

## Project: Machine Learning.

### Problem 1:

You are hired by one of the leading news channels CNBE who wants to analyze recent elections. This survey was conducted on 1525 voters with 9 variables. You have to build a model, to predict which party a voter will vote for on the basis of the given information, to create an exit poll that will help in predicting overall win and seats covered by a particular party.

### Data Dictionary

1. vote: Party choice: Conservative or Labour
2. age: in years
3. economic.cond.national: Assessment of current national economic conditions, 1 to 5.
4. economic.cond.household: Assessment of current household economic conditions, 1 to 5.
5. Blair: Assessment of the Labour leader, 1 to 5.
6. Hague: Assessment of the Conservative leader, 1 to 5.
7. Europe: an 11-point scale that measures respondents' attitudes toward European integration. High scores represent 'Eurosceptic' sentiment.
8. political.knowledge: Knowledge of parties' positions on European integration, 0 to 3.
9. gender: female or male.

1.1) Read the dataset. Describe the data briefly. Interpret the inferences for each. Initial steps like head(), .info(), Data Types, etc . Null value check, Summary stats, Skewness must be discussed.

In [2]:

```
# importing require Libraries.

import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
%matplotlib inline
import seaborn as sns
plt.style.use('ggplot')
import warnings
warnings.filterwarnings('ignore')
```

In [4]:

```
#Loading Data Set and saving it into df and checking the head (few rows and columns).
```

```
df = pd.read_excel (r'E:\Great Learning\Projects\Machine Learning,Text,Sentiment Analysis\Data Sets\Election_Data.xlsx')
df.head(8)
```

Out[4]:

	Unnamed: 0	vote	age	economic.cond.national	economic.cond.household	Blair	Hague
0	1	Labour	43	3		3	4
1	2	Labour	36	4		4	4
2	3	Labour	35	4		4	5
3	4	Labour	24	4		2	2
4	5	Labour	41	2		2	1
5	6	Labour	47	3		4	4
6	7	Labour	57	2		2	4
7	8	Labour	77	3		4	1

In [5]:

```
df.shape
```

Out[5]:

```
(1525, 10)
```

In [6]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1525 entries, 0 to 1524
Data columns (total 10 columns):
Unnamed: 0              1525 non-null int64
vote                   1525 non-null object
age                     1525 non-null int64
economic.cond.national 1525 non-null int64
economic.cond.household 1525 non-null int64
Blair                  1525 non-null int64
Hague                  1525 non-null int64
Europe                 1525 non-null int64
political.knowledge    1525 non-null int64
gender                 1525 non-null object
dtypes: int64(8), object(2)
memory usage: 119.3+ KB
```

In [7]:

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

Out[7]:

```
Unnamed: 0          0
vote              0
age               0
economic.cond.national 0
economic.cond.household 0
Blair             0
Hague             0
Europe            0
political.knowledge 0
gender            0
dtype: int64
```

In [8]:

```
dups=df.duplicated()
print ('Number of Duplicates in Given DataSet are %d' % (dups.sum()))
```

Number of Duplicates in Given DataSet are 0

In [10]:

```
df.columns.value_counts(normalize=True)
```

Out[10]:

```
age           0.1
vote          0.1
Blair         0.1
Europe        0.1
gender        0.1
political.knowledge 0.1
economic.cond.national 0.1
Hague          0.1
Unnamed: 0      0.1
economic.cond.household 0.1
dtype: float64
```

In [11]:

```
# Removing Column ('Unnamed: 0') as it dosnt have any input for given Data.

df = df.drop ('Unnamed: 0',axis=1)
df.head()
```

Out[11]:

	vote	age	economic.cond.national	economic.cond.household	Blair	Hague	Europe	pol
0	Labour	43		3		3	4	1
1	Labour	36		4		4	4	5
2	Labour	35		4		4	5	2
3	Labour	24		4		2	2	1
4	Labour	41		2		2	1	6

In [12]:

```
df.describe (include='all')
```

Out[12]:

	vote	age	economic.cond.national	economic.cond.household	Blair
count	1525	1525.000000	1525.000000	1525.000000	1525.000000
unique	2	NaN	NaN	NaN	NaN
top	Labour	NaN	NaN	NaN	NaN
freq	1063	NaN	NaN	NaN	NaN
mean	NaN	54.182295	3.245902	3.140328	3.334426
std	NaN	15.711209	0.880969	0.929951	1.174824
min	NaN	24.000000	1.000000	1.000000	1.000000
25%	NaN	41.000000	3.000000	3.000000	2.000000
50%	NaN	53.000000	3.000000	3.000000	4.000000
75%	NaN	67.000000	4.000000	4.000000	4.000000
max	NaN	93.000000	5.000000	5.000000	5.000000

In [13]:

```
# Checking for unique values in given Data Set.

for column in df.columns:
    if df[column].dtype == 'object':
        print (column.upper(), ':', df[column].nunique())
        print (df[column].value_counts().sort_values())
        print ('\n')
```

```
VOTE : 2
Conservative      462
Labour            1063
Name: vote, dtype: int64
```

```
GENDER : 2
male       713
female     812
Name: gender, dtype: int64
```

### Inferences:

Describing the Data: The shape of the data is 1525 rows and 9 columns (after removing unnamed). Columns are

vote,age,economic.cond.national,economic.cond.household,Blair,Hague,Europe,political.knowledge,gender.

Data Types: Vote and Gender columns are Object data type and remaining columns are integer data type.

Null Value: There are no Null or Missing values in the given Data set as we checked in the null condition.

Duplicates: There are no Duplicates present in the Data Set.

Stats Summary: As we know by doing describe function, Mean and Std.Dev of all the columns (other than Age) are very close to each other. Skewness: By looking at Min,50% and Max values for every column in describe function we know that there must be NO SKEWNESS as Data is Normally distributed, but for Age column we see that there could be possibility skewness but that we can easily verify when we perform the visualisation. But as of now in given data, there is no Visual evidence for SKEWNESS in any given column.

In [ ]:

1.2) Perform EDA (Check the null values, Data types, shape, Univariate, bivariate analysis). Also check for outliers (4 pts). Interpret the inferences for each (3 pts) Distribution plots(histogram) or similar plots for the continuous columns. Box plots, Correlation plots. Appropriate plots for categorical variables. Inferences on each plot. Outliers proportion should be discussed, and inferences from above used plots should be there

### EDA.

In [21]:

```
# Null Values, Data Types and Shape.  
  
print(df.isnull().sum())  
  
print(df.shape)  
  
print (df.dtypes)
```

```
vote          0  
age           0  
economic.cond.national 0  
economic.cond.household 0  
Blair         0  
Hague         0  
Europe        0  
political.knowledge 0  
gender         0  
dtype: int64  
(1525, 9)  
vote          object  
age           int64  
economic.cond.national int64  
economic.cond.household int64  
Blair         int64  
Hague         int64  
Europe        int64  
political.knowledge int64  
gender         object  
dtype: object
```

### Univariate Analysis:

Lets try to extract the information from each continuous variable.

In [29]:

```
fig , axes = plt.subplots (nrows=7,ncols=2)
fig.set_size_inches (12,14)

r = sns.distplot (df ['age'],ax=axes [0][0]);
r.set_title ('age Distribution',fontsize=15)
r = sns.boxplot (df ['age'],orient='v',ax=axes [0][1]);
r.set_title ('age Boxplot',fontsize=15)

r = sns.distplot (df ['economic.cond.national'],ax=axes [1][0]);
r.set_title ('economic.cond.national Distribution',fontsize=15)
r = sns.boxplot (df ['economic.cond.national'],orient='v',ax=axes [1][1]);
r.set_title ('economic.cond.national Boxplot',fontsize=15)

r = sns.distplot (df ['economic.cond.household'],ax=axes [2][0]);
r.set_title ('economic.cond.household Distribution',fontsize=15)
r = sns.boxplot (df ['economic.cond.household'],orient='v',ax=axes [2][1]);
r.set_title ('economic.cond.household boxplot',fontsize=15)

r = sns.distplot (df ['Blair'],ax=axes [3][0]);
r.set_title ('Blair Distribution',fontsize=15)
r = sns.boxplot (df ['Blair'],orient='v',ax=axes [3][1]);
r.set_title ('Blair Boxplot',fontsize=15)

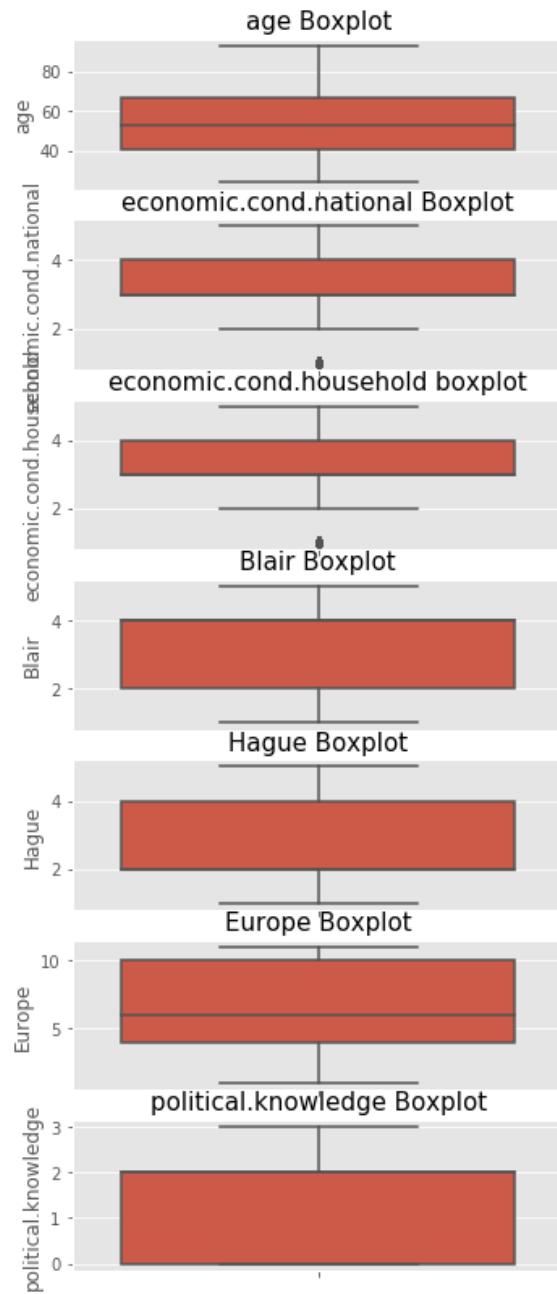
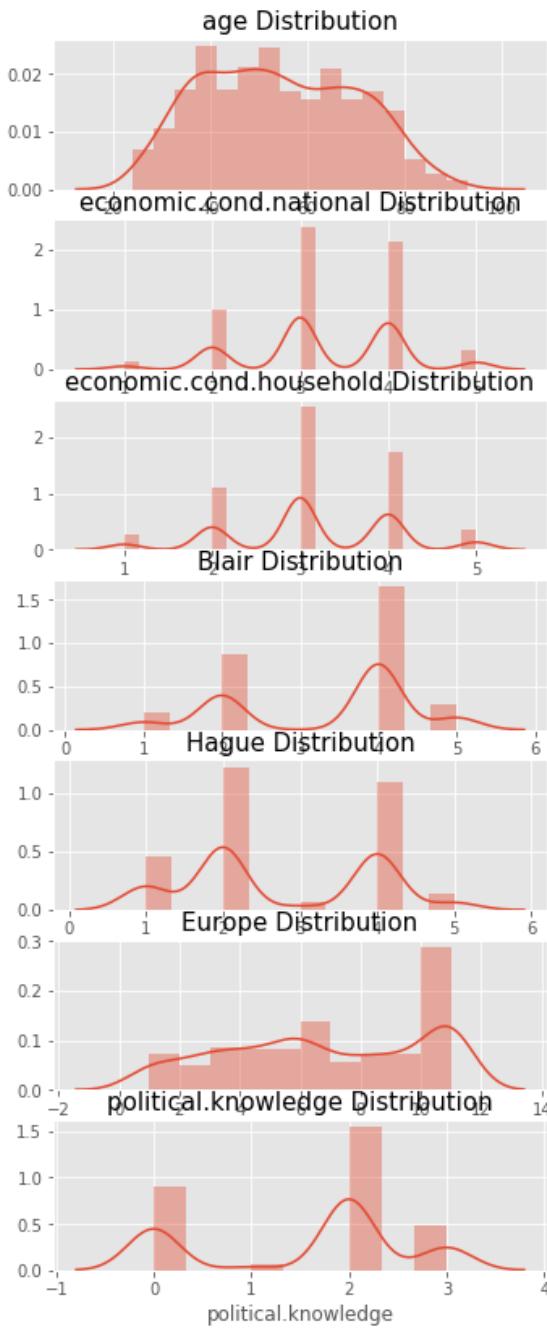
r = sns.distplot (df ['Hague'],ax=axes [4][0]);
r.set_title ('Hague Distribution',fontsize=15)
r = sns.boxplot (df ['Hague'],orient='v',ax=axes [4][1]);
r.set_title ('Hague Boxplot',fontsize=15)

r = sns.distplot (df ['Europe'],ax=axes [5][0]);
r.set_title ('Europe Distribution',fontsize=15)
r = sns.boxplot (df ['Europe'],orient='v',ax=axes [5][1]);
r.set_title ('Europe Boxplot',fontsize=15)

r = sns.distplot (df ['political.knowledge'],ax=axes [6][0]);
r.set_title ('political.knowledge Distribution',fontsize=15)
r = sns.boxplot (df ['political.knowledge'],orient='v',ax=axes [6][1]);
r.set_title ('political.knowledge Boxplot',fontsize=15)
```

Out[29]:

Text(0.5, 1.0, 'political.knowledge Boxplot')



## Inferences.

By looking at the above plot we can see that the column [AGE] can say that it is somehow Distributed Normally with no Outliers.

Remaining all are showing that Data is very Unbalanced giving small peaks at the beginning and then dropping out in the middle and then going again up at the end, so this peak can indicate us that Data is unbalanced for each column. We cannot say for every column that Data is skewed.

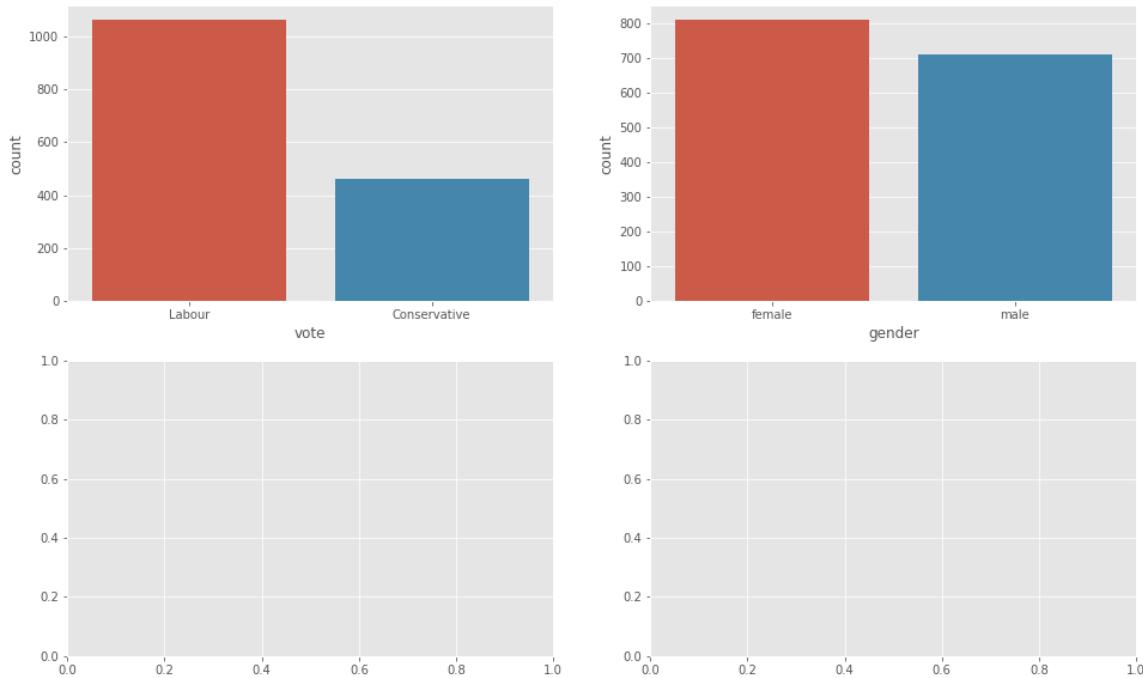
Also, Economic Cond National and household shows Outliers.

In [37]:

```
# Univariate Analysis for Object Data Type.
```

```
fig,ax = plt.subplots(2,2,figsize=(16,10))

sns.countplot ('vote',data=df,ax=ax [0][0]);
sns.countplot ('gender',data=df,ax=ax [0][1]);
```



In [39]:

```
df.gender.value_counts (normalize=True)
```

Out[39]:

```
female    0.532459
male      0.467541
Name: gender, dtype: float64
```

### Inferences:

Above VOTE plot shows that Vote to Party choice (Labour) is more as compared to Conservative, which gives us insights that people are more tend towards the Party (Labour) which is around 70 % and Conservative is having 30 %.

By looking at this Data we can say that Majority people have voted for Labour party and hence Labour party can win the elections. (also, Data is Imbalanced).

Gender Plot shows that Female voters are more as compared to the Male voters by around 7 %.

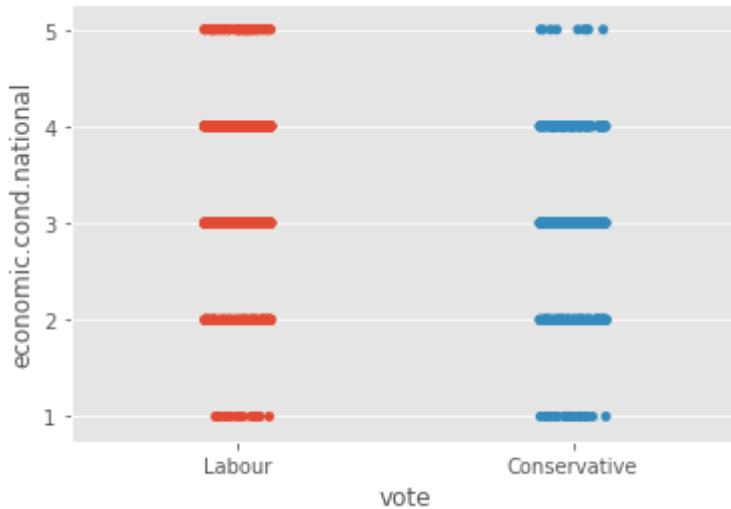
This gives insights that Females are more towards the voting.

We can see that Age is not the distinguisher as almost all the Age Group are voting to both the parties.

In [43]:

```
# Lets check how each variable is impacting on Target Column.
# economic.cond.national vs Vote.

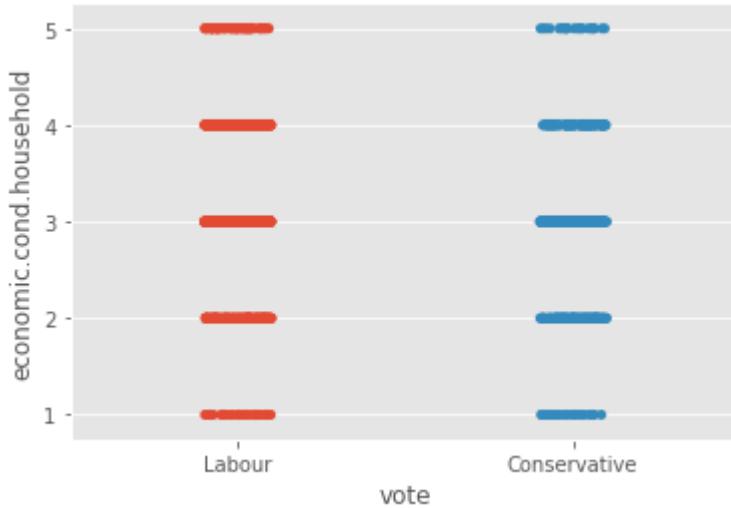
sns.stripplot (df ['vote'], df ['economic.cond.national'], jitter=True);
```



National Economic condition are much more (for 5) towards the Labour party for the voters and it is somehow less towards the Conservative Party.( this is not have a big difference).

In [44]:

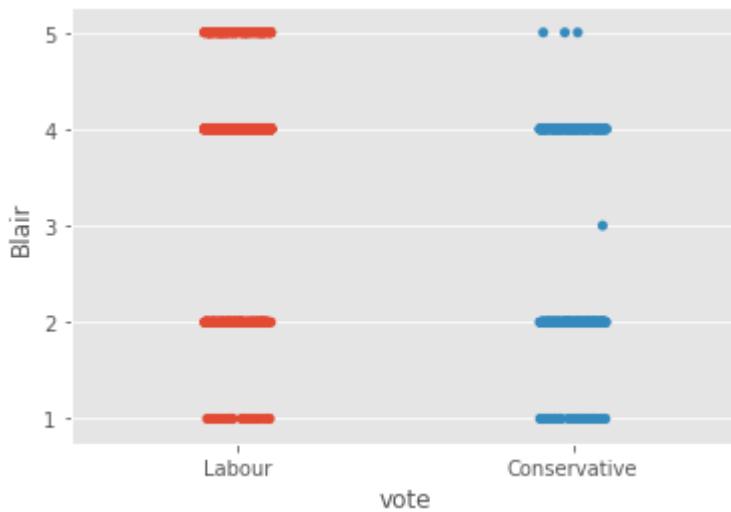
```
#Vote vs economic.cond.household
sns.stripplot (df ['vote'], df ['economic.cond.household'], jitter=True);
```



There is no Difference for Economic Household Condition for the voters who had voted for both the Parties.

In [45]:

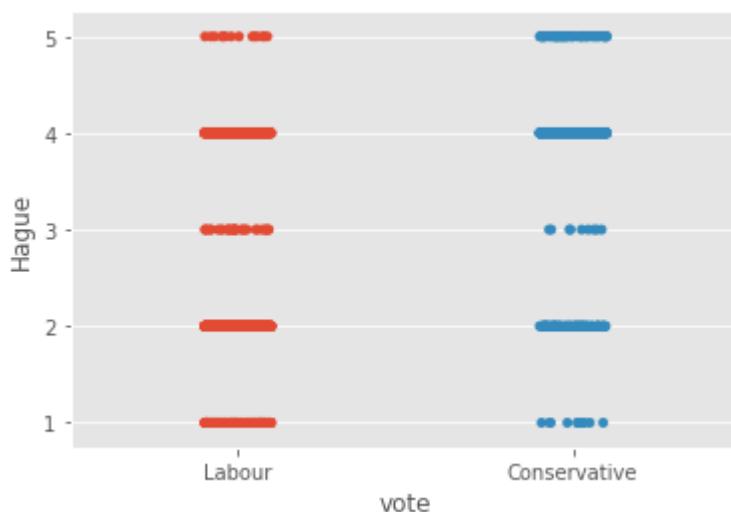
```
# Vote vs Blair
sns.stripplot (df ['vote'], df ['Blair'], jitter=True);
```



Assessment for Labour leader is almost one sided as compared to Conservative leader.

In [46]:

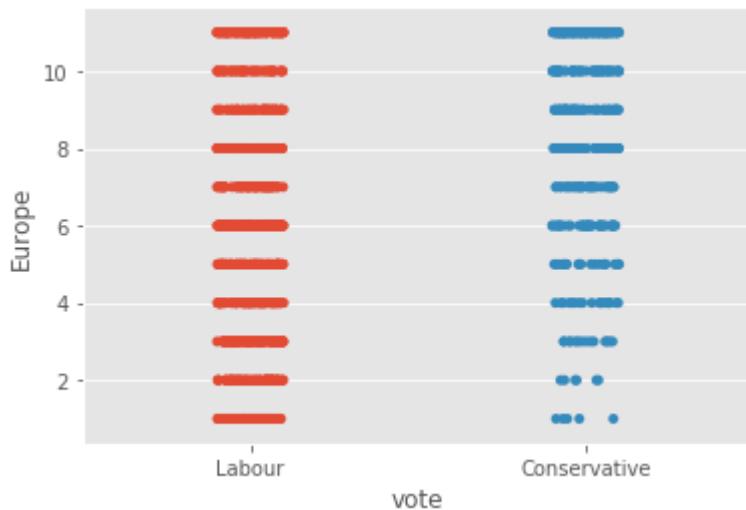
```
# Vote vs Hague
sns.stripplot (df ['vote'], df ['Hague'], jitter=True);
```



Assessment for Labour leader is also more in Hague as compared to the Conservative leader, it shows that even the Category HAGUE is dedicated to the Conservative Party then also they had more towards the Labour party.

In [47]:

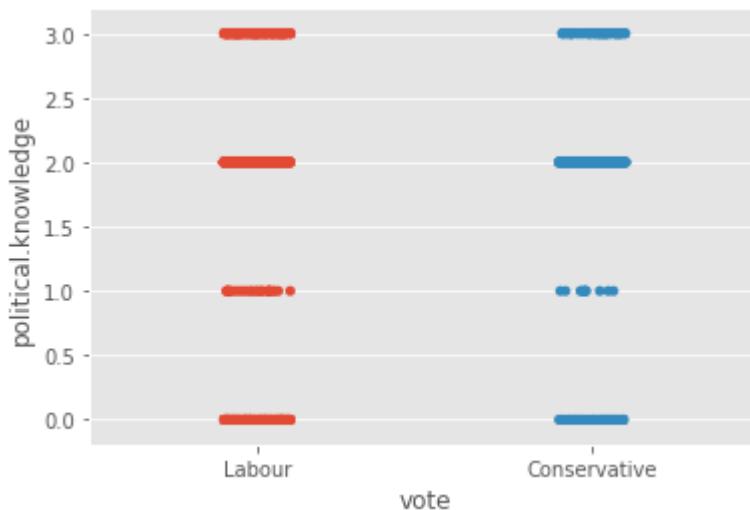
```
# Vote vs Europe  
sns.stripplot (df ['vote'], df ['Europe'], jitter=True);
```



Euroscepticism is also more towards the Labour Party; means they are criticising the party but still voting for the party.

In [48]:

