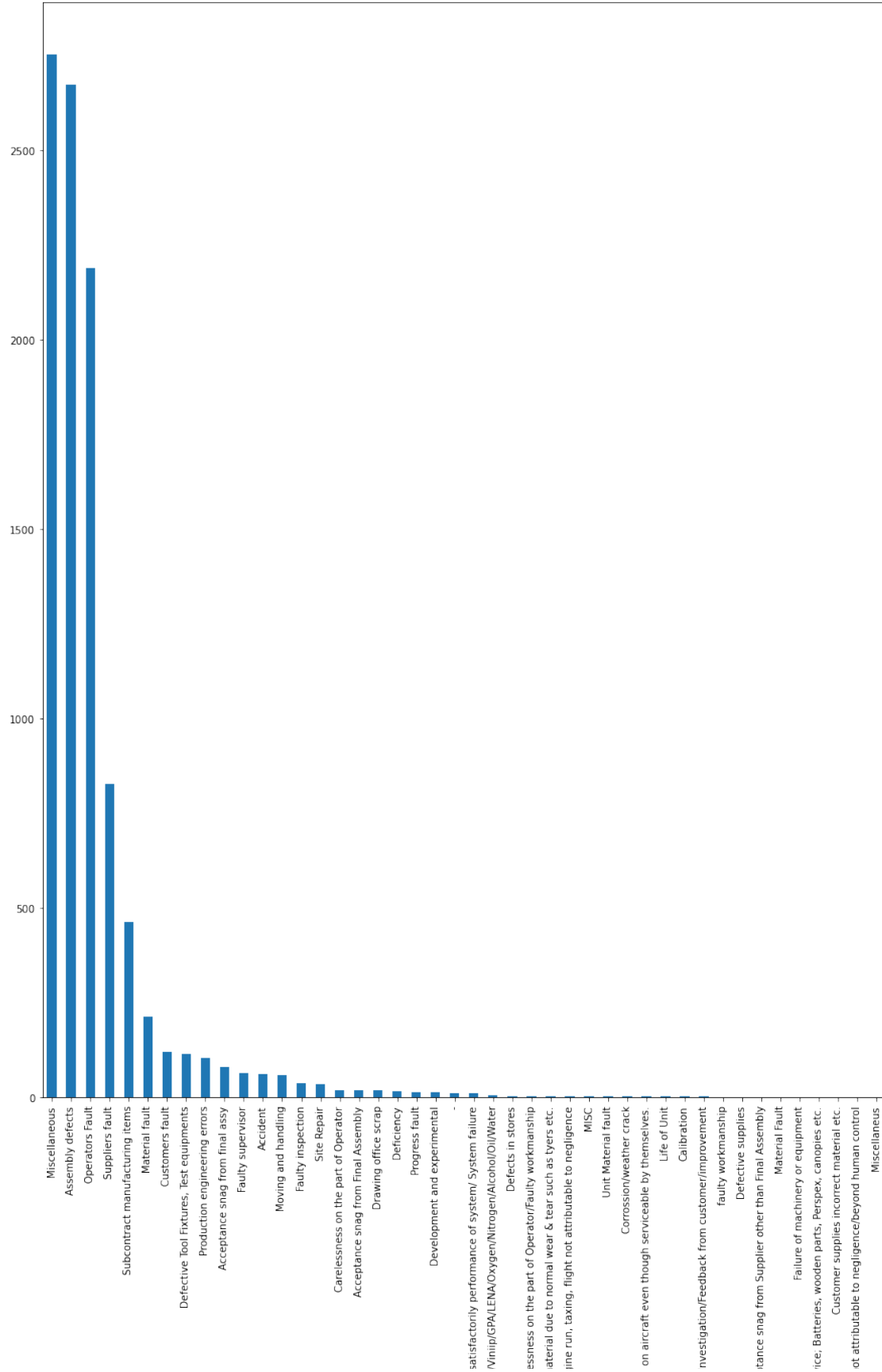
```
df['SNAG_STROKE'].value_counts().plot.pie()
plt.figure(figsize=(20,20))
print("Analysis of SNAG_STROKE observed ")
plt.show()
```

Analysis of SNAG\_STROKE observed



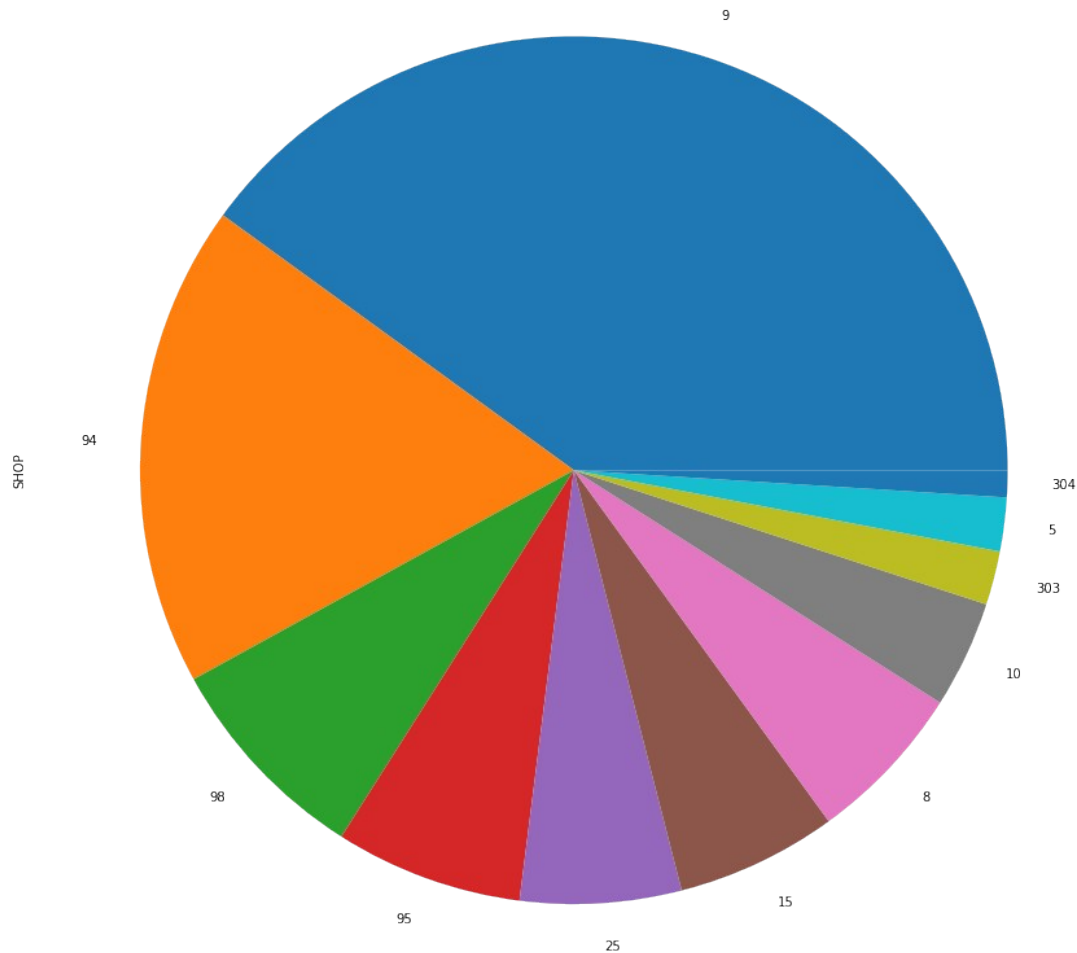
<Figure size 1440x1440 with 0 Axes>

```
df['SNAG_STROKE'].value_counts().plot.bar()
plt.figure(figsize=(30,20))
plt.show()
```

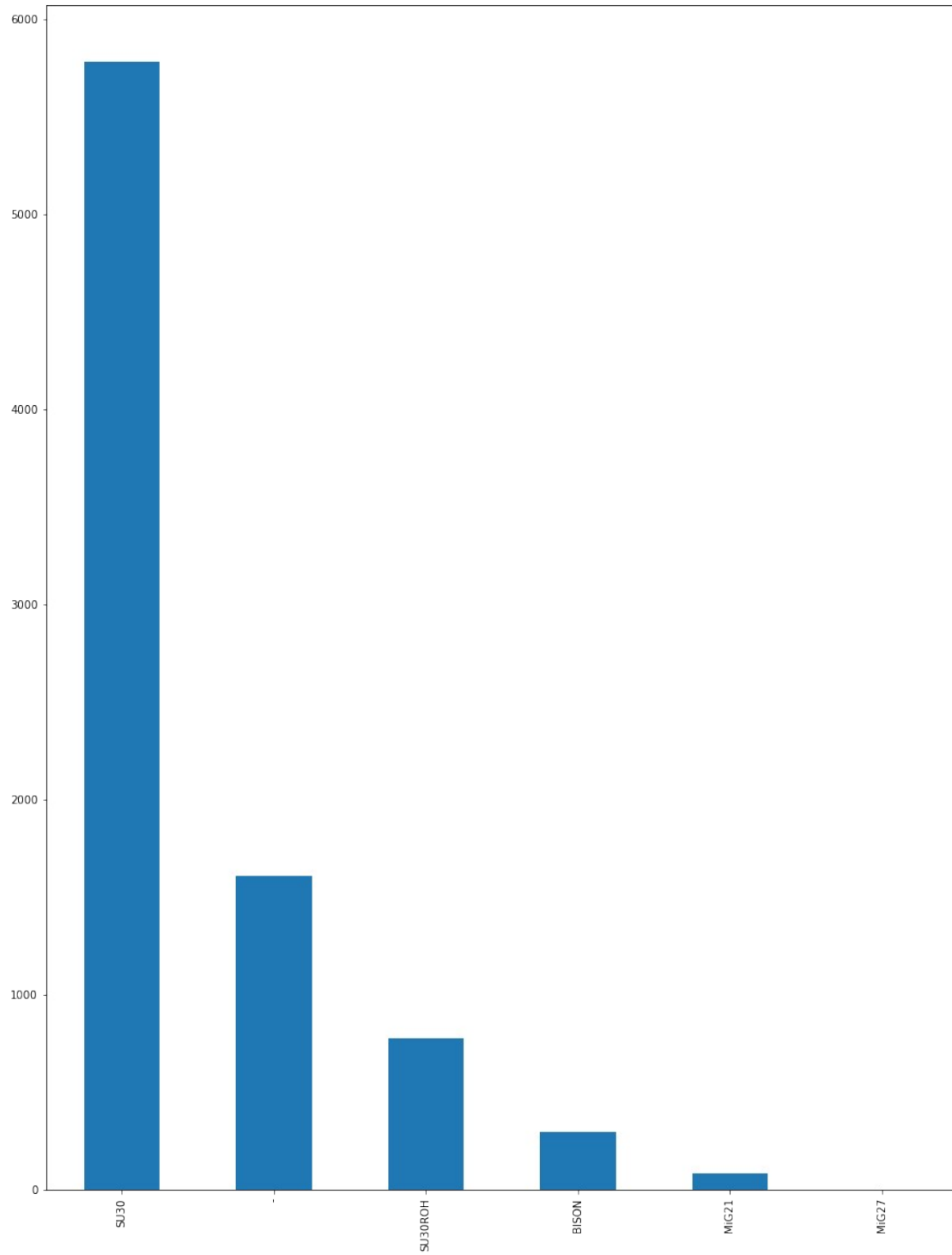




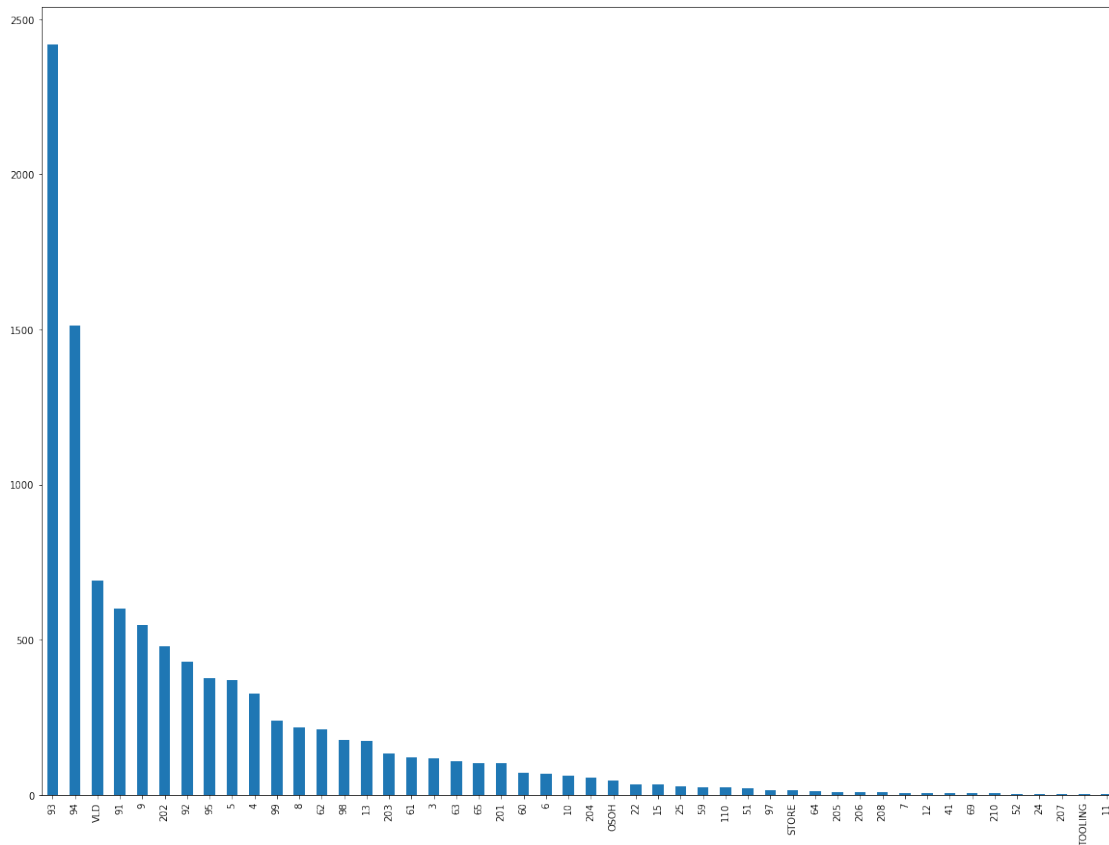
```
<Figure size 2160x1440 with 0 Axes>  
df['SHOP'].head(100).value_counts().plot.pie()  
<AxesSubplot:ylabel='SHOP'>
```



```
df['PROJECT'].value_counts().plot.bar()  
plt.rcParams['figure.figsize']=(20,15)  
plt.show()
```

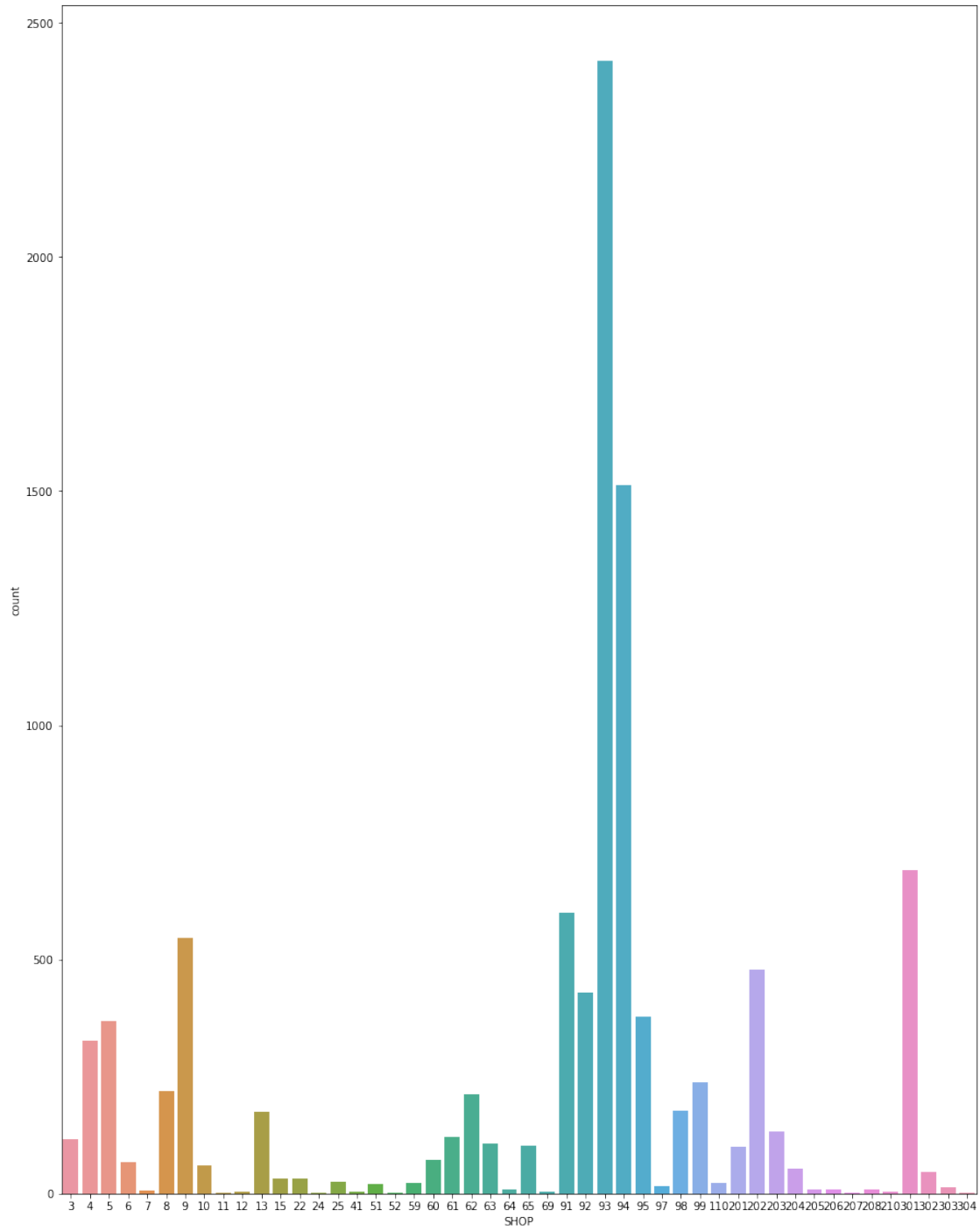


```
df['SHOP'].value_counts().plot.bar()  
plt.rcParams['figure.figsize']=(20,15)  
plt.show()
```

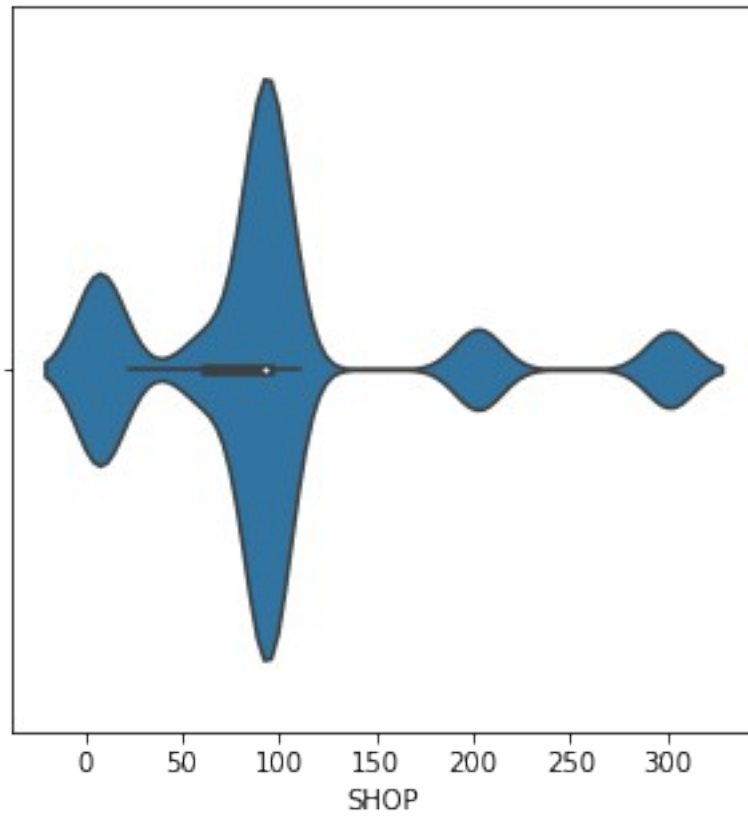


```
df['SHOP']=df['SHOP'].astype(str)
df['SHOP']=df['SHOP'].str.replace('VLD','301')
df['SHOP']=df['SHOP'].str.replace('OSOH','302')
df['SHOP']=df['SHOP'].str.replace('STORE','303')
df['SHOP']=df['SHOP'].str.replace('TOOLING','304')
df['SHOP']=df['SHOP'].astype(int)
```