```
# Vote vs Political Knowledge  
sns.stripplot (df ['vote'], df ['political.knowledge'], jitter=True);
```



## Conclusion:

Political knowledge towards European Integration is also more on Labour party but in Conservative party also if we skip the middle portion which rank (1) other than this, all the political knowledge is same as Labour party.

So we can say that

Voters have good knowledge of Political Integration but still they choose the Labour.

Voters those have more criticism towards the Europe integration but still voted for Labour.

While comparing Assessment for both the party's voters choose Labour.

Economic condition national and household for both Labour party have most numbers.

So, we can say that almost Labour party have maximum number of Voters when we check each column and we can say that all voters are Biased towards the Labour party, and in the beginning also we have seen that Voting ratio is 70/30.

In [49]:

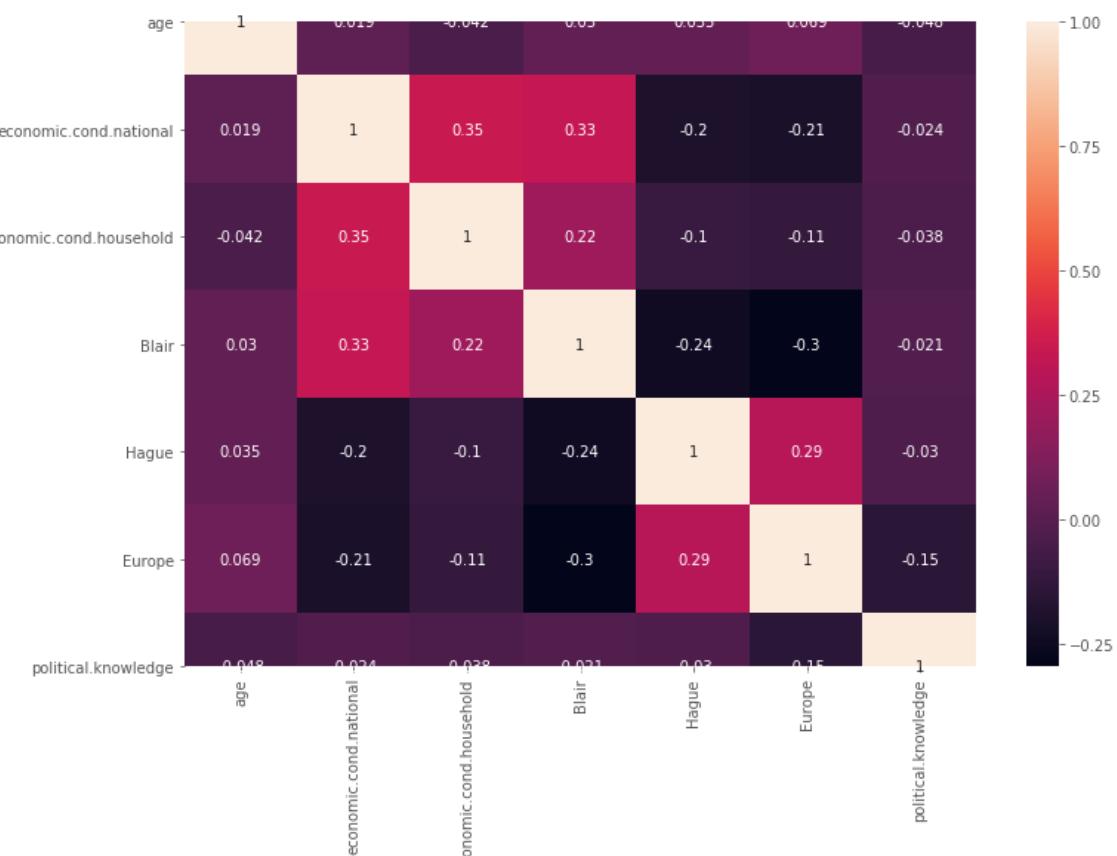
```
# Multivariate Analysis.  
df.corr(method='pearson')
```

Out[49]:

	age	economic.cond.national	economic.cond.household	Blair
age	1.000000	0.018567	-0.041587	0.0302
economic.cond.national	0.018567	1.000000	0.346303	0.3268
economic.cond.household	-0.041587	0.346303	1.000000	0.2152
Blair	0.030218	0.326878	0.215273	1.0000
Hague	0.034626	-0.199766	-0.101956	-0.2432
Europe	0.068880	-0.209429	-0.114885	-0.2961
political.knowledge	-0.048490	-0.023624	-0.037810	-0.0209

In [50]:

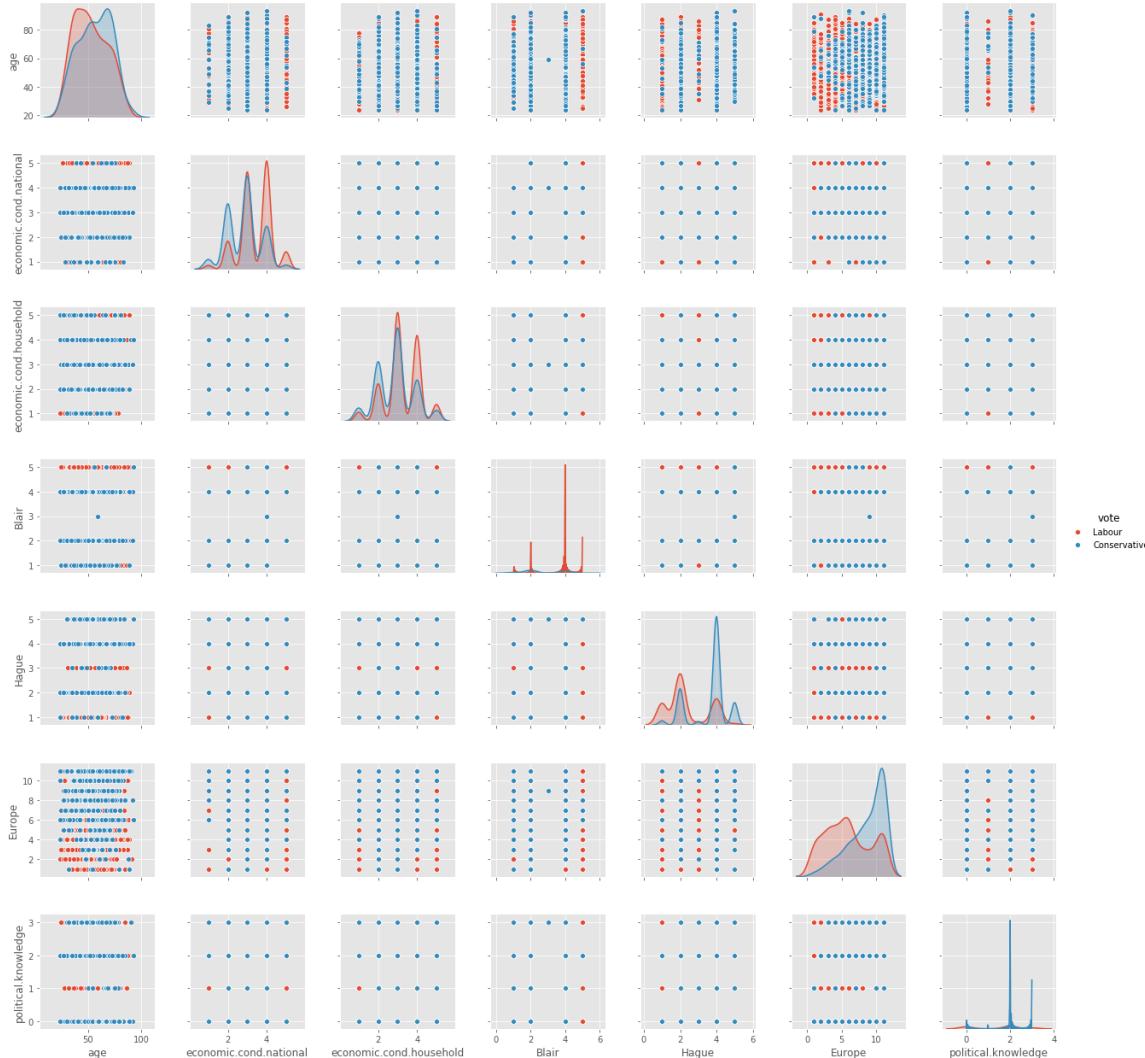
```
plt.figure (figsize=(12,8))
sns.heatmap (df.corr(),annot=True);
plt.show ()
```



In [51]:

# Pairplot with Target variable.

```
sns.pairplot (df, diag_kind='kde', hue='vote');
```



**Inferences:**

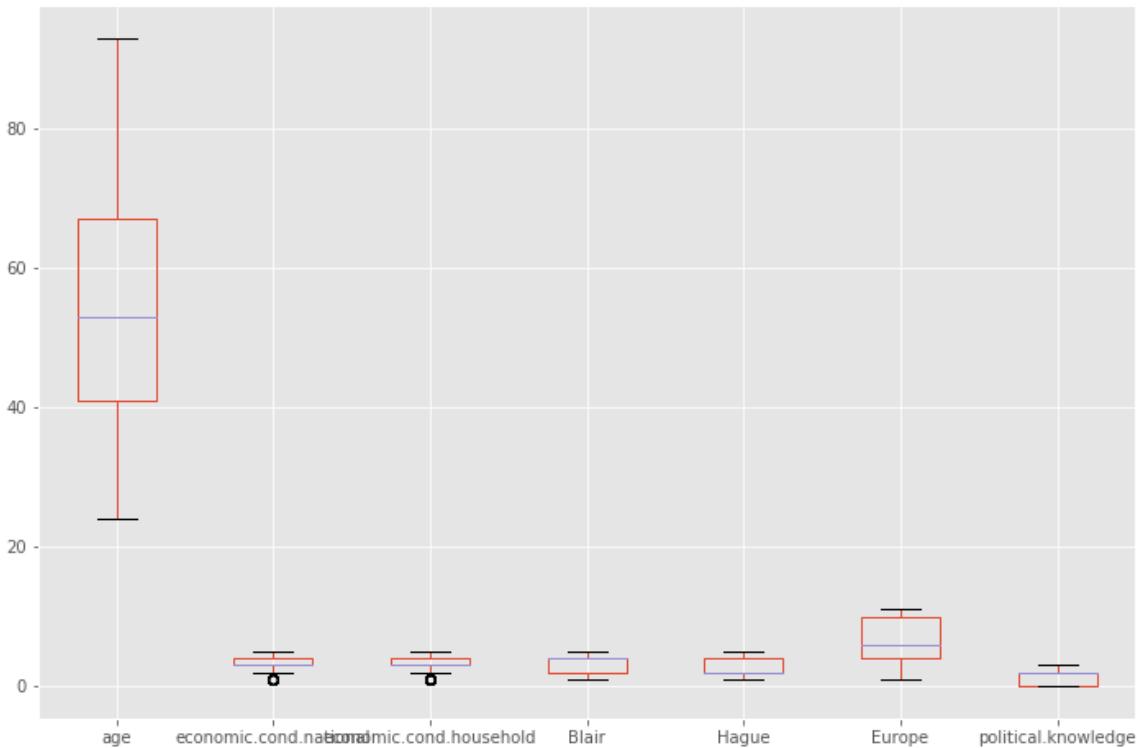
As only Europe column is classifying the Target variable Vote, and all are remaining are making its cloud only as they are not giving much information.

As we had seen the impact of each variable on Target variable and conclude that most of the independent variables are more towards the Labour vote this can also proof that Data which we have is not enough one to predict the exit polls.

***checking outliers.***

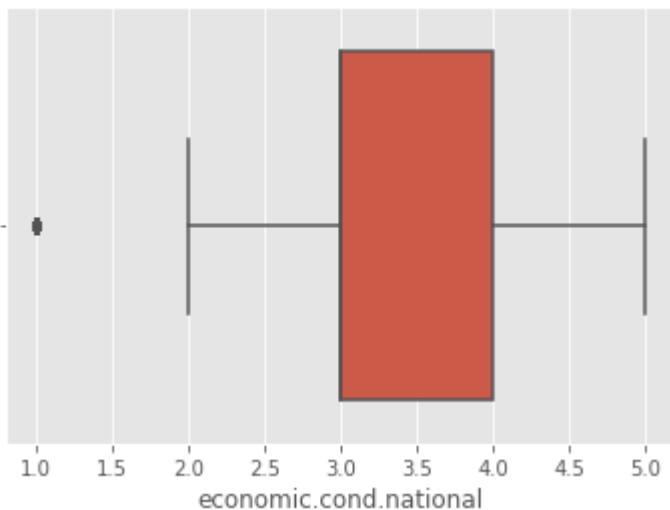
In [52]:

```
plt.figure(figsize=(12,8))
df.boxplot(vert='0')
plt.show()
```



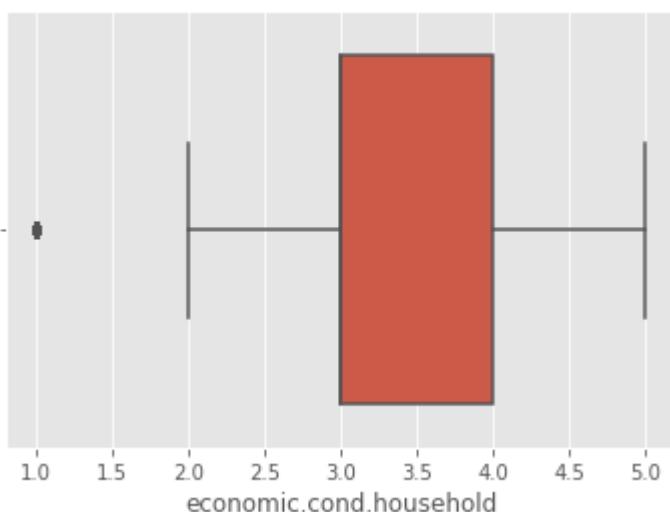
In [53]:

```
sns.boxplot (df ['economic.cond.national']);
```



In [54]:

```
sns.boxplot (df ['economic.cond.household']);
```



**Inferences:**

There is only 1 outlier present in both the columns, we can avoid them as it will not impact on our Data.

But still we will treat them by using IQR function, so that we will assure that whatever data we have is the cleaned one.

In [55]:

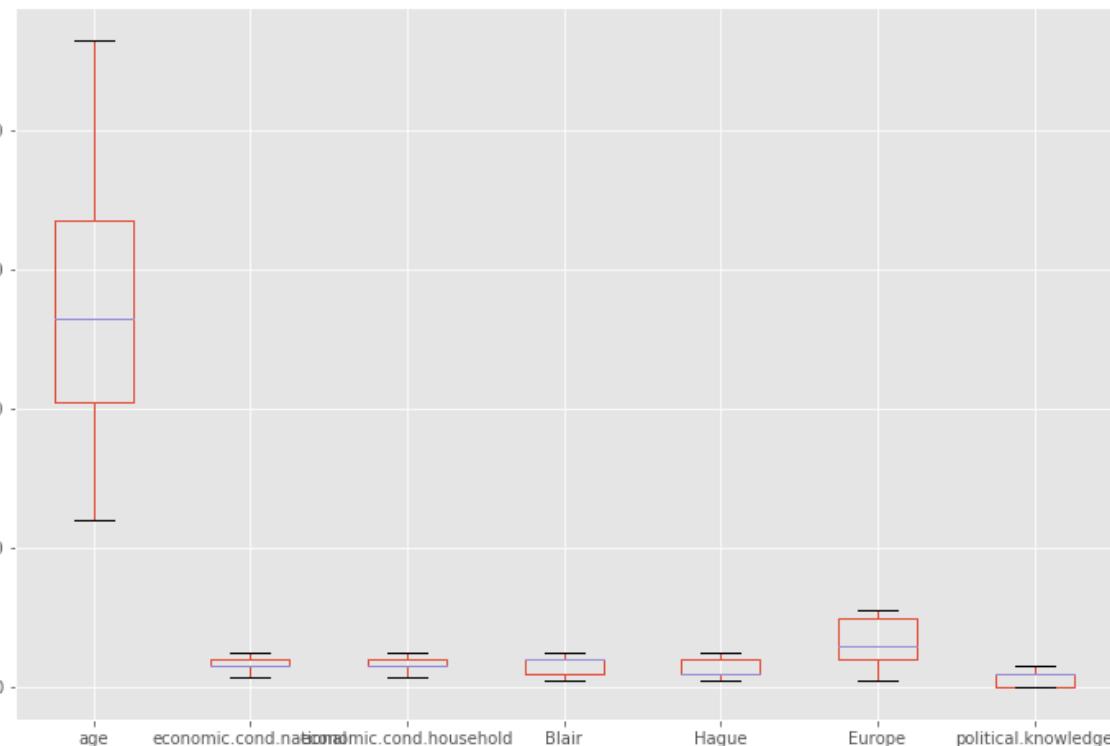
```
def remove_outlier (col):
    sorted(col)
    Q1,Q3 = np.percentile (col,[25,75])
    IQR = Q3 - Q1
    lower_limit = Q1 - (1.5 * IQR)
    upper_limit = Q3 + (1.5 * IQR)
    return lower_limit,upper_limit
```

In [57]:

```
for column in df.columns:
    if df [column].dtype !='object':
        lr,ur = remove_outlier (df [column])
        df[column] = np.where (df[column]<lr,lr, df[column])
        df[column] = np.where (df[column]>ur,ur, df [column])
```

In [58]:

```
df.boxplot (vert='0',figsize=(12,8));
```



**Inference:**

We have treated the outliers to ensure that Our Data is well cleaned with respect to the other independent variables.

In [ ]:

**1.3) Encode the data (having string values) for Modelling. Is Scaling necessary here or not?( 2 pts), Data Split: Split the data into train and test (70:30) (2 pts).**

**Scaling:**

Scaling is used to bring down the Data from all the given Independent columns and Dependent column in one range, which we can term as 0 (mean) and 1 (std.dev) which further conclude that all the values which will in scale of 0 to 1.

Once we perform scaling, we are much assure that our model will not perform poor as few models require scaling depending on the nature of their algorithm.

**In our Case we will not be performing Scaling as we will be building Logit and LDA which works on BEST FIT line or SIGMOID CURVE which captures all the input information from all the columns, but as for KNN we will be performing Scaling.**

**Also Scaling mostly is useful when we measure the Distances not Variances.**

In [59]:

```
# Encoding the Data.

# We need to encode the Data means convert the Object DataType into the Interger DataType as ALL models work on Integer Data Typs.

df = pd.get_dummies (df, columns= ['vote','gender'], drop_first=True)
```

In [61]:

df.head()

Out[61]:

	age	economic.cond.national	economic.cond.household	Blair	Hague	Europe	political.kn
0	43.0	3.0	3.0	4.0	1.0	2.0	
1	36.0	4.0	4.0	4.0	4.0	5.0	
2	35.0	4.0	4.0	5.0	2.0	3.0	
3	24.0	4.0	2.0	2.0	1.0	4.0	
4	41.0	2.0	2.0	1.0	1.0	6.0	

**Target Column Vote\_Labour (1 is Voting and 0 for not voting) and Gender\_Male (0 is Female and 1 is Male).**

Drop First is used to ensure that multiple columns created based on the levels of categorical variable are not included else it will result into multicollinearity. This is done to ensure that we do not land into dummy trap.

In [62]:

```
# Data Split.

X = df.drop ('vote_Labour',axis=1)

y = df.pop ('vote_Labour')
```

In [63]:

```
# Splitting Data into Training (70 %) and Testing (30%).

#Defining Ratio.
# X_train - it will have 70 % of training data which consist of only Independent variables.
# y_train- it will have 70 % of training data which consist of only Dependent variable.
# X_test - it will have 30 % of testing data which consist of only Independent variables.
# y_test - it will have 30 % of testing data which consist of only Dependent variable.

from sklearn.model_selection import train_test_split

X_train,X_test,y_train,y_test = train_test_split (X, y, test_size=0.30, random_state=8)
```

In [70]:

```
# Discussing the Train and Test split by giving their shape.
```

```
print ((X_train.shape))
print (X_test.shape)
print (y_train.shape)
print (y_test.shape)
```

```
(1067, 8)
(458, 8)
(1067,)
(458,)
```

In [ ]:

#### 1.4 Apply Logistic Regression and LDA (linear discriminant analysis). (4 marks)

In [71]:

```
from sklearn.linear_model import LogisticRegression
from sklearn.discriminant_analysis import LinearDiscriminantAnalysis
```

In [72]:

```
# Applying both the models.

log = LogisticRegression (max_iter=500, solver='liblinear',n_jobs=3,tol=0.0001,random_state=8)

# Reason Behind Selecting Different parameters.
# max_iter will iterate the model 500 times.
# Solver method use to bring down the difference between predicted and actual.
# n_jobs repeated times.
# tol will give the speed to stop the model.
# random_state act as a seed which is same throughout the model building.
```

In [75]:

```
# Fitting the model.
log.fit (X_train,y_train)
log.fit (X_test,y_test)
```

Out[75]:

```
LogisticRegression(max_iter=500, n_jobs=3, random_state=8, solver='liblinear')
```

In [225]:

```
lda = LinearDiscriminantAnalysis (solver='svd', tol=0.0001)

# Reason Behind Selecting Different parameters.
# Solver method use to bring down the difference between predicted and actual.
# tol will give the speed to stop the model.
```

In [81]:

```
# Fitting the model.

lda.fit (X_train,y_train)
lda.fit (X_test,y_test)
```

Out[81]:

```
LinearDiscriminantAnalysis()
```

In [82]:

```
from sklearn.metrics import classification_report,confusion_matrix,accuracy_score
```

In [83]:

```
# Calculating Train and Test Accuracy for both the models.

y_log_train_pre = log.predict (X_train)
y_log_test_pre = log.predict (X_test)
```

In [85]:

```
y_lda_train_pre = lda.predict (X_train)
y_lda_test_pre = lda.predict (X_test)
```

In [87]:

```
# Accuracy for Logistic Regression on Train and Test Set.
```

```
print (accuracy_score (y_train,y_log_train_pre))
print (accuracy_score (y_test,y_log_test_pre ))
```

0.8331771321462043

0.8362445414847162

In [88]:

```
# Accuracy for Linear Discriminate Analysis on Train and Test Set.
```

```
print (accuracy_score (y_train,y_lda_train_pre))
print (accuracy_score (y_test,y_lda_test_pre))
```

0.8369259606373008

0.834061135371179

Model	Accuracy	
	Training	Test
Logistic Regression	83.31	83.62
Linear Discriminate Analysis	83.69	83.4

### Inferences:

As both model gives us the Same Accuracy for Training and Testing set, but as we know that the Data was Imbalanced having 70/30 Ratio for Dependent Variable, we assume that it will overfit but it did not, also there are not much classifiers available in the given data, Our models perform better on this Data but still we need to Oversample it and then we can again run the model with new set of balanced data to check the accuracy and then we can go to the Deployment.

### Validation of Model:

As we can see that both models have same accuracy in training and testing set so there is no problem of Overfitting and Underfitting as the difference in accuracy between both models training and test set is hardly 0.5 % and the thumb rule says if the difference between train and test is more than 10 % then there is a problem of Overfitting and difference between test and training is more than 10 % then there is issue of Underfitting.

**So we don't have any issue of Over and Under Fitting for both the models.**

In [ ]:

### 1.5 Apply KNN Model and Naïve Bayes Model. Interpret the results. (4 marks)

In [102]:

```
from sklearn.neighbors import KNeighborsClassifier
from sklearn.naive_bayes import GaussianNB
from sklearn.preprocessing import StandardScaler
```

In [90]:

```
# Applying both the models.

gb = GaussianNB ()

# We will not specify parameters as we want to use the default all like priors and smoothing.
```

In [91]:

```
gb.fit (X_train,y_train)
gb.fit (X_test,y_test)
```

Out[91]:

GaussianNB()

In [92]:

```
# Calculating Train and Test Accuracy for both the models.

y_train_gb_pre = gb.predict (X_train)
y_test_gb_pre = gb.predict (X_test)
```

In [93]:

```
# Accuracy for Gausian Naive Bayes Model.

print (accuracy_score (y_train,y_train_gb_pre))
print (accuracy_score (y_test,y_test_gb_pre))
```

0.8388003748828491  
0.8209606986899564

### Applying KNN model.

**As we know that K-Nearest Neighbours algorithm works on Distance metrics, hence scaling is needed for this algorithm.**

**So we will be scaling the Training and Testing Data.**

In [109]:

```
knn = KNeighborsClassifier (n_neighbors=5, weights='uniform')

# n_neighbours - We want to calculate 5 nearest neighbours for every data points.
# weights - We want to keep equal weights as a distance.
# metric- We want to use the Minkowski distance which is default one.
```

In [103]:

```
sc = StandardScaler()
```

In [105]:

```
X_train = sc.fit_transform (X_train)
X_test = sc.transform (X_test)
```

In [106]:

```
X_train # All are in same scale which is mean = 0 and std.dev = 1.
```

Out[106]:

```
array([[-0.18988734, -1.47071837,  0.93854974, ..., -0.18220544,
       1.31764074, -0.9408289 ],
      [-1.03059185, -0.27827422, -0.18918964, ...,  0.12395709,
       1.31764074,  1.06289252],
      [ 0.0041214 , -1.47071837, -0.18918964, ..., -0.48836797,
       1.31764074,  1.06289252],
      ...,
      [-0.51323523, -0.27827422, -1.31692903, ...,  1.3486072 ,
       0.40588803, -0.9408289 ],
      [-1.74195721, -0.27827422,  2.06628913, ...,  0.43011962,
       0.40588803,  1.06289252],
      [-0.77191354,  0.91416993, -0.18918964, ...,  1.3486072 ,
       0.40588803,  1.06289252]])
```

In [107]:

```
X_test #All are in same scale which is mean = 0 and std.dev = 1.
```

Out[107]:

```
array([[4.70000000e+01, 3.00000000e+00, 3.00000000e+00, ...,
       4.00000000e+00, 5.99333142e-17, 5.99333142e-17],
      [4.70000000e+01, 4.00000000e+00, 4.00000000e+00, ...,
       1.00000000e+00, 2.00000000e+00, 1.00000000e+00],
      [3.90000000e+01, 4.00000000e+00, 3.00000000e+00, ...,
       8.00000000e+00, 5.99333142e-17, 1.00000000e+00],
      ...,
      [4.70000000e+01, 3.00000000e+00, 3.00000000e+00, ...,
       4.00000000e+00, 2.00000000e+00, 1.00000000e+00],
      [6.70000000e+01, 4.00000000e+00, 3.00000000e+00, ...,
       2.00000000e+00, 2.00000000e+00, 1.00000000e+00],
      [3.40000000e+01, 3.00000000e+00, 3.00000000e+00, ...,
       8.00000000e+00, 2.00000000e+00, 5.99333142e-17]])
```

In [110]:

```
# Fitting the KNN model on scaled data.
```

```
knn.fit (X_train,y_train)
knn.fit (X_test,y_test)
```

Out[110]:

```
KNeighborsClassifier()
```

In [111]:

```
# Calculating the Accuracy for Train and Test.
```

```
y_train_knn_pre = knn.predict (X_train)
y_test_knn_pre = knn.predict (X_test)
```

In [112]:

```
print (accuracy_score (y_train,y_train_knn_pre))
print (accuracy_score (y_test,y_test_knn_pre))
```