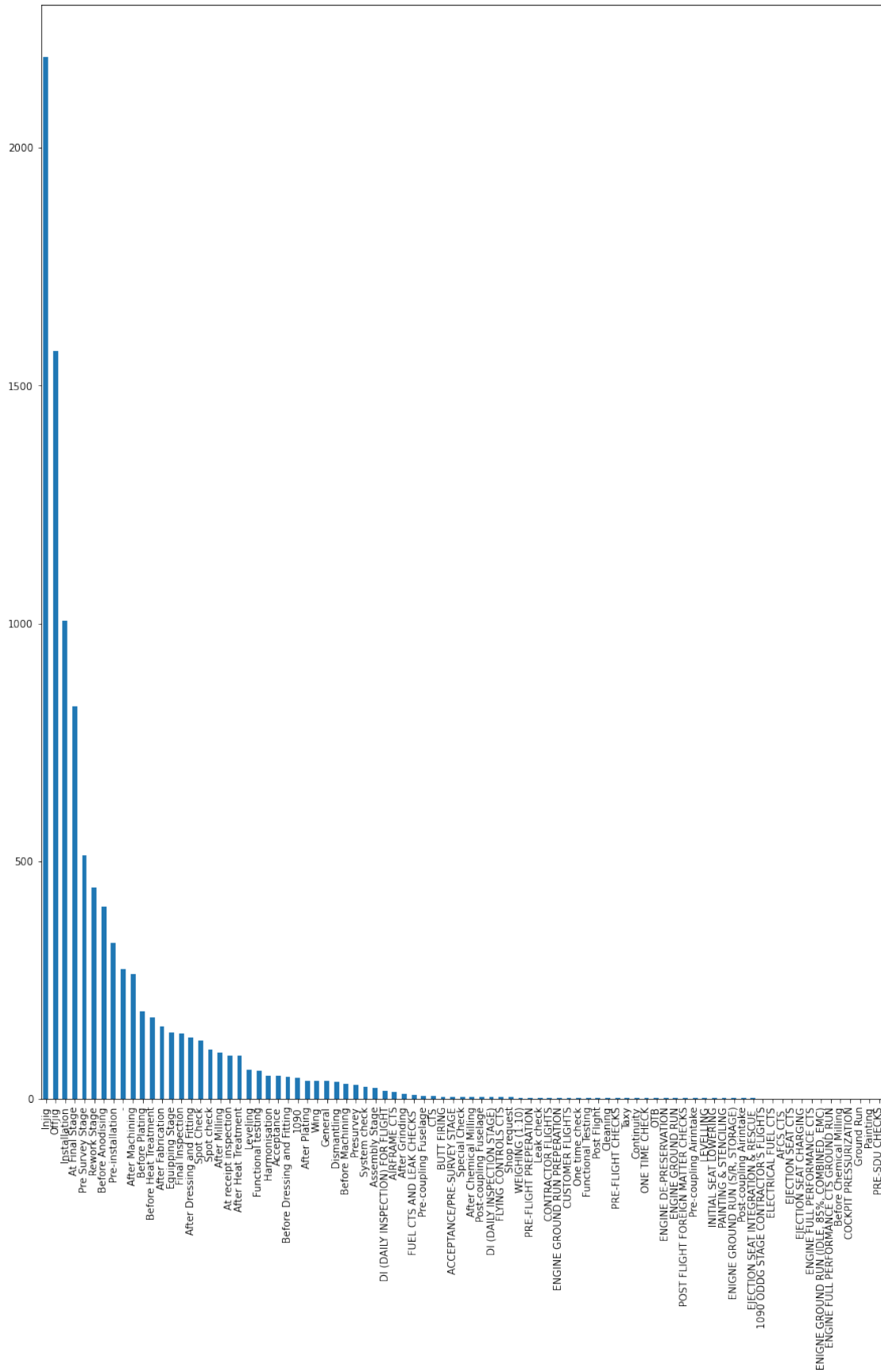
```
plt.rcParams['figure.figsize']=(15,20)
ax=sns.countplot(x=df['SHOP'])
```



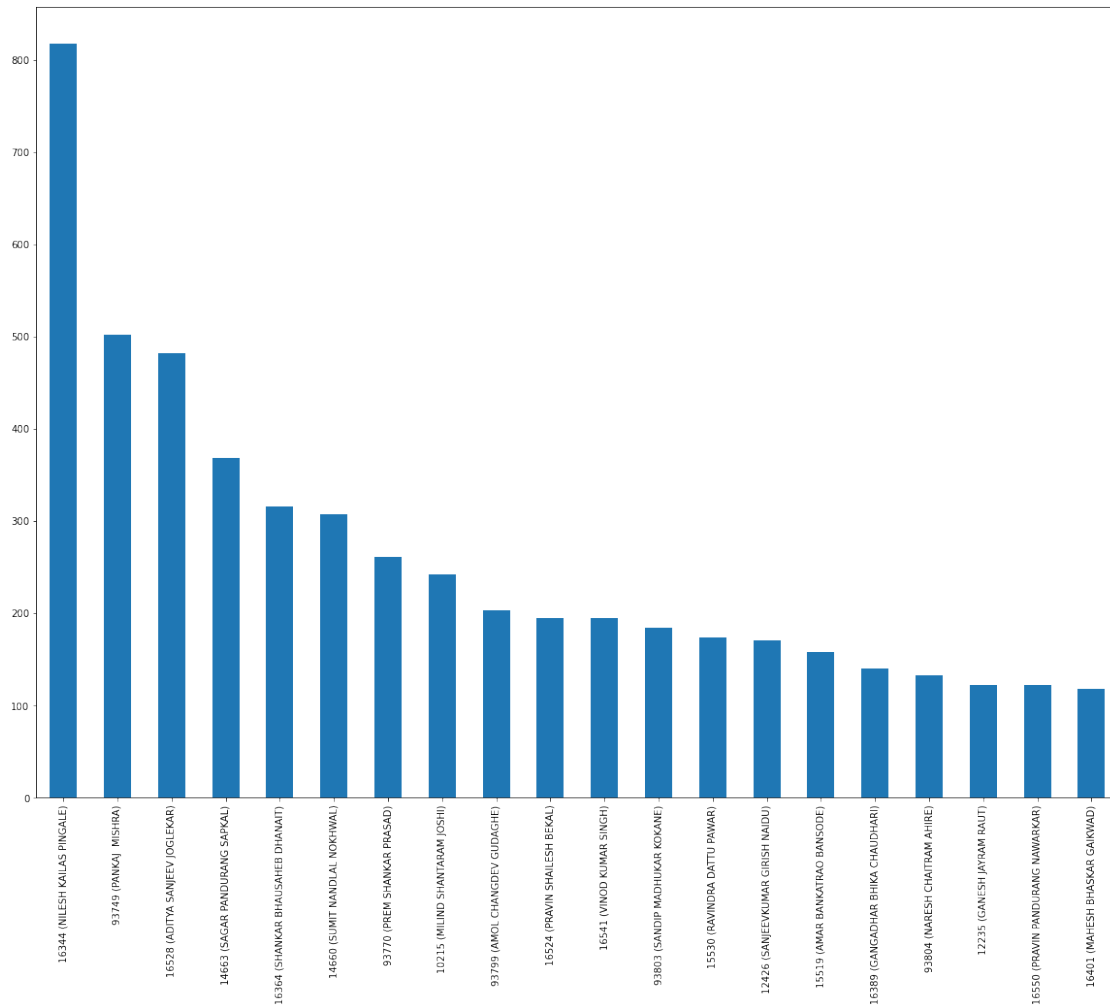
```
ax=sns.violinplot(x=df['SHOP'])  
plt.rcParams['figure.figsize']=(5,5)
```



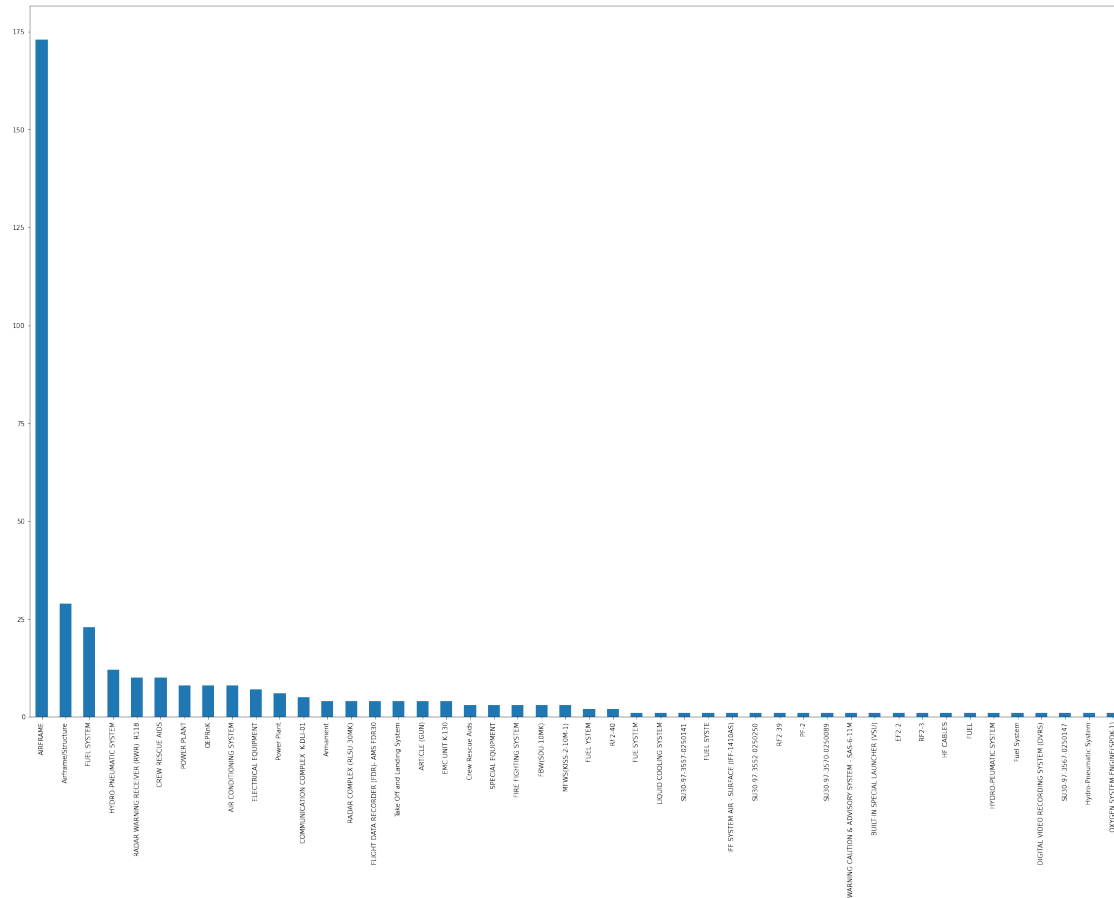
```
df['INSP_STAGE'].value_counts().plot.bar()  
plt.rcParams['figure.figsize']=(20,15)  
plt.show()
```



```
df['INSP_NAME'].value_counts()[0:20].plot.bar()
plt.rcParams['figure.figsize']=(30,20)
plt.show()
```



```
df['SYSTEM'].value_counts()[1:].plot.bar()
plt.rcParams['figure.figsize']=(30,20)
plt.show()
```



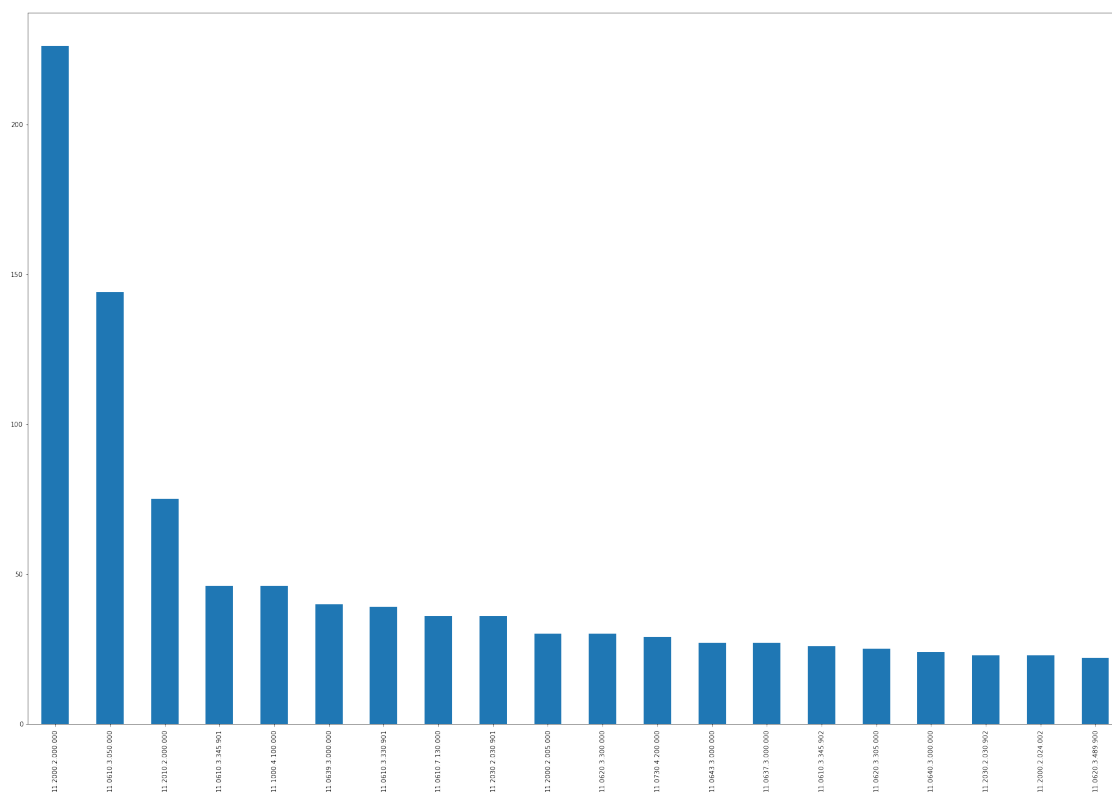
```
df['SYSTEM'].value_counts()
```

```
-
AIRFRAME                                     9632
Airframe/Structure                          173
FUEL SYSTEM                                 29
HYDRO-PNEUMATIC SYSTEM                     23
RADAR WARNING RECEIVER (RWR) R118          12
CREW RESCUE AIDS                           10
POWER PLANT                                10
OEPRnK                                     8
AIR CONDITIONING SYSTEM                     8
ELECTRICAL EQUIPMENT                       8
Power Plant                               7
COMMUNICATION COMPLEX K-DLI-01              6
Armament                                   5
RADAR COMPLEX (RLSU-30MK)                  4
FLIGHT DATA RECORDER (FDR)- AMS FDR30     4
Take Off and Landing System                 4
ARTICLE (GUN)                              4
EMC UNIT K-130                             4
Crew Rescue Aids                           3
SPECIAL EQUIPMENT                          3
```



FIRE FIGHTING SYSTEM	3
FBW(SDU-10MK)	3
MFWS(KISS-2-10M-1)	3
FUEL YSTEM	2
RF2-40	2
FUE SYSTEM	1
LIQUID COOLING SYSTEM	1
SU30-97-3557-0250141	1
FUEL SYSTE	1
IFF SYSTEM AIR - SURFACE (IFF-1410AS)	1
SU30-97-3552-0250250	1
RF2-39	1
PF-2	1
SU30-97-3570-0250089	1
WARNING CAUTION & ADVISORY SYSTEM - SAS-6-11M	1
BUILT-IN SPECIAL LAUNCHER (VSU)	1
EF2-2	1
RF2-3	1
HF CABLES	1
FUEL	1
HYDRO-PEUMATIC SYSTEM	1
Fuel System	1
DIGITAL VIDEO RECORDING SYSTEM (DVRS)	1
SU30-97-3567-0250147	1
Hydro-Pneumatic System	1
OXYGEN SYSTEM-ENGINE(SPDK-1)	1
Name: SYSTEM, dtype: int64	

```
df['DWG_NO'].value_counts()[0:20].plot.bar()
plt.rcParams['figure.figsize']=(30,20)
plt.show()
```



## Data Preparation

```
df['DWG_NO'].value_counts()
```

```
11.2000.2.000.000    226
11.0610.3.050.000    144
11.2010.2.000.000     75
11.0610.3.345.901     46
11.1000.4.100.000     46
```

```
...
11.0740.4.105.000      1
11.1005.7.004.900      1
11.0205.1.805.041      1
11.6130.0.200.000      1
11.0446.3.050.000      1
```

```
Name: DWG_NO, Length: 964, dtype: int64
```

```
df['DISPOSITION'].value_counts()
```

```
acceptable to design
1282
```

```
not acceptable to design
179
```

```
-
```

```
112
```

```
refer the attachment.
```

42  
please refer the attachment  
32

```
...
replace angle 11.0670.i.200.398 with new one removing gap of 1.5mm
1
acceptable to design with following. open out the snagged hole of all
part to dia 14.4h8. fabricate & install axle 11.4210.i.022.900 of
dia.14.4u8 in place of dia 14u8 all other dimensions & requirements as
per dwg. 11.4210.i.022.900 1
1. replace part 11.0620.i.955.022 with new one.\n2. capa to be raised
by respective outsourcing shop.
1
reject\n- disposition from russian side.
1
replace affected anchor nut with new one. restore sealing as per
drawing & instruction. check for absense of fod inside fuel
tank.remove all the traces of damaged parts/sealing compound. carry
out testing as per task no.su30-93-2376-2904062. 1
Name: DISPOSITION, Length: 7389, dtype: int64
```

```
df['DISPOSITION']=df['DISPOSITION'].str.lower()
```

```
df['DISPOSITION']=df['DISPOSITION'].str.replace('refer the
attachment.','refer the attachment')
df['DISPOSITION']=df['DISPOSITION'].str.replace('please refer the
attachment','refer the attachment')
df['DISPOSITION']=df['DISPOSITION'].str.replace('referred not
acceptable to design.','not acceptable to design')
df['DISPOSITION']=df['DISPOSITION'].str.replace('rework carried out by
shop is acceptable to design.','acceptable to design')
```

```
df['DISPOSITION'].value_counts()/len(df.index)*100
```

```
acceptable to design
12.82
not acceptable to design
1.79
-
1.12
refer the attachment
0.88
referred not acceptable to design
0.21
```

```
...
1.\tit is allowed to rework by cutting 100mm(approx) from t piece
along the pipe e10.5303.i070.013. manufacture new pipe
e10.5303.i070.013 . soldering ring (10sv-0141-00) 28.0010.0.141.001
```

and adaptor 6 ost1.11392-73.\n2 \tcoat ends of pipes along external diameter by nickel plating 6...9 microns as per pi 1.4.934-81.\n3.\n\tcarryout soldering of pipeel0.5303.i070.013 to pipe from t piece with the help of soldering ring (10sv-0141-00) 28.0010.0.141.001 and adaptor 6 ost1.11392-73. as per master and technology.\n 0.01 carryout rework as follows- ream the affected hole (01 no.) on lower panel to dia. 8h7 and install press fit bush 2-6-8-4 chem. pass. ost1 11120-73. install fasteners as per drawing.

0.01

maintain radius as per dwg

0.01

for snag point 1\n1. fabricate suit and install l profile made locally of v95 pcht2 sht. 1.5mm \n2. install the profile meeting assembly requirements maintaining ed as per standards.\nfor snag point 2\n\nacceptable to design

0.01

acceptable to designreplace existing rivets by higher size rivet 4-l-ost1 34075-85 (03 nos.).\nnpp/qc to give feedback to concerned shop in order to avoid recurrence of similar problem in future batch.