```
0.30084348641049674
0.8493449781659389
```

Model	Accuracy	
	Training	Test
Gausian Naïve Bayes	83	82
K Nearest Neighbours	30	84

### Inferences:

As Naive Bayes gives us the accuracy for both training and test data almost equal and we already know that Data is imbalanced hence need to work on the data balancing.

KNN gives us the very different result as compared to all the models so far, by increasing the k value we can recheck the accuracy for the model.

### Validness of Model:

Naive Bayes is not have any Overfitting or Underfitting issue as accuracy score is almost same for both the Training and Test data.

But KNN has the Underfitting issue as Test Data is way head from the Training Data.

**Hence KNN has Underfitting issue.**

**1.6) Model Tuning (4 pts) , Bagging ( 1.5 pts) and Boosting (1.5 pts). Apply grid search on each model (include all models) and make models on best\_params. Define a logic behind choosing particular values for different hyper-parameters for grid search. Compare and comment on performances of all. Comment on feature importance if applicable. Successful implementation of both algorithms along with inferences and comments on the model performances.**

In [114]:

```
X_train,X_test,y_train,y_test = train_test_split (X,y, test_size=0.30, random_state=8)
# Converting all the data into unscaled one.
```

Out[114]:

	age	economic.cond.national	economic.cond.household	Blair	Hague	Europe	political
881	51.0	2.0		4.0	4.0	1.0	6.0
723	38.0	3.0		3.0	4.0	1.0	7.0
791	54.0	2.0		3.0	2.0	1.0	5.0
1514	74.0	3.0		3.0	5.0	2.0	11.0
1270	54.0	2.0		2.0	2.0	5.0	11.0

In [115]:

```
# Model Tuning - We will play with different parameters for every model before fitting it in Data.
```

```
# Logistic Regression
```

```
log_tune = LogisticRegression (max_iter=800, solver='lbfgs',n_jobs=6,tol=0.001,random_state=8)
log_tune.fit (X_train,y_train)
y_train_fine_log = log_tune.predict (X_train)
y_test_fine_log = log_tune.predict (X_test)

print(accuracy_score (y_train,y_train_fine_log))
print(accuracy_score (y_test,y_test_fine_log))
```

0.8388003748828491

0.8144104803493449

In [116]:

```
# Linear Discriminate Analysis
```

```
lda_tune = LinearDiscriminantAnalysis (solver='eigen', tol=0.001)
lda_tune.fit (X_train,y_train)
y_train_lda_fine = lda_tune.predict (X_train)
y_test_lda_fine = lda_tune.predict (X_test)

print (accuracy_score (y_train,y_train_lda_fine))
print (accuracy_score (y_test,y_test_lda_fine))
```

0.8388003748828491

0.8231441048034934

In [122]:

```
# Gausian Naive Bayes.

gb_fine = GaussianNB ()
gb_fine.fit (X_train,y_train)
y_train_gb_fine = gb_fine.predict (X_train)
y_test_gb_fine = gb_fine.predict (X_test)

print (accuracy_score (y_train,y_train_gb_fine))
print (accuracy_score (y_test,y_test_gb_fine))
```

0.8359887535145267  
0.8078602620087336

In [220]:

```
# KNN.# Without Scaling.

knn_fine = KNeighborsClassifier (n_neighbors=7, weights='distance',n_jobs=3)
knn_fine.fit (X_train,y_train)
y_train_knn_fine = knn.predict (X_train)
y_test_knn_fine = knn.predict (X_test)

print (accuracy_score (y_train,y_train_knn_fine))
print (accuracy_score (y_test,y_test_knn_fine))
```

0.7910028116213683  
0.8471615720524017

In [125]:

```
# With Scaling
X_train = sc.fit_transform (X_train)
X_test = sc.transform (X_test)

knn_fine.fit (X_train,y_train)
knn_fine.fit (X_test,y_test)
y_train_knn_fine = knn.predict (X_train)
y_test_knn_fine = knn.predict (X_test)

print (accuracy_score (y_train,y_train_knn_fine))
print (accuracy_score (y_test,y_test_knn_fine))
```

0.30084348641049674  
0.3078602620087336

## Model Tuning for all Models.

Model Tuning	Accuracy		Without Scaling
	Training	Test	
Logistic Regression	84	81	
Linear Discriminate Analysis	83.8	82.3	
Gausian Naïve Bayes	83	80	
K Nearest Neighbours	79	84	Without Scaling
	30	30	With Scaling

**Bagging: We will try on all the 4 models.**

In [126]:

```
from sklearn.ensemble import BaggingClassifier
```

In [127]:

```
X_train,X_test,y_train,y_test = train_test_split (X,y, test_size=0.30, random_state=8)
```

In [128]:

```
# Logistic Regression.
```

```
bag_model_logit = BaggingClassifier (base_estimator=log_tune,n_estimators=50,random_state=8,max_features=6,oob_score=True)
bag_model_logit.fit (X_train,y_train)
bag_model_logit.fit (X_test,y_test)

y_bag_pre_train_log = bag_model_logit.predict (X_train)
y_bag_pre_test_log = bag_model_logit.predict (X_test)

print (accuracy_score (y_train,y_bag_pre_train_log))
print (accuracy_score (y_test,y_bag_pre_test_log))
```

0.8369259606373008

0.8296943231441049

In [129]:

```
# Linear Discriminate Analysis.
```

```
bag_model_lda = BaggingClassifier (base_estimator=lda_tune,n_estimators=50,random_state=8,max_features=6,oob_score=True)
bag_model_lda.fit (X_train,y_train)
bag_model_lda.fit (X_test,y_test)

y_bag_pre_train_lda = bag_model_lda.predict (X_train)
y_bag_pre_test_lda = bag_model_lda.predict (X_test)

print (accuracy_score (y_train,y_bag_pre_train_lda))
print (accuracy_score (y_test,y_bag_pre_test_lda))
```

0.8331771321462043

0.834061135371179

In [130]:

```
# Gausian Naive Bayes.

bag_model_gb = BaggingClassifier (base_estimator=gb_fine,n_estimators=50,random_state=8
,max_features=6,oob_score=True)
bag_model_gb.fit (X_train,y_train)
bag_model_gb.fit (X_test,y_test)

y_bag_pre_train_gb = bag_model_gb.predict (X_train)
y_bag_pre_test_gb = bag_model_gb.predict (X_test)

print (accuracy_score (y_train,y_bag_pre_train_gb))
print (accuracy_score (y_test,y_bag_pre_test_gb))
```

0.8416119962511716

0.8275109170305677

In [131]:

```
# K Nearest Neighbours.

bag_model_knn = BaggingClassifier (base_estimator=knn_fine,n_estimators=50,random_state
=8,max_features=6,oob_score=True)
bag_model_knn.fit (X_train,y_train)
bag_model_knn.fit (X_test,y_test)

y_bag_pre_train_knn = bag_model_knn.predict (X_train)
y_bag_pre_test_knn = bag_model_knn.predict (X_test)

print (accuracy_score (y_train,y_bag_pre_train_knn))
print (accuracy_score (y_test,y_bag_pre_test_knn))
```

0.8153701968134958

1.0

**Boosting: We will try on all the 4 models. We will try with AdaBoost.**

In [132]:

```
from sklearn.ensemble import AdaBoostClassifier
```

In [134]:

```
# Logistic Regression.

boo_model_logit = AdaBoostClassifier (base_estimator=log_tune,n_estimators=50,random_st
ate=8)
boo_model_logit.fit (X_train,y_train)
boo_model_logit.fit (X_test,y_test)

y_boo_pre_train_log = boo_model_logit.predict (X_train)
y_boo_pre_test_log = boo_model_logit.predict (X_test)

print (accuracy_score (y_train,y_boo_pre_train_log))
print (accuracy_score (y_test,y_boo_pre_test_log))
```

0.8284910965323337

0.8275109170305677

In [138]:

```
# Gausian Naive Bayes.

boo_model_gb = AdaBoostClassifier (base_estimator=gb_fine,n_estimators=50,random_state=8)
boo_model_gb.fit (X_train,y_train)
boo_model_gb.fit (X_test,y_test)

y_boo_pre_train_gb = boo_model_gb.predict (X_train)
y_boo_pre_test_gb = boo_model_gb.predict (X_test)

print (accuracy_score (y_train,y_boo_pre_train_gb))
print (accuracy_score (y_test,y_boo_pre_test_gb))
```

0.8331771321462043  
0.8231441048034934

**Boosting Technique uses weak learning models but KNN and LDA are not weak learners hence boosting will not applicable.**

In [ ]:

In [ ]:

### Applying Grid Search on Each Model:

To make model's performance better.

In [142]:

```
from sklearn.model_selection import GridSearchCV
```

In [152]:

```
grid_val = {'max_iter' : [500,1000],
            'solver' : ['liblinear'],
            'n_jobs' : [3,6],
            'tol': [0.001,0.00001],
            }

# Logic behind choosing particular values for different hyper-parameters for grid search.

# Max_Iter : How many times we want to repeat the model for the less error in predicted and target value.
# Solver : To minimise the maximum difference between Actual and Predicted value.
# n_jobs : System speed.
# tol : To make sure the algorithm does not take time.
```

In [153]:

```
# So we have four models.  
# Lets apply grid search on every fine tune model.  
  
# Logistic Regression.  
  
grid_search_log = GridSearchCV (estimator=log_tune, param_grid=grid_val, cv=3)
```

In [154]:

```
grid_search_log.fit (X_train,y_train)
```

Out[154]:

```
GridSearchCV(cv=3,  
            estimator=LogisticRegression(max_iter=800, n_jobs=6,  
                                         random_state=8, tol=0.001),  
            param_grid={'max_iter': [500, 1000], 'n_jobs': [3, 6],  
                        'solver': ['liblinear'], 'tol': [0.001, 1e-05]})
```

In [155]:

```
grid_search_log.best_params_
```

Out[155]:

```
{'max_iter': 500, 'n_jobs': 3, 'solver': 'liblinear', 'tol': 0.001}
```

In [165]:

```
best_grid_log_param = LogisticRegression (max_iter=500, n_jobs=3, solver='liblinear',tol=0.001)
```

In [172]:

```
best_grid_log_param.fit (X_train,y_train)  
best_grid_log_param.fit (X_test,y_test)
```

Out[172]:

```
LogisticRegression(max_iter=500, n_jobs=3, solver='liblinear', tol=0.001)
```

In [173]:

```
grid_train_log = best_grid_log_param.predict (X_train)  
grid_test_log = best_grid_log_param.predict (X_test)
```

In [177]:

```
print (accuracy_score (y_train,grid_train_log))  
print (accuracy_score (y_test,grid_test_log))
```

```
0.8322399250234301  
0.8362445414847162
```

In [181]:

```
# Linear Discriminate Analysis.

grid_val_lda = {'solver' : ['svd'],
                'tol': [0.001,0.00001],
                }

# Solver : To minimise the maximum difference between Actual and Predicted value.
# tol : To make sure the algorithm does not take time.

grid_search_lda = GridSearchCV (estimator=lda_tune, param_grid=grid_val_lda, cv=3)
```

In [182]:

```
grid_search_lda.fit (X_train,y_train)
```

Out[182]:

```
GridSearchCV(cv=3,
             estimator=LinearDiscriminantAnalysis(solver='eigen', tol=0.00
1),
             param_grid={'solver': ['svd'], 'tol': [0.001, 1e-05]})
```

In [183]:

```
grid_search_lda.best_params_
```

Out[183]:

```
{'solver': 'svd', 'tol': 0.001}
```

In [185]:

```
best_grid_lda_param = LinearDiscriminantAnalysis (solver='svd',tol=0.001)

best_grid_lda_param.fit (X_train,y_train)
best_grid_lda_param.fit (X_test,y_test)

grid_train_lda = best_grid_lda_param.predict (X_train)
grid_test_lda = best_grid_lda_param.predict (X_test)

print (accuracy_score (y_train,grid_train_lda))
print (accuracy_score (y_test,grid_test_lda))
```

```
0.8369259606373008
0.834061135371179
```

In [195]:

```
# Gausian Naive Bayes.

grid_val_gb = {}

# Priors: Prior probabilities of class from 3 to 5.

grid_search_gb = GridSearchCV (estimator=gb_fine, param_grid=grid_val_gb, cv=3)

grid_search_gb.fit (X_train,y_train)
grid_search_gb.best_params_
```

Out[195]:

{}

In [196]:

```
best_grid_gb_param = GaussianNB ()

best_grid_gb_param.fit (X_train,y_train)
best_grid_gb_param.fit (X_test,y_test)

grid_train_gb = best_grid_gb_param.predict (X_train)
grid_test_gb = best_grid_gb_param.predict (X_test)

print (accuracy_score (y_train,grid_train_gb))
print (accuracy_score (y_test,grid_test_gb))

0.8388003748828491
0.8209606986899564
```

In [198]:

```
# KNN.

grid_val_knn = {'n_neighbors' : [5,9],
                'weights' : ['uniform','distance'],
                'n_jobs' : [3,6],
                }

# n_neighbours - We want to calculate 5 nearest neighbours for every data points.
# weights - We want to keep equal weights as a distance.
# metric- We want to use the Minkowski distance which is default one.
# n_jobs - Parallel running nearest neighbors.
```

In [199]:

```
grid_search_knn = GridSearchCV (estimator=knn_fine, param_grid=grid_val_knn, cv=3)

grid_search_knn.fit (X_train,y_train)
grid_search_knn.best_params_
```

Out[199]:

{'n\_jobs': 3, 'n\_neighbors': 9, 'weights': 'distance'}

In [202]:

```
best_grid_knn_param = KNeighborsClassifier (n_jobs=3, n_neighbors=9, weights='distance')
)
best_grid_knn_param.fit (X_train,y_train)
best_grid_knn_param.fit (X_test,y_test)

grid_train_knn = best_grid_knn_param.predict (X_train)
grid_test_knn = best_grid_knn_param.predict (X_test)

print (accuracy_score (y_train,grid_train_knn))
print (accuracy_score (y_test,grid_test_knn))
```

0.7872539831302718

1.0

**Inferences for All Models:**

1 : Model Tuning.

Model Tuning	Accuracy		
	Training	Test	
Logistic Regression	84	81	
Linear Discriminate Analysis	83.8	82.3	
Gausian Naïve Bayes	83	80	
K Nearest Neighbours	79	84	Without Scaling
	30	30	With Scaling

As we can see all the 4 Algorithms has given us the good Accuracy score from which we can be to understand that there is no Overfitting and underfitting problem in our data set.

But after scaling the KNN algorithm it has Accuracy score has been drastically fall to 30 %, which shows that if we bring down all the data in one scale the Model performance will going to be poor.

2 : Bagging:

Bagging	Accuracy		
	Training	Test	
Logistic Regression	83.6	82.9	
Linear Discriminate Analysis	83.3	83.4	
Gausian Naïve Bayes	84	82	
K Nearest Neighbours	81	100	

After performing Bagging we had get the Accuracy for all the models which is almost same for training and testing set, without any overfitting and underfitting issue, ensemble techniques are helpful to authenticate the accuracy.

In [ ]:

3 : Boosting:

Boosting	Accuracy	
	Training	Test
Logistic Regression	82.8	82.7
Linear Discriminate Analysis	NOT Applicable	NA
Gausian Naïve Bayes	83.3	82.3
K Nearest Neighbours	NOT Applicable	NA

KNN and LDA are not the Weak learners as Boosting only effects on the weak learners, hence for these 2 models we were unable to perform boosting. But for remaining models we have performed and got the same accuracy score.

In [ ]:

4 : GRID Search.

Best Param Grid Search	Accuracy	
	Training	Test
Logistic Regression	83.2	83.6
Linear Discriminate Analysis	83.6	83.4
Gausian Naïve Bayes	83.8	82
K Nearest Neighbours	78	100

As we perform the Grid search on each model by tuning and twisting each relevant parameters for every model we got the same accuracy score for every model but for KNN we experienced the Underfitting issue this makes us to think that this model works good on small data.

In [ ]:

**Feature Importance:** As for above all the 4 models we are unable to pull out the feature importance from the Data Set as none of these all 4 models have the feature to pull up or to print the important features based on the Accuracy.

But as we have discussed above Data is Imbalanced and we should require the more Data and inputs which will classify the Dependent Variable, or we can perform SMOTE also (but we will not do it in this project).

In [ ]:

**1.7 Performance Metrics:** Check the performance of Predictions on Train and Test sets using Accuracy, Confusion Matrix, Plot ROC curve and get ROC\_AUC score for each model. Final Model: Compare the models and write inference which model is best/optimized. (7 marks)

In [207]:

```
from sklearn.metrics import classification_report,confusion_matrix,accuracy_score,roc_auc_score,roc_curve
```

In [209]:

```
# Logistic Regression: We will be using the Grid Search Model as it has given the Highest Accuracy for Training and Test Data.

# Performance Metrics on Train set.

models_names={grid_search_log:'Logistic Regression'}

print('Accuracy for {} model is'.format(models_names[grid_search_log]),'\n',accuracy_score(y_train,grid_train_log))
))

print('\n')

print('ROC AUC score for {} model is'.format(models_names[grid_search_log]),'\n',roc_auc_score(y_train,grid_train_log))
))

print('\n')

print('Classification report for {} model is'.format(models_names[grid_search_log]),'\n',classification_report(y_train,grid_train_log))
))

print('\n')

print('Confusion Matrix for {} model is'.format(models_names[grid_search_log]),'\n',confusion_matrix(y_train,grid_train_log))
))

print ('\n')

print('Confusion Matrix for {} model is'.format(models_names[grid_search_log]))

sns.heatmap(confusion_matrix(y_train,grid_train_log),annot=True,fmt='d',cbar=False)
plt.title('Confusion Matrix for {}'.format(models_names[grid_search_log]))
plt.xlabel('Predicted Label')
plt.ylabel('Actual Label')
plt.show()

print('\n')

# predict probabilities
probs = grid_search_log.predict_proba(X_train)
# keep probabilities for the positive outcome only
probs = probs[:, 1]
# calculate AUC
from sklearn.metrics import roc_auc_score
auc = roc_auc_score(y_train, probs)
print('AUC: %.3f' % auc)
# calculate roc curve
from sklearn.metrics import roc_curve
fpr, tpr, thresholds = roc_curve(y_train, probs)
plt.plot([0, 1], [0, 1], linestyle='--')
# plot the roc curve for the model
```

```
plt.plot(fpr, tpr, marker='.')
# show the plot
plt.show()
```

Accuracy for Logistic Regression model is  
0.8322399250234301

ROC AUC score for Logistic Regression model is  
0.7717650940008183

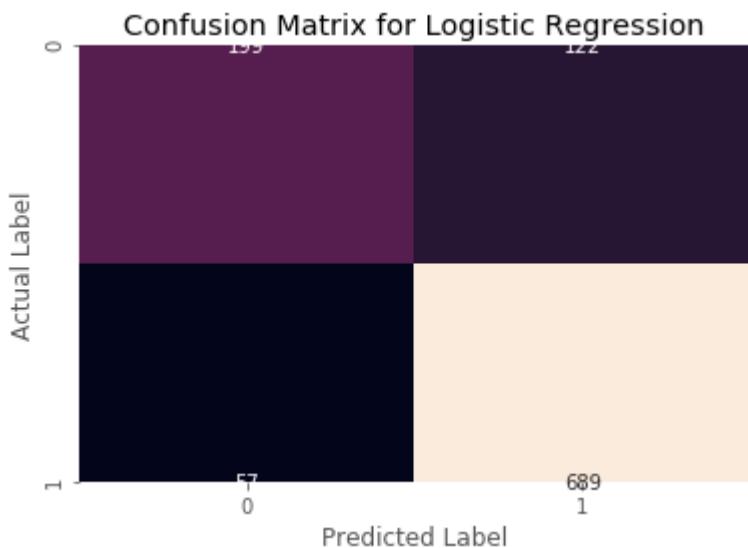
Classification report for Logistic Regression model is

	precision	recall	f1-score	support
--	-----------	--------	----------	---------

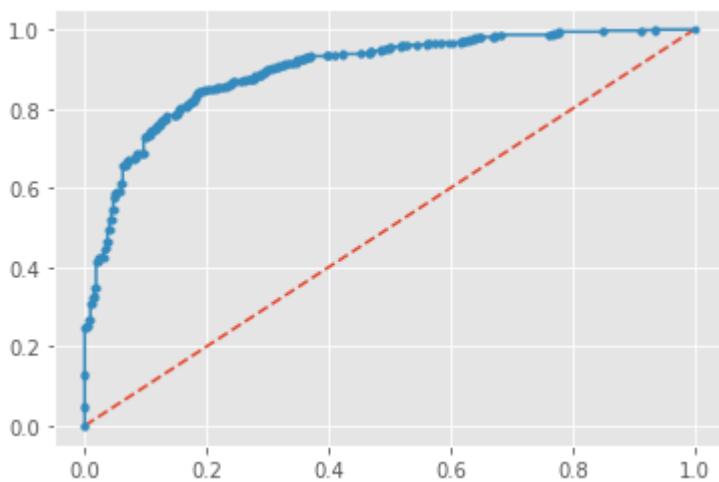
0	0.78	0.62	0.69	321
1	0.85	0.92	0.89	746
accuracy			0.83	1067
macro avg	0.81	0.77	0.79	1067
weighted avg	0.83	0.83	0.83	1067

Confusion Matrix for Logistic Regression model is  
[[199 122]  
[ 57 689]]

Confusion Matrix for Logistic Regression model is



AUC: 0.898



In [210]:

```
# Performance Metrics on Test set.

models_names={grid_search_log:'Logistic Regression'}

print('Accuracy for {} model is'.format(models_names[grid_search_log]),'\n',accuracy_score(y_test,grid_test_log))

print('\n')

print('ROC AUC score for {} model is'.format(models_names[grid_search_log]),'\n',roc_auc_score (y_test,grid_test_log))

print('\n')

print('Classification report for {} model is'.format(models_names[grid_search_log]),'\n',classification_report(y_test,grid_test_log))

print('\n')

print('Confusion Matrix for {} model is'.format(models_names[grid_search_log]),'\n',confusion_matrix(y_test,grid_test_log))

print ('\n')

print('Confusion Matrix for {} model is'.format(models_names[grid_search_log]))


sns.heatmap(confusion_matrix(y_test,grid_test_log),annot=True,fmt='d',cbar=False)
plt.title('Confusion Matrix for {}'.format(models_names[grid_search_log]))
plt.xlabel('Predicted Label')
plt.ylabel('Actual Label')
plt.show()

print('\n')


# predict probabilities
probs = grid_search_log.predict_proba (X_test)
# keep probabilities for the positive outcome only
probs = probs[:, 1]
# calculate AUC
from sklearn.metrics import roc_auc_score
auc = roc_auc_score(y_test, probs)
print('AUC: %.3f' % auc)
# calculate roc curve
from sklearn.metrics import roc_curve
fpr, tpr, thresholds = roc_curve(y_test, probs)
plt.plot([0, 1], [0, 1], linestyle='--')
# plot the roc curve for the model
plt.plot(fpr, tpr, marker='.')
# show the plot
plt.show()
```

Accuracy for Logistic Regression model is  
0.8362445414847162

ROC AUC score for Logistic Regression model is  
0.7891692954784439

Classification report for Logistic Regression model is

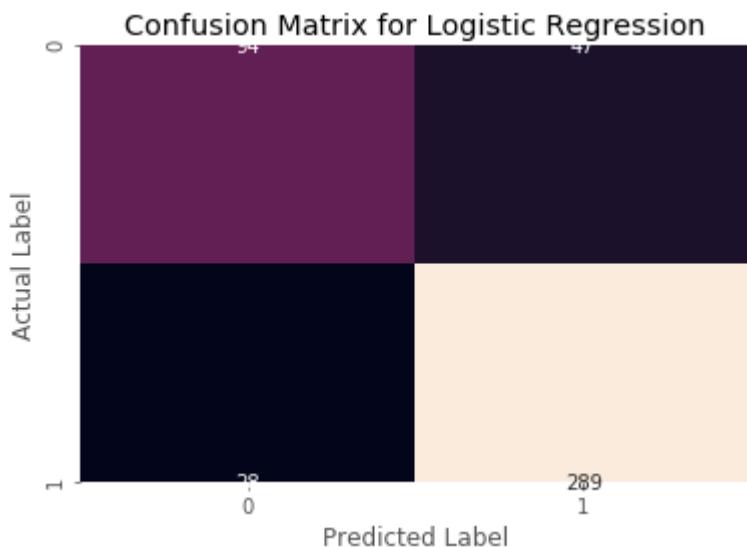
	precision	recall	f1-score	support
--	-----------	--------	----------	---------

0	0.77	0.67	0.71	141
1	0.86	0.91	0.89	317
accuracy			0.84	458
macro avg	0.82	0.79	0.80	458
weighted avg	0.83	0.84	0.83	458

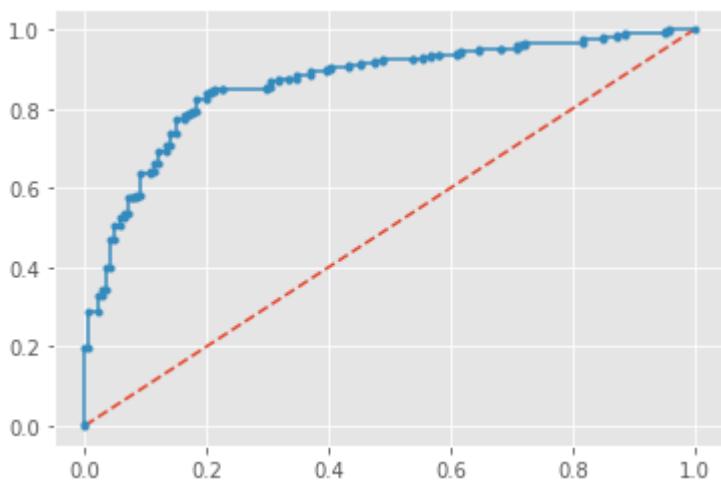
Confusion Matrix for Logistic Regression model is

```
[[ 94  47]
 [ 28 289]]
```

Confusion Matrix for Logistic Regression model is



AUC: 0.865



In [211]:

```
# Linear Discriminate Analysis: We will be using the Grid Search Model as it has given
# the Highest Accuracy for Training and Test Data.

# Performance Metrics on Train set.

models_names={grid_search_lda:'Linear Discriminate Analysis'}

print('Accuracy for {} model is'.format(models_names[grid_search_lda]),'\n',accuracy_score(y_train,grid_train_lda))

print('\n')

print('ROC AUC score for {} model is'.format(models_names[grid_search_lda]),'\n',roc_auc_score (y_train,grid_train_lda))

print('\n')

print('Classification report for {} model is'.format(models_names[grid_search_lda]),'\n',classification_report(y_train,grid_train_lda))

print('\n')

print('Confusion Matrix for {} model is'.format(models_names[grid_search_lda]),'\n',confusion_matrix(y_train,grid_train_lda))

print ('\n')

print('Confusion Matrix for {} model is'.format(models_names[grid_search_lda]))


sns.heatmap(confusion_matrix(y_train,grid_train_lda),annot=True,fmt='d',cbar=False)
plt.title('Confusion Matrix for {}'.format(models_names[grid_search_lda]))
plt.xlabel('Predicted Label')
plt.ylabel('Actual Label')
plt.show()

print('\n')


# predict probabilities
probs = grid_search_lda.predict_proba (X_train)
# keep probabilities for the positive outcome only
probs = probs[:, 1]
# calculate AUC
from sklearn.metrics import roc_auc_score
auc = roc_auc_score(y_train, probs)
print('AUC: %.3f' % auc)
# calculate roc curve
from sklearn.metrics import roc_curve
fpr, tpr, thresholds = roc_curve(y_train, probs)
plt.plot([0, 1], [0, 1], linestyle='--')
# plot the roc curve for the model
plt.plot(fpr, tpr, marker='.')
# show the plot
plt.show()
```

Accuracy for Linear Discriminate Analysis model is  
0.8369259606373008

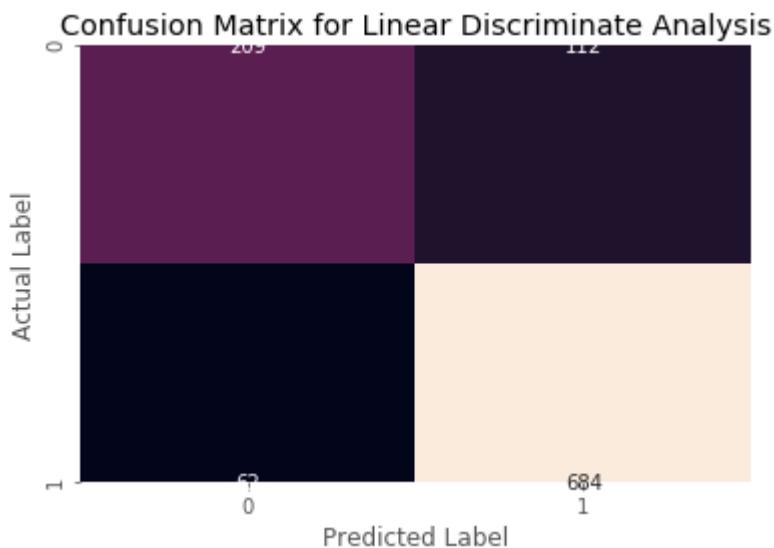
ROC AUC score for Linear Discriminate Analysis model is  
0.783990211554041

Classification report for Linear Discriminate Analysis model is  
precision recall f1-score support

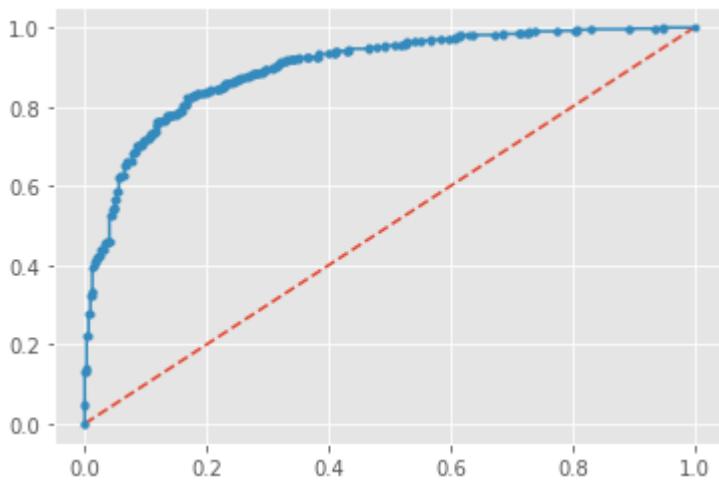
0	0.77	0.65	0.71	321
1	0.86	0.92	0.89	746
accuracy			0.84	1067
macro avg	0.82	0.78	0.80	1067
weighted avg	0.83	0.84	0.83	1067

Confusion Matrix for Linear Discriminate Analysis model is  
[[209 112]  
[ 62 684]]

Confusion Matrix for Linear Discriminate Analysis model is



AUC: 0.898



In [214]:

```
# Performance Metrics on Test set.

models_names={grid_search_lda:'Linear Discriminate Analysis'}

print('Accuracy for {} model is'.format(models_names[grid_search_lda]),'\n',accuracy_score(y_test,grid_test_lda))

print('\n')

print('ROC AUC score for {} model is'.format(models_names[grid_search_lda]),'\n',roc_auc_score (y_test,grid_test_lda))

print('\n')

print('Classification report for {} model is'.format(models_names[grid_search_lda]),'\n',classification_report(y_test,grid_test_lda))

print('\n')

print('Confusion Matrix for {} model is'.format(models_names[grid_search_lda]),'\n',confusion_matrix(y_test,grid_test_lda))

print ('\n')

print('Confusion Matrix for {} model is'.format(models_names[grid_search_lda]))


sns.heatmap(confusion_matrix(y_test,grid_test_lda),annot=True,fmt='d',cbar=False)
plt.title('Confusion Matrix for {}'.format(models_names[grid_search_lda]))
plt.xlabel('Predicted Label')
plt.ylabel('Actual Label')
plt.show()

print('\n')


# predict probabilities
probs = grid_search_lda.predict_proba (X_test)
# keep probabilities for the positive outcome only
probs = probs[:, 1]
# calculate AUC
from sklearn.metrics import roc_auc_score
auc = roc_auc_score(y_test, probs)
print('AUC: %.3f' % auc)
# calculate roc curve
from sklearn.metrics import roc_curve
fpr, tpr, thresholds = roc_curve(y_test, probs)
plt.plot([0, 1], [0, 1], linestyle='--')
# plot the roc curve for the model
plt.plot(fpr, tpr, marker='.')
# show the plot
plt.show()
```

Accuracy for Linear Discriminate Analysis model is  
0.834061135371179

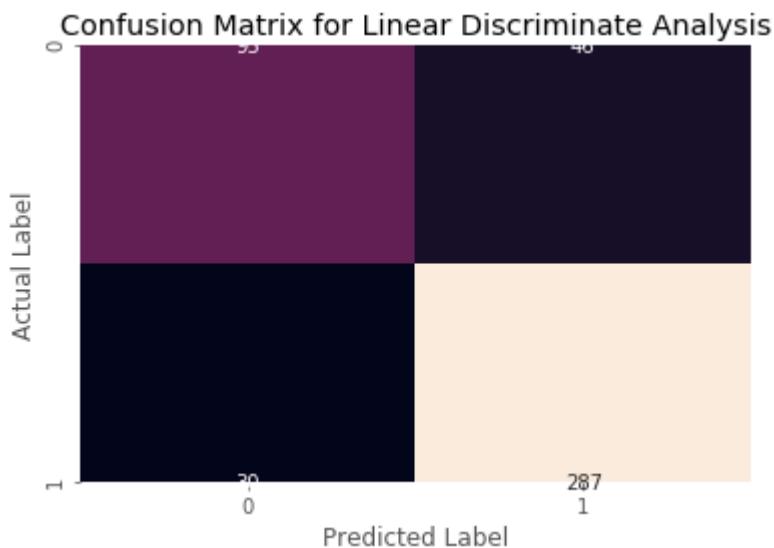
ROC AUC score for Linear Discriminate Analysis model is  
0.7895608206367317

Classification report for Linear Discriminate Analysis model is  
precision recall f1-score support

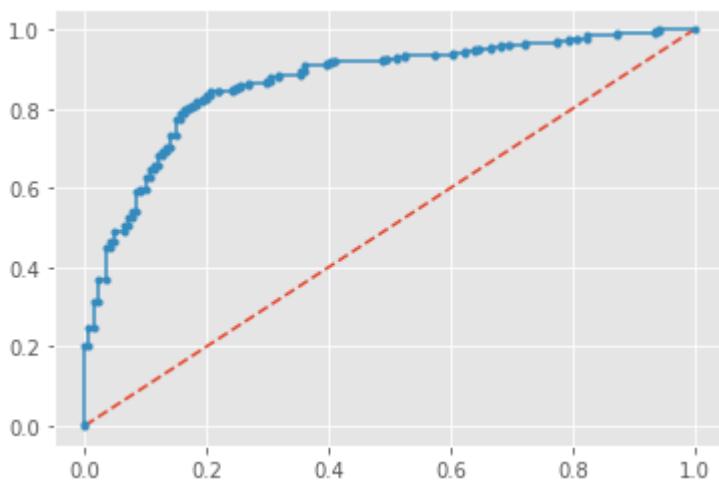
0	0.76	0.67	0.71	141
1	0.86	0.91	0.88	317
accuracy			0.83	458
macro avg	0.81	0.79	0.80	458
weighted avg	0.83	0.83	0.83	458

Confusion Matrix for Linear Discriminate Analysis model is  
[[ 95 46]  
[ 30 287]]

Confusion Matrix for Linear Discriminate Analysis model is



AUC: 0.868



In [217]:

```
# Gausian Naive Bayes: We will be using the Boosting Model as it has given the Highest Accuracy for Training and Test Data.

# Performance Metrics on Train set.

models_names={boo_model_gb:'Gausian Naive Bayes'}

print('Accuracy for {} model is'.format(models_names[boo_model_gb]),'\n',accuracy_score(y_train,y_boo_pre_train_gb))

print('\n')

print('ROC AUC score for {} model is'.format(models_names[boo_model_gb]),'\n',roc_auc_score(y_train,y_boo_pre_train_gb))

print('\n')

print('Classification report for {} model is'.format(models_names[boo_model_gb]),'\n',classification_report(y_train,y_boo_pre_train_gb))

print('\n')

print('Confusion Matrix for {} model is'.format(models_names[boo_model_gb]),'\n',confusion_matrix(y_train,y_boo_pre_train_gb))

print ('\n')

print('Confusion Matrix for {} model is'.format(models_names[boo_model_gb]))


sns.heatmap(confusion_matrix(y_train,y_boo_pre_train_gb),annot=True,fmt='d',cbar=False)
plt.title('Confusion Matrix for {}'.format(models_names[boo_model_gb]))
plt.xlabel('Predicted Label')
plt.ylabel('Actual Label')
plt.show()

print('\n')


# predict probabilities
probs = boo_model_gb.predict_proba (X_train)
# keep probabilities for the positive outcome only
probs = probs[:, 1]
# calculate AUC
from sklearn.metrics import roc_auc_score
auc = roc_auc_score(y_train, probs)
print('AUC: %.3f' % auc)
# calculate roc curve
from sklearn.metrics import roc_curve
fpr, tpr, thresholds = roc_curve(y_train, probs)
plt.plot([0, 1], [0, 1], linestyle='--')
# plot the roc curve for the model
plt.plot(fpr, tpr, marker='.')
# show the plot
plt.show()
```



Accuracy for Gausian Naive Bayes model is  
0.8331771321462043

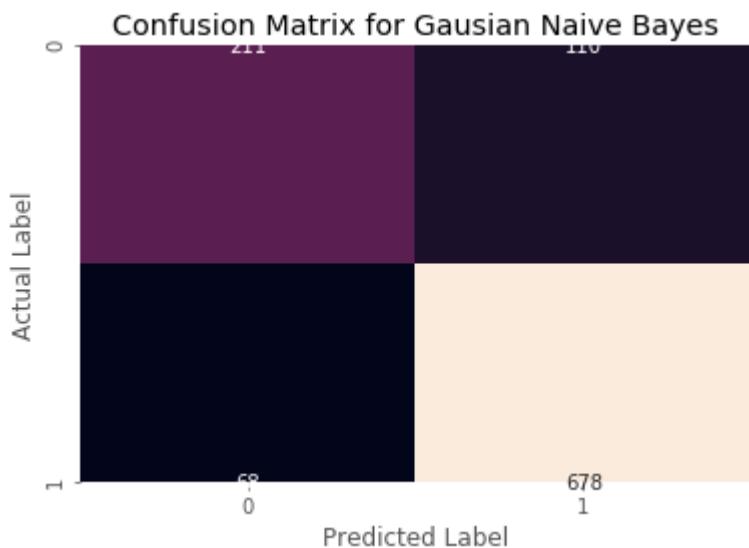
ROC AUC score for Gausian Naive Bayes model is  
0.7830840286303692

Classification report for Gausian Naive Bayes model is  
precision recall f1-score support

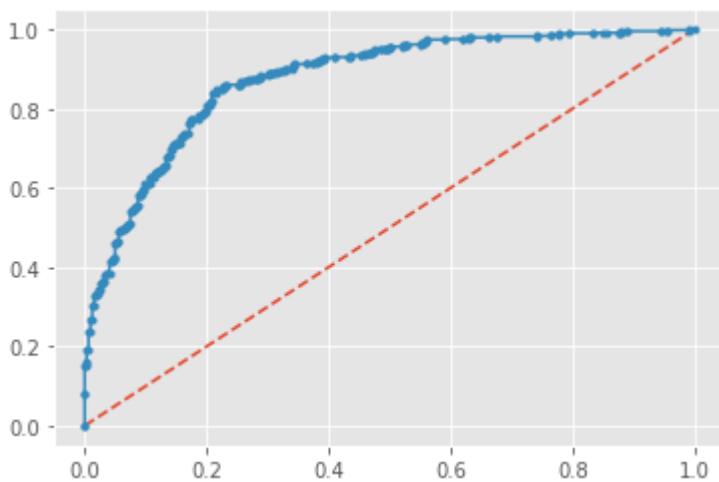
0	0.76	0.66	0.70	321
1	0.86	0.91	0.88	746
accuracy			0.83	1067
macro avg	0.81	0.78	0.79	1067
weighted avg	0.83	0.83	0.83	1067

Confusion Matrix for Gausian Naive Bayes model is  
[[211 110]  
[ 68 678]]

Confusion Matrix for Gausian Naive Bayes model is



AUC: 0.877



In [218]:

```
# Performance Metrics on Test set.

models_names={boo_model_gb:'Gausian Naive Bayes'}

print('Accuracy for {} model is'.format(models_names[boo_model_gb]),'\n',accuracy_score(y_test,y_boo_pre_test_gb))

print('\n')

print('ROC AUC score for {} model is'.format(models_names[boo_model_gb]),'\n',roc_auc_score(y_test,y_boo_pre_test_gb))

print('\n')

print('Classification report for {} model is'.format(models_names[boo_model_gb]),'\n',classification_report(y_test,y_boo_pre_test_gb))

print('\n')

print('Confusion Matrix for {} model is'.format(models_names[boo_model_gb]),'\n',confusion_matrix(y_test,y_boo_pre_test_gb))

print ('\n')

print('Confusion Matrix for {} model is'.format(models_names[boo_model_gb]))


sns.heatmap(confusion_matrix(y_test,y_boo_pre_test_gb),annot=True,fmt='d',cbar=False)
plt.title('Confusion Matrix for {}'.format(models_names[boo_model_gb]))
plt.xlabel('Predicted Label')
plt.ylabel('Actual Label')
plt.show()

print('\n')


# predict probabilities
probs = boo_model_gb.predict_proba (X_test)
# keep probabilities for the positive outcome only
probs = probs[:, 1]
# calculate AUC
from sklearn.metrics import roc_auc_score
auc = roc_auc_score(y_test, probs)
print('AUC: %.3f' % auc)
# calculate roc curve
from sklearn.metrics import roc_curve
fpr, tpr, thresholds = roc_curve(y_test, probs)
plt.plot([0, 1], [0, 1], linestyle='--')
# plot the roc curve for the model
plt.plot(fpr, tpr, marker='.')
# show the plot
plt.show()
```

Accuracy for Gausian Naive Bayes model is  
0.8231441048034934

ROC AUC score for Gausian Naive Bayes model is  
0.7797055730809674

Classification report for Gausian Naive Bayes model is

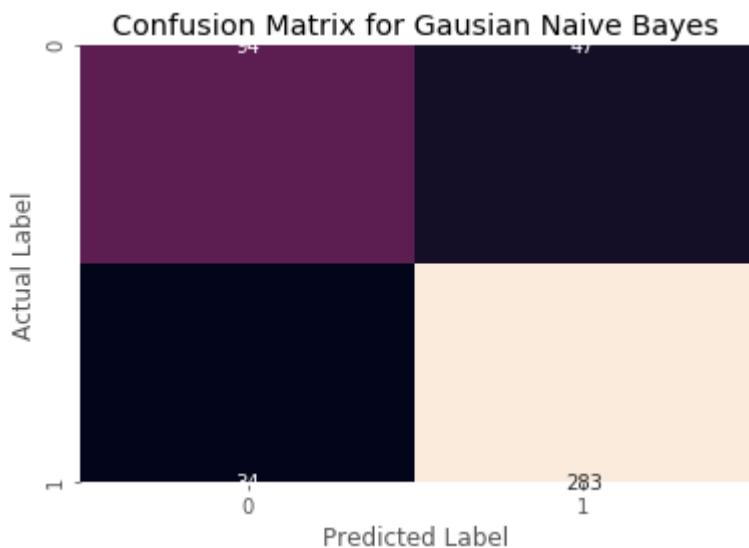
	precision	recall	f1-score	support
--	-----------	--------	----------	---------

0	0.73	0.67	0.70	141
1	0.86	0.89	0.87	317
accuracy			0.82	458
macro avg	0.80	0.78	0.79	458
weighted avg	0.82	0.82	0.82	458

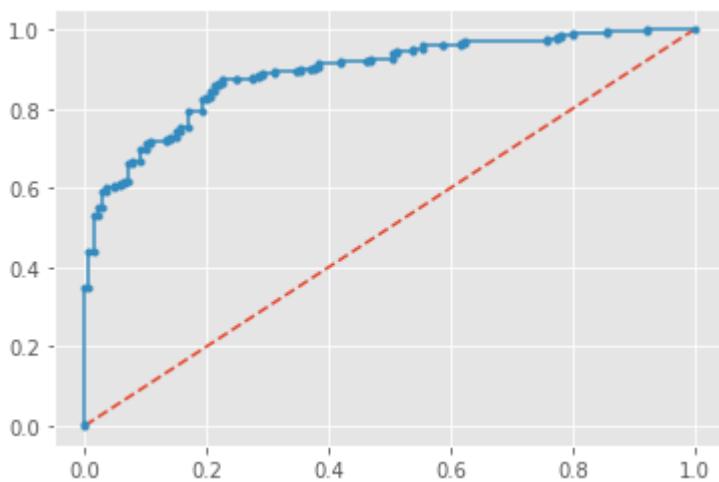
Confusion Matrix for Gausian Naive Bayes model is

```
[[ 94  47]
 [ 34 283]]
```

Confusion Matrix for Gausian Naive Bayes model is



AUC: 0.891



In [221]:

```
# K Nearest Neighbors: We will be using the Model Tuning method as it has given the Highest Accuracy for Training and Test Data.

# Performance Metrics on Train set.

models_names={knn_fine:'K Nearest Neighbors'}

print('Accuracy for {} model is'.format(models_names[knn_fine]),'\n',accuracy_score(y_train,y_train_knn_fine))

print('\n')

print('ROC AUC score for {} model is'.format(models_names[knn_fine]),'\n',roc_auc_score(y_train,y_train_knn_fine))

print('\n')

print('Classification report for {} model is'.format(models_names[knn_fine]),'\n',classification_report(y_train,y_train_knn_fine))

print('\n')

print('Confusion Matrix for {} model is'.format(models_names[knn_fine]),'\n',confusion_matrix(y_train,y_train_knn_fine))

print ('\n')

print('Confusion Matrix for {} model is'.format(models_names[knn_fine]))


sns.heatmap(confusion_matrix(y_train,y_train_knn_fine),annot=True,fmt='d',cbar=False)
plt.title('Confusion Matrix for {}'.format(models_names[knn_fine]))
plt.xlabel('Predicted Label')
plt.ylabel('Actual Label')
plt.show()

print('\n')


# predict probabilities
probs = knn_fine.predict_proba (X_train)
# keep probabilities for the positive outcome only
probs = probs[:, 1]
# calculate AUC
from sklearn.metrics import roc_auc_score
auc = roc_auc_score(y_train, probs)
print('AUC: %.3f' % auc)
# calculate roc curve
from sklearn.metrics import roc_curve
fpr, tpr, thresholds = roc_curve(y_train, probs)
plt.plot([0, 1], [0, 1], linestyle='--')
# plot the roc curve for the model
plt.plot(fpr, tpr, marker='.')
# show the plot
plt.show()
```



Accuracy for K Nearest Neighbors model is  
0.7910028116213683

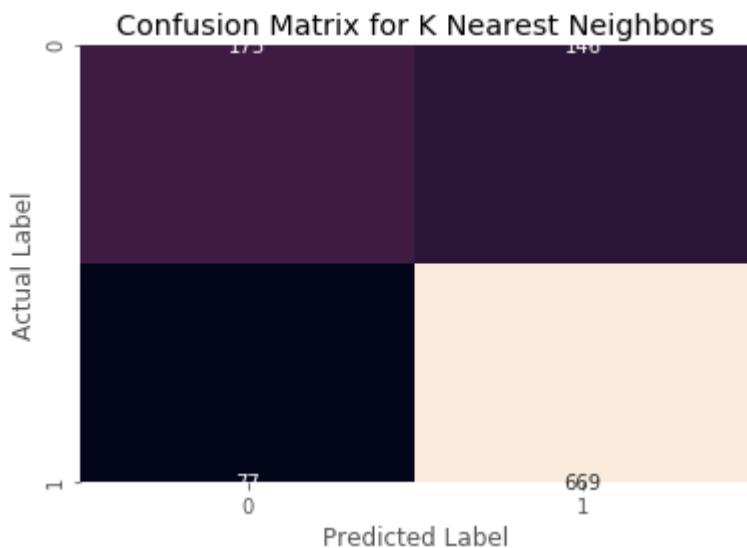
ROC AUC score for K Nearest Neighbors model is  
0.7209770906934596

Classification report for K Nearest Neighbors model is  
precision recall f1-score support

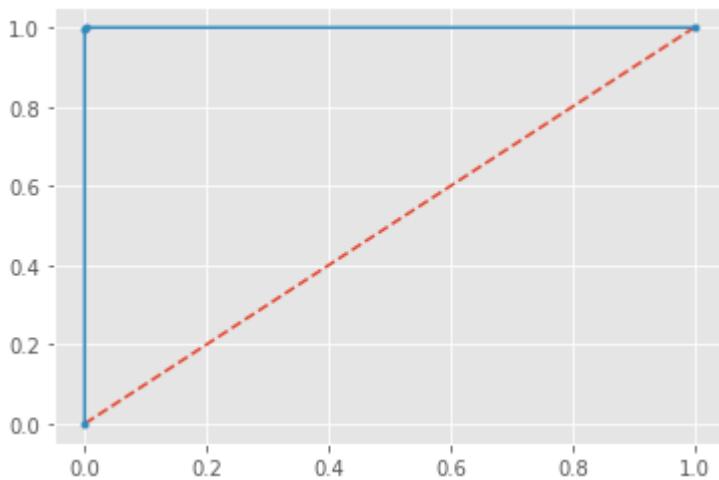
0	0.69	0.55	0.61	321
1	0.82	0.90	0.86	746
accuracy			0.79	1067
macro avg	0.76	0.72	0.73	1067
weighted avg	0.78	0.79	0.78	1067

Confusion Matrix for K Nearest Neighbors model is  
[[175 146]  
[ 77 669]]

Confusion Matrix for K Nearest Neighbors model is



AUC: 1.000



In [222]:

```
# Performance Metrics on Test set.

models_names={knn_fine:'K Nearest Neighbors'}

print('Accuracy for {} model is'.format(models_names[knn_fine]),'\n',accuracy_score(y_test,y_test_knn_fine))

print('\n')

print('ROC AUC score for {} model is'.format(models_names[knn_fine]),'\n',roc_auc_score(y_test,y_test_knn_fine))

print('\n')

print('Classification report for {} model is'.format(models_names[knn_fine]),'\n',classification_report(y_test,y_test_knn_fine))

print('\n')

print('Confusion Matrix for {} model is'.format(models_names[knn_fine]),'\n',confusion_matrix(y_test,y_test_knn_fine))

print ('\n')

print('Confusion Matrix for {} model is'.format(models_names[knn_fine]))


sns.heatmap(confusion_matrix(y_test,y_test_knn_fine),annot=True,fmt='d',cbar=False)
plt.title('Confusion Matrix for {}'.format(models_names[knn_fine]))
plt.xlabel('Predicted Label')
plt.ylabel('Actual Label')
plt.show()

print('\n')