0.01

Name: DISPOSITION, Length: 7386, dtype: float64

df['SNAG\_STROKE'].value\_counts()/len(df.index)\*100

Miscellaneous

27.54

Assembly defects

26.74

Operators Fault

21.90

Suppliers fault

8.27

Subcontract manufacturing items

4.63

Material fault

2.15

Customers fault

1.21

Defective Tool Fixtures, Test equipments

1.16

Production engineering errors

1.06

Acceptance snag from final assy

0.81

Faulty supervisor

0.65

Accident

0.62

Moving and handling

0.59

Faulty inspection

0.39  
Site Repair  
0.36  
Acceptance snag from Final Assembly  
0.20  
Carelessness on the part of Operator  
0.20  
Drawing office scrap  
0.19  
Deficiency  
0.18  
Progress fault  
0.15  
Development and experimental  
0.15  
-  
0.13  
Unsatisfactorily performance of system/ System failure  
0.11  
Leak Hydraulic/Fuel/Viniip/GPA/LENA/Oxygen/Nitrogen/Alcohol/Oil/Water  
0.07  
Failure of material due to normal wear & tear such as tyers etc.  
0.05  
Carelessness on the part of Operator/Faulty workmanship  
0.05  
Accident to aircraft/engine/components during engine run, taxing,  
flight not attributable to negligence  
0.05  
Defects in stores  
0.05  
MISC  
0.04  
Life of Unit  
0.03  
Check inrtroduced based on recommenndatios of SSC/IAF/Technical  
Investigation/Feedback from customer/improvement  
0.03  
Unit Material fault  
0.03  
Corrossion/weather crack  
0.03  
Unsatisfactorily performance even through serviceable: 1} Dopes,  
paints, glues etc., which prove unsatisfactory, even though not time  
expired.2} Gauges, accessories that do not function on aircraft even  
though serviceable by themselves. 0.03  
Calibration  
0.03  
Acceptance snag from Supplier other than Final Assembly  
0.02  
faulty workmanship

```

0.02
Defective supplies
0.02
Natural deterioration in service; Batteries, wooden parts, Perspex,
canopies etc.
0.01
Miscellaneous
0.01
Failure of machinery or equipment
0.01
Customer supplies incorrect material etc.
0.01
Accident to aircraft/engine/components during engine run, taxing,
flight not attributable to negligence/beyond human control
0.01
Material Fault
0.01
Name: SNAG_STROKE, dtype: float64

```

```

def log(string):
    display(Markdown("> <span
style='color:orange'>" + string + "</span>"))

df['SNAG_STROKE']=df['SNAG_STROKE'].str.replace('Miscellaneous',
'Miscelleneous')
df['SNAG_STROKE']=df['SNAG_STROKE'].str.replace('Material fault',
'Material Fault')

df['Status']=df['Unnamed: 0']
df.head(50)

```

	Unnamed: 0	SNAG_ID	ACNO	
INSP_NAME	SHOP	\		
0	0	009/01009	-	100376 (A A
KULKARNI)	9			
1	1	009/01010	-	15530 (RAVINDRA DATTU
PAWAR)	9			
2	2	094/01002	SB-188	16528 (ADITYA SANJEEV
JOGLEKAR)	94			
3	3	094/01005	SB-187	16364 (SHANKAR BHAUSAHEB
DHANAIT)	94			
4	4	009/01026	-	15530 (RAVINDRA DATTU
PAWAR)	9			
5	5	094/01012	-	16364 (SHANKAR BHAUSAHEB
DHANAIT)	94			
6	6	098/01006	SB-178	16084 (BIJAY
KUMAR)	98			
7	7	009/01031	-	15530 (RAVINDRA DATTU
PAWAR)	9			
8	8	STORE/01002	-	101257 (Mr. GANESH HIRAMAN
JADHAV)	303			

9	9	094/01017	SB-189	16528 (ADITYA SANJEEV
JOGLEKAR)	94			
10	10	005/01001	-	13962 (SACHIN
BHARGAVA)	5			
11	11	005/01002	-	13962 (SACHIN
BHARGAVA)	5			
12	12	009/01001	-	15530 (RAVINDRA DATTU
PAWAR)	9			
13	13	095/01006	SB-179	15519 (AMAR BANKATRAO
BANSODE)	95			
14	14	009/01037	-	16401 (MAHESH BHASKAR
GAIKWAD)	9			
15	15	009/01038	-	15530 (RAVINDRA DATTU
PAWAR)	9			
16	16	009/01039	-	15530 (RAVINDRA DATTU
PAWAR)	9			
17	17	094/01018	SB-185	13869 (SUMAN LAL
NARETI)	94			
18	18	010/01004	-	11060 (SIBY
THOMAS )	10			
19	19	009/01040	-	100376 (A A
KULKARNI)	9			
20	20	095/01004	SB-179	16541 (VINOD KUMAR
SINGH)	95			
21	21	095/01005	SB-179	16541 (VINOD KUMAR
SINGH)	95			
22	22	009/01008	-	100376 (A A
KULKARNI)	9			
23	23	025/01001	-	15165 (RAKESH KUMAR
SINGH)	25			
24	24	009/01011	-	16401 (MAHESH BHASKAR
GAIKWAD)	9			
25	25	009/01012	-	16401 (MAHESH BHASKAR
GAIKWAD)	9			
26	26	009/01013	-	15530 (RAVINDRA DATTU
PAWAR)	9			
27	27	009/01014	-	15530 (RAVINDRA DATTU
PAWAR)	9			
28	28	009/01015	-	15530 (RAVINDRA DATTU
PAWAR)	9			
29	29	009/01019	-	16401 (MAHESH BHASKAR
GAIKWAD)	9			
30	30	009/01020	-	16401 (MAHESH BHASKAR
GAIKWAD)	9			
31	31	009/01021	-	16401 (MAHESH BHASKAR
GAIKWAD)	9			
32	32	025/01004	-	10165 (RAMESH SHANKARRAO
DESAI)	25			
33	33	008/01001	-	16527 (MANOJ DAMODAR
BHAMARE)	8			

34	34	008/01002	-	15463 (VINAY ARVIND
PATIL)	8			
35	35	015/01004	-	11222 (PRASHANT SUDHAKAR
JOSHI)	15			
36	36	094/01003	-	14663 (SAGAR PANDURANG
SAPKAL)	94			
37	37	015/01005	-	11222 (PRASHANT SUDHAKAR
JOSHI)	15			
38	38	094/01001	SB-178	13869 (SUMAN LAL
NARETI)	94			
39	39	095/01003	SB-179	16541 (VINOD KUMAR
SINGH)	95			
40	40	015/01006	-	11222 (PRASHANT SUDHAKAR
JOSHI)	15			
41	41	009/01023	-	16401 (MAHESH BHASKAR
GAIKWAD)	9			
42	42	STORE/01001	-	101257 (Mr. GANESH HIRAMAN
JADHAV)	303			
43	43	098/01001	SB-110	16084 (BIJAY
KUMAR)	98			
44	44	098/01003	SB-110	16084 (BIJAY
KUMAR)	98			
45	45	098/01004	SB-110	16084 (BIJAY
KUMAR)	98			
46	46	098/01005	SB-110	16084 (BIJAY
KUMAR)	98			
47	47	010/01001	-	11318 (SANJAY DAGADU
DHOLE)	10			
48	48	010/01002	-	11318 (SANJAY DAGADU
DHOLE)	10			
49	49	010/01003	-	11318 (SANJAY DAGADU
DHOLE)	10			

	INSP_STAGE	SNAG_DATE \
0	Before Anodising	2-Mar-13
1	Before Anodising	4-Mar-13
2	Installation	8-Mar-13
3	Injig	9-Mar-13
4	Before Heat Treatment	12-Mar-13
5	Injig	12-Mar-13
6	Installation	14-Mar-13
7	At Final Stage	15-Mar-13
8	At receipt inspection	19-Mar-13
9	Pre-installation	19-Mar-13
10	After Plating	20-Mar-13
11	-	20-Mar-13
12	After Machining	2-Mar-13
13	Offjig	2-Mar-13
14	At Final Stage	20-Mar-13
15	Before Anodising	20-Mar-13



16	At Final Stage	20-Mar-13
17	Offjig	20-Mar-13
18	At Final Stage	21-Mar-13
19	At Final Stage	21-Mar-13
20	Offjig	1-Mar-13
21	Offjig	1-Mar-13
22	Before Anodising	2-Mar-13
23	After Milling	5-Mar-13
24	After Milling	5-Mar-13
25	After Milling	5-Mar-13
26	Before Anodising	5-Mar-13
27	Before Anodising	5-Mar-13
28	Before Anodising	5-Mar-13
29	After Milling	7-Mar-13
30	After Milling	7-Mar-13
31	After Machining	7-Mar-13
32	Before Anodising	7-Mar-13
33	After Plating	8-Mar-13
34	At Final Stage	9-Mar-13
35	After Fabrication	9-Mar-13
36	Injig	9-Mar-13
37	After Machining	9-Mar-13
38	Installation	28-Feb-13
39	Spot check	1-Mar-13
40	After Machining	9-Mar-13
41	After Machining	9-Mar-13
42	At receipt inspection	9-Mar-13
43	System check	9-Mar-13
44	Installation	9-Mar-13
45	Installation	9-Mar-13
46	Installation	9-Mar-13
47	Before Plating	11-Mar-13
48	Before Plating	11-Mar-13
49	Before Plating	11-Mar-13

# SNAG\_DESC \

0	(I) IN PARTS 11.0790.I.122.900;123.900;124.90...
1	TOOL MARK NOTICED ON PART NO;11.2010.2.002.002...
2	During leading edge assembly(11.2010.2.000.901...
3	52nd LH wing;DRG.11.2000.2.000.000 After insta...
4	As per main view of drg. gap noticed due to la...
5	52nd RH wing Drg.11.2000.2.000.000 After insta...
6	Dent/Tool mark observed in PVD pipe line 11.77...
7	As per technology length 1000+3.0mm tech. allo...
8	Material cotton fabric 1200 mm from M/S Urja p...
9	After preliminary installation of diaphragms(1...
10	SCRATCHES NOTICED AT BOTH THE END PIECES AFTER...
11	LEAK IS NOTICED THROUGH A CRACK ON THE CENTRAL...
12	In sectional side view at zone 2B; hieght of b...
13	During installation of dummy lock of retracted...

14 REF. VIEW A ; AS PER NOTE 3\*45 DEGREE CHAMFER...  
 15 TOOLMARK NOTICED ON THRED M4-5H6H UPTO WIDTH 1...  
 16 SLOT CENTER 9.0MM MEASURES 7.65 TO 8.1. REFER ...  
 17 During preliminary suiting of flaperon on wing...  
 18 PLAY OF MACHANICAL LOCK WITH PR. OF +/-200 KGF...  
 19 AFTER ASSY OF PART 30.5200.8277 &8276 &OTHER P...  
 20 during matching and suiting of panel 11.0670....  
 21 During matching of hatch cover 11.0250.i.140.0...  
 22 1) ED 10 MM FOR PART 11.0720.4.006.002 MEASURE...  
 23 Refer PS30L-3611-009; Web Thk. 2.9mm measures ...  
 24 AS PER TEMPLATE ANGLE 53 MINUTES NOTICE OPEN I...  
 25 AS PER TEMPLATE ANGLE 53 MINUTES NOTICE OPEN I...  
 26 \*SNAG 1)DIMN.13MM MEASURES 10.9 TO 12.4MM. SR....  
 27 \*SNAG 1)Dimension13.0MM measures 10.9 TO 12.4M...  
 28 Snag 1) Dimn 13 mm measures 10.9 to 12.4mm in ...  
 29 REF. SECTION A-A DIM. 40 +\_ 0.2MM NOTICED 40.50MM  
 30 REF. SECTION A-A DIM. 40 +\_ 0.2MM NOTICED 40.60MM  
 31 REF. SKETCH DIA. 2.7MM ADDITIONAL HOLE NOTICED...  
 32 Ref. view K2(16B);Hole Dia.2.7mm drilled at di...  
 33 IN ONE HOLE NOGO OF DIA 16H9 PASSES FREELY UP ...  
 34 1 MM THICKNESS O D 65 MM I D 40 MM WASHER OF M...  
 35 CRACK NOTICED AT THE SPECES GIVEN IN SKETCHES ...  
 36 Drawing No;- 11.2000.2.000.000 Sheet-3 Zone=-4...  
 37 CRACK NOTICED ON CASTING ( 11.0710.1.008.000) ...  
 38 ADDDDDDDDDDDDDDDD  
 39 During spot check crack of 20 mm in length obs...  
 40 CRACK NOTICED ON CASTING ( 11.0710.1.008.000) ...  
 41 REF. SECTION V-V DIA. 4H7 MM HOLE NOGO PLAIN P...  
 42 tested vide MTR/IB/12/180 found satisfactory e...  
 43 DURING RWR SYSTEM CHECK RFU-3 & RFU-4 L BAND P...  
 44 INSTALLED(FOUND) ON AIRCRAFT SB-110;\n1-P19-P1...  
 45 INSTALLED(FOUND) ON AIRCRAFT SB-110;\n1-P19-P1...  
 46 INSTALLED(FOUND) ON AIRCRAFT SB-110;\n1-P19-P1...  
 47 WHILE TURNING TECH. CENTRE ; LUG DIA 22.00F7 H...  
 48 WHILE TURNING TECH. CENTRE ; LUG DIA 22.00F7 H...  
 49 WHILE TURNING TECH. CENTRE ; LUG DIA 22.00F7 H...

	SNAG_STROKE \
0	Operators Fault
1	Operators Fault
2	Miscellaneous
3	Miscellaneous
4	Material Fault
5	Miscellaneous
6	Operators Fault
7	Operators Fault
8	Material Fault
9	Suppliers fault
10	Moving and handling
11	Miscellaneous

12	Operators Fault
13	Suppliers fault
14	Operators Fault
15	Operators Fault
16	Operators Fault
17	Miscellaneous
18	Customers fault
19	Operators Fault
20	Suppliers fault
21	Assembly defects
22	Operators Fault
23	Defective Tool Fixtures, Test equipments
24	Operators Fault
25	Operators Fault
26	Operators Fault
27	Operators Fault
28	Operators Fault
29	Operators Fault
30	Operators Fault
31	Operators Fault
32	Operators Fault
33	Operators Fault
34	Assembly defects
35	Material Fault
36	Suppliers fault
37	Material Fault
38	Customers fault
39	Moving and handling
40	Material Fault
41	Operators Fault
42	Material Fault
43	Miscellaneous
44	Miscellaneous
45	Miscellaneous
46	Customers fault
47	Operators Fault
48	Operators Fault
49	Operators Fault

	ENGR_FLAG	PART_NO \
0	14043 (GAURAV KUMAR SINGH )	R0790.009.002
1	16030 (KESHAVE PRASAD DWIVEDI)	R2010.009.002
2	13304 (ALOK KUMAR SINGH)	-
3	15028 (RAKESH KUMAR)	-
4	14044 (HEMANT N SAWANA )	E10.0200.0019.002
5	13312 (VISHAL YASHWANT DONGARE)	-
6	14380 (SUMIT DIXIT )	-
7	14044 (HEMANT N SAWANA )	11.0610.3.160.018
8	103860 (Mr. BHAGIRATH LAL MEENA)	8.44511E+11
9	13304 (ALOK KUMAR SINGH)	-

10	13606 (NILMANI KUMAR )	11.6150.I.810.901
11	10379 (CHANDRASHEKHAR SOMAJI HIREKAN)	2.11.5305.8300.91
12	12143 (CHANDRASHEKHAR SHASHIKANT BHAMARE)	11.6800.3.916.900
13	13952 (SUNIL BHARTIYA )	-
14	13392 (C V N V KIRAN KAMUJU)	11.0610.3.114.004
15	14044 (HEMANT N SAWANA )	R6400.010.001
16	14044 (HEMANT N SAWANA )	11.5309.I.838.900
17	14034 (NIRMAL KUMAR )	-
18	13727 (MOHAN LAL GUPTA )	2.25.5306.0000.91
19	14043 (GAURAV KUMAR SINGH )	R5200.009.001
20	14035 (PAWAN KUMAR )	-
21	14035 (PAWAN KUMAR )	-
22	14043 (GAURAV KUMAR SINGH )	R0720.009.001
23	104208 (Mr. MOOL CHAND GUPTA)	11.3611.2.002.001
24	13392 (C V N V KIRAN KAMUJU)	11.1109.4.112.001
25	13392 (C V N V KIRAN KAMUJU)	11.1109.4.112.002
26	12143 (CHANDRASHEKHAR SHASHIKANT BHAMARE)	11.6800.3.916.900
27	12143 (CHANDRASHEKHAR SHASHIKANT BHAMARE)	11.6800.3.916.900
28	12143 (CHANDRASHEKHAR SHASHIKANT BHAMARE)	11.6800.3.916.900
29	13392 (C V N V KIRAN KAMUJU)	11.1025.3.915.001
30	13392 (C V N V KIRAN KAMUJU)	11.1025.3.915.002
31	-	-
32	13728 (SANJEEV KUMAR SOLANKI )	11.2000.2.004.004
33	12594 (SAUGATA SANAT SARKAR)	11.0730.4.351.900
34	16055 (VINUKUMAR R)	11.7404.I.920.000
35	16081 (SAMEER AWADHUTRAO BOHARUPI)	11.0710.1.800.000
36	15028 (RAKESH KUMAR)	-
37	16081 (SAMEER AWADHUTRAO BOHARUPI)	11.0710.1.800.000
38	-	-
39	12427 (JAVED MUNOVVAR ALI)	-
40	16081 (SAMEER AWADHUTRAO BOHARUPI)	11.0710.1.800.000
41	13392 (C V N V KIRAN KAMUJU)	11.6500.3.110.001
42	103860 (Mr. BHAGIRATH LAL MEENA)	MS4920045017130
43	15723 (NAGESWARRAO KATLAGUNTA )	-
44	14454 (SATYA PRAKASH KUSHWAHA )	-
45	14454 (SATYA PRAKASH KUSHWAHA )	-
46	14454 (SATYA PRAKASH KUSHWAHA )	-
47	12574 (SUDHIR VASANT DONGARE)	01P.4A.1090.001.0AA
48	12574 (SUDHIR VASANT DONGARE)	01P.4A.1090.001.0AA
49	12574 (SUDHIR VASANT DONGARE)	01P.4A.1090.001.0AA

	TASK_NO	SYSTEM \
0	-	-
1	-	-
2	SU30-94-466-3510401	-
3	SU30-94-382-3420401	-
4	-	-
5	SU30-94-381-3320401	-
6	SU30-98-IN-1816-2504011	FLIGHT DATA RECORDER (FDR)- AMS FDR30
7	-	-

8		-	-
9	SU30-94-425-3620401		-
10		-	-
11		-	-
12		-	-
13	SU30-95-3452-4094002		-
14		-	-
15		-	-
16		-	-
17	SU30-94-783-9404001		-
18		-	-
19		-	-
20	SU30-95-3450-4004051		-
21	SU30-95-3447-4004015		-
22		-	-
23		-	-
24		-	-
25		-	-
26		-	-
27		-	-
28		-	-
29		-	-
30		-	-
31		-	-
32		-	-
33		-	-
34		-	-
35		-	-
36	SU30-94-383-3320404		-
37		-	-
38	SU30-94-466-3510402		-
39	SU30-95-3457-4904024		-
40		-	-
41		-	-
42		-	-
43	SU30-98-MODDEA-30031	RADAR WARNING RECEIVER (RWR)	R118
44	SU30-98-RS-1752-6204035	EMC UNIT	K-130
45	SU30-98-RS-1752-6204035	EMC UNIT	K-130
46	SU30-98-RS-1752-6204035	EMC UNIT	K-130
47		-	-
48		-	-
49		-	-

	SUB_SYSTEM	PROJECT	CLOSE_DATE	\
0	-	-	26-Jun-20	
1	-	-	15-Apr-13	
2	-	SU30	-	
3	-	SU30	10-Jun-13	
4	-	-	15-Apr-13	
5	-	SU30	10-Jun-13	

6	Avionics bay connector & status display	SU30	30-Jan-17
7	-	-	29-May-13
8	-	-	-
9	-	SU30	-
10	-	-	6-May-13
11	-	-	6-Apr-13
12	-	-	14-Mar-13
13	-	SU30	28-May-13
14	-	-	13-Apr-13
15	-	-	10-Dec-16
16	-	-	29-May-13
17	-	SU30	4-Jul-13
18	-	-	26-Jun-20
19	-	-	26-Jun-20
20	-	SU30	30-Apr-13
21	-	SU30	30-Apr-13
22	-	-	26-Jun-20
23	-	-	-
24	-	-	13-Apr-13
25	-	-	13-Apr-13
26	-	-	-
27	-	-	21-Jan-17
28	-	-	21-Jan-17
29	-	-	13-Apr-13
30	-	-	13-Apr-13
31	-	-	16-Mar-13
32	-	-	-
33	-	-	30-Mar-13
34	-	-	30-Jun-20
35	-	-	20-Feb-14
36	-	SU30	29-May-13
37	-	-	20-Feb-14
38	-	SU30	4-Jul-13
39	-	SU30	29-May-13
40	-	-	20-Feb-14
41	-	-	13-Jun-13
42	-	-	-
43	Interface Plate for SPU	SU30	30-Jan-17
44	Control unit	SU30	30-Jan-17
45	Control unit	SU30	30-Jan-17
46	Control unit	SU30	30-Jan-17
47	-	-	24-Jul-13
48	-	-	24-Jul-13
49	-	-	24-Jul-13

DISPOSITION Forward Date

Disp Date \

0 acceptable to design 4-Mar-13

12-Mar-13

1 suit the part 11.2010.2.002.002 with 11.2010.... 5-Mar-13

25-Mar-13		
2	it is allowed to file and merge the step.apply...	13-Mar-13
14-Mar-13		
3	install shim between the flanges of wall-3 roo...	13-Mar-13
22-Mar-13		
4	not acceptable to design	4-Apr-13
4-Apr-13		
5	it is allowed to install taper shim with seali...	13-Mar-13
22-Mar-13		
6	replace the affected pipe line 11.7750.i.930.9...	15-Mar-13
15-Mar-13		
7	snag is provisionally acceptable to pp; howeve...	-
16-Mar-13		
8	-	-
-		
9	it is allowed to file the diaphragms 11.2030.2...	19-Mar-13
20-Mar-13		
10	polish the scratch marks on the inside of pipe...	22-Mar-13
29-Mar-13		
11	not acceptable to design	22-Mar-13
30-Mar-13		
12	acceptable to design	2-Mar-13
2-Mar-13		
13	kindly provide the details like drawing no an...	7-Mar-13
15-May-13		
14	acceptable to design	21-Mar-13
21-Mar-13		
15	acceptable to stress (minor snag)	20-Mar-13
4-Jul-16		
16	during assembly of bracket 11.5309.i.857.900 w...	21-Mar-13
22-Mar-13		
17	install zp-3 filler suitably to maintain the ...	21-Mar-13
22-Mar-13		
18	acceptable to design	22-Mar-13
3-Apr-13		
19	play in the assembly is not acceptable to desi...	21-Mar-13
23-Mar-13		
20	locally trim the side panel to maintain the ~...	1-Mar-13
4-Mar-13		
21	not acceptable to design	1-Mar-13
15-Mar-13		
22	snag no.-1 & 2 are acceptable to design\nsnag ...	4-Mar-13
4-Mar-13		
23	acceptable to design\provide capa for such devat...	5-Mar-13
23-Mar-13		
24	acceptable to design\ndisposed on 11.03.13 in ...	5-Mar-13
13-Apr-13		
25	acceptable to design\ndisposed on 11.03.13 in ...	5-Mar-13
13-Apr-13		
26	please refer the attached disposition of snag	6-Mar-13

8-Mar-13		
27	please refer the attached copy of disposition	6-Mar-13
8-Mar-13		
28	please refer the attached copy of disposition	6-Mar-13
8-Mar-13		
29	acceptable to design	8-Mar-13
16-Mar-13		
30	acceptable to design	8-Mar-13
16-Mar-13		
31	please provide part no.	8-Mar-13
8-Mar-13		
32	the refered snag is acceptable for this set only.	7-Mar-13
29-Mar-13		
33	acceptable to designsubject to satisfactory ass...	11-Mar-13
11-Mar-13		
34	plse refer design dispostion no. dm74(su30)/8...	12-Mar-13
30-May-13		
35	carryout dpt\nput a stop hole of dia 2.6 at th...	9-Mar-13
11-Mar-13		
36	acceptable subjected to satisfactory x-ray rep...	13-Mar-13
22-Mar-13		
37	carryout dpt\nput a stop hole of dia 2.6 at th...	9-Mar-13
11-Mar-13		
38	raise again	-
19-Mar-13		
39	1. remove the crack fully from root and merge ...	1-Mar-13
5-Mar-13		
40	carryout dpt\nput a stop hole of dia 2.6 & pl...	9-Mar-13
11-Mar-13		
41	snag is not acceptable as it is.\nenlarge the ...	9-Mar-13
11-Mar-13		
42	-	-
-		
43	rwrr system rfu-3 & rfu-4 to be replaced by ser...	11-Mar-13
12-Mar-13		
44	the connectors 1-p19-p1;1-p19-p4;1-p19-p10;1-p...	11-Mar-13
11-Mar-13		
45	the connectors 1-p19-p1;1-p19-p4;1-p19-p10;1-p...	11-Mar-13
11-Mar-13		
46	the connectors 1-p19-p1;1-p19-p4;1-p19-p10;1-p...	11-Mar-13
11-Mar-13		
47	this part number does not belong to design air...	13-Mar-13
16-May-13		
48	this part number does not belong to design air...	13-Mar-13
16-May-13		
49	this part number does not belong to design air...	13-Mar-13
16-May-13		

	DWG_NO	Status
0	NaN	0



1	11.2010.2.002.002	1
2	11.2010.2.000.901	2
3	11.2000.2.000.000	3
4	NaN	4
5	11.2000.2.000.000	5
6	NaN	6
7	NaN	7
8	NaN	8
9	11.2030.2.004.002	9
10	NaN	10
11	NaN	11
12	NaN	12
13	NaN	13
14	NaN	14
15	NaN	15
16	NaN	16
17	11.2030.2.030.902	17
18	NaN	18
19	NaN	19
20	11.0670.3.876.002	20
21	NaN	21
22	11.0720.4.006.002	22
23	NaN	23
24	NaN	24
25	NaN	25
26	NaN	26
27	NaN	27
28	NaN	28
29	NaN	29
30	NaN	30
31	NaN	31
32	NaN	32
33	NaN	33
34	NaN	34
35	11.0710.1.008.000	35
36	11.2000.2.000.000	36
37	11.0710.1.008.000	37
38	NaN	38
39	NaN	39
40	11.0710.1.008.000	40
41	NaN	41
42	NaN	42
43	NaN	43
44	NaN	44
45	NaN	45
46	NaN	46
47	NaN	47
48	NaN	48
49	NaN	49

```
df=df.drop(columns=['Unnamed: 0'])
```

```
def snag_desc_to_no(df):
    for x in range(len(df)):
        z=str(df['DISPOSITION'][x])
        if 'not acceptable' in z:
            df['Status'][x]=1
        elif 'acceptable' in z:
            df['Status'][x]=0
        else :
            df['Status'][x]=2
```

```
snag_desc_to_no(df)
df1=df
```

```
df.head(30)
```

	SNAG_ID	ACNO	INSP_NAME	SHOP \
0	009/01009	-	100376 (A A KULKARNI)	9
1	009/01010	-	15530 (RAVINDRA DATTU PAWAR)	9
2	094/01002	SB-188	16528 (ADITYA SANJEEV JOGLEKAR)	94
3	094/01005	SB-187	16364 (SHANKAR BHAUSAHEB DHANAIT)	94
4	009/01026	-	15530 (RAVINDRA DATTU PAWAR)	9
5	094/01012	-	16364 (SHANKAR BHAUSAHEB DHANAIT)	94
6	098/01006	SB-178	16084 (BIJAY KUMAR)	98
7	009/01031	-	15530 (RAVINDRA DATTU PAWAR)	9
8	STORE/01002	-	101257 (Mr. GANESH HIRAMAN JADHAV)	303
9	094/01017	SB-189	16528 (ADITYA SANJEEV JOGLEKAR)	94
10	005/01001	-	13962 (SACHIN BHARGAVA)	5
11	005/01002	-	13962 (SACHIN BHARGAVA)	5
12	009/01001	-	15530 (RAVINDRA DATTU PAWAR)	9
13	095/01006	SB-179	15519 (AMAR BANKATRAO BANSODE)	95
14	009/01037	-	16401 (MAHESH BHASKAR GAIKWAD)	9
15	009/01038	-	15530 (RAVINDRA DATTU PAWAR)	9
16	009/01039	-	15530 (RAVINDRA DATTU PAWAR)	9
17	094/01018	SB-185	13869 (SUMAN LAL NARETI)	94
18	010/01004	-	11060 (SIBY THOMAS )	10
19	009/01040	-	100376 (A A KULKARNI)	9
20	095/01004	SB-179	16541 (VINOD KUMAR SINGH)	95
21	095/01005	SB-179	16541 (VINOD KUMAR SINGH)	95
22	009/01008	-	100376 (A A KULKARNI)	9
23	025/01001	-	15165 (RAKESH KUMAR SINGH)	25
24	009/01011	-	16401 (MAHESH BHASKAR GAIKWAD)	9
25	009/01012	-	16401 (MAHESH BHASKAR GAIKWAD)	9
26	009/01013	-	15530 (RAVINDRA DATTU PAWAR)	9
27	009/01014	-	15530 (RAVINDRA DATTU PAWAR)	9
28	009/01015	-	15530 (RAVINDRA DATTU PAWAR)	9
29	009/01019	-	16401 (MAHESH BHASKAR GAIKWAD)	9

	INSP_STAGE	SNAG_DATE \
0	Before Anodising	2-Mar-13

1	Before Anodising	4-Mar-13
2	Installation	8-Mar-13
3	Injig	9-Mar-13
4	Before Heat Treatment	12-Mar-13
5	Injig	12-Mar-13
6	Installation	14-Mar-13
7	At Final Stage	15-Mar-13
8	At receipt inspection	19-Mar-13
9	Pre-installation	19-Mar-13
10	After Plating	20-Mar-13
11	-	20-Mar-13
12	After Machining	2-Mar-13
13	Offjig	2-Mar-13
14	At Final Stage	20-Mar-13
15	Before Anodising	20-Mar-13
16	At Final Stage	20-Mar-13
17	Offjig	20-Mar-13
18	At Final Stage	21-Mar-13
19	At Final Stage	21-Mar-13
20	Offjig	1-Mar-13
21	Offjig	1-Mar-13
22	Before Anodising	2-Mar-13
23	After Milling	5-Mar-13
24	After Milling	5-Mar-13
25	After Milling	5-Mar-13
26	Before Anodising	5-Mar-13
27	Before Anodising	5-Mar-13
28	Before Anodising	5-Mar-13
29	After Milling	7-Mar-13

# SNAG\_DESC \

0 (I) IN PARTS 11.0790.I.122.900;123.900;124.90...

1 TOOL MARK NOTICED ON PART NO;11.2010.2.002.002...

2 During leading edge assembly(11.2010.2.000.901...

3 52nd LH wing;DRG.11.2000.2.000.000 After insta...

4 As per main view of drg. gap noticed due to la...

5 52nd RH wing Drg.11.2000.2.000.000 After insta...

6 Dent/Tool mark observed in PVD pipe line 11.77...

7 As per technology length 1000+3.0mm tech. allo...

8 Material cotton fabric 1200 mm from M/S Urja p...

9 After preliminary installation of diaphragms(1...

10 SCRATCHES NOTICED AT BOTH THE END PIECES AFTER...

11 LEAK IS NOTICED THROUGH A CRACK ON THE CENTRAL...

12 In sectional side view at zone 2B; hieght of b...

13 During installation of dummy lock of retracted...

14 REF. VIEW A ; AS PER NOTE 3\*45 DEGREE CHAMFER...

15 TOOLMARK NOTICED ON THRED M4-5H6H UPTO WIDTH 1...

16 SLOT CENTER 9.0MM MEASURES 7.65 TO 8.1. REFER ...

17 During preliminary suiting of flaperon on wing...

18 PLAY OF MACHANICAL LOCK WITH PR. OF +/-200 KGF...

19 AFTER ASSY OF PART 30.5200.8277 &8276 &OTHER P...  
 20 during matching and suiting of panel 11.0670....  
 21 During matching of hatch cover 11.0250.i.140.0...  
 22 1) ED 10 MM FOR PART 11.0720.4.006.002 MEASURE...  
 23 Refer PS30L-3611-009; Web Thk. 2.9mm measures ...  
 24 AS PER TEMPLATE ANGLE 53 MINUTES NOTICE OPEN I...  
 25 AS PER TEMPLATE ANGLE 53 MINUTES NOTICE OPEN I...  
 26 \*SNAG 1)DIMN.13MM MEASURES 10.9 TO 12.4MM. SR....  
 27 \*SNAG 1)Dimension13.0MM measures 10.9 TO 12.4M...  
 28 Snag 1) Dimn 13 mm measures 10.9 to 12.4mm in ...  
 29 REF. SECTION A-A DIM. 40 +\_ 0.2MM NOTICED 40.50MM

	SNAG_STROKE \
0	Operators Fault
1	Operators Fault
2	Miscellaneous
3	Miscellaneous
4	Material Fault
5	Miscellaneous
6	Operators Fault
7	Operators Fault
8	Material Fault
9	Suppliers fault
10	Moving and handling
11	Miscellaneous
12	Operators Fault
13	Suppliers fault
14	Operators Fault
15	Operators Fault
16	Operators Fault
17	Miscellaneous
18	Customers fault
19	Operators Fault
20	Suppliers fault
21	Assembly defects
22	Operators Fault
23	Defective Tool Fixtures, Test equipments
24	Operators Fault
25	Operators Fault
26	Operators Fault
27	Operators Fault
28	Operators Fault
29	Operators Fault

	ENGR_FLAG	PART_NO \
0	14043 (GAURAV KUMAR SINGH )	R0790.009.002
1	16030 (KESHAVE PRASAD DWIVEDI)	R2010.009.002
2	13304 (ALOK KUMAR SINGH)	-
3	15028 (RAKESH KUMAR)	-
4	14044 (HEMANT N SAWANA )	E10.0200.0019.002

5	13312 (VISHAL YASHWANT DONGARE)	-
6	14380 (SUMIT DIXIT )	-
7	14044 (HEMANT N SAWANA )	11.0610.3.160.018
8	103860 (Mr. BHAGIRATH LAL MEENA)	8.44511E+11
9	13304 (ALOK KUMAR SINGH)	-
10	13606 (NILMANI KUMAR )	11.6150.I.810.901
11	10379 (CHANDRASHEKHAR SOMAJI HIREKAN)	2.11.5305.8300.91
12	12143 (CHANDRASHEKHAR SHASHIKANT BHAMARE)	11.6800.3.916.900
13	13952 (SUNIL BHARTIYA )	-
14	13392 (C V N V KIRAN KAMUJU)	11.0610.3.114.004
15	14044 (HEMANT N SAWANA )	R6400.010.001
16	14044 (HEMANT N SAWANA )	11.5309.I.838.900
17	14034 (NIRMAL KUMAR )	-
18	13727 (MOHAN LAL GUPTA )	2.25.5306.0000.91
19	14043 (GAURAV KUMAR SINGH )	R5200.009.001
20	14035 (PAWAN KUMAR )	-
21	14035 (PAWAN KUMAR )	-
22	14043 (GAURAV KUMAR SINGH )	R0720.009.001
23	104208 (Mr. MOOL CHAND GUPTA)	11.3611.2.002.001
24	13392 (C V N V KIRAN KAMUJU)	11.1109.4.112.001
25	13392 (C V N V KIRAN KAMUJU)	11.1109.4.112.002
26	12143 (CHANDRASHEKHAR SHASHIKANT BHAMARE)	11.6800.3.916.900
27	12143 (CHANDRASHEKHAR SHASHIKANT BHAMARE)	11.6800.3.916.900
28	12143 (CHANDRASHEKHAR SHASHIKANT BHAMARE)	11.6800.3.916.900
29	13392 (C V N V KIRAN KAMUJU)	11.1025.3.915.001

	TASK_NO	SYSTEM \
0	-	-
1	-	-
2	SU30-94-466-3510401	-
3	SU30-94-382-3420401	-
4	-	-
5	SU30-94-381-3320401	-
6	SU30-98-IN-1816-2504011	FLIGHT DATA RECORDER (FDR)- AMS FDR30
7	-	-
8	-	-
9	SU30-94-425-3620401	-
10	-	-
11	-	-
12	-	-
13	SU30-95-3452-4094002	-
14	-	-
15	-	-
16	-	-
17	SU30-94-783-9404001	-
18	-	-
19	-	-
20	SU30-95-3450-4004051	-
21	SU30-95-3447-4004015	-
22	-	-

23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-

	SUB_SYSTEM	PROJECT	CLOSE_DATE	\
0	-	-	26-Jun-20	
1	-	-	15-Apr-13	
2	-	SU30	-	
3	-	SU30	10-Jun-13	
4	-	-	15-Apr-13	
5	-	SU30	10-Jun-13	
6	Avionics bay connector & status display	SU30	30-Jan-17	
7	-	-	29-May-13	
8	-	-	-	
9	-	SU30	-	
10	-	-	6-May-13	
11	-	-	6-Apr-13	
12	-	-	14-Mar-13	
13	-	SU30	28-May-13	
14	-	-	13-Apr-13	
15	-	-	10-Dec-16	
16	-	-	29-May-13	
17	-	SU30	4-Jul-13	
18	-	-	26-Jun-20	
19	-	-	26-Jun-20	
20	-	SU30	30-Apr-13	
21	-	SU30	30-Apr-13	
22	-	-	26-Jun-20	
23	-	-	-	
24	-	-	13-Apr-13	
25	-	-	13-Apr-13	
26	-	-	-	
27	-	-	21-Jan-17	
28	-	-	21-Jan-17	
29	-	-	13-Apr-13	

DISPOSITION Forward Date		
Disp Date	\	
0	acceptable to design	4-Mar-13
12-Mar-13		
1	suit the part 11.2010.2.002.002 with 11.2010....	5-Mar-13
25-Mar-13		
2	it is allowed to file and merge the step.apply...	13-Mar-13
14-Mar-13		
3	install shim between the flanges of wall-3 roo...	13-Mar-13
22-Mar-13		

4	not acceptable to design	4-Apr-13
4-Apr-13		
5	it is allowed to install taper shim with seali...	13-Mar-13
22-Mar-13		
6	replace the affected pipe line 11.7750.i.930.9...	15-Mar-13
15-Mar-13		
7	snag is provisionally acceptable to pp; howeve...	-
16-Mar-13		
8	-	-
-		
9	it is allowed to file the diaphragms 11.2030.2...	19-Mar-13
20-Mar-13		
10	polish the scratch marks on the inside of pipe...	22-Mar-13
29-Mar-13		
11	not acceptable to design	22-Mar-13
30-Mar-13		
12	acceptable to design	2-Mar-13
2-Mar-13		
13	kindly provide the details like drawing no an...	7-Mar-13
15-May-13		
14	acceptable to design	21-Mar-13
21-Mar-13		
15	acceptable to stress (minor snag)	20-Mar-13
4-Jul-16		
16	during assembly of bracket 11.5309.i.857.900 w...	21-Mar-13
22-Mar-13		
17	install zp-3 filler suitably to maintain the ...	21-Mar-13
22-Mar-13		
18	acceptable to design	22-Mar-13
3-Apr-13		
19	play in the assembly is not acceptable to desi...	21-Mar-13
23-Mar-13		
20	locally trim the side panel to maintain the ~...	1-Mar-13
4-Mar-13		
21	not acceptable to design	1-Mar-13
15-Mar-13		
22	snag no.-1 & 2 are acceptable to design\nsnag ...	4-Mar-13
4-Mar-13		
23	acceptable to design\nrovide capa for such devat...	5-Mar-13
23-Mar-13		
24	acceptable to design\nndisposed on 11.03.13 in ...	5-Mar-13
13-Apr-13		
25	acceptable to design\nndisposed on 11.03.13 in ...	5-Mar-13
13-Apr-13		
26	please refer the attached disposition of snag	6-Mar-13
8-Mar-13		
27	please refer the attached copy of disposition	6-Mar-13
8-Mar-13		
28	please refer the attached copy of disposition	6-Mar-13
8-Mar-13		

29  
16-Mar-13

acceptable to design

8-Mar-13

	DWG_NO	Status
0	NaN	0
1	11.2010.2.002.002	2
2	11.2010.2.000.901	2
3	11.2000.2.000.000	2
4	NaN	1
5	11.2000.2.000.000	2
6	NaN	2
7	NaN	0
8	NaN	2
9	11.2030.2.004.002	2
10	NaN	2
11	NaN	1
12	NaN	0
13	NaN	2
14	NaN	0
15	NaN	0
16	NaN	0
17	11.2030.2.030.902	2
18	NaN	0
19	NaN	1
20	11.0670.3.876.002	2
21	NaN	1
22	11.0720.4.006.002	0
23	NaN	0
24	NaN	0
25	NaN	0
26	NaN	2
27	NaN	2
28	NaN	2
29	NaN	0

```
df1=df1.drop(columns=['Forward Date','Disp  
Date','CLOSE_DATE','SNAG_DATE'])
```

```
df1.columns
```

```
Index(['SNAG_ID', 'ACNO', 'INSP_NAME', 'SHOP', 'INSP_STAGE',  
'SNAG_DESC',  
      'SNAG_STROKE', 'ENGR_FLAG', 'PART_NO', 'TASK_NO', 'SYSTEM',  
      'SUB_SYSTEM', 'PROJECT', 'DISPOSITION', 'DWG_NO', 'Status'],  
      dtype='object')
```

```
df1=df1.drop(columns=['SNAG_ID', 'ACNO', 'INSP_NAME', 'SHOP',  
'INSP_STAGE',  
      'SNAG_STROKE', 'ENGR_FLAG', 'PART_NO', 'TASK_NO', 'SYSTEM',  
      'SUB_SYSTEM', 'PROJECT', 'DWG_NO'])
```



df1.head(30)

	SNAG_DESC \
0	(I) IN PARTS 11.0790.I.122.900;123.900;124.90...
1	TOOL MARK NOTICED ON PART NO;11.2010.2.002.002...
2	During leading edge assembly(11.2010.2.000.901...
3	52nd LH wing;DRG.11.2000.2.000.000 After insta...
4	As per main view of drg. gap noticed due to la...
5	52nd RH wing Drg.11.2000.2.000.000 After insta...
6	Dent/Tool mark observed in PVD pipe line 11.77...
7	As per technology length 1000+3.0mm tech. allo...
8	Material cotton fabric 1200 mm from M/S Urja p...
9	After preliminary installation of diaphragms(1...
10	SCRATCHES NOTICED AT BOTH THE END PIECES AFTER...
11	LEAK IS NOTICED THROUGH A CRACK ON THE CENTRAL...
12	In sectional side view at zone 2B; hieght of b...
13	During installation of dummy lock of retracted...
14	REF. VIEW A ; AS PER NOTE 3*45 DEGREE CHAMFER...
15	TOOLMARK NOTICED ON THRED M4-5H6H UPTO WIDTH 1...
16	SLOT CENTER 9.0MM MEASURES 7.65 TO 8.1. REFER ...
17	During preliminary suiting of flaperon on wing...
18	PLAY OF MACHANICAL LOCK WITH PR. OF +/-200 KGF...
19	AFTER ASSY OF PART 30.5200.8277 &8276 &OTHER P...
20	during matching and suiting of panel 11.0670....
21	During matching of hatch cover 11.0250.i.140.0...
22	1) ED 10 MM FOR PART 11.0720.4.006.002 MEASURE...
23	Refer PS30L-3611-009; Web Thk. 2.9mm measures ...
24	AS PER TEMPLATE ANGLE 53 MINUTES NOTICE OPEN I...
25	AS PER TEMPLATE ANGLE 53 MINUTES NOTICE OPEN I...
26	*SNAG 1)DIMN.13MM MEASURES 10.9 TO 12.4MM. SR....
27	*SNAG 1)Dimension13.0MM measures 10.9 TO 12.4M...
28	Snag 1) Dimn 13 mm measures 10.9 to 12.4mm in ...
29	REF. SECTION A-A DIM. 40 +_ 0.2MM NOTICED 40.50MM

	DISPOSITION	Status
0	acceptable to design	0
1	suit the part 11.2010.2.002.002 with 11.2010....	2
2	it is allowed to file and merge the step.apply...	2
3	install shim between the flanges of wall-3 roo...	2
4	not acceptable to design	1
5	it is allowed to install taper shim with seali...	2
6	replace the affected pipe line 11.7750.i.930.9...	2
7	snag is provisionally acceptable to pp; howeve...	0
8	-	2
9	it is allowed to file the diaphragms 11.2030.2...	2
10	polish the scratch marks on the inside of pipe...	2
11	not acceptable to design	1
12	acceptable to design	0
13	kindly provide the details like drawing no an...	2
14	acceptable to design	0

```

15             acceptable to stress (minor snag)                0
16 during assembly of bracket 11.5309.i.857.900 w...            0
17 install zp-3 filler suitably to maintain the ...            2
18             acceptable to design                             0
19 play in the assembly is not acceptable to desi...            1
20 locally trim the side panel to maintain the ~...            2
21             not acceptable to design                          1
22 snag no.-1 & 2 are acceptable to design\nsnag ...            0
23 acceptable to designrovide capa for such devat...           0
24 acceptable to design\ndisposed on 11.03.13 in ...            0
25 acceptable to design\ndisposed on 11.03.13 in ...            0
26     please refer the attached disposition of snag            2
27     please refer the attached copy of disposition            2
28     please refer the attached copy of disposition            2
29             acceptable to design                             0

df1['SNAG_DESC']=df1['SNAG_DESC'].str.lower()

df1['SNAG_DESC']=df1['SNAG_DESC'].str.replace('ref','reference')

```

## Making Test and Train DataSets

### Test -Train - Split

*#Splitiing the dataset into training and testing data sets*

```

from sklearn.model_selection import train_test_split

X_train,X_test,y_train,y_test =
train_test_split(df1['SNAG_DESC'],df1['Status'],test_size=0.15,random_
state=0)

X_train

7800    drg.no. 11.7603.3.100.000 ; during installatio...
9453    three brackets of nose door attachment bracket...
9690    reference nose cone bracket 11.7121.i325.000;b...
6477    reference part no 11.3115.3.021.900 and 11.311...
4178    during matching of engine hatch cover l.h. si...
...
9225    reference privious snag 202/01123 {reference v...
4859    during rework of rivets of stringer-13 ( e10.1...
3264    dwg no-11.0620.i.005.000\na gap of 2.5mm notic...
9845    during suiting of angle 11.9267.i.008.001 with...
2732    drg.no. e10.061.i200.000 \njig no. 318.10ki.44...
Name: SNAG_DESC, Length: 8500, dtype: object

```

y\_train

7800	2
9453	2
9690	0
6477	2
4178	2

9225	0
4859	2
3264	2
9845	2
2732	0

Name: Status, Length: 8500, dtype: int64

X\_test

```

9394 snag raised by mahesh lohar\nsb-036 lh wing de...
898 drawing no;- 11.2000.2.110.000 11.2000.2.000...
2398 depression of 3mm to 5 mm noticed between fram...
5906 1)flange heightvary both side from 12.5mm to 1...
2343 during suiting bracket(11.7724i.860.000) to th...