# predict probabilities
probs = knn_fine.predict_proba (X_test)
# keep probabilities for the positive outcome only
probs = probs[:, 1]
# calculate AUC
from sklearn.metrics import roc_auc_score
auc = roc_auc_score(y_test, probs)
print('AUC: %.3f' % auc)
# calculate roc curve
from sklearn.metrics import roc_curve
fpr, tpr, thresholds = roc_curve(y_test, probs)
plt.plot([0, 1], [0, 1], linestyle='--')
# plot the roc curve for the model
plt.plot(fpr, tpr, marker='.')
# show the plot
plt.show()
```

Accuracy for K Nearest Neighbors model is  
0.847161520524017

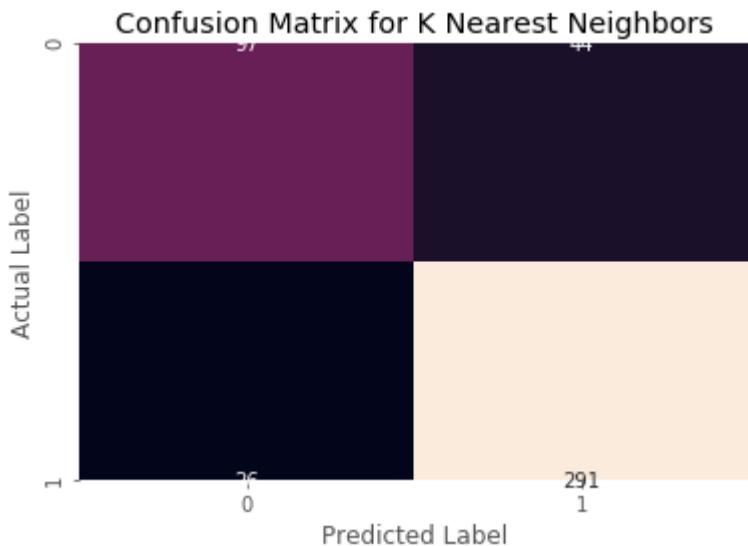
ROC AUC score for K Nearest Neighbors model is  
0.8029621674832763

Classification report for K Nearest Neighbors model is  
precision recall f1-score support

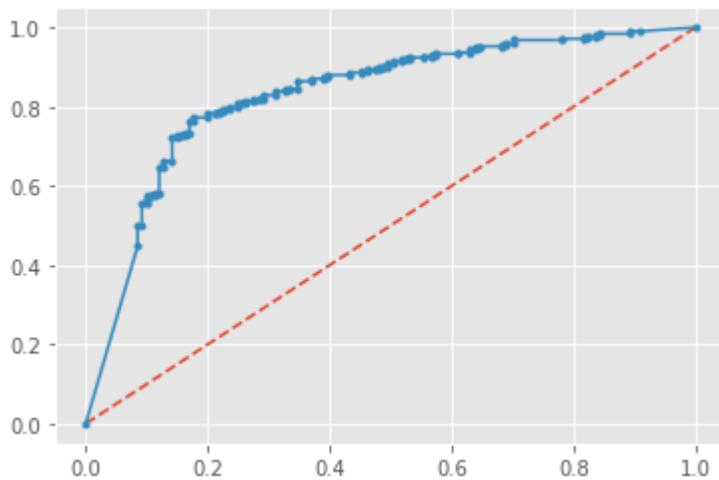
	precision	recall	f1-score	support
0	0.79	0.69	0.73	141
1	0.87	0.92	0.89	317
accuracy			0.85	458
macro avg	0.83	0.80	0.81	458
weighted avg	0.84	0.85	0.84	458

Confusion Matrix for K Nearest Neighbors model is  
[[ 97 44]  
[ 26 291]]

Confusion Matrix for K Nearest Neighbors model is



AUC: 0.833



Final Model - Compare and comment on all models on the basis of the performance metrics in a structured tabular manner

Performance Matrix	Models							
	Grid Logistic Regression		Grid Linear Discriminate		Boosting Gausian Naive Bayes		Model Tuning KNN	
	Training	Testing	Training	Testing	Training	Testing	Training	Testing
Accuracy	83.2	83.6	83.6	83.4	83.3	82.3	79.1	84.7
AUC	89.8	86.5	89.8	86.8	87.7	89.1	100	83
ROC AUC score	77.1	78.9	78.3	78.9	78.3	77.9	72	80
Precision								
0	0.78	0.77	0.77	0.76	0.76	0.73	0.69	0.79
1	0.85	0.86	0.86	0.86	0.86	0.86	0.82	0.87
Recall								
0	0.62	0.67	0.65	0.67	0.66	0.67	0.55	0.69
1	0.92	0.91	0.92	0.91	0.91	0.89	0.9	0.92
f1 score								
0	0.69	0.71	0.71	0.71	0.7	0.7	0.61	0.73
1	0.89	0.89	0.89	0.88	0.88	0.87	0.86	0.89
Confusion Matrix	[199 122 57 689]	[94 47 28 289]	[209 112 62 684]	[95 46 30 287]	[211 110 68 678]	[94 47 34 283]	[175 146 77 669]	[97 44 26 291]

**Describe on which model is best/optimized, After comparison which model suits the best for the problem in hand on the basis of different measures. Comment on the final model.(3 pts)**

1 is voting for labour 0 is voting for Conservative

(We are focusing on 1 (voting for labour)).

### Grid Linear discriminate analysis Training 83.6 and Testing 83.4.

precision:  $tp / tp + fp$  = out of total positive how many are wrong positives 0-1 recall:  $tp / tp + fn$  = out of total positive how many are wrong negative 1-0

**When we compare the Recall for grid LDA, we know that only 8 % in train and 9 % in test our model is predicting incorrectly out of 100, which is the above the benchmark which means our model is correctly predicting 91 % that means out of 100 times, our predicting rate is 91 % for selecting Labour party.**

And when we check prediction for Conservative party (dedicated 0) our grid lda model is predicting 36 % out of 100 it is predicting correctly for the party, which we observe in the early stage of the data.

Our main goal is to have the higher accuracy and high Recall value (incorrect prediction should be less) and by selecting the Grid Search Linear Discriminate Analysis model, we are achieving the same.

**Our Final Model will be Grid Search (Hypertune) Linear Discriminate Analysis Model.**

**If Client wants to Deploy the model in Production, They can choose this model (best\_grid\_lda\_param).**

Grid Linear Discriminate		
Training		Testing
	83.6	83.4
Precision		
0	0.77	0.76
1	0.86	0.86
Recall		
0	0.65	0.67
1	0.92	0.91

In [ ]:

## 1.8 Based on these predictions, what are the insights? (5 marks)

### **Insights :**

With Reference to all the above analysis, I would like to mention that the Data which News channel collected for predicting the election winner via exit polls is very minimum and not accurate as we have seen 70 % of voters' choice is the Labour Party which is coming up.

The Columns or Attributes are not relevant to capture the prediction for the party via voters, as most of the columns are biased towards the single party.

Every column is having the higher tendency to move to the Labour party only as we have seen while comparing every single attribute to the target column, even though some columns are tended to not towards the Labour party but when we analyse, they all were towards the Labour party, which makes prediction easy when we check the total percentages for voting for every party which was almost 70/30.

### **Recommendations :**

1: Number of Voters count should be maximum as we have only 1525 and 8 Variables (excluding the sr.no), as we know maximum data is directly proportional to the accurate predictions and, we can assure that once our model will deploy it will give the Same exact result which was seen on Testing Data and this will only be possible once we have huge amount of Data. So, try to increase maximum number of voters.

2: Number of Columns should be more specific and more towards the public related as the existing columns on which poll has been conducted are not more relevant towards the people.

3: There must be number of centres for the election, we have not informed that yet but as we can assume that it's not from all the centres, so it's more important and relevant to collect the Data from the voters across all the centres where we will have more benefits for model building like we will have different type of inputs in our Data and also we will be assure that the Data is not biased, as we know that some centres have the more publicity for one party and some are not so maximizing the collection of Data from multiple centres will help for better predictions.

4: Based on current ruling party we can take inputs from the general public the work what promised and what they had delivered, also we can check the all the records specific to the government which impacts the capita income for public, as we know all inputs cannot be put into the Data as behaviour certainly depends on the real time so this type of inputs from last multiple years can help to predict the nature of voters even before elections.

5: Our Data should be more relevant towards the public information like education, income, business, or job class which will also help us to understand the different nature of people and their inputs and the suggestions which we can use in our later analysis.

## Conclusion on Business Report:

By doing analysis on given Dataset, we easily found that the entire data is biased towards one party and we have given the reasons behind it.

We have finalise one model and it is working properly as per the expectations but when actual poll results will come from the authority we never know what could be the possibilities that our model will predict as per its accuracy when compare to the actual results, and chances are very less that our model will be exactly same as per the real results, because real results will show the entire poll and our model (as of now we don't know) looking at data that we have the similar data on which actual results will come.

So, I would suggest owner of the News channel or the authority to get more data so that our model will not be biased and be accurate as per the actual results.

In [ ]:

In [ ]:

## Problem 2:

In this particular project, we are going to work on the inaugural corpora from the nltk in Python. We will be looking at the following speeches of the Presidents of the United States of America:

President Franklin D. Roosevelt in 1941 President John F. Kennedy in 1961 President Richard Nixon in 1973  
(Hint: use .words(), .raw(), .sent() for extracting counts).

**2.1) Find the number of characters, words and sentences for the mentioned documents. (Hint: use .words(), .raw(), .sent() for extracting counts).**

In [4]:

```
# First we will export the entire Speech and store in one variable and then we will create one DataFrame
# for specific given 3 speeches .

# So importing Libraries.

import nltk
nltk.download('inaugural')
from nltk.corpus import inaugural
inaugural.fileids()
inaugural.raw('1941-Roosevelt.txt')
inaugural.raw('1961-Kennedy.txt')
inaugural.raw('1973-Nixon.txt')
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt

[nltk_data] Downloading package inaugural to
[nltk_data]      C:\Users\Romil\AppData\Roaming\nltk_data...
[nltk_data]      Package inaugural is already up-to-date!
```

In [6]:

```
r = pd.DataFrame ({'speech' : 'Mr. Vice President, Mr. Speaker, Mr. Chief Justice, Senator Cook, Mrs. Eisenhower, and my fellow citizens of this great and good country we share together:\n\nWhen we met here four years ago, America was bleak in spirit, depressed by the prospect of seemingly endless war abroad and of destructive conflict at home.\n\nAs we meet here today, we stand on the threshold of a new era of peace in the world.\n\nThe central question before us is: How shall we use that peace? Let us resolve that this era we are about to enter will not be what other postwar periods have so often been: a time of retreat and isolation that leads to stagnation at home and invites new danger abroad.\n\nLet us resolve that this will be what it can become: a time of great responsibilities greatly borne, in which we renew the spirit and the promise of America as we enter our third century as a nation.\n\nThis past year saw far-reaching results from our new policies for peace. By continuing to revitalize our traditional friendships, and by our missions to Peking and to Moscow, we were able to establish the base for a new and more durable pattern of relationships among the nations of the world. Because of America's bold initiatives, 1972 will be long remembered as the year of the greatest progress since the end of World War II toward a lasting peace in the world.\n\nThe peace we seek in the world is not the flimsy peace which is merely an interlude between wars, but a peace which can endure for generations to come.\n\nIt is important that we understand both the necessity and the limitations of America's role in maintaining that peace.\n\nUnless we in America work to preserve the peace, there will be no peace.\n\nUnless we in America work to preserve freedom, there will be no freedom.\n\nBut let us clearly understand the new nature of America's role, as a result of the new policies we have adopted over these past four years.\n\nWe shall respect our treaty commitments.\n\nWe shall support vigorously the principle that no country has the right to impose its will or rule on another by force.\n\nWe shall continue, in this era of negotiation, to work for the limitation of nuclear arms, and to reduce the danger of confrontation between the great powers.\n\nWe shall do our share in defending peace and freedom in the world. But we shall expect others to do their share.\n\nThe time has passed when America will make every other nation's conflict our own, or make every other nation's future our responsibility, or presume to tell the people of other nations how to manage their own affairs.\n\nJust as we respect the right of each nation to determine its own future, we also recognize the responsibility of each nation to secure its own future.\n\nJust as America's role is indispensable in preserving the world's peace, so is each nation's role indispensable in preserving its own peace.\n\nTogether with the rest of the world, let us resolve to move forward from the beginnings we have made. Let us continue to bring down the walls of hostility which have divided the world for too long, and to build in their place bridges of understanding -- so that despite profound differences between systems of government, the people of the world can be friends.\n\nLet us build a structure of peace in the world in which the weak are as safe as the strong -- in which each respects the right of the other to live by a different system -- in which those who would influence others will do so by the strength of their ideas, and not by the force of their arms.\n\nLet us accept that high responsibility not as a burden, but gladly -- gladly because the chance to build such a peace is the noblest endeavor in which a nation can engage; gladly, also, because only if we act greatly in meeting our responsibilities abroad will we remain a great Nation, and only if we remain a great Nation will we act greatly in meeting our challenges at home.\n\nWe have the chance today to do more than ever before in our history to make life better in America -- to ensure better education, better health, better housing, better transportation, a cleaner environment -- to restore respect for law, to make our communities more livable -- and to insure the God-given right of every American to full and equal opportunity.\n\nBecause the range of our needs is so great -- because the reach of our opportunities is so great -- let us be bold in our determination to meet those needs in new ways.\n\nJust as building a structure of peace abroad has required turning away from old policies that failed, so building a new era of progress at home requires turning away from old policies that have failed.\n\nAbroad, the shift from old policies to new has not been a retreat from our responsibilities, but a better way to peace.\n\nAnd at home, the shift from old policies to new will not be a retreat from our responsibilities, but a better way to progress.\n\nAbroad and at home, the key to those new responsibilities lies in the placing and the division of responsibility. We have lived too long with the consequences of attempting'
```

ng to gather all power and responsibility in Washington.\n\nAbroad and at home, the time has come to turn away from the condescending policies of paternalism -- of "Washington knows best."\n\nA person can be expected to act responsibly only if he has responsibility. This is human nature. So let us encourage individuals at home and nations abroad to do more for themselves, to decide more for themselves. Let us locate responsibility in more places. Let us measure what we will do for others by what they will do for themselves.\n\nThat is why today I offer no promise of a purely governmental solution for every problem. We have lived too long with that false promise. In trusting too much in government, we have asked of it more than it can deliver. This leads only to inflated expectations, to reduced individual effort, and to a disappointment and frustration that erode confidence both in what government can do and in what people can do.\n\nGovernment must learn to take less from people so that people can do more for themselves.\n\nLet us remember that America was built not by government, but by people -- not by welfare, but by work -- not by shirking responsibility, but by seeking responsibility.\n\nIn our own lives, let each of us ask -- not just what will government do for me, but what can I do for myself?\n\nIn the challenges we face together, let each of us ask -- not just how can government help, but how can I help?\n\nYour National Government has a great and vital role to play. And I pledge to you that where this Government should act, we will act boldly and we will lead boldly. But just as important is the role that each and every one of us must play, as an individual and as a member of his own community.\n\nFrom this day forward, let each of us make a solemn commitment in his own heart: to bear his responsibility, to do his part, to live his ideals -- so that together, we can see the dawn of a new age of progress for America, and together, as we celebrate our 200th anniversary as a nation, we can do so proud in the fulfillment of our promise to ourselves and to the world.\n\nAs America's longest and most difficult war comes to an end, let us again learn to debate our differences with civility and decency. And let each of us reach out for that one precious quality government cannot provide -- a new level of respect for the rights and feelings of one another, a new level of respect for the individual human dignity which is the cherished birthright of every American.\n\nAbove all else, the time has come for us to renew our faith in ourselves and in America.\n\nIn recent years, that faith has been challenged.\n\nOur children have been taught to be ashamed of their country, ashamed of their parents, ashamed of America's record at home and of its role in the world.\n\nAt every turn, we have been beset by those who find everything wrong with America and little that is right. But I am confident that this will not be the judgment of history on these remarkable times in which we are privileged to live.\n\nAmerica's record in this century has been unparalleled in the world's history for its responsibility, for its generosity, for its creativity and for its progress.\n\nLet us be proud that our system has produced and provided more freedom and more abundance, more widely shared, than any other system in the history of the world.\n\nLet us be proud that in each of the four wars in which we have been engaged in this century, including the one we are now bringing to an end, we have fought not for our selfish advantage, but to help others resist aggression.\n\nLet us be proud that by our bold, new initiatives, and by our steadfastness for peace with honor, we have made a breakthrough toward creating in the world what the world has not known before -- a structure of peace that can last, not merely for our time, but for generations to come.\n\nWe are embarking here today on an era that presents challenges great as those any nation, or any generation, has ever faced.\n\nWe shall answer to God, to history, and to our conscience for the way in which we use these years.\n\nAs I stand in this place, so hallowed by history, I think of others who have stood here before me. I think of the dreams they had for America, and I think of how each recognized that he needed help far beyond himself in order to make those dreams come true.\n\nToday, I ask your prayers that in the years ahead I may have God's help in making decisions that are right for America, and I pray for your help so that together we may be worthy of our challenge.\n\nLet us pledge together to make these next four years the best four years in America's history, so that on its 200th birthday America will be as young and as vital as when it began, and as bright a beacon of hope for all the world.\n\nLet us go forward from here confident in hope, strong in our faith in one another, sustained by our faith in God who created us, and striving always to serve His purpose.\n'

}, index=[0])

r.head()

Out[6]:

**speech**

---

0 Mr. Vice President, Mr. Speaker, Mr. Chief Jus...

### Number of Words for Each President.

1 : Roosevelt

In [5]:

```
rose = pd.DataFrame ({'velt':'On each national day of inauguration since 1789, the people have renewed their sense of dedication to the United States.\n\nIn Washington\\\'s day the task of the people was to create and weld together a nation.\n\nIn Lincoln\\\'s day the task of the people was to preserve that Nation from disruption from within.\n\nIn this day the task of the people is to save that Nation and its institutions from disruption from without.\n\nTo us there has come a time, in the midst of swift happenings, to pause for a moment and take stock -- to recall what our place in history has been, and to rediscover what we are and what we may be. If we do not, we risk the real peril of inaction.\n\nLives of nations are determined not by the count of years, but by the lifetime of the human spirit. The life of a man is three-score years and ten: a little more, a little less. The life of a nation is the fullness of the measure of its will to live.\n\nThere are men who doubt this. There are men who believe that democracy, as a form of Government and a frame of life, is limited or measured by a kind of mystical and artificial fate that, for some unexplained reason, tyranny and slavery have become the surging wave of the future -- and that freedom is an ebbing tide.\n\nBut we Americans know that this is not true.\n\nEight years ago, when the life of this Republic seemed frozen by a fatalistic terror, we proved that this is not true. We were in the midst of shock -- but we acted. We acted quickly, boldly, decisively.\n\nThese later years have been living years -- fruitful years for the people of this democracy. For they have brought to us greater security and, I hope, a better understanding that life\\\'s ideals are to be measured in other than material things.\n\nMost vital to our present and our future is this experience of a democracy which successfully survived crisis at home; put away many evil things; built new structures on enduring lines; and, through it all, maintained the fact of its democracy.\n\nFor action has been taken within the three-way framework of the Constitution of the United States. The coordinate branches of the Government continue freely to function. The Bill of Rights remains inviolate. The freedom of elections is wholly maintained. Prophets of the downfall of American democracy have seen their dire predictions come to naught.\n\nDemocracy is not dying.\n\nWe know it because we have seen it revive--and grow.\n\nWe know it cannot die -- because it is built on the unhampered initiative of individual men and women joined together in a common enterprise -- an enterprise undertaken and carried through by the free expression of a free majority.\n\nWe know it because democracy alone, of all forms of government, enlists the full force of men\\\'s enlightened will.\n\nWe know it because democracy alone has constructed an unlimited civilization capable of infinite progress in the improvement of human life.\n\nWe know it because, if we look below the surface, we sense it still spreading on every continent -- for it is the most humane, the most advanced, and in the end the most unconquerable of all forms of human society.\n\nA nation, like a person, has a body--a body that must be fed and clothed and housed, invigorated and rested, in a manner that measures up to the objectives of our time.\n\nA nation, like a person, has a mind -- a mind that must be kept informed and alert, that must know itself, that understands the hopes and the needs of its neighbors -- all the other nations that live within the narrowing circle of the world.\n\nAnd a nation, like a person, has something deeper, something more permanent, something larger than the sum of all its parts. It is that something which matters most to its future -- which calls forth the most sacred guarding of its present.\n\nIt is a thing for which we find it difficult -- even impossible -- to hit upon a single, simple word.\n\nAnd yet we all understand what it is -- the spirit -- the faith of America. It is the product of centuries. It was born in the multitudes of those who came from many lands -- some of high degree, but mostly plain people, who sought here, early and late, to find freedom more freely.\n\nThe democratic aspiration is no mere recent phase in human history. It is human history. It permeated the ancient life of early peoples. It blazed anew in the middle ages. It was written in Magna Carta.\n\nIn the Americas its impact has been irresistible. America has been the New World in all tongues, to all peoples, not because this continent was a new-found land, but because all those who came here believed they could create upon this continent a new life -- a life that should be new in freedom.\n\nIts vitality was written into our own Mayflower Compact, into the Declaration of Independence, into the Constitution of the United States, into the Gettysburg Address.\n\nThose who first came here to carry out the longings of their spirit, and the millions who followed, and the stock that sprang from them -- all have moved forward constantly and consistently toward an ideal which in itself
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has gained stature and clarity with each generation.\n\nThe hopes of the Republic cannot forever tolerate either undeserved poverty or self-serving wealth.\n\nWe know that we still have far to go; that we must more greatly build the security and the opportunity and the knowledge of every citizen, in the measure justified by the resources and the capacity of the land.\n\nBut it is not enough to achieve these purposes alone. It is not enough to clothe and feed the body of this Nation, and instruct and inform its mind. For there is also the spirit. And of the three, the greatest is the spirit.\n\nWithout the body and the mind, as all men know, the Nation could not live.\n\nBut if the spirit of America were killed, even though the Nation's body and mind, constricted in an alien world, lived on, the America we know would have perished.\n\nThat spirit -- that faith -- speaks to us in our daily lives in ways often unnoticed, because they seem so obvious. It speaks to us here in the Capital of the Nation. It speaks to us through the processes of governing in the sovereignties of 48 States. It speaks to us in our counties, in our cities, in our towns, and in our villages. It speaks to us from the other nations of the hemisphere, and from those across the seas -- the enslaved, as well as the free. Sometimes we fail to hear or heed these voices of freedom because to us the privilege of our freedom is such an old, old story.\n\nThe destiny of America was proclaimed in words of prophecy spoken by our first President in his first inaugural in 1789 -- words almost directed, it would seem, to this year of 1941: "The preservation of the sacred fire of liberty and the destiny of the republican model of government are justly considered deeply, finally, staked on the experiment intrusted to the hands of the American people."\n\nIf we lose that sacred fire--if we let it be smothered with doubt and fear -- then we shall reject the destiny which Washington strove so valiantly and so triumphantly to establish. The preservation of the spirit and faith of the Nation does, and will, furnish the highest justification for every sacrifice that we may make in the cause of national defense.\n\nIn the face of great perils never before encountered, our strong purpose is to protect and to perpetuate the integrity of democracy.\n\nFor this we muster the spirit of America, and the faith of America.\n\nWe do not retreat. We are not content to stand still. As Americans, we go forward, in the service of our country, by the will of God.\n'

}, index=[0])

rose.head()

Out[5]:

### velt

0 On each national day of inauguration since 178...

In [7]:

```
# Number of words.
```

```
r['Number of words in Roosevelt Speech'] = rose['velt'].apply (lambda x: len (str (x).split ()))
```

Out[7]:

speech	Number of words in Roosevelt Speech
--------	-------------------------------------

0 Mr. Vice President, Mr. Speaker, Mr. Chief Jus...	1360
---	------

2 : Kennedy

In [8]:

```
keen = pd.DataFrame ({'nedy' : 'Vice President Johnson, Mr. Speaker, Mr. Chief Justice, President Eisenhower, Vice President Nixon, President Truman, reverend clergy, fellow citizens, we observe today not a victory of party, but a celebration of freedom -- symbolizing an end, as well as a beginning -- signifying renewal, as well as change. For I have sworn I before you and Almighty God the same solemn oath our forebears I prescribed nearly a century and three quarters ago.\n\nThe world is very different now. For man holds in his mortal hands the power to abolish all forms of human poverty and all forms of human life. And yet the same revolutionary beliefs for which our forebears fought are still at issue around the globe -- the belief that the rights of man come not from the generosity of the state, but from the hand of God.\n\nWe dare not forget today that we are the heirs of that first revolution. Let the word go forth from this time and place, to friend and foe alike, that the torch has been passed to a new generation of Americans -- born in this century, tempered by war, disciplined by a hard and bitter peace, proud of our ancient heritage -- and unwilling to witness or permit the slow undoing of those human rights to which this Nation has always been committed, and to which we are committed today at home and around the world.\n\nLet every nation know, whether it wishes us well or ill, that we shall pay any price, bear any burden, meet any hardship, support any friend, oppose any foe, in order to assure the survival and the success of liberty.\n\nThis much we pledge -- and more.\n\nTo those old allies whose cultural and spiritual origins we share, we pledge the loyalty of faithful friends. United, there is little we cannot do in a host of cooperative ventures. Divided, there is little we can do -- for we dare not meet a powerful challenge at odds and split asunder.\n\nTo those new States whom we welcome to the ranks of the free, we pledge our word that one form of colonial control shall not have passed away merely to be replaced by a far more iron tyranny. We shall not always expect to find them supporting our view. But we shall always hope to find them strongly supporting their own freedom -- and to remember that, in the past, those who foolishly sought power by riding the back of the tiger ended up inside.\n\nTo those peoples in the huts and villages across the globe struggling to break the bonds of mass misery, we pledge our best efforts to help them help themselves, for whatever period is required -- not because the Communists may be doing it, not because we seek their votes, but because it is right. If a free society cannot help the many who are poor, it cannot save the few who are rich.\n\nTo our sister republics south of our border, we offer a special pledge -- to convert our good words into good deeds -- in a new alliance for progress -- to assist free men and free governments in casting off the chains of poverty. But this peaceful revolution of hope cannot become the prey of hostile powers. Let all our neighbors know that we shall join with them to oppose aggression or subversion anywhere in the Americas. And let every other power know that this Hemisphere intends to remain the master of its own house.\n\nTo that world assembly of sovereign states, the United Nations, our last best hope in an age where the instruments of war have far outpaced the instruments of peace, we renew our pledge of support--to prevent it from becoming merely a forum for invective -- to strengthen its shield of the new and the weak -- and to enlarge the area in which its writ may run.\n\nFinally, to those nations who would make themselves our adversary, we offer not a pledge but a request: that both sides begin anew the quest for peace, before the dark powers of destruction unleashed by science engulf all humanity in planned or accidental self-destruction.\n\nWe dare not tempt them with weakness. For only when our arms are sufficient beyond doubt can we be certain beyond doubt that they will never be employed.\n\nBut neither can two great and powerful groups of nations take comfort from our present course -- both sides overburdened by the cost of modern weapons, both rightly alarmed by the steady spread of the deadly atom, yet both racing to alter that uncertain balance of terror that stays the hand of mankind's final war.\n\nSo let us begin anew -- remembering on both sides that civility is not a sign of weakness, and sincerity is always subject to proof. Let us never negotiate out of fear. But let us never fear to negotiate.\n\nLet both sides explore what problems unite us instead of belaboring those problems which divide us.\n\nLet both sides, for the first time, formulate serious and precise proposals for the inspection and control of arms -- and bring the absolute power to destroy other nations under the absolute control of all nations.\n\nLet both sides seek to invoke the wonders of science instead of its terrors. Together let us explore the stars, conquer the deserts, eradicate disease, tap the ocean depths, and encourage the arts and commerce.
```

rce.\n\nLet both sides unite to heed in all corners of the earth the command of Isaiah -- to "undo the heavy burdens ... and to let the oppressed go free."\n\nAnd if a beach head of cooperation may push back the jungle of suspicion, let both sides join in creating a new endeavor, not a new balance of power, but a new world of law, where the strong are just and the weak secure and the peace preserved.\n\nAll this will not be finished in the first 100 days. Nor will it be finished in the first 1,000 days, nor in the life of this Administration, nor even perhaps in our lifetime on this planet. But let us begin.\n\nIn your hands, my fellow citizens, more than in mine, will rest the final success or failure of our course. Since this country was founded, each generation of Americans has been summoned to give testimony to its national loyalty. The graves of young Americans who answered the call to service surround the globe.\n\nNow the trumpet summons us again -- not as a call to bear arms, though arms we need; not as a call to battle, though embattled we are -- but a call to bear the burden of a long twilight struggle, year in and year out, "rejoicing in hope, patient in tribulation" -- a struggle against the common enemies of man: tyranny, poverty, disease, and war itself.\n\nCan we forge against these enemies a grand and global alliance, North and South, East and West, that can assure a more fruitful life for all mankind? Will you join in that historic effort?\n\nIn the long history of the world, only a few generations have been granted the role of defending freedom in its hour of maximum danger. I do not shrink from this responsibility -- I welcome it. I do not believe that any of us would exchange places with any other people or any other generation. The energy, the faith, the devotion which we bring to this endeavor will light our country and all who serve it -- and the glow from that fire can truly light the world.\n\nAnd so, my fellow Americans: ask not what your country can do for you -- ask what you can do for your country.\n\nMy fellow citizens of the world: ask not what America will do for you, but what together we can do for the freedom of man.\n\nFinally, whether you are citizens of America or citizens of the world, ask of us the same high standards of strength and sacrifice which we ask of you. With a good conscience our only sure reward, with history the final judge of our deeds, let us go forth to lead the land we love, asking His blessing and His help, but knowing that here on earth God's work must truly be our own.\n'

```
}, index=[0])
```

```
keen.head()
```