```

```

7990      drawing no- e10.0650.i.105.000\nduring install...
5056      as per attached snag copy received from vendor...
3910      dwg no- 11.0620.i.005.000\nfive holes of dia. ...
1281      dimension ~15 mm measures ~16 mm.
8022      control stick rh side deflection found 153mm a...

```

Name: SNAG\_DESC, Length: 1500, dtype: object

y\_test

9394	2
898	0
2398	2
5906	2
2343	0

7990	0
5056	0
3910	0
1281	0
8022	2

Name: Status, Length: 1500, dtype: int64

```
from sklearn.feature_extraction.text import CountVectorizer
```

```
vec=CountVectorizer(strip_accents='ascii', token_pattern=u'(?ui)\\b\\w*[a-z]+\\w*\\b' or '\\D', ngram_range=(0,6), lowercase=True, stop_words='english')
```

```
X_train_transformed=vec.fit_transform(X_train)
X_test_transformed=vec.transform(X_test)

X_train_transformed
<8500x378758 sparse matrix of type '<class 'numpy.int64'>'
  with 725120 stored elements in Compressed Sparse Row format>

vec.vocabulary_
{'': 0,
 'drg': 110095,
 'installation': 179301,
 'bolt': 59179,
 'hole': 162686,
 'dia': 94299,
 '5mm': 23281,
 'open': 252077,
 'edge': 125103,
 'drg installation': 111423,
 'installation bolt': 179630,
 'bolt hole': 59874,
 'hole dia': 163381,
 'dia 5mm': 95935,
 '5mm open': 27619,
 'open edge': 252136,
 'drg installation bolt': 111481,
 'installation bolt hole': 179647,
 'bolt hole dia': 59875,
 'hole dia 5mm': 163808,
 'dia 5mm open': 96572,
 '5mm open edge': 27620,
 'drg installation bolt hole': 111482,
 'installation bolt hole dia': 179648,
 'bolt hole dia 5mm': 59882,
 'hole dia 5mm open': 163970,
 'dia 5mm open edge': 96573,
 'drg installation bolt hole dia': 111483,
 'installation bolt hole dia 5mm': 179649,
 'bolt hole dia 5mm open': 59893,
 'hole dia 5mm open edge': 163971,
 'drg installation bolt hole dia 5mm': 111484,
 'installation bolt hole dia 5mm open': 179651,
 'bolt hole dia 5mm open edge': 59894,
 'brackets': 63712,
 'nose': 235713,
 'door': 105242,
 'attachment': 53423,
 'bracket': 61989,
 'n1': 230878,
 'n2': 231395,
```

'n3': 231581,  
'coaxial': 76075,  
'center': 70085,  
'offset': 251558,  
'mm': 221931,  
'pin': 268052,  
'inserting': 178049,  
'repetitive': 296419,  
'problem': 277716,  
'doors': 105818,  
'referenceer': 293346,  
'drawing': 106603,  
'brackets nose': 63909,  
'nose door': 235772,  
'door attachment': 105266,  
'attachment bracket': 53441,  
'bracket n1': 62951,  
'n1 bracket': 230903,  
'bracket n2': 62956,  
'n2 bracket': 231400,  
'bracket n3': 62984,  
'n3 coaxial': 231592,  
'coaxial center': 76076,  
'center bracket': 70103,  
'bracket offset': 63127,  
'offset mm': 251591,  
'mm pin': 227224,  
'pin inserting': 268187,  
'inserting attachment': 178050,  
'bracket repetitive': 63347,  
'repetitive problem': 296431,  
'problem nose': 277780,  
'nose doors': 235873,  
'doors referenceer': 105839,  
'referenceer drawing': 293608,  
'brackets nose door': 63910,  
'nose door attachment': 235783,  
'door attachment bracket': 105271,  
'attachment bracket n1': 53453,  
'bracket n1 bracket': 62952,  
'n1 bracket n2': 230904,  
'bracket n2 bracket': 62957,  
'n2 bracket n3': 231401,  
'bracket n3 coaxial': 62985,  
'n3 coaxial center': 231593,  
'coaxial center bracket': 76077,  
'center bracket offset': 70104,  
'bracket offset mm': 63128,  
'offset mm pin': 251596,  
'mm pin inserting': 227229,

'pin inserting attachment': 268188,  
'inserting attachment bracket': 178051,  
'attachment bracket repetitive': 53461,  
'bracket repetitive problem': 63348,  
'repetitive problem nose': 296436,  
'problem nose doors': 277781,  
'nose doors referenceer': 235874,  
'doors referenceer drawing': 105840,  
'brackets nose door attachment': 63911,  
'nose door attachment bracket': 235784,  
'door attachment bracket n1': 105272,  
'attachment bracket n1 bracket': 53454,  
'bracket n1 bracket n2': 62953,  
'n1 bracket n2 bracket': 230905,  
'bracket n2 bracket n3': 62958,  
'n2 bracket n3 coaxial': 231402,  
'bracket n3 coaxial center': 62986,  
'n3 coaxial center bracket': 231594,  
'coaxial center bracket offset': 76078,  
'center bracket offset mm': 70105,  
'bracket offset mm pin': 63129,  
'offset mm pin inserting': 251597,  
'mm pin inserting attachment': 227230,  
'pin inserting attachment bracket': 268189,  
'inserting attachment bracket repetitive': 178052,  
'attachment bracket repetitive problem': 53462,  
'bracket repetitive problem nose': 63349,  
'repetitive problem nose doors': 296437,  
'problem nose doors referenceer': 277782,  
'nose doors referenceer drawing': 235875,  
'brackets nose door attachment bracket': 63912,  
'nose door attachment bracket n1': 235785,  
'door attachment bracket n1 bracket': 105273,  
'attachment bracket n1 bracket n2': 53455,  
'bracket n1 bracket n2 bracket': 62954,  
'n1 bracket n2 bracket n3': 230906,  
'bracket n2 bracket n3 coaxial': 62959,  
'n2 bracket n3 coaxial center': 231403,  
'bracket n3 coaxial center bracket': 62987,  
'n3 coaxial center bracket offset': 231595,  
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'qty rivet ostl': 284457,  
'rivet ostl having': 308287,  
'ostl having 4mm': 254032,  
'having 4mm ed': 160416,  
'4mm ed cover': 19856,  
'rh air intake rivetting': 300158,  
'air intake rivetting inner': 41587,  
'intake rivetting inner triangular': 185775,  
'rivetting inner triangular skin': 310798,  
'inner triangular skin cover': 177910,  
'triangular skin cover qty': 357770,  
'skin cover qty rivet': 326024,  
'cover qty rivet ostl': 82379,  
'qty rivet ostl having': 284464,  
'rivet ostl having 4mm': 308288,  
'ostl having 4mm ed': 254033,  
'having 4mm ed cover': 160417,  
'rh air intake rivetting inner': 300161,  
'air intake rivetting inner triangular': 41588,  
'intake rivetting inner triangular skin': 185776,  
'rivetting inner triangular skin cover': 310799,  
'inner triangular skin cover qty': 177911,  
'triangular skin cover qty rivet': 357771,  
'skin cover qty rivet ostl': 326025,  
'cover qty rivet ostl having': 82380,  
'qty rivet ostl having 4mm': 284465,  
'rivet ostl having 4mm ed': 308289,  
'ostl having 4mm ed cover': 254034,  
'rh air intake rivetting inner triangular': 300162,  
'air intake rivetting inner triangular skin': 41589,  
'intake rivetting inner triangular skin cover': 185777,  
'rivetting inner triangular skin cover qty': 310800,  
'inner triangular skin cover qty rivet': 177912,  
'triangular skin cover qty rivet ostl': 357772,  
'skin cover qty rivet ostl having': 326026,  
'cover qty rivet ostl having 4mm': 82381,  
'qty rivet ostl having 4mm ed': 284466,  
'rivet ostl having 4mm ed cover': 308290,  
'copy': 79955,  
'received': 290625,  
'venddor': 364165,  
'shanmukha': 320504,  
'dt': 114287,  
'attached snag': 53287,  
'snag copy': 330494,  
'copy received': 80038,  
'received venddor': 290969,  
'venddor snag': 364166,

'snag shanmukha': 332524,  
'shanmukha dt': 320506,  
'attached snag copy': 53288,  
'snag copy received': 330516,  
'copy received venddor': 80039,  
'received venddor snag': 290970,  
'venddor snag shanmukha': 364167,  
'snag shanmukha dt': 332526,  
'attached snag copy received': 53303,  
'snag copy received venddor': 330517,  
'copy received venddor snag': 80040,  
'received venddor snag shanmukha': 290971,  
'venddor snag shanmukha dt': 364168,  
'attached snag copy received venddor': 53304,  
'snag copy received venddor snag': 330518,  
'copy received venddor snag shanmukha': 80041,  
'received venddor snag shanmukha dt': 290972,  
'attached snag copy received venddor snag': 53305,  
'snag copy received venddor snag shanmukha': 330519,  
'copy received venddor snag shanmukha dt': 80042,  
'scratch': 316047,  
'rub': 312610,  
'mark': 210120,  
'pipeline': 269467,  
'e10': 118400,  
'925a': 37506,  
'frame': 145582,  
'tank': 347087,  
'scratch tool': 316138,  
'tool rub': 356421,  
'rub mark': 312611,  
'mark pipeline': 210675,  
'pipeline e10': 269546,  
'e10 925a': 118451,  
'925a noticed': 37507,  
'noticed frame': 240725,  
'frame tank': 149961,  
'scratch tool rub': 316139,  
'tool rub mark': 356422,  
'rub mark pipeline': 312612,  
'mark pipeline e10': 210676,  
'pipeline e10 925a': 269547,  
'e10 925a noticed': 118452,  
'925a noticed frame': 37508,  
'noticed frame tank': 240774,  
'scratch tool rub mark': 316140,  
'tool rub mark pipeline': 356423,  
'rub mark pipeline e10': 312613,  
'mark pipeline e10 925a': 210677,  
'pipeline e10 925a noticed': 269548,

'e10 925a noticed frame': 118453,  
'925a noticed frame tank': 37509,  
'scratch tool rub mark pipeline': 316141,  
'tool rub mark pipeline e10': 356424,  
'rub mark pipeline e10 925a': 312614,  
'mark pipeline e10 925a noticed': 210678,  
'pipeline e10 925a noticed frame': 269549,  
'e10 925a noticed frame tank': 118454,  
'scratch tool rub mark pipeline e10': 316142,  
'tool rub mark pipeline e10 925a': 356425,  
'rub mark pipeline e10 925a noticed': 312615,  
'mark pipeline e10 925a noticed frame': 210679,  
'pipeline e10 925a noticed frame tank': 269550,  
'i300': 173974,  
'locating': 203749,  
'point': 273095,  
'insert': 178000,  
'3mm': 16005,  
'mismatching': 221521,  
'notice': 236728,  
'locator': 203934,  
'cut': 85738,  
'near': 232313,  
'internal': 185986,  
'drawing e10': 107197,  
'e10 i300': 121054,  
'i300 locating': 174419,  
'locating point': 203777,  
'point insert': 273335,  
'insert hatch': 178011,  
'cover e10': 81405,  
'e10 rh': 123076,  
'rh 3mm': 299891,  
'3mm 4mm': 16047,  
'4mm mismatching': 20284,  
'mismatching notice': 221578,  
'notice locator': 237268,  
'locator cut': 203950,  
'cut hatch': 85931,  
'e10 near': 122854,  
'near frame': 232855,  
'frame internal': 148006,  
'drawing e10 i300': 107360,  
'e10 i300 locating': 121366,  
'i300 locating point': 174420,  
'locating point insert': 203786,  
'point insert hatch': 273336,  
'insert hatch cover': 178012,  
'hatch cover e10': 159492,  
'cover e10 rh': 81496,

'e10 rh 3mm': 123081,  
'rh 3mm 4mm': 299892,  
'3mm 4mm mismatching': 16080,  
'4mm mismatching notice': 20285,  
'mismatching notice locator': 221583,  
'notice locator cut': 237269,  
'locator cut hatch': 203951,  
'cut hatch cover': 85932,  
'cover e10 near': 81492,  
'e10 near frame': 122861,  
'near frame internal': 232997,  
'drawing e10 i300 locating': 107390,  
'e10 i300 locating point': 121367,  
'i300 locating point insert': 174421,  
'locating point insert hatch': 203787,  
'point insert hatch cover': 273337,  
'insert hatch cover e10': 178013,  
'hatch cover e10 rh': 159556,  
'cover e10 rh 3mm': 81500,  
'e10 rh 3mm 4mm': 123082,  
'rh 3mm 4mm mismatching': 299893,  
'3mm 4mm mismatching notice': 16081,  
'4mm mismatching notice locator': 20286,  
'mismatching notice locator cut': 221584,  
'notice locator cut hatch': 237270,  
'locator cut hatch cover': 203952,  
'cut hatch cover e10': 85933,  
'hatch cover e10 near': 159552,  
'cover e10 near frame': 81493,  
'e10 near frame internal': 122862,  
'drawing e10 i300 locating point': 107391,  
'e10 i300 locating point insert': 121368,  
'i300 locating point insert hatch': 174422,  
'locating point insert hatch cover': 203788,  
'point insert hatch cover e10': 273338,  
'insert hatch cover e10 rh': 178014,  
'hatch cover e10 rh 3mm': 159559,  
'cover e10 rh 3mm 4mm': 81501,  
'e10 rh 3mm 4mm mismatching': 123083,  
'rh 3mm 4mm mismatching notice': 299894,  
'3mm 4mm mismatching notice locator': 16082,  
'4mm mismatching notice locator cut': 20287,  
'mismatching notice locator cut hatch': 221585,  
'notice locator cut hatch cover': 237271,  
'locator cut hatch cover e10': 203953,  
'cut hatch cover e10 near': 85934,  
'hatch cover e10 near frame': 159553,  
'cover e10 near frame internal': 81494,  
'drawing e10 i300 locating point insert': 107392,  
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'i300 locating point insert hatch cover': 174423,  
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'point insert hatch cover e10 rh': 273339,  
'insert hatch cover e10 rh 3mm': 178015,  
'hatch cover e10 rh 3mm 4mm': 159560,  
'cover e10 rh 3mm 4mm mismatching': 81502,  
'e10 rh 3mm 4mm mismatching notice': 123084,  
'rh 3mm 4mm mismatching notice locator': 299895,  
'3mm 4mm mismatching notice locator cut': 16083,  
'4mm mismatching notice locator cut hatch': 20288,  
'mismatching notice locator cut hatch cover': 221586,  
'notice locator cut hatch cover e10': 237272,  
'locator cut hatch cover e10 near': 203954,  
'cut hatch cover e10 near frame': 85935,  
'hatch cover e10 near frame internal': 159554,  
'blow': 58781,  
'sketch': 325048,  
'blow hole': 58782,  
'hole noticed': 165649,  
'noticed dia': 239660,  
'dia mm': 98814,  
'mm reference': 227617,  
'attached sketch': 53099,  
'sketch sheet': 325396,  
'blow hole noticed': 58791,  
'hole noticed dia': 165662,  
'noticed dia mm': 239719,  
'dia mm reference': 99397,  
'mm reference attached': 227618,  
'reference attached sketch': 291506,  
'attached sketch sheet': 53192,  
'blow hole noticed dia': 58792,  
'hole noticed dia mm': 165669,  
'noticed dia mm reference': 239726,  
'dia mm reference attached': 99398,  
'mm reference attached sketch': 227621,  
'reference attached sketch sheet': 291538,  
'blow hole noticed dia mm': 58795,  
'hole noticed dia mm reference': 165670,  
'noticed dia mm reference attached': 239727,  
'dia mm reference attached sketch': 99399,  
'mm reference attached sketch sheet': 227624,  
'blow hole noticed dia mm reference': 58796,  
'hole noticed dia mm reference attached': 165671,  
'noticed dia mm reference attached sketch': 239728,  
'dia mm reference attached sketch sheet': 99400,  
'lh': 197275,  
'fastening': 133867,  
'fitting': 137502,  
'washer': 370129,

```
'thickness': 352198,
'installed': 182609,
'upper': 360228,
'panel': 257034,
'area': 48644,
'drg e10': 110471,
'i300 lh': 174370,
'lh fastening': 198688,
'fastening fitting': 134232,
...}
```

```
len(vec.vocabulary_)
```

```
395130
```

## MODEL PREPARATION

```
from sklearn.naive_bayes import MultinomialNB
from sklearn import model_selection, svm
from sklearn.svm import SVC
from sklearn.ensemble import BaggingClassifier
from sklearn import metrics
```

```
mnb=MultinomialNB()
mnb.fit(X_train_transformed,y_train)
y_pred_class=mnb.predict(X_test_transformed)
```

```
print( "Accuracy of the Test
is:",metrics.accuracy_score(y_test,y_pred_class)*100,"%")
```

```
Accuracy of the Test is: 72.06666666666666 %
```

```
from sklearn.metrics import precision_recall_fscore_support as score
from sklearn.metrics import accuracy_score, precision_score,
recall_score
precision, recall, fscore, support = score(y_test, y_pred_class)
print('precision: {}'.format(precision))
print('recall: {}'.format(recall))
print('fscore: {}'.format(fscore))
print('support: {}'.format(support))
```

```
precision: [0.74363328 0.375      0.70874862]
recall: [0.6656535  0.03896104 0.83660131]
fscore: [0.70248597 0.07058824 0.76738609]
support: [658  77 765]
```

```
print("The Training Accuracy of the Model
is:" ,metrics.accuracy_score(y_train,mnb.predict(X_train_transformed))
*100, "%")
```

```
The Training Accuracy of the Model is: 95.27058823529411 %
```



```

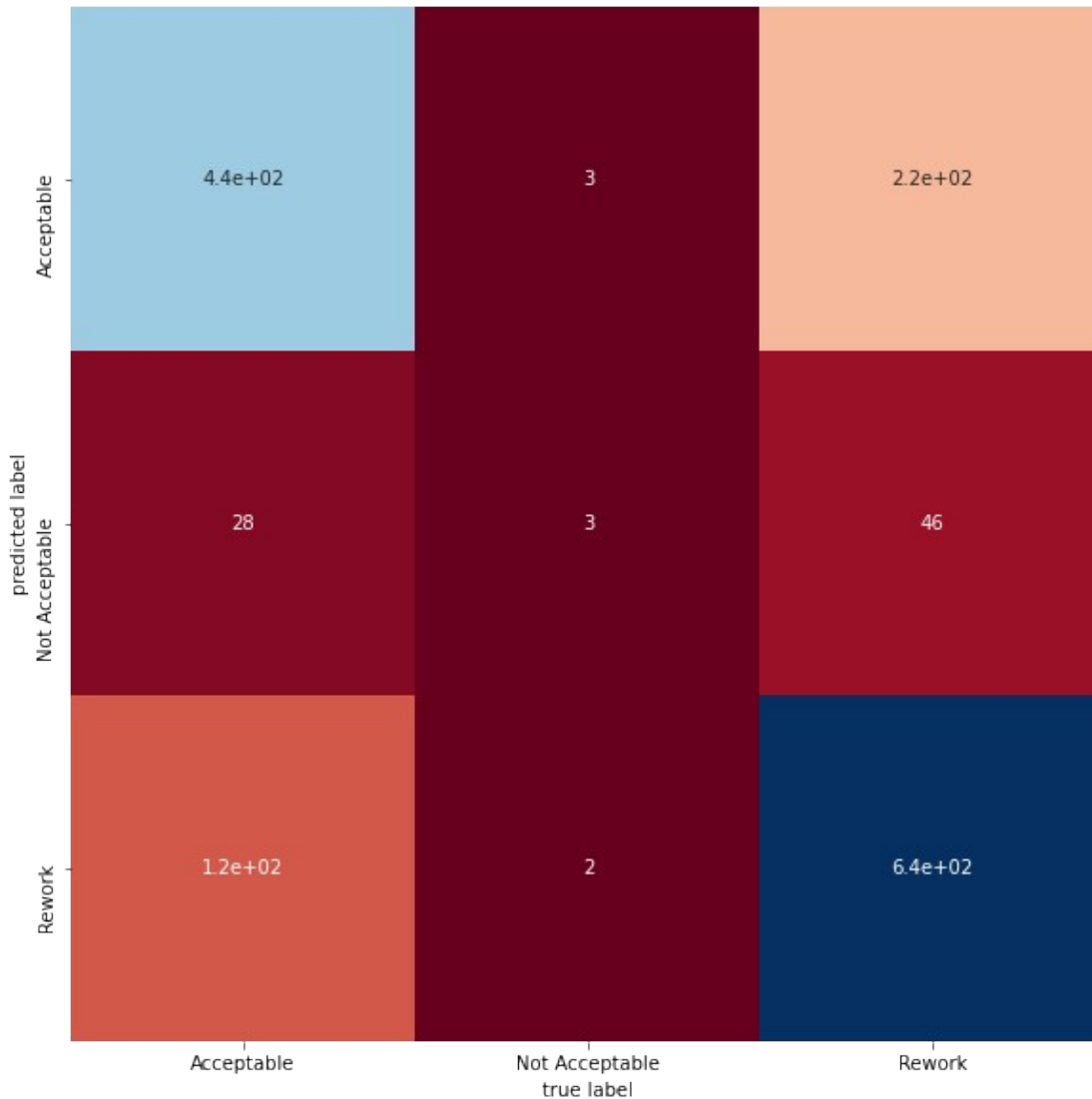
from sklearn.metrics import confusion_matrix
cm = confusion_matrix(y_test, y_pred_class)
cm

array([[438,    3, 217],
       [ 28,    3,  46],
       [123,    2, 640]], dtype=int64)

from sklearn.metrics import confusion_matrix
import matplotlib.pyplot as plt
import seaborn as sns
plt.figure(figsize=(15,10))

cm = confusion_matrix(y_test, y_pred_class)
sns.heatmap(cm, square=True, annot=True, cmap='RdBu', cbar=False,
xticklabels=['Acceptable', 'Not Acceptable', 'Rework'],
yticklabels=['Acceptable', 'Not Acceptable', 'Rework'])
plt.xlabel('true label')
plt.ylabel('predicted label')
plt.show()

```



## Using SVM

```
from sklearn.feature_extraction.text import CountVectorizer
cv = CountVectorizer(strip_accents='ascii', token_pattern=u'(?ui)\\b\\b\\w*[a-z]+\\b\\b' or '\\D', ngram_range=(0,5), lowercase=True,
stop_words='english')
X_train_cv = cv.fit_transform(X_train)
X_test_cv = cv.transform(X_test)
```

```
from sklearn.svm import SVC
SVM = svm.SVC(C=1.0, kernel='linear', degree=3, gamma='auto')
SVM.fit(X_train_cv, y_train)
# predict the labels on validation dataset
predictions_SVM = SVM.predict(X_test_cv)
```

```
print("SVM Accuracy Score :", accuracy_score(predictions_SVM,
y_test)*100, "%")
```

```

print("SVM Training Accuracy
Score :",accuracy_score(SVM.predict(X_train_cv), y_train)*100,"%")

SVM Accuracy Score : 72.2 %
SVM Training Accuracy Score : 99.01176470588236 %

from sklearn.metrics import precision_recall_fscore_support as score
from sklearn.metrics import accuracy_score, precision_score,
recall_score
precision, recall, fscore, support = score(y_test, predictions_SVM)
print('precision: {}'.format(precision))
print('recall: {}'.format(recall))
print('fscore: {}'.format(fscore))
print('support: {}'.format(support))

precision: [0.73387097 0.28571429 0.72769953]
recall: [0.69148936 0.1038961 0.81045752]
fscore: [0.71205008 0.15238095 0.7668522 ]
support: [658 77 765]

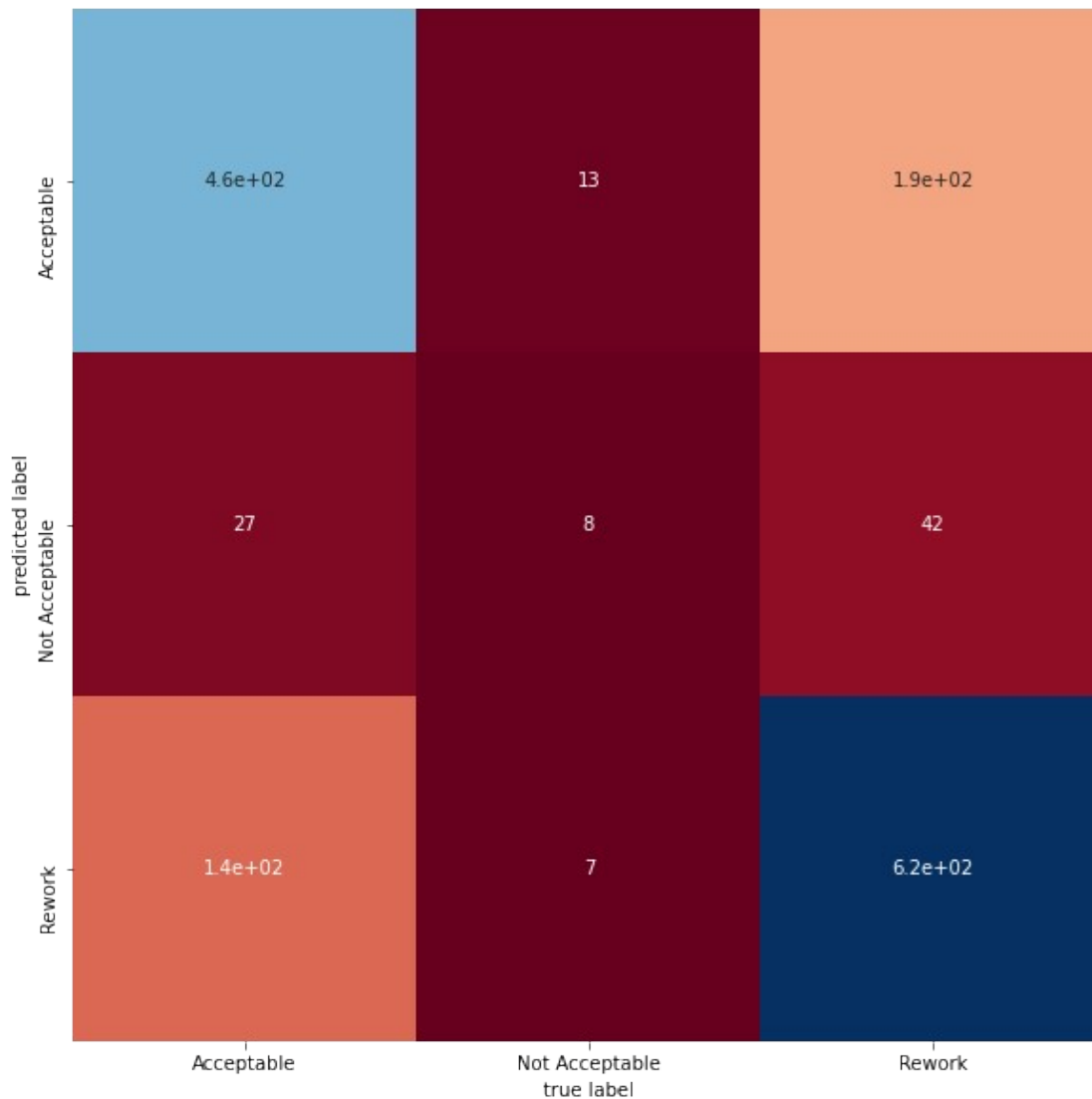
cm = confusion_matrix(y_test,predictions_SVM )
cm

array([[455, 13, 190],
       [ 27,  8, 42],
       [138,  7, 620]], dtype=int64)

from sklearn.metrics import confusion_matrix
import matplotlib.pyplot as plt
import seaborn as sns
plt.figure(figsize=(15,10))

cm = confusion_matrix(y_test,predictions_SVM )
sns.heatmap(cm, square=True, annot=True, cmap='RdBu', cbar=False,
xticklabels=['Acceptable','Not Acceptable','Rework'],
yticklabels=['Acceptable','Not Acceptable','Rework'])
plt.xlabel('true label')
plt.ylabel('predicted label')
plt.show()

```



The Model is good with accuracy greater than 70% but still can be enhanced using

(1) Dealing with class imbalance

(2) Hypertuning the parameters

```
def to_no(df):
    noc = 0
    acc = 0
    rew = 0
    for x in range(len(df)):
        z=int(df['Status'][x])
        if z == 1:
            noc+=1
        elif z == 0:
            acc+=1
        else:
```

```

        rew+=1
    return noc,acc,rew

```

```

noc,acc,rew=to_no(df)
print("noc:",noc)
print("acc:",acc)
print("rew:",rew)

```

```

noc: 569
acc: 4206
rew: 5225

```

#### Upscaling the minority samples

```

df_majority=pd.DataFrame()
df_majority1=pd.DataFrame()
df_minority=pd.DataFrame()
df_minority_upsample=pd.DataFrame()
df_upsample=pd.DataFrame()

```

```

df_majority=df[(df['Status']==2)]
df_majority1=df[(df['Status']==0)]
df_minority=df[(df['Status']==1)]

```

```

for i in range(8):

```

```

    df_minority_upsample=pd.concat([df_minority,df_minority_upsample],ignore_index=True)

```

```

print(df_minority_upsample.shape)
df_minority_upsample.head()

```

```

(4552, 20)

```

	SNAG_ID	ACNO	INSP_NAME	SHOP	\
0	009/01026	-	15530 (RAVINDRA DATTU PAWAR)	9	
1	005/01002	-	13962 (SACHIN BHARGAVA)	5	
2	009/01040	-	100376 (A A KULKARNI)	9	
3	095/01005	SB-179	16541 (VINOD KUMAR SINGH)	95	
4	009/01023	-	16401 (MAHESH BHASKAR GAIKWAD)	9	

	INSP_STAGE	SNAG_DATE	\
0	Before Heat Treatment	12-Mar-13	
1	-	20-Mar-13	
2	At Final Stage	21-Mar-13	
3	Offjig	1-Mar-13	
4	After Machining	9-Mar-13	

	SNAG_DESC	SNAG_STROKE
0	As per main view of drg. gap noticed due to la...	Material Fault

1	LEAK IS NOTICED THROUGH A CRACK ON THE CENTRAL...	Miscellaneous
2	AFTER ASSY OF PART 30.5200.8277 &8276 &OTHER P...	Operators Fault
3	During matching of hatch cover 11.0250.i.140.0...	Assembly defects
4	REF. SECTION V-V DIA. 4H7 MM HOLE NOGO PLAIN P...	Operators Fault

	ENGR_FLAG	PART_NO \
0	14044 (HEMANT N SAWANA )	E10.0200.0019.002
1	10379 (CHANDRASHEKHAR SOMAJI HIREKAN)	2.11.5305.8300.91
2	14043 (GAURAV KUMAR SINGH )	R5200.009.001
3	14035 (PAWAN KUMAR )	-
4	13392 (C V N V KIRAN KAMUJU)	11.6500.3.110.001

	TASK_NO	SYSTEM	SUB_SYSTEM	PROJECT	CLOSE_DATE \
0	-	-	-	-	15-Apr-13
1	-	-	-	-	6-Apr-13
2	-	-	-	-	26-Jun-20
3	SU30-95-3447-4004015	-	-	SU30	30-Apr-13
4	-	-	-	-	13-Jun-13

DISPOSITION Forward Date			
Disp	Date \		
0		not acceptable to design	4-Apr-13 4-
1	Apr-13	not acceptable to design	22-Mar-13 30-
2	Mar-13	play in the assembly is not acceptable to desi...	21-Mar-13 23-
3	Mar-13	not acceptable to design	1-Mar-13 15-
4	Mar-13	snag is not acceptable as it is.\nenlarge the ...	9-Mar-13 11-

	DWG_NO	Status
0	NaN	1
1	NaN	1
2	NaN	1
3	NaN	1
4	NaN	1

```
df_majority=pd.concat([df_majority,df_majority1],ignore_index=True)
df_upsample=pd.concat([df_majority,df_minorty_upsample],ignore_index=
True)
df_upsample.shape
(13983, 20)
```

```

noc,acc,rew=to_no(df_upsample)
print("noc:",noc)
print("acc:",acc)
print("rew:",rew)

noc: 4552
acc: 4206
rew: 5225

X_train,X_test,y_train,y_test =
train_test_split(df_upsample['SNAG_DESC'],df_upsample['Status'],test_s
ize=0.15,random_state=0)
vec=CountVectorizer(strip_accents='ascii', token_pattern=u'(?ui)\\b\\
w*[a-z]+\\w*\\b' or '\\D',ngram_range=(0,6), lowercase=True,
stop_words='english')
X_train_transformed=vec.fit_transform(X_train)
X_test_transformed=vec.transform(X_test)

from sklearn.naive_bayes import MultinomialNB
mnb=MultinomialNB()
mnb.fit(X_train_transformed,y_train)
predictions=mnb.predict(X_test_transformed)

print( "MultinomialNB Test Accuracy
is :",metrics.accuracy_score(y_test,predictions)*100,"%")
print("MultinomialNB Training Accuracy
is:" ,metrics.accuracy_score(y_train,mnb.predict(X_train_transformed))
*100, "%" , "\n")
precision, recall, fscore, support = score(y_test, predictions)
print(metrics.classification_report(y_test,predictions))

MultinomialNB Test Accuracy is : 78.31267874165873 %
MultinomialNB Training Accuracy is: 95.97812368531763 %

```

	precision	recall	f1-score	support
0	0.77	0.56	0.65	619
1	0.80	1.00	0.89	717
2	0.77	0.76	0.76	762
accuracy			0.78	2098
macro avg	0.78	0.77	0.77	2098
weighted avg	0.78	0.78	0.77	2098

```

cm = confusion_matrix(y_test,predictions )
cm

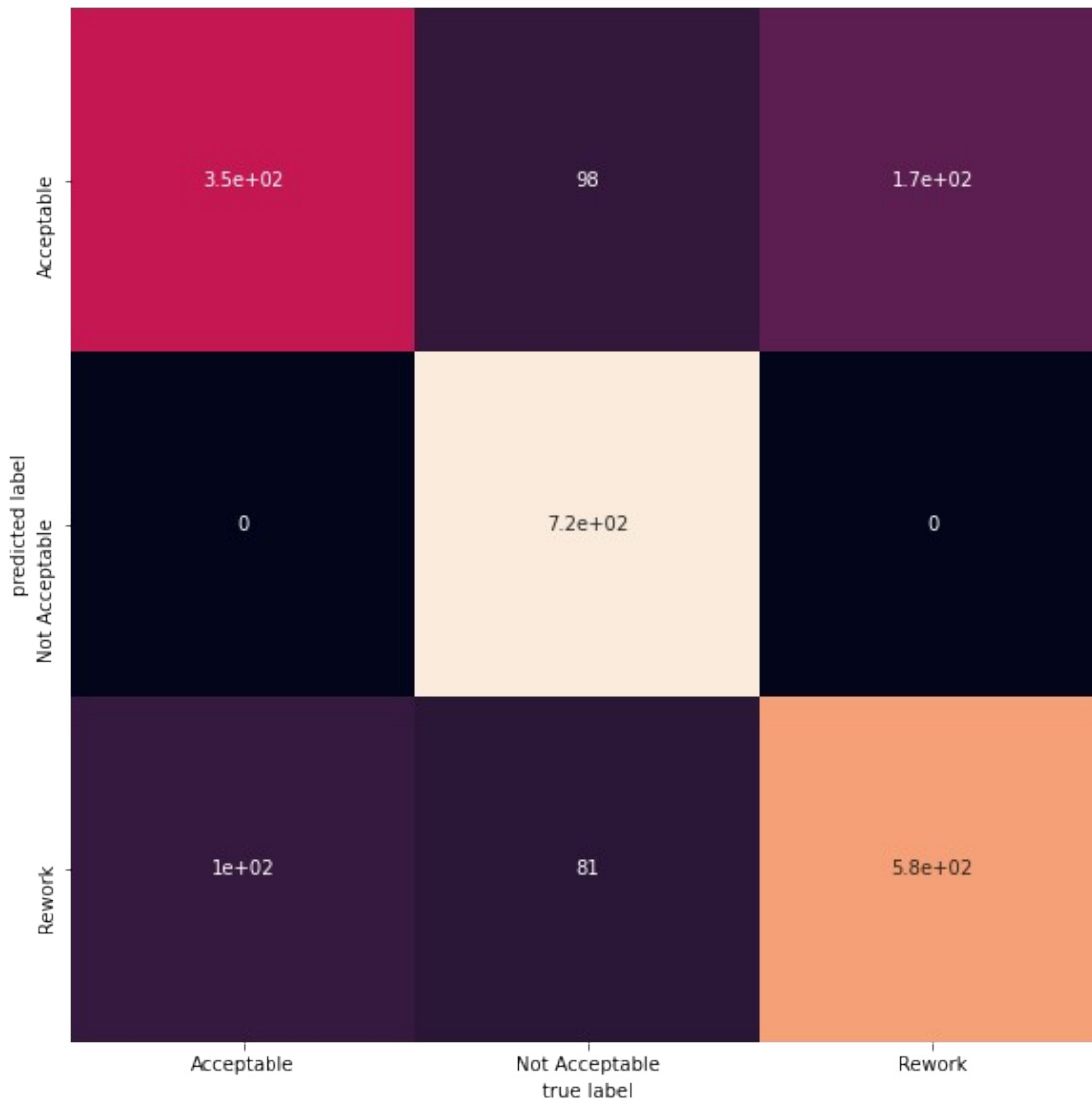
```

```

array([[348, 98, 173],
       [ 0, 717, 0],
       [103, 81, 578]], dtype=int64)

```

```
plt.figure(figsize=(15,10))
cm = confusion_matrix(y_test,predictions )
sns.heatmap(cm, square=True, annot=True,
cbar=False,xticklabels=['Acceptable','Not Acceptable','Rework'],
yticklabels=['Acceptable','Not Acceptable','Rework'])
plt.xlabel('true label')
plt.ylabel('predicted label')
plt.show()
```



```
from sklearn import model_selection,svm
from sklearn.svm import SVC
```

```
SVM = svm.SVC(C=1.0, kernel='linear', degree=3, gamma=0.01)
SVM.fit(X_train_transformed, y_train)
predictions_SVM = SVM.predict(X_test_transformed)
```



```

print("SVM Accuracy Score :",accuracy_score(predictions_SVM,
y_test)*100,"%" )
print("SVM Training Accuracy
Score :",accuracy_score(SVM.predict(X_train_transformed),
y_train)*100,"%" , "\n")
precision, recall, fscore, support = score(y_test, predictions_SVM)
print('precision: {}'.format(precision))
print('recall: {}'.format(recall))
print('fscore: {}'.format(fscore))
print('support: {}'.format(support))
print(metrics.classification_report(y_test,predictions_SVM))

```

```

SVM Accuracy Score : 82.93612964728312 %
SVM Training Accuracy Score : 99.25115692048801 %
precision: [0.75181159 0.94591029 0.7715736 ]
recall: [0.67043619 1.          0.79790026]
fscore: [0.7087959  0.97220339 0.78451613]
support: [619 717 762]

```

	precision	recall	f1-score	support
0	0.75	0.67	0.71	619
1	0.95	1.00	0.97	717
2	0.77	0.80	0.78	762
accuracy			0.83	2098
macro avg	0.82	0.82	0.82	2098
weighted avg	0.83	0.83	0.83	2098

```

cm = confusion_matrix(y_test,predictions_SVM )
cm