Out[8]:

### nedy

```
0 Vice President Johnson, Mr. Speaker, Mr. Chief...
```

In [9]:

```
# Number of words.
```

```
r['Number of words in Kennedy Speech'] = keen['nedy'].apply (lambda x: len (str (x).split ()))  
r
```

Out[9]:

	speech	Number of words in Roosevelt Speech	Number of words in Kennedy Speech
0	Mr. Vice President, Mr. Speaker, Mr. Chief Jus...	1360	1390

3 : Nixon

In [10]:

```
nix = pd.DataFrame ({'xon':'Mr. Vice President, Mr. Speaker, Mr. Chief Justice, Senator Cook, Mrs. Eisenhower, and my fellow citizens of this great and good country we share together:\n\nWhen we met here four years ago, America was bleak in spirit, depressed by the prospect of seemingly endless war abroad and of destructive conflict at home.\n\nAs we meet here today, we stand on the threshold of a new era of peace in the world.\n\nThe central question before us is: How shall we use that peace? Let us resolve that this era we are about to enter will not be what other postwar periods have so often been: a time of retreat and isolation that leads to stagnation at home and invites new danger abroad.\n\nLet us resolve that this will be what it can become: a time of great responsibilities greatly borne, in which we renew the spirit and the promise of America as we enter our third century as a nation.\n\nThis past year saw far-reaching results from our new policies for peace. By continuing to revitalize our traditional friendships, and by our missions to Peking and to Moscow, we were able to establish the base for a new and more durable pattern of relationships among the nations of the world. Because of America's bold initiatives, 1972 will be long remembered as the year of the greatest progress since the end of World War II toward a lasting peace in the world.\n\nThe peace we seek in the world is not the flimsy peace which is merely an interlude between wars, but a peace which can endure for generations to come.\n\nIt is important that we understand both the necessity and the limitations of America's role in maintaining that peace.\n\nUnless we in America work to preserve the peace, there will be no peace.\n\nUnless we in America work to preserve freedom, there will be no freedom.\n\nBut let us clearly understand the new nature of America's role, as a result of the new policies we have adopted over these past four years.\n\nWe shall respect our treaty commitments.\n\nWe shall support vigorously the principle that no country has the right to impose its will or rule on another by force.\n\nWe shall continue, in this era of negotiation, to work for the limitation of nuclear arms, and to reduce the danger of confrontation between the great powers.\n\nWe shall do our share in defending peace and freedom in the world. But we shall expect others to do their share.\n\nThe time has passed when America will make every other nation's conflict our own, or make every other nation's future our responsibility, or presume to tell the people of other nations how to manage their own affairs.\n\nJust as we respect the right of each nation to determine its own future, we also recognize the responsibility of each nation to secure its own future.\n\nJust as America's role is indispensable in preserving the world's peace, so is each nation's role indispensable in preserving its own peace.\n\nTogether with the rest of the world, let us resolve to move forward from the beginnings we have made. Let us continue to bring down the walls of hostility which have divided the world for too long, and to build in their place bridges of understanding -- so that despite profound differences between systems of government, the people of the world can be friends.\n\nLet us build a structure of peace in the world in which the weak are as safe as the strong -- in which each respects the right of the other to live by a different system -- in which those who would influence others will do so by the strength of their ideas, and not by the force of their arms.\n\nLet us accept that high responsibility not as a burden, but gladly -- gladly because the chance to build such a peace is the noblest endeavor in which a nation can engage; gladly, also, because only if we act greatly in meeting our responsibilities abroad will we remain a great Nation, and only if we remain a great Nation will we act greatly in meeting our challenges at home.\n\nWe have the chance today to do more than ever before in our history to make life better in America -- to ensure better education, better health, better housing, better transportation, a cleaner environment -- to restore respect for law, to make our communities more livable -- and to insure the God-given right of every American to full and equal opportunity.\n\nBecause the range of our needs is so great -- because the reach of our opportunities is so great -- let us be bold in our determination to meet those needs in new ways.\n\nJust as building a structure of peace abroad has required turning away from old policies that failed, so building a new era of progress at home requires turning away from old policies that have failed.\n\nAbroad, the shift from old policies to new has not been a retreat from our responsibilities, but a better way to peace.\n\nAnd at home, the shift from old policies to new will not be a retreat from our responsibilities, but a better way to progress.\n\nAbroad and at home, the key to those new responsibilities lies in the placing and the division of responsibility. We have lived too long with the consequences of attempt
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ing to gather all power and responsibility in Washington.\n\nAbroad and at home, the time has come to turn away from the condescending policies of paternalism -- of "Washington knows best."\n\nA person can be expected to act responsibly only if he has responsibility. This is human nature. So let us encourage individuals at home and nations abroad to do more for themselves, to decide more for themselves. Let us locate responsibility in more places. Let us measure what we will do for others by what they will do for themselves.\n\nThat is why today I offer no promise of a purely governmental solution for every problem. We have lived too long with that false promise. In trusting too much in government, we have asked of it more than it can deliver. This leads only to inflated expectations, to reduced individual effort, and to a disappointment and frustration that erode confidence both in what government can do and in what people can do.\n\nGovernment must learn to take less from people so that people can do more for themselves.\n\nLet us remember that America was built not by government, but by people -- not by welfare, but by work -- not by shirking responsibility, but by seeking responsibility.\n\nIn our own lives, let each of us ask -- not just what will government do for me, but what can I do for myself?\n\nIn the challenges we face together, let each of us ask -- not just how can government help, but how can I help?\n\nYour National Government has a great and vital role to play. And I pledge to you that where this Government should act, we will act boldly and we will lead boldly. But just as important is the role that each and every one of us must play, as an individual and as a member of his own community.\n\nFrom this day forward, let each of us make a solemn commitment in his own heart: to bear his responsibility, to do his part, to live his ideals -- so that together, we can see the dawn of a new age of progress for America, and together, as we celebrate our 200th anniversary as a nation, we can do so proud in the fulfillment of our promise to ourselves and to the world.\n\nAs America's longest and most difficult war comes to an end, let us again learn to debate our differences with civility and decency. And let each of us reach out for that one precious quality government cannot provide -- a new level of respect for the rights and feelings of one another, a new level of respect for the individual human dignity which is the cherished birthright of every American.\n\nAbove all else, the time has come for us to renew our faith in ourselves and in America.\n\nIn recent years, that faith has been challenged.\n\nOur children have been taught to be ashamed of their country, ashamed of their parents, ashamed of America's record at home and of its role in the world.\n\nAt every turn, we have been beset by those who find everything wrong with America and little that is right. But I am confident that this will not be the judgment of history on these remarkable times in which we are privileged to live.\n\nAmerica's record in this century has been unparalleled in the world's history for its responsibility, for its generosity, for its creativity and for its progress.\n\nLet us be proud that our system has produced and provided more freedom and more abundance, more widely shared, than any other system in the history of the world.\n\nLet us be proud that in each of the four wars in which we have been engaged in this century, including the one we are now bringing to an end, we have fought not for our selfish advantage, but to help others resist aggression.\n\nLet us be proud that by our bold, new initiatives, and by our steadfastness for peace with honor, we have made a break-through toward creating in the world what the world has not known before -- a structure of peace that can last, not merely for our time, but for generations to come.\n\nWe are embarking here today on an era that presents challenges great as those any nation, or any generation, has ever faced.\n\nWe shall answer to God, to history, and to our conscience for the way in which we use these years.\n\nAs I stand in this place, so hallowed by history, I think of others who have stood here before me. I think of the dreams they had for America, and I think of how each recognized that he needed help far beyond himself in order to make those dreams come true.\n\nToday, I ask your prayers that in the years ahead I may have God's help in making decisions that are right for America, and I pray for your help so that together we may be worthy of our challenge.\n\nLet us pledge together to make these next four years the best four years in America's history, so that on its 200th birthday America will be as young and as vital as when it began, and as bright a beacon of hope for all the world.\n\nLet us go forward from here confident in hope, strong in our faith in one another, sustained by our faith in God who created us, and striving always to serve His purpose.\n'

}, index=[0])

nix.head()

```
Out[10]:
```

**xon**

```
0 Mr. Vice President, Mr. Speaker, Mr. Chief Jus...
```

```
In [11]:
```

```
# Number of words.  
  
r['Number of words in Nixon Speech'] = nix['xon'].apply (lambda x: len (str (x).split  
()))  
r
```

```
Out[11]:
```

	speech	Number of words in Rosevelt Speech	Number of words in Kennedy Speech	Number of words in Nixon Speech
0	Mr. Vice President, Mr. Speaker, Mr. Chief Jus...	1360	1390	1819

### Number of Characters:

Lets create one new DataFrame where we will combine all 3 speeches for Character counts.

In [12]:

```
df = pd.DataFrame ({'full':'On each national day of inauguration since 1789, the people have renewed their sense of dedication to the United States.\n\nIn Washington\'s day the task of the people was to create and weld together a nation.\n\nIn Lincoln\'s day the task of the people was to preserve that Nation from disruption from within.\n\nIn this day the task of the people is to save that Nation and its institutions from disruption from without.\n\nTo us there has come a time, in the midst of swift happenings, to pause for a moment and take stock -- to recall what our place in history has been, and to rediscover what we are and what we may be. If we do not, we risk the real peril of inaction.\n\nLives of nations are determined not by the count of years, but by the lifetime of the human spirit. The life of a man is three-score years and ten: a little more, a little less. The life of a nation is the fullness of the measure of its will to live.\n\nThere are men who doubt this. There are men who believe that democracy, as a form of Government and a frame of life, is limited or measured by a kind of mystical and artificial fate that, for some unexplained reason, tyranny and slavery have become the surging wave of the future -- and that freedom is an ebbing tide.\n\nBut we Americans know that this is not true.\n\nEight years ago, when the life of this Republic seemed frozen by a fatalistic terror, we proved that this is not true. We were in the midst of shock -- but we acted. We acted quickly, boldly, decisively.\n\nThese later years have been living years -- fruitful years for the people of this democracy. For they have brought to us greater security and, I hope, a better understanding that life\'s ideals are to be measured in other than material things.\n\nMost vital to our present and our future is this experience of a democracy which successfully survived crisis at home; put away many evil things; built new structures on enduring lines; and, through it all, maintained the fact of its democracy.\n\nFor action has been taken within the three-way framework of the Constitution of the United States. The coordinate branches of the Government continue freely to function. The Bill of Rights remains inviolate. The freedom of elections is wholly maintained. Prophets of the downfall of American democracy have seen their dire predictions come to naught.\n\nDemocracy is not dying.\n\nWe know it because we have seen it revive--and grow.\n\nWe know it cannot die -- because it is built on the unhampered initiative of individual men and women joined together in a common enterprise -- an enterprise undertaken and carried through by the free expression of a free majority.\n\nWe know it because democracy alone, of all forms of government, enlists the full force of men\'s enlightened will.\n\nWe know it because democracy alone has constructed an unlimited civilization capable of infinite progress in the improvement of human life.\n\nWe know it because, if we look below the surface, we sense it still spreading on every continent -- for it is the most humane, the most advanced, and in the end the most unconquerable of all forms of human society.\n\nA nation, like a person, has a body--a body that must be fed and clothed and housed, invigorated and rested, in a manner that measures up to the objectives of our time.\n\nA nation, like a person, has a mind -- a mind that must be kept informed and alert, that must know itself, that understands the hopes and the needs of its neighbors -- all the other nations that live within the narrowing circle of the world.\n\nAnd a nation, like a person, has something deeper, something more permanent, something larger than the sum of all its parts. It is that something which matters most to its future -- which calls forth the most sacred guarding of its present.\n\nIt is a thing for which we find it difficult -- even impossible -- to hit upon a single, simple word.\n\nAnd yet we all understand what it is -- the spirit -- the faith of America. It is the product of centuries. It was born in the multitudes of those who came from many lands -- some of high degree, but mostly plain people, who sought here, early and late, to find freedom more freely.\n\nThe democratic aspiration is no mere recent phase in human history. It is human history. It permeated the ancient life of early peoples. It blazed anew in the middle ages. It was written in Magna Charta.\n\nIn the Americas its impact has been irresistible. America has been the New World in all tongues, to all peoples, not because this continent was a new-found land, but because all those who came here believed they could create upon this continent a new life -- a life that should be new in freedom.\n\nIts vitality was written into our own Mayflower Compact, into the Declaration of Independence, into the Constitution of the United States, into the Gettysburg Address.\n\nThose who first came here to carry out the longings of their spirit, and the millions who followed, and the stock that sprang from them -- all have moved forward constantly and consistently toward an ideal which in it
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self has gained stature and clarity with each generation.\n\nThe hopes of the Republic cannot forever tolerate either undeserved poverty or self-serving wealth.\n\nWe know that we still have far to go; that we must more greatly build the security and the opportunity and the knowledge of every citizen, in the measure justified by the resources and the capacity of the land.\n\nBut it is not enough to achieve these purposes alone. It is not enough to clothe and feed the body of this Nation, and instruct and inform its mind. For there is also the spirit. And of the three, the greatest is the spirit.\n\nWithout the body and the mind, as all men know, the Nation could not live.\n\nBut if the spirit of America were killed, even though the Nation's body and mind, constricted in an alien world, lived on, the America we know would have perished.\n\nThat spirit -- that faith -- speaks to us in our daily lives in ways often unnoticed, because they seem so obvious. It speaks to us here in the Capital of the Nation. It speaks to us through the processes of governing in the sovereignties of 48 States. It speaks to us in our counties, in our cities, in our towns, and in our villages. It speaks to us from the other nations of the hemisphere, and from those across the seas -- the enslaved, as well as the free. Sometimes we fail to hear or heed these voices of freedom because to us the privilege of our freedom is such an old, old story.\n\nThe destiny of America was proclaimed in words of prophecy spoken by our first President in his first inaugural in 1789 - words almost directed, it would seem, to this year of 1941: "The preservation of the sacred fire of liberty and the destiny of the republican model of government are justly considered deeply, finally, staked on the experiment intrusted to the hands of the American people."\n\nIf we lose that sacred fire--if we let it be smothered with doubt and fear -- then we shall reject the destiny which Washington strove so valiantly and so triumphantly to establish. The preservation of the spirit and faith of the Nation does, and will, furnish the highest justification for every sacrifice that we may make in the cause of national defense.\n\nIn the face of great perils never before encountered, our strong purpose is to protect and to perpetuate the integrity of democracy.\n\nFor this we muster the spirit of America, and the faith of America.\n\nWe do not retreat. We are not content to stand still. As Americans, we go forward, in the service of our country, by the will of God.\n\n'Vice President Johnson, Mr. Speaker, Mr. Chief Justice, President Eisenhower, Vice President Nixon, President Truman, reverend clergy, fellow citizens, we observe today not a victory of party, but a celebration of freedom -- symbolizing an end, as well as a beginning -- signifying renewal, as well as change. For I have sworn I before you and Almighty God the same solemn oath our forebears I prescribed nearly a century and three quarters ago.\n\nThe world is very different now. For man holds in his mortal hands the power to abolish all forms of human poverty and all forms of human life. And yet the same revolutionary beliefs for which our forebears fought are still at issue around the globe -- the belief that the rights of man come not from the generosity of the state, but from the hand of God.\n\nWe dare not forget today that we are the heirs of that first revolution. Let the word go forth from this time and place, to friend and foe alike, that the torch has been passed to a new generation of Americans -- born in this century, tempered by war, disciplined by a hard and bitter peace, proud of our ancient heritage -- and unwilling to witness or permit the slow undoing of those human rights to which this Nation has always been committed, and to which we are committed today at home and around the world.\n\nLet every nation know, whether it wishes us well or ill, that we shall pay any price, bear any burden, meet any hardship, support any friend, oppose any foe, in order to assure the survival and the success of liberty.\n\nThis much we pledge -- and more.\n\nTo those old allies whose cultural and spiritual origins we share, we pledge the loyalty of faithful friends. United, there is little we cannot do in a host of cooperative ventures. Divided, there is little we can do -- for we dare not meet a powerful challenge at odds and split asunder.\n\nTo those new States whom we welcome to the ranks of the free, we pledge our word that one form of colonial control shall not have passed away merely to be replaced by a far more iron tyranny. We shall not always expect to find them supporting our view. But we shall always hope to find them strongly supporting their own freedom -- and to remember that, in the past, those who foolishly sought power by riding the back of the tiger ended up inside.\n\nTo those peoples in the huts and villages across the globe struggling to break the bonds of mass misery, we pledge our best efforts to help them help themselves, for whatever period is required -- not because the Communists may be doing it, not because we seek their votes, but because it is right. If a free society cannot help the many who are poor, it cannot save the few who are rich.\n\nTo our sister republics south of our bor

der, we offer a special pledge -- to convert our good words into good deeds -- in a new alliance for progress -- to assist free men and free governments in casting off the chains of poverty. But this peaceful revolution of hope cannot become the prey of hostile powers. Let all our neighbors know that we shall join with them to oppose aggression or subversion anywhere in the Americas. And let every other power know that this Hemisphere intends to remain the master of its own house.  
To that world assembly of sovereign states, the United Nations, our last best hope in an age where the instruments of war have far outpaced the instruments of peace, we renew our pledge of support--to prevent it from becoming merely a forum for invective -- to strengthen its shield of the new and the weak -- and to enlarge the area in which its writ may run.  
Finally, to those nations who would make themselves our adversary, we offer not a pledge but a request: that both sides begin anew the quest for peace, before the dark powers of destruction unleashed by science engulf all humanity in planned or accidental self-destruction.  
We dare not tempt them with weakness. For only when our arms are sufficient beyond doubt can we be certain beyond doubt that they will never be employed.  
But neither can two great and powerful groups of nations take comfort from our present course -- both sides overburdened by the cost of modern weapons, both rightly alarmed by the steady spread of the deadly atom, yet both racing to alter that uncertain balance of terror that stays the hand of mankind's final war.  
So let us begin anew -- remembering on both sides that civility is not a sign of weakness, and sincerity is always subject to proof. Let us never negotiate out of fear. But let us never fear to negotiate.  
Let both sides explore what problems unite us instead of belaboring those problems which divide us.  
Let both sides, for the first time, formulate serious and precise proposals for the inspection and control of arms -- and bring the absolute power to destroy other nations under the absolute control of all nations.  
Let both sides seek to invoke the wonders of science instead of its terrors. Together let us explore the stars, conquer the deserts, eradicate disease, tap the ocean depths, and encourage the arts and commerce.  
Let both sides unite to heed in all corners of the earth the command of Isaiah -- to "undo the heavy burdens ... and to let the oppressed go free."  
And if a beachhead of cooperation may push back the jungle of suspicion, let both sides join in creating a new endeavor, not a new balance of power, but a new world of law, where the strong are just and the weak secure and the peace preserved.  
All this will not be finished in the first 100 days. Nor will it be finished in the first 1,000 days, nor in the life of this Administration, nor even perhaps in our lifetime on this planet. But let us begin.  
In your hands, my fellow citizens, more than in mine, will rest the final success or failure of our course. Since this country was founded, each generation of Americans has been summoned to give testimony to its national loyalty. The graves of young Americans who answered the call to service surround the globe.  
Now the trumpet summons us again -- not as a call to bear arms, though arms we need; not as a call to battle, though embattled we are -- but a call to bear the burden of a long twilight struggle, year in and year out, "rejoicing in hope, patient in tribulation" -- a struggle against the common enemies of man: tyranny, poverty, disease, and war itself.  
Can we forge against these enemies a grand and global alliance, North and South, East and West, that can assure a more fruitful life for all mankind? Will you join in that historic effort?  
In the long history of the world, only a few generations have been granted the role of defending freedom in its hour of maximum danger. I do not shrink from this responsibility -- I welcome it. I do not believe that any of us would exchange places with any other people or any other generation. The energy, the faith, the devotion which we bring to this endeavor will light our country and all who serve it -- and the glow from that fire can truly light the world.  
And so, my fellow Americans: ask not what your country can do for you -- ask what you can do for your country.  
My fellow citizens of the world: ask not what America will do for you, but what together we can do for the freedom of man.  
Finally, whether you are citizens of America or citizens of the world, ask of us the same high standards of strength and sacrifice which we ask of you. With a good conscience our only sure reward, with history the final judge of our deeds, let us go forth to lead the land we love, asking His blessing and His help, but knowing that here on earth God's work must truly be our own.  
Mr. Vice President, Mr. Speaker, Mr. Chief Justice, Senator Cook, Mrs. Eisenhower, and my fellow citizens of this great and good country we share together:  
When we met here four years ago, America was bleak in spirit, depressed by the prospect of seemingly endless war abroad and of destructive conflict at home.  
As we meet here today, we stand on the threshold of a new era of peace in

the world.\n\nThe central question before us is: How shall we use that peace? Let us resolve that this era we are about to enter will not be what other postwar periods have so often been: a time of retreat and isolation that leads to stagnation at home and invites new danger abroad.\n\nLet us resolve that this will be what it can become: a time of great responsibilities greatly borne, in which we renew the spirit and the promise of America as we enter our third century as a nation.\n\nThis past year saw far-reaching results from our new policies for peace. By continuing to revitalize our traditional friendships, and by our missions to Peking and to Moscow, we were able to establish the base for a new and more durable pattern of relationships among the nations of the world.

Because of America's bold initiatives, 1972 will be long remembered as the year of the greatest progress since the end of World War II toward a lasting peace in the world.

\n\nThe peace we seek in the world is not the flimsy peace which is merely an interlude between wars, but a peace which can endure for generations to come.\n\nIt is important

that we understand both the necessity and the limitations of America's role in maintaining that peace.\n\nUnless we in America work to preserve the peace, there will be no peace.\n\nUnless we in America work to preserve freedom, there will be no freedom.\n\n

But let us clearly understand the new nature of America's role, as a result of the new policies we have adopted over these past four years.\n\nWe shall respect our treaty commitments.\n\nWe shall support vigorously the principle that no country has the right to impose its will or rule on another by force.\n\nWe shall continue, in this era of negotiation, to work for the limitation of nuclear arms, and to reduce the danger of confrontation between the great powers.\n\nWe shall do our share in defending peace and freedom in the world. But we shall expect others to do their share.\n\nThe time has passed when America will make every other nation's conflict our own, or make every other nation

's future our responsibility, or presume to tell the people of other nations how to manage their own affairs.\n\nJust as we respect the right of each nation to determine its own future, we also recognize the responsibility of each nation to secure its own future.\n\nJust as America's role is indispensable in preserving the world's peace, so is

each nation's role indispensable in preserving its own peace.\n\nTogether with the rest of the world, let us resolve to move forward from the beginnings we have made. Let us continue to bring down the walls of hostility which have divided the world for too long, and to build in their place bridges of understanding -- so that despite profound differences between systems of government, the people of the world can be friends.\n\n

Let us build a structure of peace in the world in which the weak are as safe as the strong -- in which each respects the right of the other to live by a different system -- in which those who would influence others will do so by the strength of their ideas, and not by the force of their arms.\n\nLet us accept that high responsibility not as a burden, but gladly -- gladly because the chance to build such a peace is the noblest endeavor in which a nation can engage; gladly, also, because only if we act greatly in meeting our responsibilities abroad will we remain a great Nation, and only if we remain a great Nation will we act greatly in meeting our challenges at home.\n\n

We have the chance today to do more than ever before in our history to make life better in America -- to ensure better education, better health, better housing, better transportation, a cleaner environment -- to restore respect for law, to make our communities more livable -- and to insure the God-given right of every American to full and equal opportunity.\n\n

Because the range of our needs is so great -- because the reach of our opportunities is so great -- let us be bold in our determination to meet those needs in new ways.\n\n

Just as building a structure of peace abroad has required turning away from old policies that failed, so building a new era of progress at home requires turning away from old policies that have failed.\n\n

A broad, the shift from old policies to new has not been a retreat from our responsibilities, but a better way to peace.\n\nAnd at home, the shift from old policies to new will not be a retreat from our responsibilities, but a better way to progress.\n\n

Abroad and at home, the key to those new responsibilities lies in the placing and the division of responsibility. We have lived too long with the consequences of attempting to gather all power and responsibility in Washington.\n\n

Abroad and at home, the time has come to turn away from the condescending policies of paternalism -- of "Washington knows best."

A person can be expected to act responsibly only if he has responsibility. This is human nature. So let us encourage individuals at home and nations abroad to do more for themselves, to decide more for themselves. Let us locate responsibility in more places. Let us measure what we will do for others by what they will do for themselves.\n\nThat is why today I offer no promise of a purely governmental

solution for every problem. We have lived too long with that false promise. In trusting too much in government, we have asked of it more than it can deliver. This leads only to inflated expectations, to reduced individual effort, and to a disappointment and frustration that erode confidence both in what government can do and in what people can do.