```

```

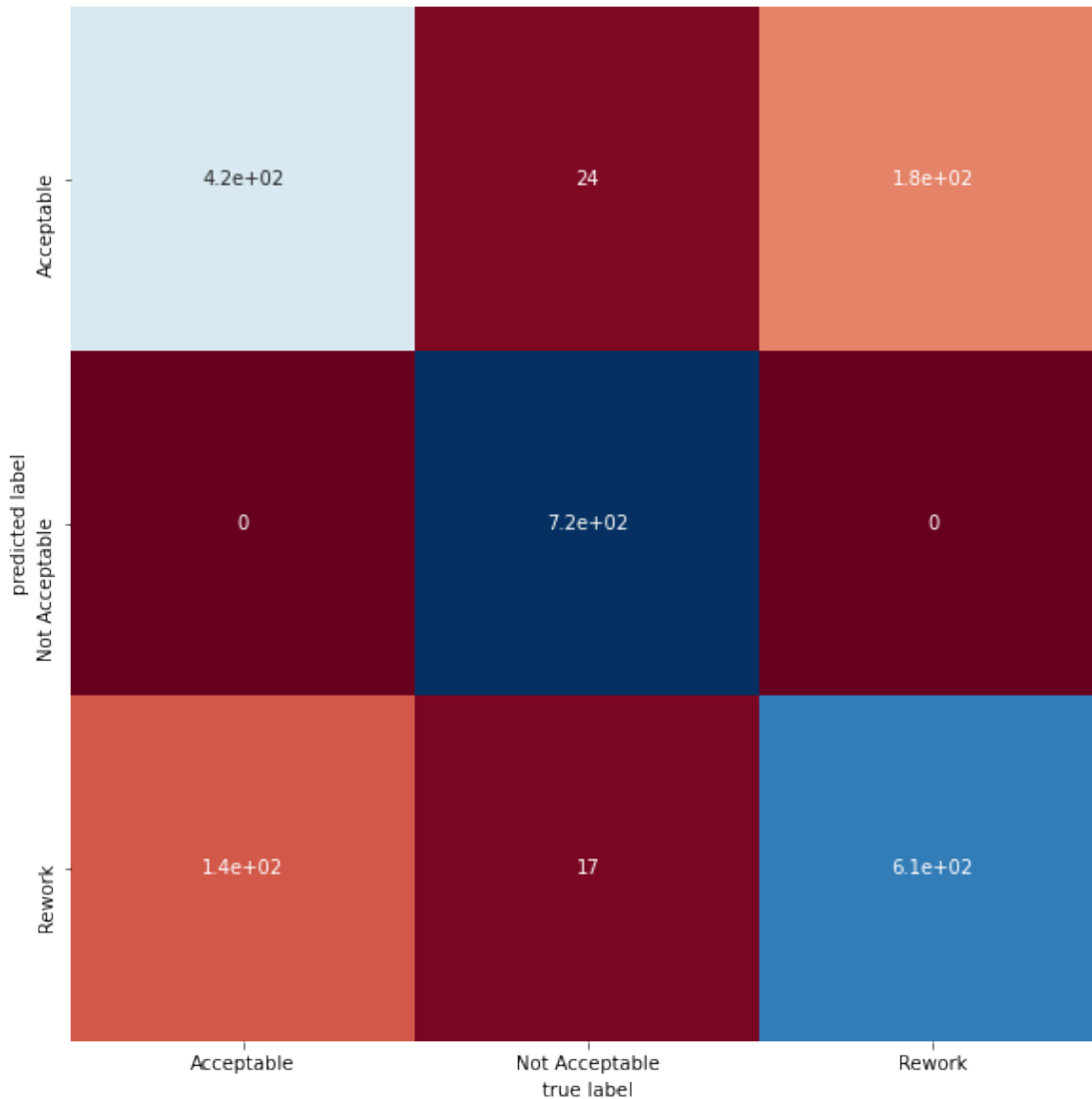
array([[415, 24, 180],
       [ 0, 717,  0],
       [137, 17, 608]], dtype=int64)

```

```

plt.figure(figsize=(15,10))
cm = confusion_matrix(y_test,predictions_SVM )
sns.heatmap(cm, square=True, annot=True, cmap='RdBu',
cbar=False,xticklabels=['Acceptable', 'Not Acceptable', 'Rework'],
yticklabels=['Acceptable', 'Not Acceptable', 'Rework'])
plt.xlabel('true label')
plt.ylabel('predicted label')
plt.show()

```



Hypertuning the parameters

```
X_train_cv = X_train_transformed
X_test_cv = X_test_transformed
```

```
from sklearn.svm import SVC
SVM_t1 = svm.SVC(C=10.0, kernel='linear', degree=3, gamma=0.01)
SVM_t1.fit(X_train_cv, y_train)
# predict the labels on validation dataset
predictions_SVM = SVM_t1.predict(X_test_cv)

print("SVM Accuracy Score :",accuracy_score(predictions_SVM,
y_test)*100,"%")
print("SVM Training Accuracy
Score :",accuracy_score(SVM_t1.predict(X_train_cv), y_train)*100,"%")
```

SVM Accuracy Score : 82.65014299332698 %  
SVM Training Accuracy Score : 99.25115692048801 %

```
from sklearn.svm import SVC
SVM_t2 = svm.SVC(C=1.0, kernel='linear', degree=3, gamma=0.01)
SVM_t2.fit(X_train_cv, y_train)
# predict the labels on validation dataset
predictions_SVM = SVM_t2.predict(X_test_cv)

print("SVM Accuracy Score :",accuracy_score(predictions_SVM,
y_test)*100,"%")
print("SVM Training Accuracy
Score :",accuracy_score(SVM_t2.predict(X_train_cv), y_train)*100,"%")
```

SVM Accuracy Score : 82.93612964728312 %  
SVM Training Accuracy Score : 99.25115692048801 %

```
from sklearn.svm import SVC
SVM_t3 = svm.SVC(C=0.1, kernel='linear', degree=3, gamma=0.01)
SVM_t3.fit(X_train_cv, y_train)
# predict the labels on validation dataset
predictions_SVM = SVM_t3.predict(X_test_cv)

print("SVM Accuracy Score :",accuracy_score(predictions_SVM,
y_test)*100,"%")
print("SVM Training Accuracy
Score :",accuracy_score(SVM_t3.predict(X_train_cv), y_train)*100,"%")
```

SVM Accuracy Score : 83.46043851286939 %  
SVM Training Accuracy Score : 98.90618426588136 %

```
from sklearn.svm import SVC
SVM_t4 = svm.SVC(C=0.1, kernel='rbf', degree=3, gamma=0.01)
SVM_t4.fit(X_train_cv, y_train)
# predict the labels on validation dataset
predictions_SVM = SVM_t4.predict(X_test_cv)

print("SVM Accuracy Score :",accuracy_score(predictions_SVM,
y_test)*100,"%")
print("SVM Training Accuracy
Score :",accuracy_score(SVM_t4.predict(X_train_cv), y_train)*100,"%")
```

SVM Accuracy Score : 51.42993326978075 %  
SVM Training Accuracy Score : 55.42280185107278 %

```
from sklearn.svm import SVC
SVM_t5 = svm.SVC(C=1, kernel='rbf', degree=3, gamma=0.01)
SVM_t5.fit(X_train_cv, y_train)
# predict the labels on validation dataset
predictions_SVM = SVM_t5.predict(X_test_cv)
```

```
print("SVM Accuracy Score :",accuracy_score(predictions_SVM,
y_test)*100,"%")
print("SVM Training Accuracy
Score :",accuracy_score(SVM_t5.predict(X_train_cv), y_train)*100,"%")
```

SVM Accuracy Score : 81.41086749285034 %  
SVM Training Accuracy Score : 95.10307109802272 %

```
from sklearn.svm import SVC
SVM_t6 = svm.SVC(C=10, kernel='rbf', degree=3, gamma=0.01)
SVM_t6.fit(X_train_cv, y_train)
# predict the labels on validation dataset
predictions_SVM = SVM_t6.predict(X_test_cv)
```

```
print("SVM Accuracy Score :",accuracy_score(predictions_SVM,
y_test)*100,"%")
print("SVM Training Accuracy
Score :",accuracy_score(SVM_t6.predict(X_train_cv), y_train)*100,"%")
```

SVM Accuracy Score : 83.0791229742612 %  
SVM Training Accuracy Score : 99.1586032814472 %

```
from sklearn.svm import SVC
SVM_t7 = svm.SVC(C=100, kernel='rbf', degree=3, gamma=0.01)
SVM_t7.fit(X_train_cv, y_train)
# predict the labels on validation dataset
predictions_SVM = SVM_t7.predict(X_test_cv)
```

```
print("SVM Accuracy Score :",accuracy_score(predictions_SVM,
y_test)*100,"%")
print("SVM Training Accuracy
Score :",accuracy_score(SVM_t7.predict(X_train_cv), y_train)*100,"%")
```

SVM Accuracy Score : 82.84080076263108 %  
SVM Training Accuracy Score : 99.25115692048801 %

### Upsampling again using randomClassifiers and Smote and proceeding further

```
df2=pd.read_csv("e:\\snagsover1.csv",encoding='ANSI')
df2=df2.drop(columns=['Forward Date','Disp
Date','CLOSE_DATE','SNAG_DATE'])
pd.set_option('display.max_columns',None)
df2.shape
```

(24562, 17)

```
df2['Status']=df2["target"]
df2.head()
```

SNAG_ID	INSP_NAME	SHOP
INSP_STAGE \		
0 009/01009	100376 (A A KULKARNI)	9
Anodising		Before

1	009/01010	15530 (RAVINDRA DATTU PAWAR)	9	Before
Anodising				
2	094/01002	16528 (ADITYA SANJEEV JOGLEKAR)	94	
Installation				
3	094/01005	16364 (SHANKAR BHAUSAHEB DHANAIT)	94	
Injig				
4	009/01026	15530 (RAVINDRA DATTU PAWAR)	9	Before Heat
Treatment				

	SNAG_DESC	SNAG_STROKE
\		
0	(1) IN partS 11.0790.I.122.900;123.900;124.90...	Operators Fault
1	TOOL MARK NOTICED ON part N0;11.2010.2.002.002...	Operators Fault
2	During leading edge assembly(11.2010.2.000.901...	Miscellaneous
3	52nd LH wing; drawing .11.2000.2.000.000 Aft...	Miscellaneous
4	As per main view of drawing . gap noticed ...	Material fault

TASK_NO	ENGR_FLAG	PART_NO
\		
0	14043 (GAURAV KUMAR SINGH )	R0790.009.002
-		
1	16030 (KESHAVE PRASAD DWIVEDI)	R2010.009.002
-		
2	13304 (ALOK KUMAR SINGH)	- SU30-94-466-
3510401		
3	15028 (RAKESH KUMAR)	- SU30-94-382-
3420401		
4	14044 (HEMANT N SAWANA )	E10.0200.0019.002
-		

SYSTEM	SUB_SYSTEM	PROJECT	\
0	NaN	-	-
1	NaN	-	-
2	NaN	-	SU30
3	NaN	-	SU30
4	NaN	-	-

DWG_NO	DISPOSITION
\	
0	acceptable to design
NaN	
1	suit the part 11.2010.2.002.002 with 11.2010....
	11.2010.2.002.002
2	it is allowed to file and merge the step.apply...

```

11.2010.2.000.901
3  install shim between the flanges of wall-3 roo...
11.2000.2.000.000
4                                not acceptable to design
NaN

```

	target	ACNO	P	Status
0	0	NaN	NaN	0
1	2	NaN	NaN	2
2	2	SBNA188	NaN	2
3	2	SBNA187	NaN	2
4	1	NaN	NaN	1

```

def snag_desc_to_no(df):
    for x in range(len(df)):
        z=str(df['DISPOSITION'][x])
        if 'not acceptable' in z:
            df['Status'][x]=1
        elif 'acceptable' in z:
            df['Status'][x]=0
        else :
            df['Status'][x]=2

noc,acc,rew=to_no(df2)
print("noc:",noc)
print("acc:",acc)
print("rew:",rew)

noc: 5692
acc: 8419
rew: 10451

df2=df2.drop(columns=['P','target'])
snag_desc_to_no(df2)

X_train,X_test,y_train,y_test =
train_test_split(df2['SNAG_DESC'],df2['Status'],test_size=0.15,random_
state=0)
vec=CountVectorizer(strip_accents='ascii', token_pattern=u'(?ui)\\b\\
w*[a-z]+\\w*\\b' or '\\D',ngram_range=(0,6), lowercase=True,
stop_words='english')
X_train_transformed=vec.fit_transform(X_train)
X_test_transformed=vec.transform(X_test)

mnb=MultinomialNB()
mnb.fit(X_train_transformed,y_train)
Predictions=mnb.predict(X_test_transformed)

print( "Accuracy of the Test
is:",metrics.accuracy_score(y_test,Predictions)*100,"%")
print("The Training Accuracy of the Model

```

```
is:" ,metrics.accuracy_score(y_train,mnb.predict(X_train_transformed))
*100, "%", "\n")
precision, recall, fscore, support = score(y_test,Predictions)
print('precision: {}'.format(precision))
print('recall: {}'.format(recall))
print('fscore: {}'.format(fscore))
print('support: {}'.format(support))
```

Accuracy of the Test is: 91.2347354138399 %  
The Training Accuracy of the Model is: 95.11424055180342 %

```
precision: [0.8989575  0.87253886 0.94976239]
recall: [0.888977  0.98364486 0.89221939]
fscore: [0.89393939 0.92476661 0.92009207]
support: [1261  856 1568]
```

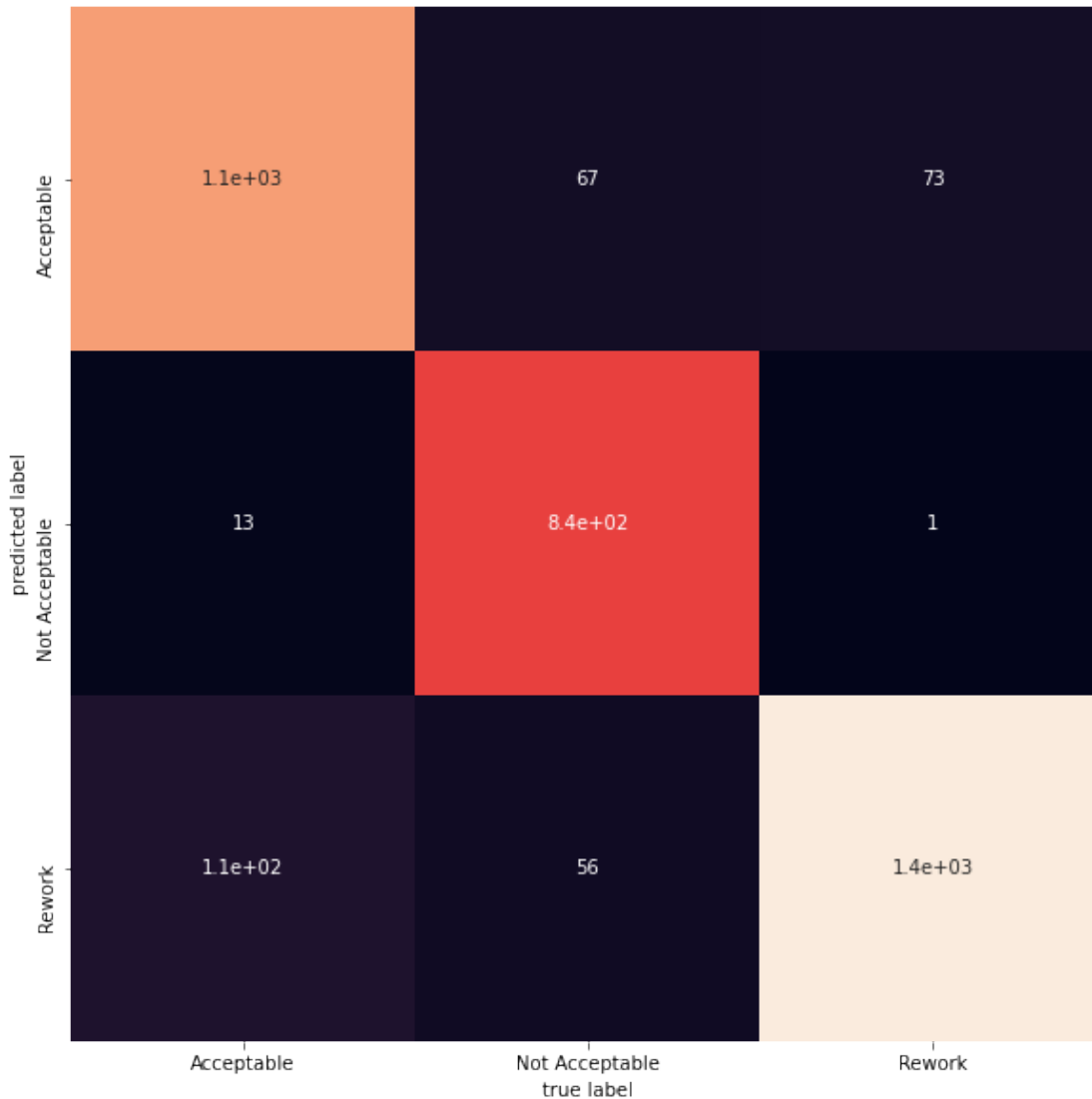
```
from sklearn.metrics import confusion_matrix
cm = confusion_matrix(y_test,Predictions)
cm
```

```
array([[1121,  67,  73],
       [ 13, 842,  1],
       [113,  56, 1399]], dtype=int64)
```

```
print(metrics.classification_report(y_test,Predictions))
```

	precision	recall	f1-score	support
0	0.90	0.89	0.89	1261
1	0.87	0.98	0.92	856
2	0.95	0.89	0.92	1568
accuracy			0.91	3685
macro avg	0.91	0.92	0.91	3685
weighted avg	0.91	0.91	0.91	3685

```
import matplotlib.pyplot as plt
import seaborn as sns
plt.figure(figsize=(15,10))
cm = confusion_matrix(y_test,Predictions )
sns.heatmap(cm, square=True, annot=True, cbar=False,
xticklabels=['Acceptable','Not Acceptable','Rework'],
yticklabels=['Acceptable','Not Acceptable','Rework'])
plt.xlabel('true label')
plt.ylabel('predicted label')
plt.show()
```



```

from sklearn.svm import SVC
SVM = svm.SVC(C=1.0, kernel='linear', degree=3, gamma=0.01)
SVM.fit(X_train_transformed, y_train)
predictions_SVM = SVM.predict(X_test_transformed)

print("SVM Accuracy Score :",accuracy_score(predictions_SVM,
y_test)*100,"%")
print("SVM Training Accuracy
Score :",accuracy_score(SVM.predict(X_train_transformed),
y_train)*100,"%" , "\n")
precision, recall, fscore, support = score(y_test, predictions_SVM)
print('precision: {}'.format(precision))
print('recall: {}'.format(recall))
print('fscore: {}'.format(fscore))
print('support: {}'.format(support))

```



SVM Accuracy Score : 95.5495251017639 %  
SVM Training Accuracy Score : 98.76419025722086 %

```
precision: [0.9432      0.97139588 0.95643818]  
recall: [0.93497224 0.99182243 0.95216837]  
fscore: [0.9390681  0.98150289 0.9542985 ]  
support: [1261   856 1568]
```

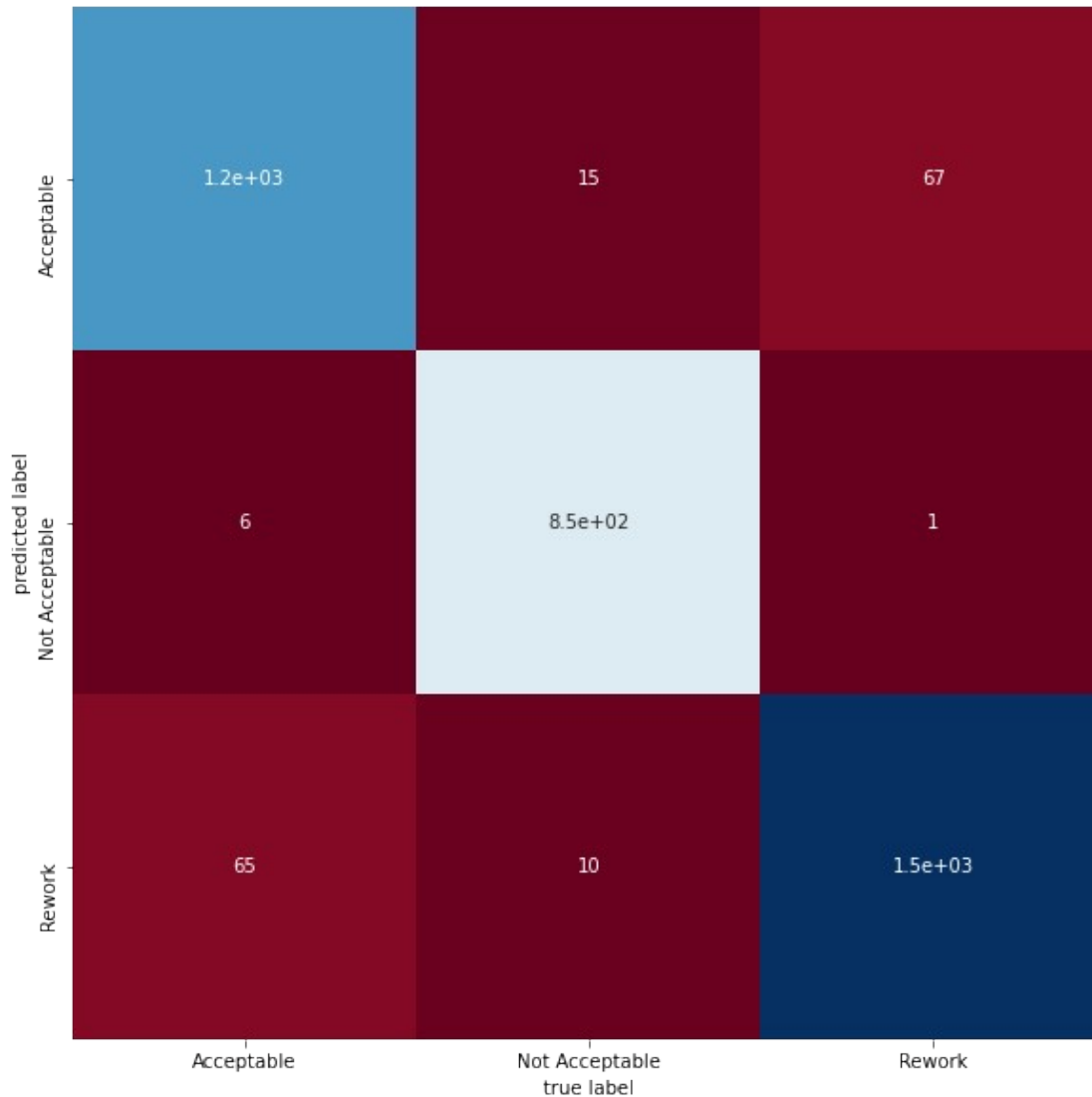
```
cm = confusion_matrix(y_test,predictions_SVM )  
cm
```

```
array([[1179,   15,   67],  
       [    6,  849,    1],  
       [   65,   10, 1493]], dtype=int64)
```

```
print(metrics.classification_report(y_test,predictions_SVM))
```

	precision	recall	f1-score	support
0	0.94	0.93	0.94	1261
1	0.97	0.99	0.98	856
2	0.96	0.95	0.95	1568
accuracy			0.96	3685
macro avg	0.96	0.96	0.96	3685
weighted avg	0.96	0.96	0.96	3685

```
from sklearn.metrics import confusion_matrix  
import matplotlib.pyplot as plt  
import seaborn as sns  
plt.figure(figsize=(15,10))  
cm = confusion_matrix(y_test,predictions_SVM )  
sns.heatmap(cm, square=True, annot=True, cmap='RdBu', cbar=False,  
xticklabels=['Acceptable','Not Acceptable','Rework'],  
yticklabels=['Acceptable','Not Acceptable','Rework'])  
plt.xlabel('true label')  
plt.ylabel('predicted label')  
plt.show()
```



### Hyperparameter tuning

```
X_train,X_test,y_train,y_test =
train_test_split(df2['SNAG_DESC'],df2['Status'],test_size=0.15,random_
state=0)
vec=CountVectorizer(strip_accents='ascii', token_pattern=u'(?ui)\\b\\
w*[a-z]+\\w*\\b' or '\\D',
                    ngram_range=(0,6), lowercase=True,
stop_words='english')
X_train_transformed=vec.fit_transform(X_train)
X_test_transformed=vec.transform(X_test)
```

### #Kfold cross-validation

```
folds = KFold(n_splits = 5, shuffle = True, random_state = 101)
hyper_params = [{'gamma':[1e-1,1e-2,1e-3],'C':[1,10,100]}]
model = svm.SVC(kernel='rbf')
```

```

model_cv_svm =
GridSearchCV(estimator=model,param_grid=hyper_params,scoring="accuracy
",cv=folds,
               n_jobs=-
1,verbose=1,return_train_score=True)
model_cv_svm.fit(X_train_transformed,y_train)

```

Fitting 5 folds for each of 9 candidates, totalling 45 fits

```

GridSearchCV(cv=KFold(n_splits=5, random_state=101, shuffle=True),
             estimator=SVC(), n_jobs=-1,
             param_grid=[{'C': [1, 10, 100], 'gamma': [0.1, 0.01,
0.001]}],
             return_train_score=True, scoring='accuracy', verbose=1)

```

```

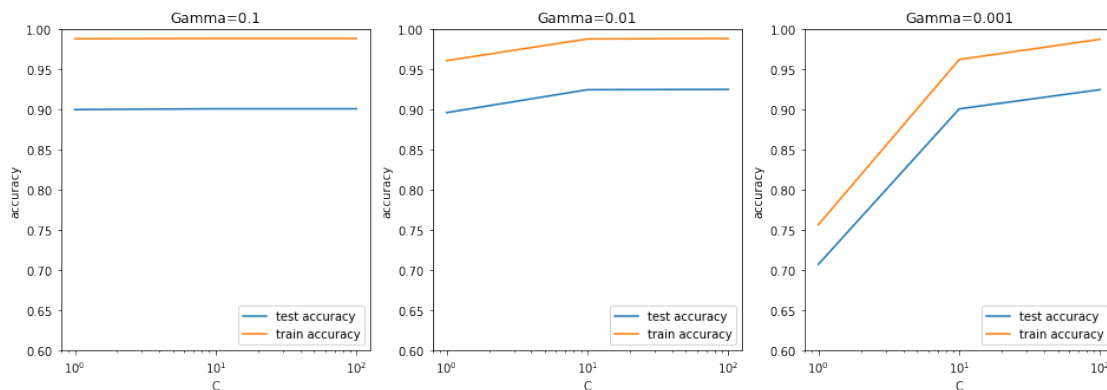
def display_stats(cv_results,param_value):
    gamma = cv_results[cv_results['param_gamma']==param_value]
    plt.plot(gamma['param_C'],gamma['mean_test_score'])
    plt.plot(gamma['param_C'],gamma['mean_train_score'])
    plt.xlabel('C')
    plt.ylabel('accuracy')
    plt.title("Gamma="+str(param_value))
    plt.ylim([0.6,1])
    plt.legend(['test accuracy','train accuracy'],loc='lower right')
    plt.xscale('log')

```

```

svm_cv_results = pd.DataFrame(model_cv_svm.cv_results_)
svm_cv_results['param_C'] = svm_cv_results['param_C'].astype('int')
gamma=[1e-1,1e-2,1e-3]
plt.figure(figsize=(16,5))
plt.subplot(131)
display_stats(svm_cv_results,gamma[0])
plt.subplot(132)
display_stats(svm_cv_results,gamma[1])
plt.subplot(133)
display_stats(svm_cv_results,gamma[2])
plt.show()

```



```

X_train,X_test,y_train,y_test =
train_test_split(df2['SNAG_DESC'],df2['Status'],test_size=0.15,random_
state=0)
vec=CountVectorizer(strip_accents='ascii', token_pattern=u'(?ui)\\b\\
w*[a-z]+\\w*\\b' or '\\D',ngram_range=(0,6), lowercase=True,
stop_words='english')
X_train_transformed=vec.fit_transform(X_train)
X_test_transformed=vec.transform(X_test)
X_train_cv = X_train_transformed
X_test_cv = X_test_transformed

```

```

from sklearn.svm import SVC
SVM_t1 = svm.SVC(C=10.0, kernel='linear', degree=3, gamma=0.01)
SVM_t1.fit(X_train_cv, y_train)
# predict the labels on validation dataset
predictions_SVM = SVM_t1.predict(X_test_cv)

```

```

print("SVM Accuracy Score :",accuracy_score(predictions_SVM,
y_test)*100,"%")
print("SVM Training Accuracy
Score :",accuracy_score(SVM_t1.predict(X_train_cv), y_train)*100,"%")

```

```

SVM Accuracy Score : 95.30529172320217 %
SVM Training Accuracy Score : 98.7689802174642 %

```

```

from sklearn.svm import SVC
SVM_t2 = svm.SVC(C=1.0, kernel='linear', degree=3, gamma=0.01)
SVM_t2.fit(X_train_cv, y_train)
# predict the labels on validation dataset
predictions_SVM = SVM_t2.predict(X_test_cv)

```

```

print("SVM Accuracy Score :",accuracy_score(predictions_SVM,
y_test)*100,"%")
print("SVM Training Accuracy
Score :",accuracy_score(SVM_t2.predict(X_train_cv), y_train)*100,"%")

```

```

SVM Accuracy Score : 95.5495251017639 %
SVM Training Accuracy Score : 98.76419025722086 %

```

```

from sklearn.svm import SVC
SVM_t3 = svm.SVC(C=0.1, kernel='linear', degree=3, gamma=0.01)
SVM_t3.fit(X_train_cv, y_train)
# predict the labels on validation dataset
predictions_SVM = SVM_t3.predict(X_test_cv)

```

```

print("SVM Accuracy Score :",accuracy_score(predictions_SVM,
y_test)*100,"%")
print("SVM Training Accuracy
Score :",accuracy_score(SVM_t3.predict(X_train_cv), y_train)*100,"%")

```

SVM Accuracy Score : 95.359565807327 %  
SVM Training Accuracy Score : 98.51990228481104 %

```
testing_predictions = []
for i in range(len(X_test)):
    if predictions_SVM[i] == 1:
        testing_predictions.append('NOT acc')
    elif predictions_SVM[i] == 0:
        testing_predictions.append('acceptable')
    else:
        testing_predictions.append('rework')
check_df = pd.DataFrame({'actual_label': list(y_test), 'prediction':
testing_predictions, 'SNAG_DESC':list(X_test)})
check_df.replace(to_replace=1, value='Not Acc', inplace=True)
check_df.replace(to_replace=0, value='acceptable', inplace=True)
check_df.replace(to_replace=2, value='rework', inplace=True)

predictions_SVM
array([1, 1, 2, ..., 1, 2, 2], dtype=int64)

check_df.head(30)

   actual_label prediction
SNAG_DESC
0      Not Acc      NOT acc  SNAG RAISED BY ABHIJIT KOTASTHANE\npart
NO 11....
1      Not Acc      NOT acc  drawing   number 11.5305.3.760.000\nAxis
of N...
2      rework      rework   51st RH wing
drawing .11.2000.2.000.000 she...
3      rework      rework   drawing   .mo.11.0670.i200.000\nDuring
suitin...
4      Not Acc      NOT acc  MATERIAL THICKNESS measured 2 mm
inspection o...
5      rework      rework   75 RH AIR INTAKE\n1) While installation
of fr...
6      rework      NOT acc  undercut found of area 10X6 mm on three
part...
7      acceptable  acceptable  During suiting of hatch cover
11.2003.2.000.0...
8      rework      rework   drawing   No-E10.0610.I.200.000\n After
riveti...
9      Not Acc      NOT acc  TANK SL NO 236. LEAK IS NOTICED THROUGH A
CRAC...
10     acceptable  acceptable  drawing   .number 11.0610.7.130.000\
nAfter fa...
11     acceptable  acceptable  SB-419;69TH RH LEADING EDGE
ASSEMBLY(11.2010.2...
```

12	rework	rework	drawing	. No- E10.0620.I380.000\
nExcess thi...				
13	Not Acc	NOT acc	drawing	.number 11.0620.3.300.000\
nDuring i...				
14	acceptable	acceptable	drawing	.number E10.0610.i200.000 ;
E10.061...				
15	rework	rework	drawing	no- 11.0620.I.580.000\nDuring
impli...				
16	rework	rework	drawing	-11.0710.1.800.000\n\n
DURING ...				
17	rework	rework	Canopy butting marks at 2 to 3 places	
observed...				
18	Not Acc	NOT acc	reference X RAY NO NX 1179 CAVITY and	
SURFACE...				
19	acceptable	acceptable	reference No- SU30/ROH/201/12-13/118 Snag	
No 6...				
20	rework	rework	drawing	No- 11.0610.3.807.900\n After
suitin...				
21	Not Acc	NOT acc	TANK SL NO - 115 DEPRESSION ON T-profile	
MEAS...				
22	Not Acc	NOT acc	set no; -37 RH & LH\n drawing	no;-
11.0610.i...				
23	acceptable	acceptable	AS PER DISPOSITION	reference SQMS SNAG
ID 0...				
24	rework	rework	drawing	No-11.1000.4.100.000 During
installa...				
25	rework	acceptable	Refer PSS Sl.number 06. Dent (Area	
approximate...				
26	acceptable	acceptable	Radiator P No 21-7604-10 Sl No 0106062	
(Rotabl...				
27	acceptable	acceptable	drawing	.number E10.0610.i200.000\
nAfter fa...				
28	acceptable	acceptable	SET number 31 LH \nAFTER FASTENING 4	
stiffene...				
29	acceptable	acceptable	69th LH After checking the contor of	
wing in ...				

SNAG\_DESC="draw"

ch = pd.DataFrame({SNAG\_DESC})

chv=vec.transform(ch[0])

print(SVM.predict(chv))

[2]

SNAG\_DESC1=['Dent/Tool mark observd in the peice','As per main view of  
drw gap noticed due to lack of material up to length 165.5mm, dpth  
51mm,width 120m ref attached sketch','LEAK','acceptable','not  
acceptable',

'lh air intake ext i/b p.s.s number 245 qty 1 joe bolt  
found pulled up approx 1.2 mm at frame number 18','refer drawing  
number 11.2003.2.000.000 zone 4 during installation of verticle bolt

part number 11.2003.7.208.900 on lh/rh wing it is observed that length is short by 2.5 mm for split pinning even using the washer of minimum dimension of 1 mm and maintaining the 1.5 mm gap between head of bolt and wing structure. design/ppo is requested to give disposition']

```
ch = pd.DataFrame(SNAG_DESC1)
chv=vec.transform(ch[0])
print(SVM.predict(chv))
```

```
[2 2 2 2 2 2 0]
```

```
def num_to_disposition(tar):
    for i in tar:
        if i == 0 : print("Design is Acceptable")
        elif i==1 : print("Design is Not Acceptable")
        else : print("Rework is Required")
```

```
SNAG_DESC1=['Dent/Tool mark observd in the peice','As per main view of
drw gap noticed due to lack of material up to length 165.5mm, dpth
51mm,width 120m ref attached sketch','LEAK','acceptable','not
acceptable',
```

```
        'lh air intake ext i/b p.s.s number 245 qty 1 joe bolt
found pulled up approx 1.2 mm at frame number 18','refer drawing
number 11.2003.2.000.000 zone 4 during installation of verticle bolt
part number 11.2003.7.208.900 on lh/rh wing it is observed that length
is short by 2.5 mm for split pinning even using the washer of minimum
dimension of 1 mm and maintaining the 1.5 mm gap between head of bolt
and wing structure. design/ppo is requested to give disposition',
        'reference. attached sketch & dwg detail view g...' ]
```

```
ch = pd.DataFrame(SNAG_DESC1)
print(ch.head(30),"\n")
chv=vec.transform(ch[0])
print(chv,"\n")
tar=SVM.predict(chv)
print("Status array :",tar)
```

```

0
0          Dent/Tool mark observd in the peice
1 As per main view of drw gap noticed due to lac...
2          LEAK
3          acceptable
4          not acceptable
5 lh air intake ext i/b p.s.s number 245 qty 1 j...
6 refer drawing number 11.2003.2.000.000 zone 4 ...
7 reference. attached sketch & dwg detail view g...
```

```
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(0, 75946) 1
(0, 76654) 1
(0, 76655) 1
(0, 197128) 1
(0, 371248) 1
```

(0, 371307)	1
(1, 0)	17
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(1, 29597)	1
(1, 138199)	1
(1, 139627)	1
(1, 139952)	1
(1, 139953)	1
(1, 139954)	1
(1, 178321)	1
(1, 178331)	1
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(1, 180351)	1
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:	:
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(6, 318112)	1
(6, 338148)	1
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(6, 357386)	1
(6, 378759)	1
(6, 378814)	1
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(6, 387900)	2
(6, 389767)	1
(6, 390269)	1
(6, 393747)	1
(6, 394496)	1
(7, 0)	7
(7, 29186)	1
(7, 29597)	1
(7, 137887)	1
(7, 306036)	1
(7, 306064)	1
(7, 306099)	1
(7, 340129)	1
(7, 380504)	1
(7, 380981)	1

Status array : [2 2 2 2 2 2 0 2]

num\_to\_disposition(tar)



Rework is Required  
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Design is Acceptable  
Rework is Required

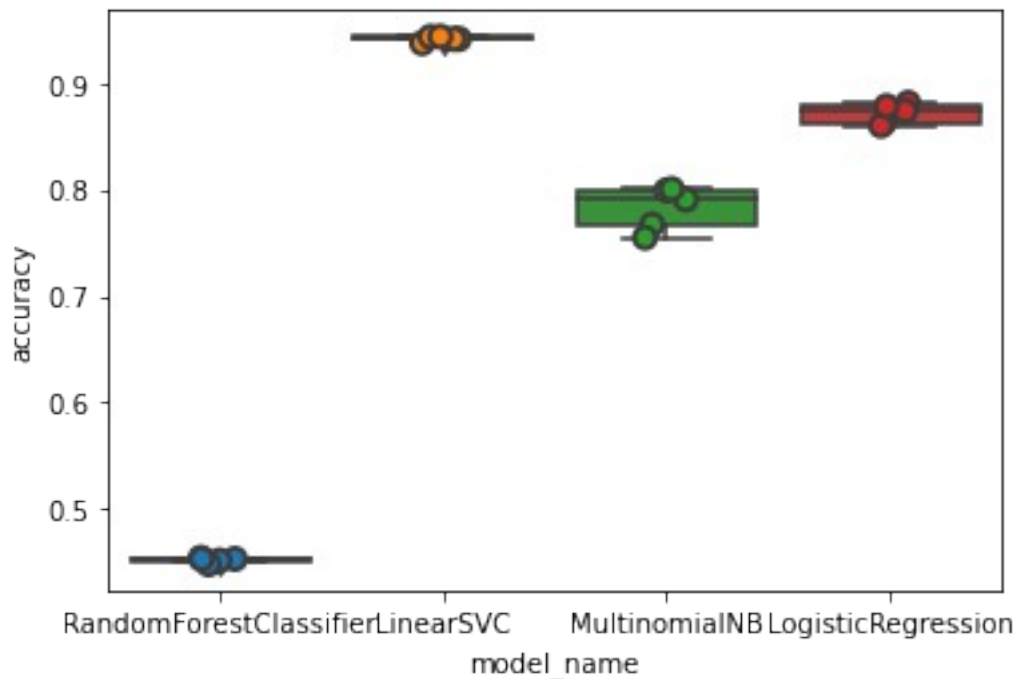
## Using Various Machine Learning Models

```
from sklearn.feature_extraction.text import TfidfVectorizer
tfidf = TfidfVectorizer(sublinear_tf=True, min_df=5, norm='l2',
encoding='latin-1', ngram_range=(1, 2), stop_words='english')
features = tfidf.fit_transform(df2.SNAG_DESC).toarray()
labels = df2.Status
features.shape
from sklearn.model_selection import train_test_split
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.feature_extraction.text import TfidfTransformer
from sklearn.naive_bayes import MultinomialNB
X_train, X_test, y_train, y_test = train_test_split(df2['SNAG_DESC'],
df2['Status'], random_state = 0)
count_vect = CountVectorizer()
X_train_counts = count_vect.fit_transform(X_train)
tfidf_transformer = TfidfTransformer()
X_train_tfidf = tfidf_transformer.fit_transform(X_train_counts)
clf = MultinomialNB().fit(X_train_tfidf, y_train)

from sklearn.linear_model import LogisticRegression
from sklearn.ensemble import RandomForestClassifier
from sklearn.svm import LinearSVC
from sklearn.model_selection import cross_val_score
models = [
    RandomForestClassifier(n_estimators=200, max_depth=3,
random_state=0),
    LinearSVC(),
    MultinomialNB(),
    LogisticRegression(random_state=0),
]
CV = 5
cv_df = pd.DataFrame(index=range(CV * len(models)))
entries = []
for model in models:
    model_name = model.__class__.__name__
    accuracies = cross_val_score(model, features, labels,
scoring='accuracy', cv=CV)
    for fold_idx, accuracy in enumerate(accuracies):
        entries.append((model_name, fold_idx, accuracy))
```

```
cv_df = pd.DataFrame(entries, columns=['model_name', 'fold_idx',
'accuracy'])

import seaborn as sns
sns.boxplot(x='model_name', y='accuracy', data=cv_df)
sns.stripplot(x='model_name', y='accuracy', data=cv_df,
              size=8, jitter=True, edgecolor="gray", linewidth=2)
plt.show()
```



```
cv_df.groupby('model_name').accuracy.mean()
```

```
model_name
LinearSVC          0.941861
LogisticRegression 0.871631
MultinomialNB      0.782713
RandomForestClassifier 0.451999
Name: accuracy, dtype: float64
```

```
from sklearn.ensemble import GradientBoostingClassifier
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.model_selection import train_test_split
```

```
X_train,X_test,y_train,y_test =
train_test_split(df2['SNAG_DESC'],df2['Status'],test_size=0.15,random_
state=0)
```

```
vec=CountVectorizer(strip_accents='ascii', token_pattern=u'(?ui)\b\\
w*[a-z]+\w*\b' or '\D',ngram_range=(0,6), lowercase=True,
stop_words='english')
X_train=vec.fit_transform(X_train)
```

```
X_test=vec.transform(X_test)

model=GradientBoostingClassifier(n_estimators=200, max_depth=3,
random_state=0)
model.fit(X_train,y_train)
predicts_train = model.predict(X_train)
Training_Accuracy = accuracy_score(y_train,predicts_train)
print("Training_Accuracy :",Training_Accuracy*100 )
predicts_test = model.predict(X_test)
Testing_Accuracy = accuracy_score(y_test,predicts_test)
print("Testing_Accuracy :",Testing_Accuracy*100)

Training_Accuracy : 72.58226756717919
Testing_Accuracy : 68.60244233378562
```

**The Mean Accuracy Scores using Various Models are as follows :**

**The Highest Accuracy was reached with SVM using the hyperparameters C=10.0,  
kernel='linear', degree=3,**

**gamma=0.01**

*SVM Accuracy Score : 95.5495251017639 %*

*SVM Training Accuracy Score : 98.76419025722086 %*