\n\nGovernment must learn to take less from people so that people can do more for themselves.\n\nLet us remember that America was built not by government, but by people -- not by welfare, but by work -- not by shirking responsibility, but by seeking responsibility.\n\nIn our own lives, let each of us ask -- not just what will government do for me, but what can I do for myself?\n\nIn the challenges we face together, let each of us ask -- not just how can government help, but how can I help?\n\nYour National Government has a great and vital role to play. And I pledge to you that where this Government should act, we will act boldly and we will lead boldly. But just as important is the role that each and every one of us must play, as an individual and as a member of his own community.\n\nFrom this day forward, let each of us make a solemn commitment in his own heart: to bear his responsibility, to do his part, to live his ideals -- so that together, we can see the dawn of a new age of progress for America, and together, as we celebrate our 200th anniversary as a nation, we can do so proud in the fulfillment of our promise to ourselves and to the world.\n\nAs America's longest and most difficult war comes to an end, let us again learn to debate our differences with civility and decency. And let each of us reach out for that one precious quality government cannot provide -- a new level of respect for the rights and feelings of one another, a new level of respect for the individual human dignity which is the cherished birthright of every American.\n\nAbove all else, the time has come for us to renew our faith in ourselves and in America.\n\nIn recent years, that faith has been challenged.\n\nOur children have been taught to be ashamed of their country, ashamed of their parents, ashamed of America's record at home and of its role in the world.\n\nAt every turn, we have been beset by those who find everything wrong with America and little that is right. But I am confident that this will not be the judgment of history on these remarkable times in which we are privileged to live.\n\nAmerica's record in this century has been unparalleled in the world's history for its responsibility, for its generosity, for its creativity and for its progress.\n\nLet us be proud that our system has produced and provided more freedom and more abundance, more widely shared, than any other system in the history of the world.\n\nLet us be proud that in each of the four wars in which we have been engaged in this century, including the one we are now bringing to an end, we have fought not for our selfish advantage, but to help others resist aggression.\n\nLet us be proud that by our bold, new initiatives, and by our steadfastness for peace with honor, we have made a break-through toward creating in the world what the world has not known before -- a structure of peace that can last, not merely for our time, but for generations to come.\n\nWe are embarking here today on an era that presents challenges great as those any nation, or any generation, has ever faced.\n\nWe shall answer to God, to history, and to our conscience for the way in which we use these years.\n\nAs I stand in this place, so hallowed by history, I think of others who have stood here before me. I think of the dreams they had for America, and I think of how each recognized that he needed help far beyond himself in order to make those dreams come true.\n\nToday, I ask your prayers that in the years ahead I may have God's help in making decisions that are right for America, and I pray for your help so that together we may be worthy of our challenge.\n\nLet us pledge together to make these next four years the best four years in America's history, so that on its 200th birthday America will be as young and as vital as when it began, and as bright a beacon of hope for all the world.\n\nLet us go forward from here confident in hope, strong in our faith in one another, sustained by our faith in God who created us, and striving always to serve His purpose.\n'

```
}, index=[0])
```

```
df.head()
```

Out[12]:

full

---

0 On each national day of inauguration since 178...

In [13]:

```
df['char_count'] = df['full'].str.len()  
df[['full','char_count']].head()
```

Out[13]:

	full	char_count
0	On each national day of inauguration since 178...	25183

**Number of Sentences.**

In [14]:

```
import nltk
nltk.download('punkt')
from nltk.tokenize import sent_tokenize

sent = 'On each national day of inauguration since 1789, the people have renewed their sense of dedication to the United States.\n\nIn Washington's day the task of the people was to create and weld together a nation.\n\nIn Lincoln's day the task of the people was to preserve that Nation from disruption from within.\n\nIn this day the task of the people is to save that Nation and its institutions from disruption from without.\n\nTo us there has come a time, in the midst of swift happenings, to pause for a moment and take stock -- to recall what our place in history has been, and to rediscover what we are and what we may be. If we do not, we risk the real peril of inaction.\n\nLives of nations are determined not by the count of years, but by the lifetime of the human spirit. The life of a man is three-score years and ten: a little more, a little less. The life of a nation is the fullness of the measure of its will to live.\n\nThere are men who doubt this. There are men who believe that democracy, as a form of Government and a frame of life, is limited or measured by a kind of mystical and artificial fate that, for some unexplained reason, tyranny and slavery have become the surging wave of the future -- and that freedom is an ebbing tide.\n\nBut we Americans know that this is not true.\n\nEight years ago, when the life of this Republic seemed frozen by a fatalistic terror, we proved that this is not true. We were in the midst of shock -- but we acted. We acted quickly, boldly, decisively.\n\nThese later years have been living years -- fruitful years for the people of this democracy. For they have brought to us greater security and, I hope, a better understanding that life's ideals are to be measured in other than material things.\n\nMost vital to our present and our future is this experience of a democracy which successfully survived crisis at home; put away many evil things; built new structures on enduring lines; and, through it all, maintained the fact of its democracy.\n\nFor action has been taken within the three-way framework of the Constitution of the United States. The coordinate branches of the Government continue freely to function. The Bill of Rights remains inviolate. The freedom of elections is wholly maintained. Prophets of the downfall of American democracy have seen their dire predictions come to naught.\n\nDemocracy is not dying.\n\nWe know it because we have seen it revive-and grow.\n\nWe know it cannot die -- because it is built on the unhampered initiative of individual men and women joined together in a common enterprise -- an enterprise undertaken and carried through by the free expression of a free majority.\n\nWe know it because democracy alone, of all forms of government, enlists the full force of men's enlightened will.\n\nWe know it because democracy alone has constructed an unlimited civilization capable of infinite progress in the improvement of human life.\n\nWe know it because, if we look below the surface, we sense it still spreading on every continent -- for it is the most humane, the most advanced, and in the end the most unconquerable of all forms of human society.\n\nA nation, like a person, has a body--a body that must be fed and clothed and housed, invigorated and rested, in a manner that measures up to the objectives of our time.\n\nA nation, like a person, has a mind -- a mind that must be kept informed and alert, that must know itself, that understands the hopes and the needs of its neighbors -- all the other nations that live within the narrowing circle of the world.\n\nAnd a nation, like a person, has something deeper, something more permanent, something larger than the sum of all its parts. It is that something which matters most to its future -- which calls forth the most sacred guarding of its present.\n\nIt is a thing for which we find it difficult -- even impossible -- to hit upon a single, simple word.\n\nAnd yet we all understand what it is -- the spirit -- the faith of America. It is the product of centuries. It was born in the multitudes of those who came from many lands -- some of high degree, but mostly plain people, who sought here, early and late, to find freedom more freely.\n\nThe democratic aspiration is no mere recent phase in human history. It is human history. It permeated the ancient life of early peoples. It blazed anew in the middle ages. It was written in Magna Charta.\n\nIn the Americas its impact has been irresistible. America has been the New World in all tongues, to all peoples, not because this continent was a new-found land, but because all those who came here believed they could create upon this continent a new life -- a life that should be new in freedom.\n\nIts vitality was written into our own Mayflower Compact, into the
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Declaration of Independence, into the Constitution of the United States, into the Gettysburg Address.  
Those who first came here to carry out the longings of their spirit, and the millions who followed, and the stock that sprang from them -- all have moved forward constantly and consistently toward an ideal which in itself has gained stature and clarity with each generation.  
The hopes of the Republic cannot forever tolerate either undeserved poverty or self-serving wealth.  
We know that we still have far to go; that we must more greatly build the security and the opportunity and the knowledge of every citizen, in the measure justified by the resources and the capacity of the land.  
But it is not enough to achieve these purposes alone. It is not enough to clothe and feed the body of this Nation, and instruct and inform its mind. For there is also the spirit. And of the three, the greatest is the spirit.  
Without the body and the mind, as all men know, the Nation could not live.  
But if the spirit of America were killed, even though the Nation's body and mind, constricted in an alien world, lived on, the America we know would have perished.  
That spirit -- that faith -- speaks to us in our daily lives in ways often unnoticed, because they seem so obvious. It speaks to us here in the Capital of the Nation. It speaks to us through the processes of governing in the sovereignties of 48 States. It speaks to us in our counties, in our cities, in our towns, and in our villages. It speaks to us from the other nations of the hemisphere, and from those across the seas -- the enslaved, as well as the free. Sometimes we fail to hear or heed these voices of freedom because to us the privilege of our freedom is such an old, old story.  
The destiny of America was proclaimed in words of prophecy spoken by our first President in his first inaugural in 1789 -- words almost directed, it would seem, to this year of 1941: "The preservation of the sacred fire of liberty and the destiny of the republican model of government are justly considered deeply, finally, staked on the experiment intrusted to the hands of the American people."  
If we lose that sacred fire--if we let it be smothered with doubt and fear -- then we shall reject the destiny which Washington strove so valiantly and so triumphantly to establish. The preservation of the spirit and faith of the Nation does, and will, furnish the highest justification for every sacrifice that we may make in the cause of national defense.  
In the face of great perils never before encountered, our strong purpose is to protect and to perpetuate the integrity of democracy.  
For this we muster the spirit of America, and the faith of America.  
We do not retreat. We are not content to stand still. As Americans, we go forward, in the service of our country, by the will of God.  
Vice President Johnson, Mr. Speaker, Mr. Chief Justice, President Eisenhower, Vice President Nixon, President Truman, reverend clergy, fellow citizens, we observe today not a victory of party, but a celebration of freedom -- symbolizing an end, as well as a beginning -- signifying renewal, as well as change. For I have sworn I before you and Almighty God the same solemn oath our forebears I prescribed nearly a century and three quarters ago.  
The world is very different now. For man holds in his mortal hands the power to abolish all forms of human poverty and all forms of human life. And yet the same revolutionary beliefs for which our forebears fought are still at issue around the globe -- the belief that the rights of man come not from the generosity of the state, but from the hand of God.  
We dare not forget today that we are the heirs of that first revolution. Let the word go forth from this time and place, to friend and foe alike, that the torch has been passed to a new generation of Americans -- born in this century, tempered by war, disciplined by a hard and bitter peace, proud of our ancient heritage -- and unwilling to witness or permit the slow undoing of those human rights to which this Nation has always been committed, and to which we are committed today at home and around the world.  
Let every nation know, whether it wishes us well or ill, that we shall pay any price, bear any burden, meet any hardship, support any friend, oppose any foe, in order to assure the survival and the success of liberty.  
This much we pledge -- and more.  
To those old allies whose cultural and spiritual origins we share, we pledge the loyalty of faithful friends. United, there is little we cannot do in a host of cooperative ventures. Divided, there is little we can do -- for we dare not meet a powerful challenge at odds and split asunder.  
To those new States whom we welcome to the ranks of the free, we pledge our word that one form of colonial control shall not have passed away merely to be replaced by a far more iron tyranny. We shall not always expect to find them supporting our view. But we shall always hope to find them strongly supporting their own freedom -- and to remember that, in the past, those who foolishly sought power by riding the back of the tiger ended up inside.  
To those peoples in the huts and villages across the globe struggling to break the bonds of mass mi

sery, we pledge our best efforts to help them help themselves, for whatever period is required -- not because the Communists may be doing it, not because we seek their votes, but because it is right. If a free society cannot help the many who are poor, it cannot save the few who are rich.\n\nTo our sister republics south of our border, we offer a special pledge -- to convert our good words into good deeds -- in a new alliance for progress -- to assist free men and free governments in casting off the chains of poverty.

But this peaceful revolution of hope cannot become the prey of hostile powers. Let all our neighbors know that we shall join with them to oppose aggression or subversion anywhere in the Americas. And let every other power know that this Hemisphere intends to remain the master of its own house.\n\nTo that world assembly of sovereign states, the United Nations, our last best hope in an age where the instruments of war have far outpaced the instruments of peace, we renew our pledge of support--to prevent it from becoming merely a forum for invective -- to strengthen its shield of the new and the weak -- and to enlarge the area in which its writ may run.\n\nFinally, to those nations who would make themselves our adversary, we offer not a pledge but a request: that both sides begin anew the quest for peace, before the dark powers of destruction unleashed by science engulf all humanity in planned or accidental self-destruction.\n\nWe dare not tempt them with weakness. For only when our arms are sufficient beyond doubt can we be certain beyond doubt that they will never be employed.\n\nBut neither can two great and powerful groups of nations take comfort from our present course -- both sides overburdened by the cost of modern weapons, both rightly alarmed by the steady spread of the deadly atom, yet both racing to alter that uncertain balance of terror that stays the hand of mankind's final war.\n\nSo let us begin anew -- remembering on both sides that civility is not a sign of weakness, and sincerity is always subject to proof. Let us never negotiate out of fear. But let us never fear to negotiate.\n\nLet both sides explore what problems unite us instead of belaboring those problems which divide us.\n\nLet both sides, for the first time, formulate serious and precise proposals for the inspection and control of arms -- and bring the absolute power to destroy other nations under the absolute control of all nations.\n\nLet both sides seek to invoke the wonders of science instead of its terrors. Together let us explore the stars, conquer the deserts, eradicate disease, tap the ocean depths, and encourage the arts and commerce.\n\nLet both sides unite to heed in all corners of the earth the command of Isaiah -- to "undo the heavy burdens ... and to let the oppressed go free."  
\n\nAnd if a beachhead of cooperation may push back the jungle of suspicion, let both sides join in creating a new endeavor, not a new balance of power, but a new world of law, where the strong are just and the weak secure and the peace preserved.\n\nAll this will not be finished in the first 100 days. Nor will it be finished in the first 1,000 days, nor in the life of this Administration, nor even perhaps in our lifetime on this planet. But let us begin.\n\nIn your hands, my fellow citizens, more than in mine, will rest the final success or failure of our course. Since this country was founded, each generation of Americans has been summoned to give testimony to its national loyalty. The graves of young Americans who answered the call to service surround the globe.\n\nNow the trumpet summons us again -- not as a call to bear arms, though arms we need; not as a call to battle, though embattled we are -- but a call to bear the burden of a long twilight struggle, year in and year out, "rejoicing in hope, patient in tribulation" -- a struggle against the common enemies of man: tyranny, poverty, disease, and war itself.\n\nCan we forge against these enemies a grand and global alliance, North and South, East and West, that can assure a more fruitful life for all mankind? Will you join in that historic effort?\n\nIn the long history of the world, only a few generations have been granted the role of defending freedom in its hour of maximum danger. I do not shrink from this responsibility -- I welcome it. I do not believe that any of us would exchange places with any other people or any other generation. The energy, the faith, the devotion which we bring to this endeavor will light our country and all who serve it -- and the glow from that fire can truly light the world.\n\nAnd so, my fellow Americans: ask not what your country can do for you -- ask what you can do for your country.\n\nMy fellow citizens of the world: ask not what America will do for you, but what together we can do for the freedom of man.\n\nFinally, whether you are citizens of America or citizens of the world, ask of us the same high standards of strength and sacrifice which we ask of you. With a good conscience our only sure reward, with history the final judge of our deeds, let us go forth to lead the land we love, asking His blessing and His help, but knowing that here on earth God's work must truly be our own.\n\nMr. Vice President, Mr. Speaker, Mr. Chief Justice, Sen

ator Cook, Mrs. Eisenhower, and my fellow citizens of this great and good country we share together:  
When we met here four years ago, America was bleak in spirit, depressed by the prospect of seemingly endless war abroad and of destructive conflict at home.  
As we meet here today, we stand on the threshold of a new era of peace in the world.  
The central question before us is: How shall we use that peace? Let us resolve that at this era we are about to enter will not be what other postwar periods have so often been: a time of retreat and isolation that leads to stagnation at home and invites new danger abroad.  
Let us resolve that this will be what it can become: a time of great responsibilities greatly borne, in which we renew the spirit and the promise of America as we enter our third century as a nation.  
This past year saw far-reaching results from our new policies for peace. By continuing to revitalize our traditional friendships, and by our missions to Peking and to Moscow, we were able to establish the base for a new and more durable pattern of relationships among the nations of the world. Because of America's bold initiatives, 1972 will be long remembered as the year of the greatest progress since the end of World War II toward a lasting peace in the world.  
The peace we seek in the world is not the flimsy peace which is merely an interlude between wars, but a peace which can endure for generations to come.  
It is important that we understand both the necessity and the limitations of America's role in maintaining that peace.  
Unless we in America work to preserve the peace, there will be no peace.  
Unless we in America work to preserve freedom, there will be no freedom.  
But let us clearly understand the new nature of America's role, as a result of the new policies we have adopted over these past four years.  
We shall respect our treaty commitments.  
We shall support vigorously the principle that no country has the right to impose its will or rule on another by force.  
We shall continue, in this era of negotiation, to work for the limitation of nuclear arms, and to reduce the danger of confrontation between the great powers.  
We shall do our share in defending peace and freedom in the world. But we shall expect others to do their share.  
The time has passed when America will make every other nation's conflict our own, or make every other nation's future our responsibility, or presume to tell the people of other nations how to manage their own affairs.  
Just as we respect the right of each nation to determine its own future, we also recognize the responsibility of each nation to secure its own future.  
Just as America's role is indispensable in preserving the world's peace, so is each nation's role indispensable in preserving its own peace.  
Together with the rest of the world, let us resolve to move forward from the beginnings we have made. Let us continue to bring down the walls of hostility which have divided the world for too long, and to build in their place bridges of understanding -- so that despite profound differences between systems of government, the people of the world can be friends.  
Let us build a structure of peace in the world in which the weak are as safe as the strong -- in which each respects the right of the other to live by a different system -- in which those who would influence others will do so by the strength of their ideas, and not by the force of their arms.  
Let us accept that high responsibility not as a burden, but gladly -- gladly because the chance to build such a peace is the noblest endeavor in which a nation can engage; gladly, also, because only if we act greatly in meeting our responsibilities abroad will we remain a great Nation, and only if we remain a great Nation will we act greatly in meeting our challenges at home.  
We have the chance today to do more than ever before in our history to make life better in America -- to ensure better education, better health, better housing, better transportation, a cleaner environment -- to restore respect for law, to make our communities more livable -- and to insure the God-given right of every American to full and equal opportunity.  
Because the range of our needs is so great -- because the reach of our opportunities is so great -- let us be bold in our determination to meet those needs in new ways.  
Just as building a structure of peace abroad has required turning away from old policies that failed, so building a new era of progress at home requires turning away from old policies that have failed.  
Abroad, the shift from old policies to new has not been a retreat from our responsibilities, but a better way to peace.  
And at home, the shift from old policies to new will not be a retreat from our responsibilities, but a better way to progress.  
Abroad and at home, the key to those new responsibilities lies in the placing and the division of responsibility. We have lived too long with the consequences of attempting to gather all power and responsibility in Washington.  
Abroad and at home, the time has come to turn away from the condescending policies of paternalism -- of "Washington knows best."  
A person can be expected to act responsibly only if he has responsib

ility. This is human nature. So let us encourage individuals at home and nations abroad to do more for themselves, to decide more for themselves. Let us locate responsibility in more places. Let us measure what we will do for others by what they will do for themselves.  
That is why today I offer no promise of a purely governmental solution for every problem. We have lived too long with that false promise. In trusting too much in government, we have asked of it more than it can deliver. This leads only to inflated expectations, to reduced individual effort, and to a disappointment and frustration that erode confidence both in what government can do and in what people can do.  
Government must learn to take less from people so that people can do more for themselves.  
Let us remember that America was built not by government, but by people -- not by welfare, but by work -- not by shirking responsibility, but by seeking responsibility.  
In our own lives, let each of us ask -- not just what will government do for me, but what can

I do for myself?  
In the challenges we face together, let each of us ask -- not just how can government help, but how can I help?  
Your National Government has a great and vital role to play. And I pledge to you that where this Government should act, we will act boldly and we will lead boldly. But just as important is the role that each and every one of us must play, as an individual and as a member of his own community.  
From this day forward, let each of us make a solemn commitment in his own heart: to bear his responsibility, to do his part, to live his ideals -- so that together, we can see the dawn of a new age of progress for America, and together, as we celebrate our 200th anniversary as a nation, we can do so proud in the fulfillment of our promise to ourselves and to the world.  
As America's longest and most difficult war comes to an end, let us again learn to debate our differences with civility and decency. And let each of us reach out for that one precious quality government cannot provide -- a new level of respect for the rights and feelings of one another, a new level of respect for the individual human dignity which is the cherished birthright of every American.  
Above all else, the time has come for us to renew our faith in ourselves and in America.  
In recent years, that faith has been challenged.  
Our children have been taught to be ashamed of their country, ashamed of their parents, ashamed of America's record at home and of its role in the world.  
At every turn, we have been beset by those who find everything wrong with America and little that is right. But I am confident that this will not be the judgment of history on these remarkable times in which we are privileged to live.  
America's record in this century has been unparalleled in the world's history for its responsibility, for its generosity, for its creativity and for its progress.  
Let us be proud that our system has produced and provided more freedom and more abundance, more widely shared, than any other system in the history of the world.  
Let us be proud that in each of the four wars in which we have been engaged in this century, including the one we are now bringing to an end, we have fought not for our selfish advantage, but to help others resist aggression.  
Let us be proud that by our bold, new initiatives, and by our steadfastness for peace with honor, we have made a break-through toward creating in the world what the world has not known before -- a structure of peace that can last, not merely for our time, but for generations to come.  
We are embarking here today on an era that presents challenges great as those any nation, or any generation, has ever faced.  
We shall answer to God, to history, and to our conscience for the way in which we use these years.  
As I stand in this place, so hallowed by history, I think of others who have stood here before me. I think of the dreams they had for America, and I think of how each recognized that he needed help far beyond himself in order to make those dreams come true.  
Today, I ask your prayers that in the years ahead I may have God's help in making decisions that are right for America, and I pray for your help so that together we may be worthy of our challenge.  
Let us pledge together to make these next four years the best four years in America's history, so that on its 200th birthday America will be as young and as vital as when it began, and as bright a beacon of hope for all the world.  
Let us go forward from here confident in hope, strong in our faith in one another, sustained by our faith in God who created us, and striving always to serve His purpose.

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#sentences='Mr. Vice President, Mr. Speaker, Mr. Chief Justice, Senator Cook, Mrs. Eisenhower fellow citizens great good country share together: When met four years ago, America bleak spirit, depressed prospect seemingly endless war abroad destructive conflict home. As meet today, stand threshold new era peace world. The central question us is: How shall use peace? Let us resolve era enter postwar periods often been time retreat'
```

isolation Leads stagnation home invites new danger abroad. Let us resolve become time great responsibilities greatly borne, renew spirit promise America enter third century nation. This past year saw far-reaching results new policies peace. By continuing revitalize traditional friendships, missions Peking Moscow, able establish base new durable pattern relationships among nations world. Because America bold initiatives, 1972 Long remembered year greatest progress since end World War II toward Lasting peace world. The peace seek world flimsy peace merely interlude wars, peace endure generations come. It is important understand necessity limitations America role maintaining peace. Unless America work preserve peace, peace. Unless America work preserve freedom, freedom. But let us clearly understand new nature America role, result new policies adopted past four years. We shall respect treaty commitments. We shall support vigorously principle country right impose rule another force. We shall continue, era negotiation, work limitation nuclear arms, reduce danger confrontation great powers. We shall share defending peace freedom world. But shall expect others share. The time passed America make every nation conflict own, make every nation future responsibility, presume tell people nations manage affairs. Just respect right nation determine future, also recognize responsibility nation secure future. Just America role indispensable preserving world peace, nation role indispensable preserving peace. Together rest world, let us resolve move forward beginnings made. Let us continue bring walls hostility divided world Long, build place bridge s understanding -- despite profound differences systems government, people world friends. Let us build structure peace world weak safe strong -- respects right live different system -- would influence others strength ideas, force arms. Let us accept high responsibility burden, gladly -- gladly chance build peace noblest endeavor nation engage; gladly, also, act greatly meeting responsibilities abroad remain great Nation, remain great Nation act greatly meeting challenges home. We chance today ever history make life better America -- ensure better education, better health, better housing, better transportation, cleaner environment -- restore respect Law, make communities livable -- insure God-given right every American full equal opportunity. Because range needs great -- reach opportunities great -- let us bold determination meet needs new ways. Just building structure peace abroad required turning away old policies failed, building new era progress home requires turning away old policies failed. Abroad, shift old policies new retreat responsibilities, better way peace. And home, shift old policies new retreat responsibilities, better way progress. Abroad home, key new responsibilities lies placing division responsibility. We lived Long consequences attempting gather power responsibility Washington. Abroad home, time come turn away condescending policies paternalism -- "Washington knows best." A person expected act responsibly responsibility. This human nature. So let us encourage individuals home nations abroad themselves, decide themselves. Let us locate responsibility places. Let us measure others themselves. That today I offer promise purely governmental solution every problem. We lived long false promise. In trusting much government, asked deliver. This leads inflated expectations, reduced individual effort, disappointment frustration erode confidence government people do. Government must learn take less people people themselves. Let us remember America built government, people -- welfare, work -- shirking responsibility, seeking responsibility. In lives, let us ask -- government me, I myself? In challenges face together, let us ask -- government help, I help? Your National Government great vital role play. And I pledge Government act, act boldly lead boldly. But important role every one us must play, individual member community. From day forward, let us make solemn commitment heart: bear responsibility, part, live ideals -- together, see dawn new age progress America, together, celebrate 200th anniversary nation, proud fulfillment promise world. As America longest difficult war comes end, let us learn debate differences civility decency. And let us reach one precious quality government cannot provide -- new level respect rights feelings one another, new level respect individual human dignity cherished birthright every American. Above else, time come us renew faith America. In recent years, faith challenged. Our children taught ashamed country, ashamed parents, ashamed America record home role world. At every turn, beset find everything wrong America little right. But I confident judgment history remarkable times privileged live. America record century unparalleled world history responsibility, generosity, creativity progress. Let us proud system produced provided freedom abundance, widely shared, system history world. Let us proud four wars engaged century, including one bringing end, fought selfish advantage, help others resist aggression. Let us proud bold, new initiatives, steadfastness peace honor, made break-through toward creating world world known -- structure peace last, mer

*ely time, generations come. We embarking today era presents challenges great nation, generation, ever faced. We shall answer God, history, conscience way use years. As I stand place, hallowed history, I think others stood me. I think dreams America, I think recognized needed help far beyond order make dreams come true. Today, I ask prayers years ahead I may God help making decisions right America, I pray help together may worthy challenge. Let us pledge together make next four years best four years America history, 200th birthday America young vital began, bright beacon hope world. Let us go forward confident hope, strong faith one another, sustained faith God created us, striving always serve His purpose.'*

```
number_of_sentences = sent_tokenize(sent)
```

```
print(len(number_of_sentences))
```

```
[nltk_data] Downloading package punkt to
[nltk_data]      C:\Users\Romil\AppData\Roaming\nltk_data...
```

188

```
[nltk_data] Package punkt is already up-to-date!
```

Number Of Words in Roosevelt Speech	Number of words in Kennedy Speech	Number Of words in Nixon Speech
1360	1390	1819
Number Of Characters in all 3 Speech		
25183		
Number Of Sentences in all 3 Speech		
188		

In [ ]:

## 2.2) Remove all the stopwords from the three speeches.

In [15]:

```
# Lets check
# Which are stop words.
# How many are in each speech.
# Remove the stop words.
```

In [17]:

```
# importing necessary libraries.
```

```
from nltk.corpus import stopwords
stop_words_are = stopwords.words('english')
print(stop_words_are)
```

```
['i', 'me', 'my', 'myself', 'we', 'our', 'ours', 'ourselves', 'you', "yo
u're", "you've", "you'll", "you'd", 'your', 'yours', 'yourself', 'yoursel
es', 'he', 'him', 'his', 'himself', 'she', "she's", 'her', 'hers', 'hersel
f', 'it', "it's", 'its', 'itself', 'they', 'them', 'their', 'theirs', 'the
mselves', 'what', 'which', 'who', 'whom', 'this', 'that', "that'll", 'thes
e', 'those', 'am', 'is', 'are', 'was', 'were', 'be', 'been', 'being', 'hav
e', 'has', 'had', 'having', 'do', 'does', 'did', 'doing', 'a', 'an', 'th
e', 'and', 'but', 'if', 'or', 'because', 'as', 'until', 'while', 'of', 'a
t', 'by', 'for', 'with', 'about', 'against', 'between', 'into', 'through',
'during', 'before', 'after', 'above', 'below', 'to', 'from', 'up', 'down',
'in', 'out', 'on', 'off', 'over', 'under', 'again', 'further', 'then', 'on
ce', 'here', 'there', 'when', 'where', 'why', 'how', 'all', 'any', 'both',
'each', 'few', 'more', 'most', 'other', 'some', 'such', 'no', 'nor', 'no
t', 'only', 'own', 'same', 'so', 'than', 'too', 'very', 's', 't', 'can',
'will', 'just', 'don', "don't", 'should', "should've", 'now', 'd', 'll',
'm', 'o', 're', 've', 'y', 'ain', 'aren', "aren't", 'couldn', "couldn't",
'didn', "didn't", 'doesn', "doesn't", 'hadn', "hadn't", 'hasn', "hasn't",
'haven', "haven't", 'isn', "isn't", 'ma', 'mightn', "mightn't", 'mustn',
"mustn't", 'needn', "needn't", 'shan', "shan't", 'shouldn', "shouldn't",
'wasn', "wasn't", 'weren', "weren't", 'won', "won't", 'wouldn', "would
n't"]
```

In [18]:

```
# Removing all the stop words from all three speeches.
```

```
# We already have our Dataframe (df) where we have kept all three speeches so by using
it.
```

```
stop_words_are = stopwords.words('english')
df['full'] = df['full'].apply(lambda x: " ".join(x for x in x.split() if x not in stop_
words_are))
df['full'].head()
```

Out[18]:

```
0    On national day inauguration since 1789, peopl...
Name: full, dtype: object
```

In [19]:

```
# Lets check how many stop words are remaining after removing.
```

```
df['stopwords'] = df['full'].apply(lambda x: len([x for x in x.split() if x in stop]))
df[['full', 'stopwords']].head()
```

Out[19]:

	full	stopwords
0	On national day inauguration since 1789, peopl...	0

So we have removed all the Stop words from all Three Speeches.

**2.3) Which word occurs the most number of times in his inaugural address for each president?  
Mention the top three words. (after removing the stopwords)**

In [20]:

```
# Here we need to check frequency of each word for every single President.
# We will use every President's Dataframe which we have created with their speech column.

# For President Nixon.

words_occur_for_Nixon = pd.Series(' '.join(nix['xon']).split()).value_counts()[:5]
words_occur_for_Nixon
```

Out[20]:

```
the    80
of     68
to     65
in     54
and    47
dtype: int64
```

In [21]:

```
# For President Kennedy.

words_occur_for_kennedy = pd.Series(' '.join(keen['nedy']).split()).value_counts()[:5]
words_occur_for_kennedy
```

Out[21]:

```
the    83
of     65
and    37
to     37
a      29
dtype: int64
```

In [22]:

```
# For President Roosevelt.

words_occur_for_rosevelt = pd.Series(' '.join(rose['velt']).split()).value_counts()[:5]
words_occur_for_rosevelt
```

Out[22]:

```
the    104
of     81
and    41
to     35
in     30
dtype: int64
```

Top 3 words in Presidents speech :

President	Top 3 Words in his Speech (after removing stopwords)
Nixon	the , of, to
Kennedy	the , of , and
Rosevelt	the , of , and

#### 2.4) Plot the word cloud of each of the three speeches. (after removing the stopwords)

We will create one variable for every President's speech (after removing stopwords) and then we will plot word cloud.

In [24]:

```
from wordcloud import WordCloud
```

In [29]:

```
# 1 : For President Nixon.

# Lets check how many stop words are present in Nixon.

stop_words_who = stopwords.words('english')

nix['xon'] = nix['xon'].apply(lambda x: " ".join(x for x in x.split() if x not in stop_
words_who))
nix['xon'].head()
```

Out[29]:

```
0    Mr. Vice President, Mr. Speaker, Mr. Chief Jus...
Name: xon, dtype: object
```

In [27]:

```
# Lets check how many stop words are remaining after removing for Nixon.

nix['stopwords'] = nix['xon'].apply(lambda x: len([x for x in x.split() if x in stop]))
nix[['xon', 'stopwords']].head()
```

Out[27]:

	xon	stopwords
0	Mr. Vice President, Mr. Speaker, Mr. Chief Jus...	0

In [31]:

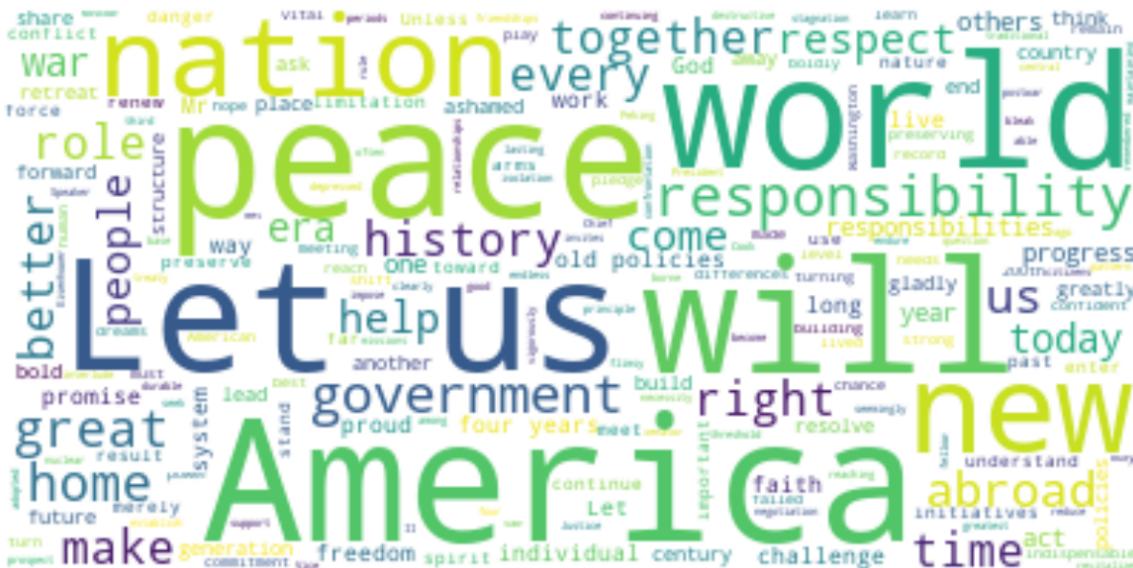
WordCloud\_Nixon = 'Mr. Vice President, Mr. Speaker, Mr. Chief Justice, Senator Cook, Mr. S. Eisenhower, and my fellow citizens of this great and good country we share together:  
\n\nWhen we met here four years ago, America was bleak in spirit, depressed by the prospect of seemingly endless war abroad and of destructive conflict at home.\n\nAs we meet here today, we stand on the threshold of a new era of peace in the world.\n\nThe central question before us is: How shall we use that peace? Let us resolve that this era we are about to enter will not be what other postwar periods have so often been: a time of retreat and isolation that leads to stagnation at home and invites new danger abroad.  
\n\nLet us resolve that this will be what it can become: a time of great responsibilities greatly borne, in which we renew the spirit and the promise of America as we enter our third century as a nation.\n\nThis past year saw far-reaching results from our new policies for peace. By continuing to revitalize our traditional friendships, and by our missions to Peking and to Moscow, we were able to establish the base for a new and more durable pattern of relationships among the nations of the world. Because of America's bold initiatives, 1972 will be long remembered as the year of the greatest progress since the end of World War II toward a lasting peace in the world.\n\nThe peace we seek in the world is not the flimsy peace which is merely an interlude between wars, but a peace which can endure for generations to come.\n\nIt is important that we understand both the necessity and the limitations of America's role in maintaining that peace.\n\nUnless we in America work to preserve the peace, there will be no peace.\n\nUnless we in America work to preserve freedom, there will be no freedom.\n\nBut let us clearly understand the new nature of America's role, as a result of the new policies we have adopted over these past four years.\n\nWe shall respect our treaty commitments.\n\nWe shall support vigorously the principle that no country has the right to impose its will or rule on another by force.\n\nWe shall continue, in this era of negotiation, to work for the limitation of nuclear arms, and to reduce the danger of confrontation between the great powers.\n\nWe shall do our share in defending peace and freedom in the world. But we shall expect others to do their share.\n\nThe time has passed when America will make every other nation's conflict our own, or make every other nation's future our responsibility, or presume to tell the people of other nations how to manage their own affairs.\n\nJust as we respect the right of each nation to determine its own future, we also recognize the responsibility of each nation to secure its own future.\n\nJust as America's role is indispensable in preserving the world's peace, so is each nation's role indispensable in preserving its own peace.\n\nTogether with the rest of the world, let us resolve to move forward from the beginnings we have made. Let us continue to bring down the walls of hostility which have divided the world for too long, and to build in their place bridges of understanding -- so that despite profound differences between systems of government, the people of the world can be friends.\n\nLet us build a structure of peace in the world in which the weak are as safe as the strong -- in which each respects the right of the other to live by a different system -- in which those who would influence others will do so by the strength of their ideas, and not by the force of their arms.\n\nLet us accept that high responsibility not as a burden, but gladly -- gladly because the chance to build such a peace is the noblest endeavor in which a nation can engage; gladly, also, because only if we act greatly in meeting our responsibilities abroad will we remain a great Nation, and only if we remain a great Nation will we act greatly in meeting our challenges at home.\n\nWe have the chance today to do more than ever before in our history to make life better in America -- to ensure better education, better health, better housing, better transportation, a cleaner environment -- to restore respect for law, to make our communities more livable -- and to insure the God-given right of every American to full and equal opportunity.\n\nBecause the range of our needs is so great -- because the reach of our opportunities is so great -- let us be bold in our determination to meet those needs in new ways.\n\nJust as building a structure of peace abroad has required turning away from old policies that failed, so building a new era of progress at home requires turning away from old policies that have failed.  
\n\nAbroad, the shift from old policies to new has not been a retreat from our responsibilities, but a better way to peace.\n\nAnd at home, the shift from old policies to new will not be a retreat from our responsibilities, but a better way to progress.  
\n\nAbroad and at home, the key to those new responsibilities lies in the placing and the division of responsibility. We have lived too long with the consequences of attempting to get

her all power and responsibility in Washington.\n\nAbroad and at home, the time has come to turn away from the condescending policies of paternalism -- of "Washington knows best."\n\nA person can be expected to act responsibly only if he has responsibility. This is human nature. So let us encourage individuals at home and nations abroad to do more for themselves, to decide more for themselves. Let us locate responsibility in more places. Let us measure what we will do for others by what they will do for themselves.\n\nThat is why today I offer no promise of a purely governmental solution for every problem. We have lived too long with that false promise. In trusting too much in government, we have asked of it more than it can deliver. This leads only to inflated expectations, to reduced individual effort, and to a disappointment and frustration that erode confidence both in what government can do and in what people can do.\n\nGovernment must learn to take less from people so that people can do more for themselves.\n\nLet us remember that America was built not by government, but by people -- not by welfare, but by work -- not by shirking responsibility, but by seeking responsibility.\n\nIn our own lives, let each of us ask -- not just what will government do for me, but what can I do for myself?\n\nIn the challenges we face together, let each of us ask -- not just how can government help, but how can I help?\n\nYour National Government has a great and vital role to play. And I pledge to you that where this Government should act, we will act boldly and we will lead boldly. But just as important is the role that each and every one of us must play, as an individual and as a member of his own community.\n\nFrom this day forward, let each of us make a solemn commitment in his own heart: to bear his responsibility, to do his part, to live his ideals -- so that together, we can see the dawn of a new age of progress for America, and together, as we celebrate our 200th anniversary as a nation, we can do so proud in the fulfillment of our promise to ourselves and to the world.\n\nAs America's longest and most difficult war comes to an end, let us again learn to debate our differences with civility and decency. And let each of us reach out for that one precious quality government cannot provide -- a new level of respect for the rights and feelings of one another, a new level of respect for the individual human dignity which is the cherished birthright of every American.\n\nAbove all else, the time has come for us to renew our faith in ourselves and in America.\n\nIn recent years, that faith has been challenged.\n\nOur children have been taught to be ashamed of their country, ashamed of their parents, ashamed of America's record at home and of its role in the world.\n\nAt every turn, we have been beset by those who find everything wrong with America and little that is right. But I am confident that this will not be the judgment of history on these remarkable times in which we are privileged to live.\n\nAmerica's record in this century has been unparalleled in the world's history for its responsibility, for its generosity, for its creativity and for its progress.\n\nLet us be proud that our system has produced and provided more freedom and more abundance, more widely shared, than any other system in the history of the world.\n\nLet us be proud that in each of the four wars in which we have been engaged in this century, including the one we are now bringing to an end, we have fought not for our selfish advantage, but to help others resist aggression.\n\nLet us be proud that by our bold, new initiatives, and by our steadfastness for peace with honor, we have made a break-through toward creating in the world what the world has not known before -- a structure of peace that can last, not merely for our time, but for generations to come.\n\nWe are embarking here today on an era that presents challenges great as those any nation, or any generation, has ever faced.\n\nWe shall answer to God, to history, and to our conscience for the way in which we use these years.\n\nAs I stand in this place, so hallowed by history, I think of others who have stood here before me. I think of the dreams they had for America, and I think of how each recognized that he needed help far beyond himself in order to make those dreams come true.\n\nToday, I ask your prayers that in the years ahead I may have God's help in making decisions that are right for America, and I pray for your help so that together we may be worthy of our challenge.\n\nLet us pledge together to make these next four years the best four years in America's history, so that on its 200th birthday America will be as young and as vital as when it began, and as bright a beacon of hope for all the world.\n\nLet us go forward from here confident in hope, strong in our faith in one another, sustained by our faith in God who created us, and striving always to serve His purpose.\n'

```
wordcloud = WordCloud(max_font_size=60,background_color='white').generate(WordCloud_Nixon)
plt.figure(figsize=(16,12))
```

```
# plot wordcloud in matplotlib
plt.imshow(wordcloud, interpolation="bilinear")
plt.axis("off")
plt.tight_layout(pad = 0)

plt.show()
```



In [32]:

## # 2 : For President Kennedy.

```
# Lets check how many stop words are present in Kennedy.
```

```
stop_words_who = stopwords.words('english')
```

```
keen[ 'nedy' ] = keen[ 'nedy' ].apply(lambda x: " ".join(x for x in x.split() if x not in stop_words_who))
keen[ 'nedy' ].head()
```

Out[32]:

0 Vice President Johnson, Mr. Speaker, Mr. Chief...  
Name: nedy, dtype: object

In [33]:

# Lets check how many stop words are remaining after removing for Kennedy.

```
keen['stopwords'] = keen['nedy'].apply(lambda x: len([x for x in x.split() if x in stop]))
keen[['nedy', 'stopwords']].head()
```

Out[33]:

## nedy stopwords

0 Vice President Johnson, Mr. Speaker, Mr. Chief...

In [34]:

WordCloud\_Kennedy = 'Vice President Johnson, Mr. Speaker, Mr. Chief Justice, President Eisenhower, Vice President Nixon, President Truman, reverend clergy, fellow citizens, observe today victory party, celebration freedom -- symbolizing end, well beginning -- signifying renewal, well change. For I sworn I Almighty God solemn oath forebears I prescribed nearly century three quarters ago. The world different now. For man holds mortal hands power abolish forms human poverty forms human life. And yet revolutionary beliefs forebears fought still issue around globe -- belief rights man come generosity state, hand God. We dare forget today heirs first revolution. Let word go forth time place, friend foe alike, torch passed new generation Americans -- born century, tempered war, disciplined hard bitter peace, proud ancient heritage -- unwilling witness permit slow undoing human rights Nation always committed, committed today home around world. Let every nation know, whether wishes us well ill, shall pay price, bear burden, meet hardship, support friend, oppose foe, order assure survival success liberty. This much pledge -- more. To old allies whose cultural spiritual origins share, pledge loyalty faithful friends. United, little cannot host cooperative ventures. Divided, little -- dare meet powerful challenge odds split asunder. To new States welcome ranks free, pledge word one form colonial control shall passed away merely replaced far iron tyranny. We shall always expect find supporting view. But shall always hope find strongly supporting freedom -- remember that, past, foolishly sought power riding back tiger ended inside. To peoples huts villages across globe struggling break bonds mass misery, pledge best efforts help themselves, whatever period required -- Communists may it, seek votes, right. If free society cannot help many poor, cannot save rich. To sister republics south border, offer special pledge -- convert good words good deeds -- new alliance progress -- assist free men free governments casting chains poverty. But peaceful revolution hope cannot become prey hostile powers. Let neighbors know shall join oppose aggression subversion anywhere Americas. And let every power know Hemisphere intends remain master house. To world assembly sovereign states, United Nations, last best hope age instruments war far outpaced instruments peace, renew pledge support--to prevent becoming merely forum invective -- strengthen shield new weak -- enlarge area writ may run. Finally, nations would make adversary, offer pledge request: sides begin anew quest peace, dark powers destruction unleashed science engulf humanity planned accidental self-destruction.

We dare tempt weakness. For arms sufficient beyond doubt certain beyond doubt never employed. But neither two great powerful groups nations take comfort present course -- sides overburdened cost modern weapons, rightly alarmed steady spread deadly atom, yet racing alter uncertain balance terror stays hand mankind final war. So let us begin anew remembering sides civility sign weakness, sincerity always subject proof. Let us never negotiate fear. But let us never fear negotiate. Let sides explore problems unite us instead belaboring problems divide us. Let sides, first time, formulate serious precise proposals inspection control arms -- bring absolute power destroy nations absolute control nations. Let sides seek invoke wonders science instead terrors. Together let us explore stars, conquer deserts, eradicate disease, tap ocean depths, encourage arts commerce. Let sides unite heed corners earth command Isaiah -- "undo heavy burdens ... let oppressed go free." And beachhead cooperation may push back jungle suspicion, let sides join in creating new endeavor, new balance power, new world law, strong weak secure peace preserved. All finished first 100 days. Nor finished first 1,000 days, life Administration, even perhaps lifetime planet. But let us begin. In hands, fellow citizens, mine, rest final success failure course. Since country founded, generation Americans summoned give testimony national loyalty. The graves young Americans answered call service surrounded globe. Now trumpet summons us -- call bear arms, though arms need; call battle, though embattled -- call bear burden long twilight struggle, year year out, "rejoicing hope, patient tribulation" -- struggle common enemies man: tyranny, poverty, disease, war itself. Can forge enemies grand global alliance, North South, East West, assure fruitful life mankind? Will join historic effort? In long history world, generations granted role defending freedom hour maximum danger. I shrink responsibility -- I welcome it. I believe us would exchange places people generation. The energy, faith, devotion bring endeavor light country serve -- glow fire truly light world. And so, fellow Americans: ask country -- ask country. My fellow citizens world: ask America you, together freedom man.

Finally, whether citizens America citizens world, ask us high standards strength sacrifice ask you. With good conscience sure reward, history final judge deeds, let us go fo

```
orth lead land love, asking His blessing His help, knowing earth God work must truly own.  
n.1'  
wordcloud = WordCloud(max_font_size=60,background_color='white').generate(WordCloud_Ken  
nedy)  
plt.figure(figsize=(16,12))  
# plot wordcloud in matplotlib  
plt.imshow(wordcloud, interpolation="bilinear")  
plt.axis("off")  
plt.show()
```



In [35]:

### *# 3 : For President Roosevelt.*

```
# Lets check how many stop words are present in Roosevelt.
```

```
stop_words_who = stopwords.words('english')
```

```
rose['velt'] = rose['velt'].apply(lambda x: " ".join(x for x in x.split() if x not in stop_words_who))
rose['velt'].head()
```

Out[35]:

0 On national day inauguration since 1789, peopl...  
Name: velt, dtype: object

In [36]:

# Lets check how many stop words are remaining after removing for Roosevelt.

```
rose['stopwords'] = rose['velt'].apply(lambda x: len([x for x in x.split() if x in stop]))
rose[['velt','stopwords']].head()
```

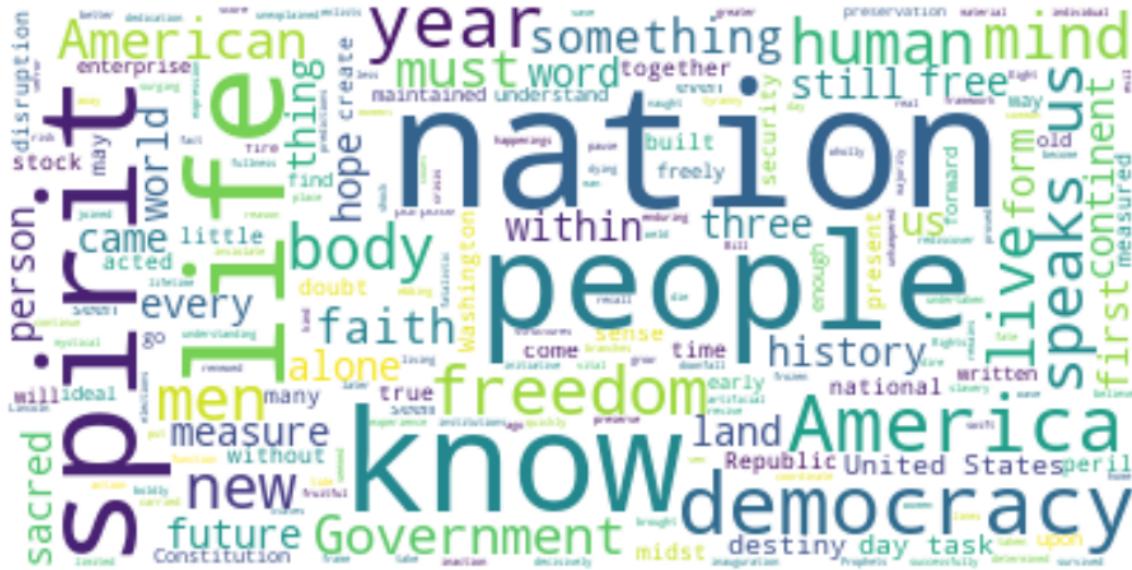
Out[36]:

	velt	stopwords
0	On national day inauguration since 1789, peopl...	0

In [37]:

WordCloud\_Rosevelt = 'On national day inauguration since 1789, people renewed sense dedication United States. In Washington day task people create weld together nation. In Lincoln day task people preserve Nation disruption within. In day task people save Nation institutions disruption without. To us come time, midst swift happenings, pause moment take stock -- recall place history been, rediscover may be. If not, risk real peril in action. Lives nations determined count years, lifetime human spirit. The life man three-score years ten: little more, little less. The life nation fullness measure live. There men doubt this. There men believe democracy, form Government frame life, limited measured kind mystical artificial fate that, unexplained reason, tyranny slavery become surging wave future -- freedom ebbing tide. But Americans know true. Eight years ago, life Republic seemed frozen fatalistic terror, proved true. We midst shock -- acted. We acted quickly, boldly, decisively. These later years living years -- fruitful years people democracy. For brought us greater security and, I hope, better understanding life ideals measured material things. Most vital present future experience democracy successfully survived crisis home; put away many evil things; built new structures enduring lines; and, all, maintained fact democracy. For action taken within three-way framework Constitution United States. The coordinate branches Government continue freely function. The Bill Rights remains inviolate. The freedom elections wholly maintained. Prophets downfall American democracy seen dire predictions come naught. Democracy dying. We know seen revive--and grow. We know cannot die -- built unhampered initiative individual men women joined together common enterprise -- enterprise undertaken carried free expression free majority. We know democracy alone, forms government, enlists full force men enlightened will. We know democracy alone constructed unlimited civilization capable infinite progress improvement human life. We know because, look surface, sense still spreading every continent -- humane, advanced, end unconquerable forms human society. A nation, like person, body--a body must fed clothed housed, invigorated rested, manner measures objectives time. A nation, like person, mind -- mind must kept informed alert, must know itself, understands hopes needs neighbors -- nations live within narrowing circle world. And nation, like person, something deeper, something permanent, something larger sum parts. It something matters future -- calls forth sacred guarding present. It thing find difficult -- even impossible -- hit upon single, simple word. And yet understand -- spirit -- faith America. It product centuries. It born multitudes came many lands -- high degree, mostly plain people, sought here, early late, find freedom freely. The democratic aspiration mere recent phase human history. It human history. It permeated ancient life early peoples. It blazed anew middle ages. It written Magna Charta. In Americas impact irresistible. America New World tongues, peoples, continent new-found land, came believed could create upon continent new life -- life new freedom. Its vitality written Mayflower Compact, Declaration Independence, Constitution United States, Gettysburg Address. Those first came carry longings spirit, millions followed, stock sprang -- moved forward constantly consistently toward ideal gained stature clarity generation. The hopes Republic cannot forever tolerate either undeserved poverty self-serving wealth. We know still far go; must greatly build security opportunity knowledge every citizen, measure justified resources capacity land. But enough achieve purposes alone. It enough clothe feed body Nation, instruct inform mind. For also spirit. And three, greatest spirit. Without body mind, men know, Nation could live. But spirit America killed, even though Nation body mind, constricted alien world, lived on, America know would perished. That spirit -- faith -- speaks us daily lives ways often unnoticed, seem obvious. It speaks us Capital Nation. It speaks us processes governing sovereignties 48 States. It speaks us counties, cities, towns, villages. It speaks us nations hemisphere, across seas -- enslaved, well free. Sometimes fail hear heed voices freedom us privilege freedom old, old story. The destiny America proclaimed words prophecy spoken first President first in augural 1789 -- words almost directed, would seem, year 1941: "The preservation sacred fire liberty destiny republican model government justly considered deeply, finally, staked experiment intrusted hands American people." If lose sacred fire--if let smothered doubt fear -- shall reject destiny Washington strove valiantly triumphantly establish. The preservation spirit faith Nation does, will, furnish highest justification every sacrifice may make cause national defense. In face great perils never encountered, strong purpose protect perpetuate integrity democracy. For muster spirit America, faith America. We retreat. We content stand still. As Americans, go forward, service country, Go

```
d. 1'
wordcloud = WordCloud(max_font_size=60,background_color='white').generate(WordCloud_Ros
evelt)
plt.figure(figsize=(16,12))
# plot wordcloud in matplotlib
plt.imshow(wordcloud, interpolation="bilinear")
plt.axis("off")
plt.show()
```



**Most Common words are in WordClouds for All Presidents are :**

President	WordCloud words are:
Nixon	Peace, Nation, America, World, Let us, Will, New and so on.
Kennedy	Power, Pledge, New, Let, Nation, World, Sides and so on.
Rosevelt	Nation, Spirit, Know, People, Life, Democracy and son on.

In [ ]: