```
# Import libraries
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import numpy as np

%matplotlib inline
```

```
from google.colab import drive
drive.mount('/content/drive')
```

```
     Mounted at /content/drive
```

```
# Reading in datasets
data = pd.read_csv('/content/drive/MyDrive/Dataset of DAFE project/2015_16_Statewise_Elementary.csv')
meta_data = pd.read_csv('/content/drive/MyDrive/Dataset of DAFE project/2015_16_Statewise_Elementary_Metadata.csv')
```

```
def sort_vals(df,col):
    df_new = df.sort_values(by = col)
    df_new.reset_index().drop('index', axis = 1, inplace = True)
    return df_new
```

```
def plot_barh(df, col1, col2, size = (10,10), title = None, xlabel = None):
    fig, ax = plt.subplots(1,1,figsize = size)
    plt.barh(df[col1],df[col2],label = col2)

    if title:
        ax.set_title(title)
    else:
        ax.set_title('{} vs {}'.format(col2, col1))
    if xlabel:
        ax.set_xlabel(xlabel)
    else:
        ax.set_xlabel(col2)
```

```
def display_desc(row):
    return meta_data[meta_data['Field name'] == row].Description.values[0]
```

```
print(data.shape)
print(meta_data.shape)
```

```
     (36, 816)
     (816, 2)
```

```
print(data.isnull().sum()[data.isnull().sum() > 0].shape)
```

```
     (0,)
```

```
data.head(2)
```

	AC_YEAR	STATCD	STATNAME	DISTRICTS	BLOCKS	VILLAGES	CLUSTERS	TOTPOPULAT	P_URB_POP	POPULATION_0_
0	2015-16	1	JAMMU & KASHMIR	22	201	7263	1628	12549	20.05	16.(
1	2015-16	2	HIMACHAL PRADESH	12	124	10120	2243	6857	8.69	11.1

2 rows × 816 columns

```
meta_data.head(2)
```

	Field name	Description
0	AC_YEAR	AC_YEAR: AC_YEAR
1	STATCD	Data Reported from: Data Reported from

```
data['OVERALL_LI'].describe()
```

```
     count    36.000000
     mean     78.309444
     std       8.257752
     min      63.820000
     25%      70.937500
```

```
50%      78.480000
75%      86.287500
max      93.910000
Name: OVERALL_LI, dtype: float64
```

```
data.AREA_SQKM.describe()
```

```
count        36.000000
mean      94501.111111
std      102321.909726
min          32.000000
25%        9926.750000
50%       54578.000000
75%      140320.000000
max      342239.000000
Name: AREA_SQKM, dtype: float64
```

```
data.GROWTHRATE.describe()
```

```
count    36.000000
mean     19.990556
std      11.455856
min      -0.470000
25%      13.880000
50%      18.910000
75%      22.637500
max      55.500000
Name: GROWTHRATE, dtype: float64
```

```
data[data.GROWTHRATE == -0.47]
```

	AC_YEAR	STATCD	STATNAME	DISTRICTS	BLOCKS	VILLAGES	CLUSTERS	TOTPOPULAT	P_URB_POP	POPULATION_
12	2015-16	13	NAGALAND	11	47	1478	125	1981	17.31	14

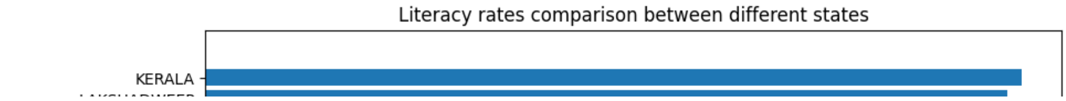
1 rows × 816 columns

```
(data.MALE_LIT - data.FEMALE_LIT).describe()
```

```
count    36.000000
mean     13.893611
std       5.679685
min       3.390000
25%      10.130000
50%      13.720000
75%      18.182500
max      27.850000
dtype: float64
```

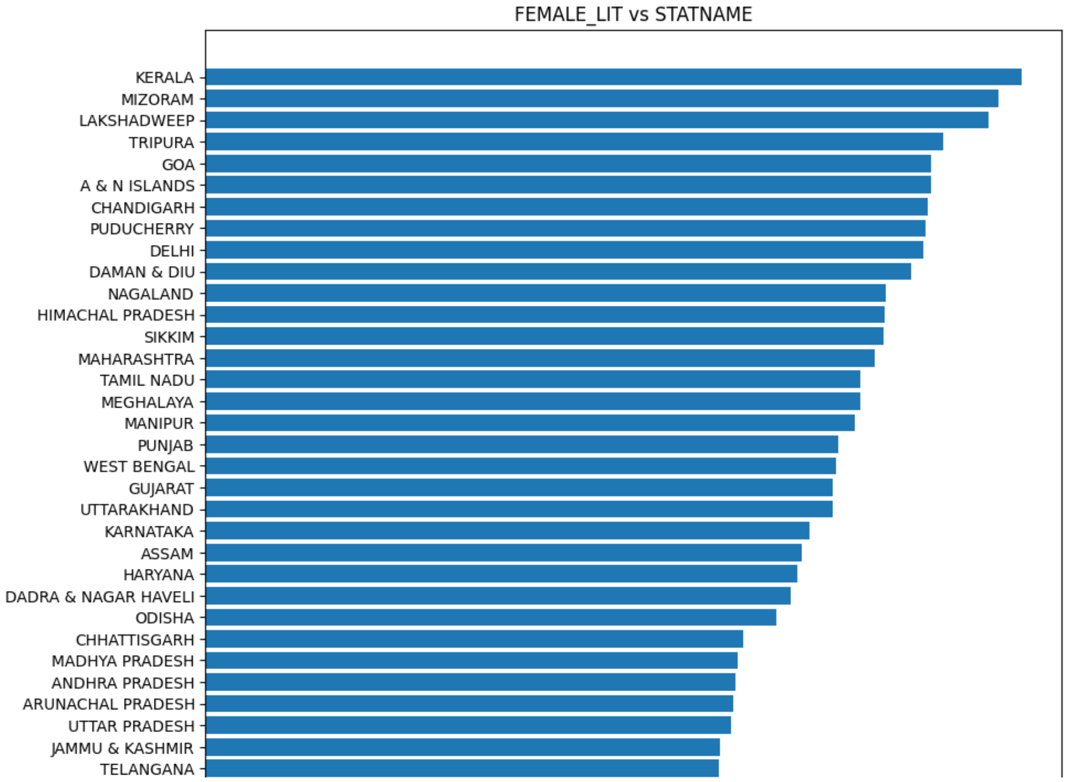
```
# 'OVERALL_LI' is the overall literacy rate for each state
data = sort_vals(data, 'OVERALL_LI')
```

```
plot_barh(data, 'STATNAME', 'OVERALL_LI', title = 'Literacy rates comparison between different states' , xlabel = 'Literacy rate')
```



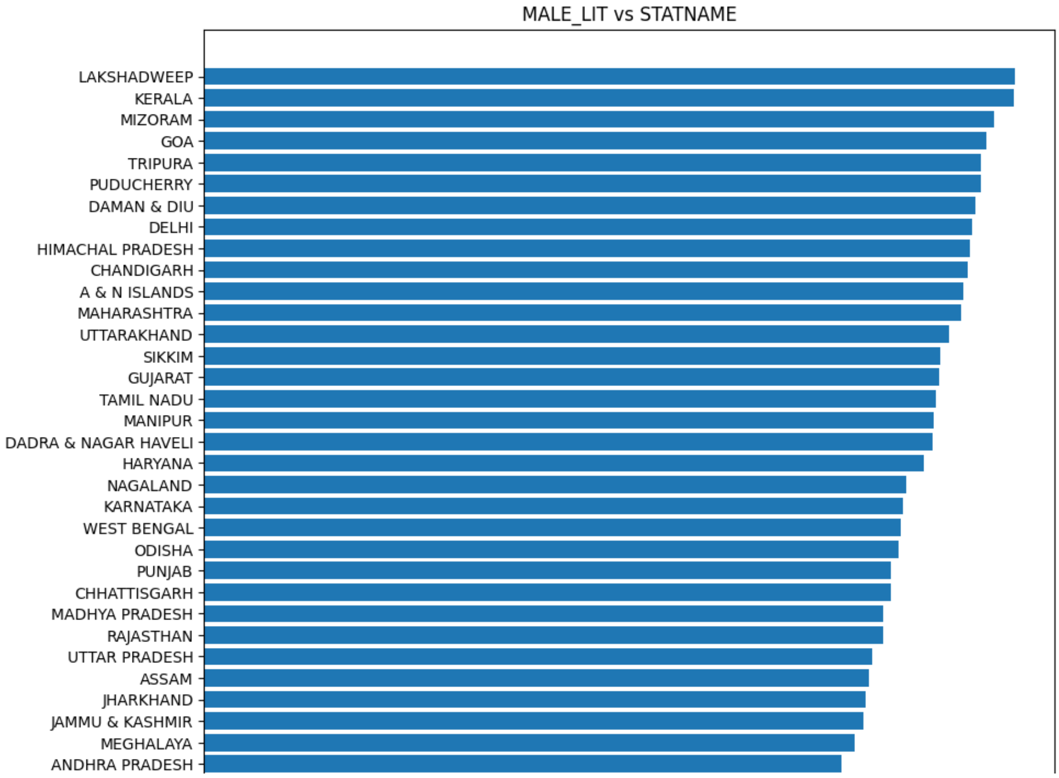
```
data = sort_vals(data, 'FEMALE_LIT')
```

```
plot_barh(data, 'STATNAME', 'FEMALE_LIT')
```



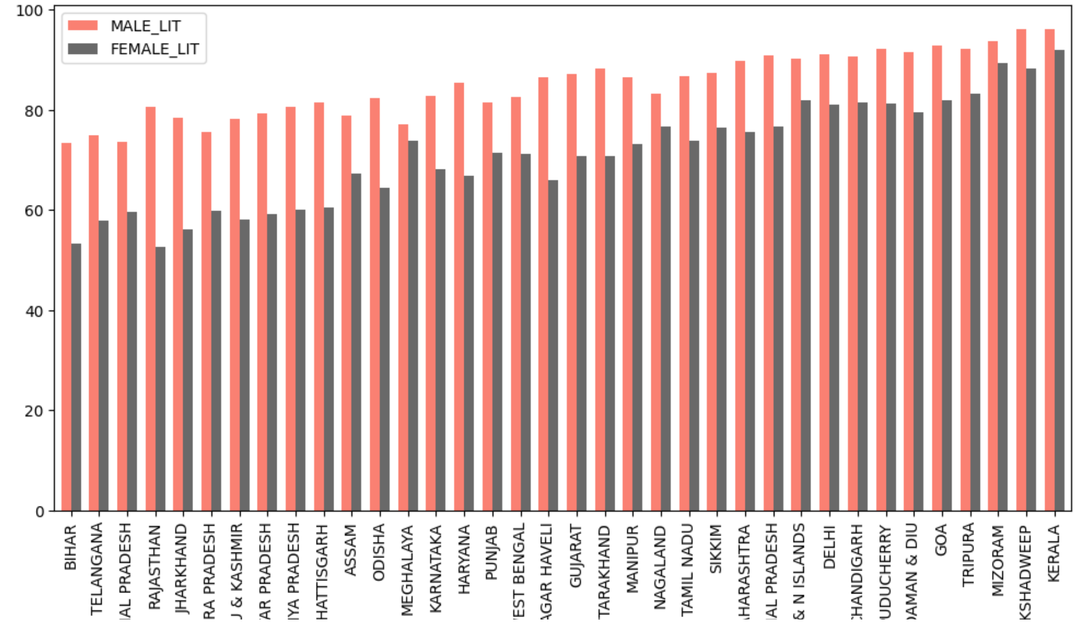
```
data = sort_vals(data, 'MALE_LIT')
```

```
plot_barh(data, 'STATNAME', 'MALE_LIT')
```



```
data = sort_vals(data, 'OVERALL_LI')
```

```
data.plot(kind = 'bar',x = 'STATNAME',y = ['MALE_LIT','FEMALE_LIT'],stacked = False,figsize=(12,6),width = 0.7,color = ['salmon','dimgrey
<Axes: xlabel='STATNAME'>
```



```
data['DIFF_LIT'] = data.MALE_LIT - data.FEMALE_LIT
```

```
diff_lit_mean = data.DIFF_LIT.mean()
print("India's avg difference in literacy rate between men and women is : {}".format(diff_lit_mean))
```

```
India's avg difference in literacy rate between men and women is : 13.893611111111113
```

```
sort_vals(data, 'DIFF_LIT').head()[['STATNAME','DIFF_LIT']]
```

	STATNAME	DIFF_LIT
16	MEGHALAYA	3.39
31	KERALA	4.04
14	MIZORAM	4.32
12	NAGALAND	6.60
30	LAKSHADWEEP	7.86

```
sort_vals(data, 'DIFF_LIT').tail()[['STATNAME','DIFF_LIT']]
```

	STATNAME	DIFF_LIT
22	MADHYA PRADESH	20.51
25	DADRA & NAGAR HAVELI	20.53
21	CHHATTISGARH	20.86
19	JHARKHAND	22.24
7	RAJASTHAN	27.85

```
north_east = ['NAGALAND','MANIPUR','MIZORAM','ASSAM','TRIPURA','ARUNACHAL PRADESH','MEGHALAYA','SIKKIM']
data.set_index(data.STATNAME,inplace = True)
ne_diff_lit_mean = data.loc[north_east,'DIFF_LIT' ].mean()
print('The avg in DIFF_LIT for north-eastern states ({}) is much less than the national avg ({}).'.format(ne_diff_lit_mean,diff_lit_mean)
```

```
The avg in DIFF_LIT for north-eastern states (9.1475) is much less than the national avg (13.893611111111113).
```

```
print("The Female literacy rate for meghalaya : {} .VS. the avg female literacy rate : {}".format(data.loc['MEGHALAYA','FEMALE_LIT'],data
```

```
The Female literacy rate for meghalaya : 73.78 .VS. the avg female literacy rate : 71.09138888888889
```

```
# We will drop Telangana from bottom 3 as its been recently founded(2014)
top_3_elem = data.sort_values(by = 'OVERALL_LI', ascending = False).head(3)
bottom_3_elem = data.sort_values(by = 'OVERALL_LI', ascending = True).head(4).drop('TELANGANA',axis = 0)
```

```
top_bottom = pd.concat([top_3_elem, bottom_3_elem], axis = 0, sort = False)
```

```
top_bottom
```

	AC_YEAR	STATCD	STATNAME	DISTRICTS	BLOCKS	VILLAGES	CLUSTERS	TOTPOPULAT	P_URB_
STATNAME									
KERALA	2015-16	32	KERALA	14	166	1907	1375	33388	24
LAKSHADWEEP	2015-16	31	LAKSHADWEEP	1	3	10	9	64	4
MIZORAM	2015-16	15	MIZORAM	8	36	851	169	1091	40
BIHAR	2015-16	10	BIHAR	38	537	40779	5633	103805	8
ARUNACHAL PRADESH	2015-16	12	ARUNACHAL PRADESH	20	99	2982	234	1383	10
RAJASTHAN	2015-16	8	RAJASTHAN	33	302	41441	10594	68621	19

6 rows × 817 columns

```
display_desc('TOTPOPULAT')
```

```
'Basic data from Census 2011: Total Population(in 1000's)'
```

```
top_bottom.TOTPOPULAT/top_bottom.AREA_SQKM * 1000
```

```
STATNAME
KERALA                859.120500
LAKSHADWEEP          2000.000000
MIZORAM                51.752763
BIHAR                1102.396907
ARUNACHAL PRADESH      16.514813
RAJASTHAN             200.506079
dtype: float64
```

```
top_bottom.DIFF_LIT
```

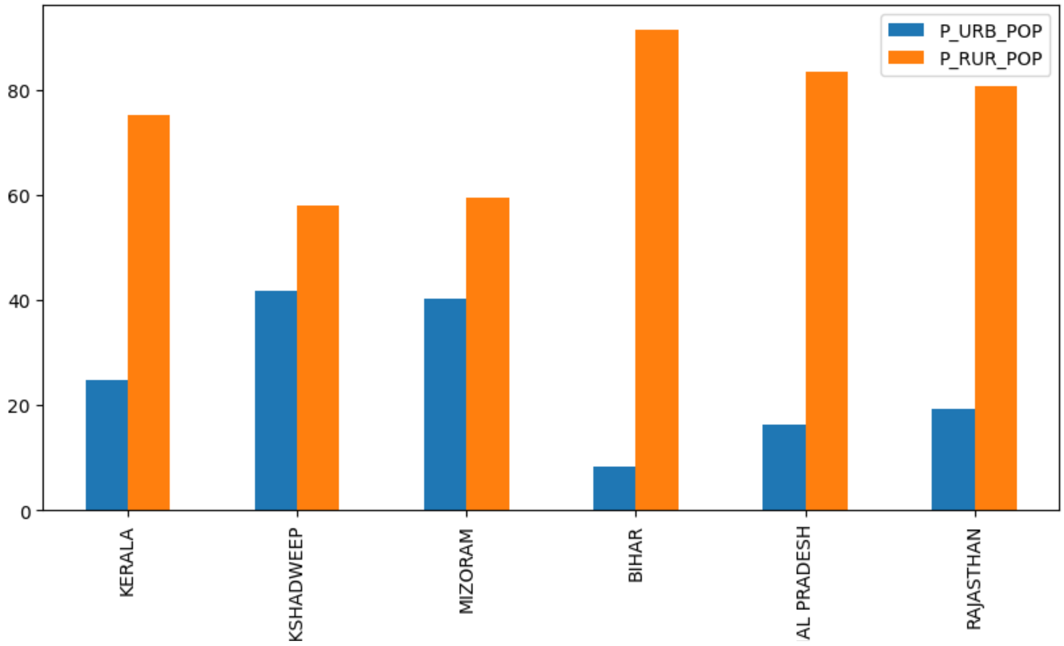
```
STATNAME
KERALA                4.04
LAKSHADWEEP           7.86
MIZORAM               4.32
BIHAR                20.06
ARUNACHAL PRADESH    14.12
RAJASTHAN            27.85
Name: DIFF_LIT, dtype: float64
```

```
top_bottom.plot(y = 'DIFF_LIT',kind= 'bar')
plt.title('Top 3 vs Bottom 3 states for DIFF_LIT')
```

```
display_desc('P_URB_POP')

     'Basic data from Census 2011: Percentage Urban Population'
          |                                                          ▬   |
```

```
top_bottom['P_RUR_POP'] = 100 - top_bottom['P_URB_POP']
          |                                                          ▬   |
```

```
top_bottom.plot(y = ['P_URB_POP', 'P_RUR_POP'], kind = 'bar', figsize = (10,5))

     <Axes: xlabel='STATNAME'>
```



```
# Approximate National average
data.SEXRATIO.mean()

     930.8888888888889
```

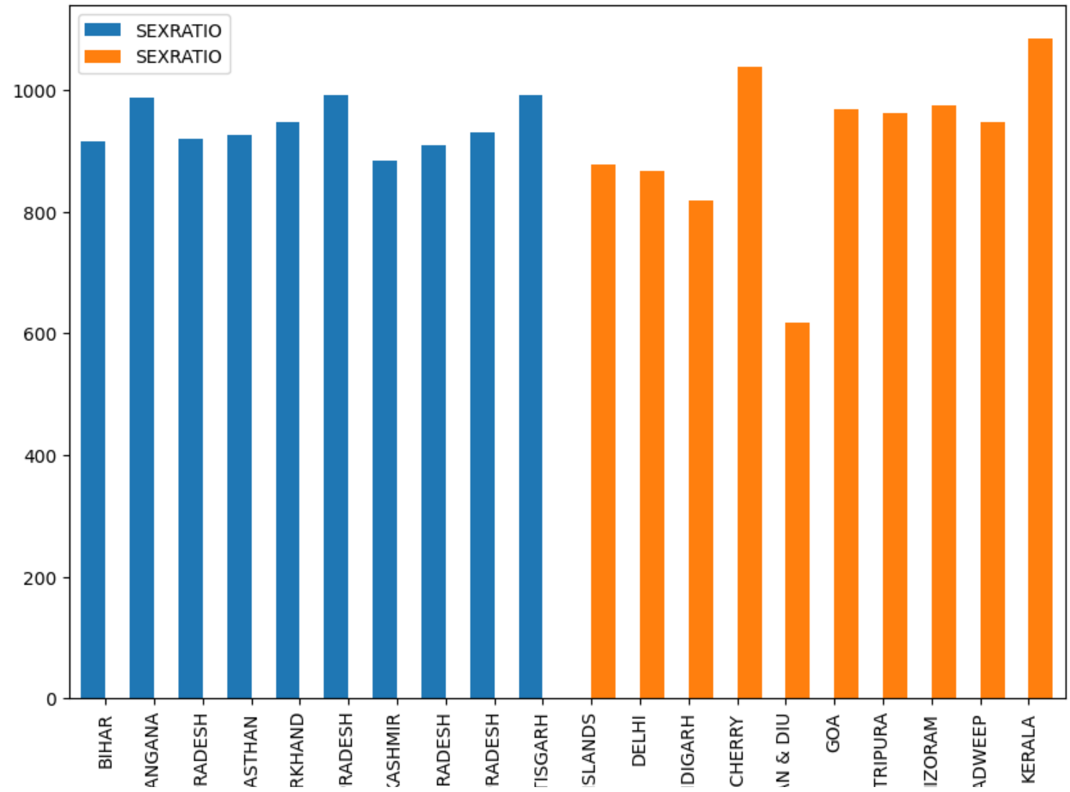
```
top_bottom.SEXRATIO

     STATNAME
     KERALA               1084
     LAKSHADWEEP           946
     MIZORAM               975
     BIHAR                 916
     ARUNACHAL PRADESH     920
     RAJASTHAN             926
     Name: SEXRATIO, dtype: int64
```

```
top_bottom.plot(y ='SEXRATIO', kind = 'bar')
```

```
<Axes: xlabel='STATNAME'>
```

```
data.sort_values(by = 'OVERALL_LI', inplace=True)
pd.concat([data.head(10),data.tail(10)], axis = 1, sort = False).plot(kind= 'bar', y = 'SEXRATIO', figsize = (10,7),width = 1)
```

```
<Axes: xlabel='STATNAME'>
```



```
data.loc[:,['SEXRATIO','OVERALL_LI']].corr()
```

	SEXRATIO	OVERALL_LI
SEXRATIO	1.000000	-0.037555
OVERALL_LI	-0.037555	1.000000

```
print(display_desc('P_SC_POP'))
print(display_desc('P_ST_POP'))
```

```
Basic data from Census 2011: Percentage SC Population
Basic data from Census 2011: Percentage ST Population
```

```
top_bottom['SC_ST_POP'] = top_bottom.P_SC_POP + top_bottom.P_ST_POP
```

```
top_bottom.plot(y = ['SC_ST_POP','P_SC_POP','P_ST_POP'], kind = 'bar', figsize = (15,7))
```

```
<Axes: xlabel='STATNAME'>
```

```
meta_sch = meta_data[meta_data['Field name'].str.contains(r'^SCH\w*TOT')]
print(meta_sch)
```

```
     Field name                                        Description
28       SCHTOT                          Schools By Category: Total
37      SCHTOTG              Schools by Category: Government: Total
46      SCHTOTP                Schools by Category: Private : Total
55      SCHTOTM  Schools by Category: Madarsas & Unrecognised: ...
64     SCHTOTGR      Government Schools by Category - Rural: Total
73     SCHTOTGA    Schools by Category: Government & Aided : Total
82     SCHTOTPR         Private Schools by Category - Rural: Total
91    SCHBOYTOT               Schools by Category: Boys Only: Total
100   SCHGIRTOT              Schools by Category: Girls Only: Total
```

```
display_desc('SCHTOT')
```

```
'Schools By Category: Total'
```

```
display_desc('TOT_6_10_15')
```

```
'Projected Population : Age Group 6 to 10'
```

```
display_desc('TOT_11_13_15')
```

```
'Projected Population : Age Group 11 to 13'
```

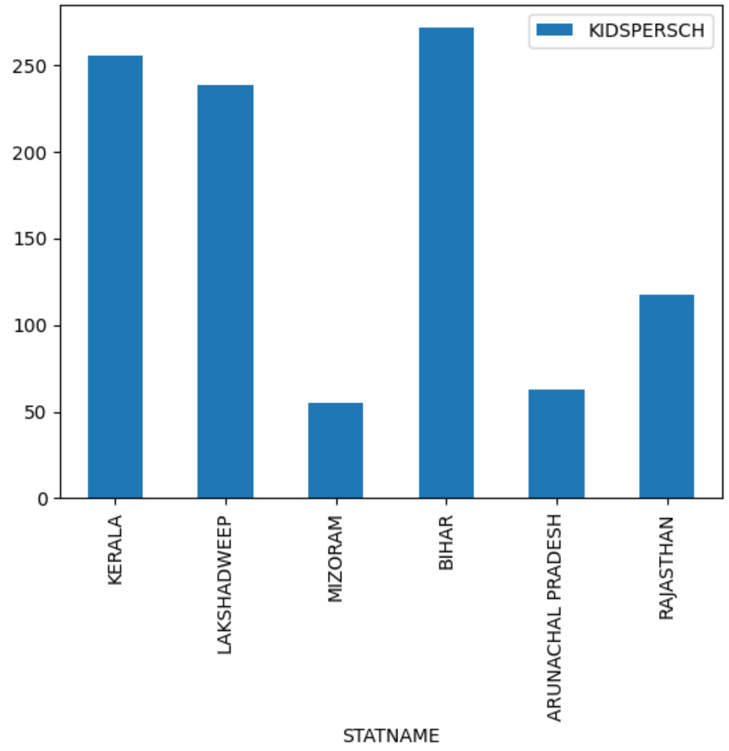
```
top_bottom.SCHTOT
```

```
STATNAME
KERALA                16458
LAKSHADWEEP              41
MIZORAM                3072
BIHAR                 80166
ARUNACHAL PRADESH      4012
RAJASTHAN            107931
Name: SCHTOT, dtype: int64
```

```
top_bottom['SCHKIDS'] = top_bottom.TOT_6_10_15 + top_bottom.TOT_11_13_15
top_bottom['KIDSPERSCH'] = top_bottom.SCHKIDS/top_bottom.SCHTOT
```

```
top_bottom.plot(y = 'KIDSPERSCH', kind = 'bar',)
```

```
<Axes: xlabel='STATNAME'>
```

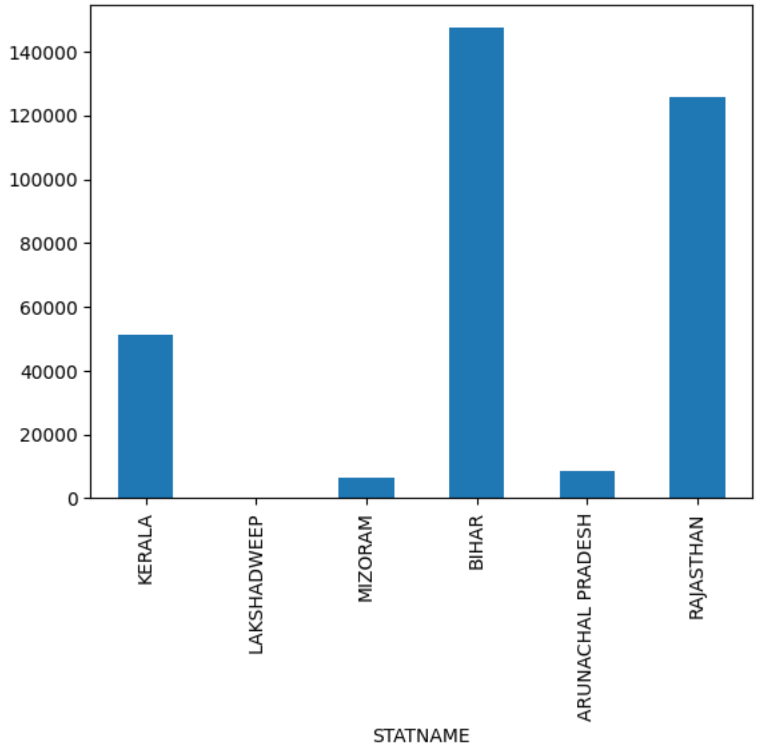


```
display_desc('TOTCLS1G')
```

```
    'Total Classrooms: Primary Only - Primary Only'
```

```
top_bottom['TOTCLS1G'].plot(kind= 'bar')
```

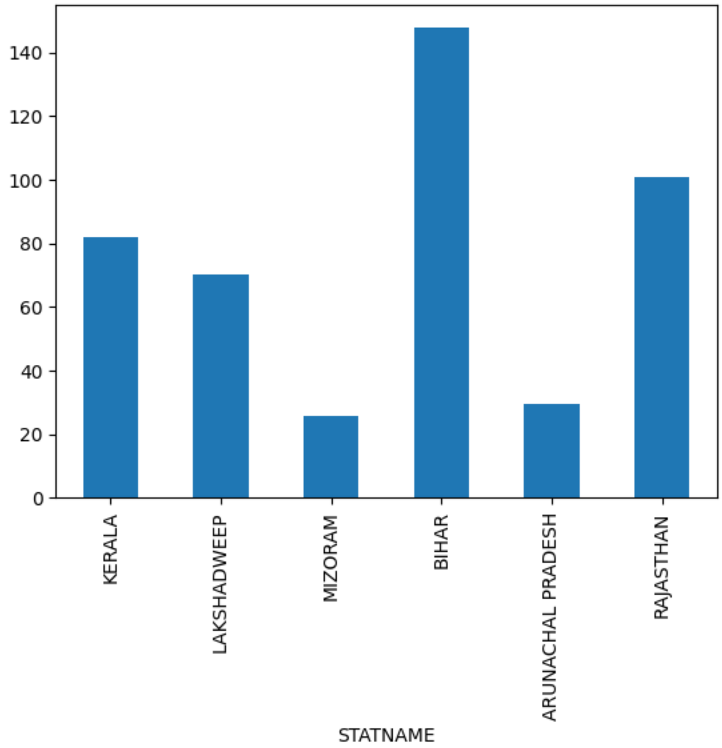
```
    <Axes: xlabel='STATNAME'>
```



```
# primary kids per class
top_bottom['KIDSPERCL'] = top_bottom['SCHKIDS']/top_bottom['TOTCLS1G']
```

```
top_bottom['KIDSPERCL'].plot(kind= 'bar')
```

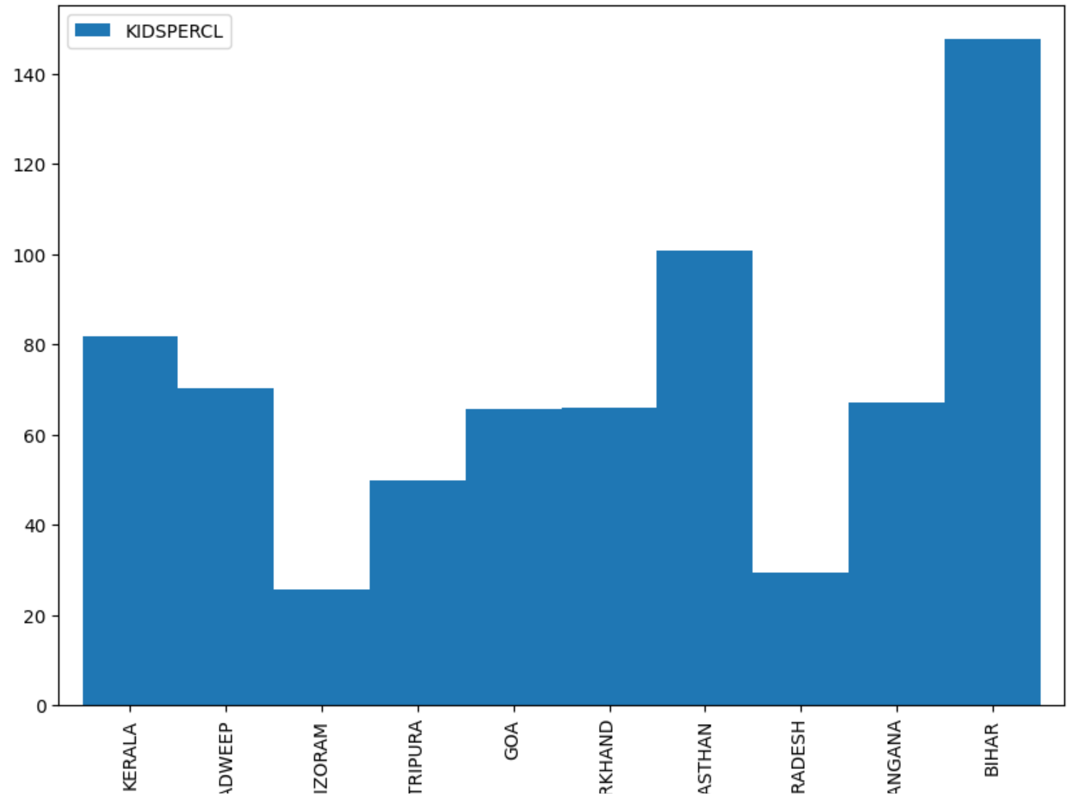
```
    <Axes: xlabel='STATNAME'>
```



```
elem = data.copy(deep = True)
elem['SCHKIDS'] = elem.TOT_6_10_15 + elem.TOT_11_13_15
elem['KIDSPERCL'] = elem['SCHKIDS']/elem['TOTCLS1G']
elem.sort_values(by = 'OVERALL_LI',ascending = False,inplace = True)
```

```
pd.concat([elem.head(5),elem.tail(5)], axis = 0, sort = False).plot(kind= 'bar', y = 'KIDSPERCL', figsize = (10,7),width = 1)
```

```
<Axes: xlabel='STATNAME'>
```

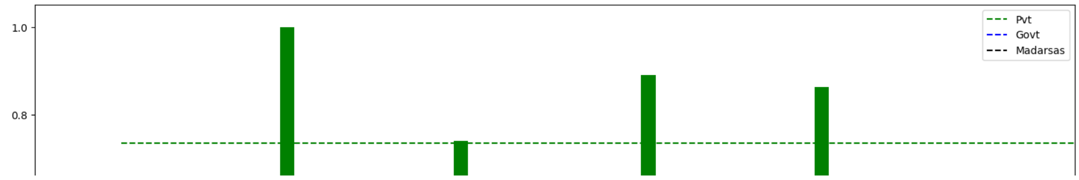


```
elem[['KIDSPERCL','OVERALL_LI']].corr()
```

	KIDSPERCL	OVERALL_LI
KIDSPERCL	1.00000	0.16714
OVERALL_LI	0.16714	1.00000

```
# Plot of the % of data private, govt schools and Madarsas and comparing them with the national avg.
schtotg_avg = (data.SCHTOTG/data.SCHTOT).mean()
schtotp_avg = (data.SCHTOTP/data.SCHTOT).mean()
schtotm_avg = (data.SCHTOTM/data.SCHTOT).mean()

top_3_elem['SCHTOTG_P'] = (top_3_elem.SCHTOTG/top_3_elem.SCHTOT)
top_3_elem['SCHTOTP_P'] = (top_3_elem.SCHTOTP/top_3_elem.SCHTOT)
top_3_elem['SCHTOTM_P'] = (top_3_elem.SCHTOTM/top_3_elem.SCHTOT)

bottom_3_elem['SCHTOTG_P'] = (bottom_3_elem.SCHTOTG/bottom_3_elem.SCHTOT)
bottom_3_elem['SCHTOTP_P'] = (bottom_3_elem.SCHTOTP/bottom_3_elem.SCHTOT)
bottom_3_elem['SCHTOTM_P'] = (bottom_3_elem.SCHTOTM/bottom_3_elem.SCHTOT)

pd.concat([top_3_elem, bottom_3_elem], axis = 1, sort = False).plot(y = ['SCHTOTP_P','SCHTOTG_P','SCHTOTM_P'],\
                                                                     figsize = (18,8), kind = 'bar',\
                                                                     color =['blue','blue','g','g','black','black'], \
                                                                        )

plt.plot([schtotg_avg]*8, linestyle ='--',color = 'g') # National avg for % of govt schools

plt.plot([schtotp_avg]*8, linestyle ='--',color = 'blue') # National avg for % of private schools

plt.plot([schtotm_avg]*8, linestyle ='--',color= 'black') # National avg for % of Madarsas

plt.legend(['Pvt','Govt','Madarsas'],loc = 1)
```

```
<matplotlib.legend.Legend at 0x7dca85f40d30>
```



```
display_desc('CONTIE')
```

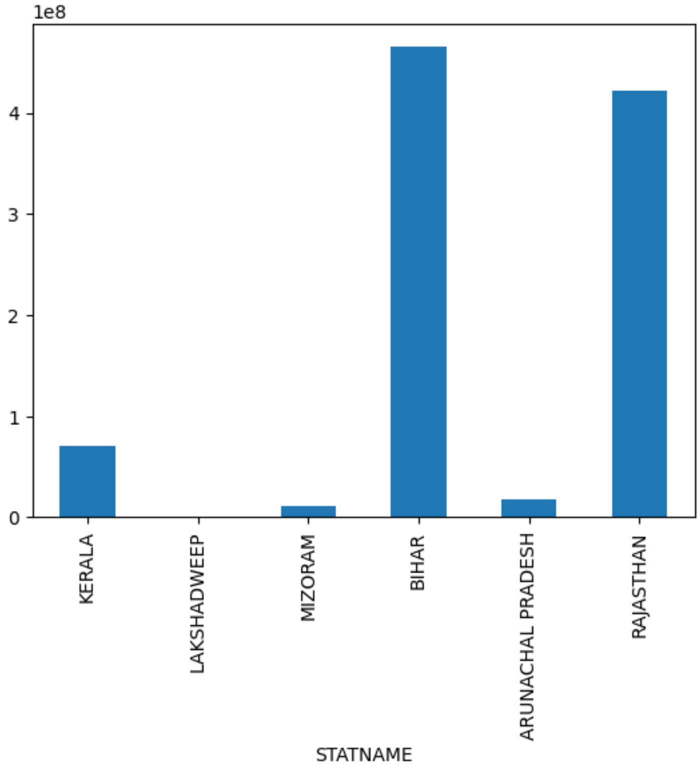
```
'Grants: School Development - Expended'
```

```
elem[['CONTIE','OVERALL_LI']].corr()
```

	CONTIE	OVERALL_LI
CONTIE	1.000000	-0.481281
OVERALL_LI	-0.481281	1.000000

```
top_bottom.CONTIE.plot(kind = 'bar')
```

```
<Axes: xlabel='STATNAME'>
```



```
display_desc('C9_B')
```

```
'Enrolment By Grade: Boys - Grade 9'
```

```
display_desc('C9_G')
```

```
'Enrolment By Grade: Girls - Grade 9'
```

```
display_desc('C8_B')
```

```
'Enrolment By Grade: Boys - Grade 8'
```

```
display_desc('C8_G')
```

```
'Enrolment By Grade: Girls - Grade 8'
```

```
data['C9_TOTAL'] = data.loc[:,'C9_B'] + data.loc[:,'C9_G']
```

```
data['C8_TOTAL'] = data.loc[:,'C8_B'] + data.loc[:,'C8_G']
```

```
data['DROP_8_9'] = (data.C8_TOTAL - data.C9_TOTAL)/data.C8_TOTAL
```

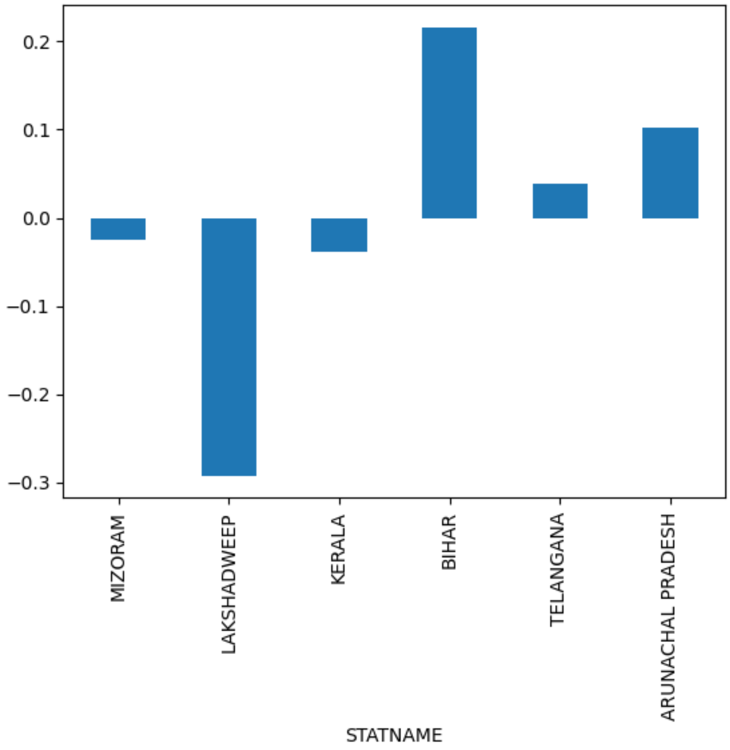
```
top_bottom_drop = pd.concat([data.sort_values('OVERALL_LI').tail(3).DROP_8_9,
                             data.sort_values('OVERALL_LI').head(3).DROP_8_9], axis = 0)
```

```
top_bottom_drop
```

```
STATNAME
MIZORAM             -0.025558
LAKSHADWEEP         -0.292279
KERALA              -0.038128
BIHAR                0.216246
TELANGANA            0.038714
ARUNACHAL PRADESH    0.102825
Name: DROP_8_9, dtype: float64
```

```
top_bottom_drop.plot(kind='bar', y = 'DROP_8_9', x = 'STATNAME')
```

```
<Axes: xlabel='STATNAME'>
```



```
data[['DROP_8_9','OVERALL_LI']].corr()
```

	DROP_8_9	OVERALL_LI
DROP_8_9	1.000000	-0.703246
OVERALL_LI	-0.703246	1.000000

```
data.set_index('STATNAME', inplace = True)
```

```
class_b_columns = data.columns[data.columns.str.contains('C\d_[B]$',case = False, r
class_g_columns = data.columns[data.columns.str.contains('C\d_[G]$',case = False, r
```

```
sums_classes_df = pd.DataFrame(np.matrix(data[class_b_columns]) + np.matrix(data[cl
```

```
sums_classes_cols=[i[:2] for i in class_b_columns]
sums_classes_index = data.index
```

```
sums_classes_df.columns = sums_classes_cols
```

```
totals = sums_classes_df.sum(axis = 0)
```

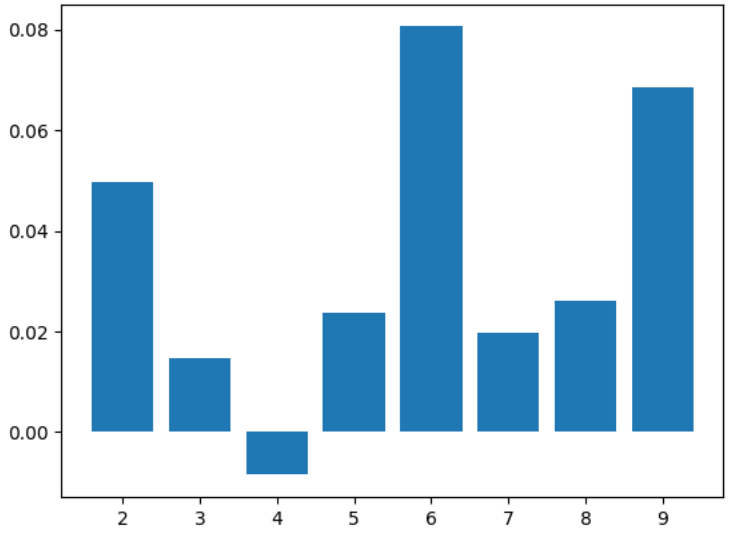
```
dropout = []
for i,_ in enumerate(totals):
    try:
        dropout.append((totals[i] - totals[i+1])/totals[i])
    except:
        pass
```

```
dropout
```

```
[0.049807894807547,
 0.014726304017832778,
 -0.008486844753752712,
 0.023597734638681263,
 0.08056395873036064,
 0.019658139068640237,
 0.026063321302817914,
 0.06841362994279623]
```

```
plt.bar(x = range(2,10,1),height = dropout)
```

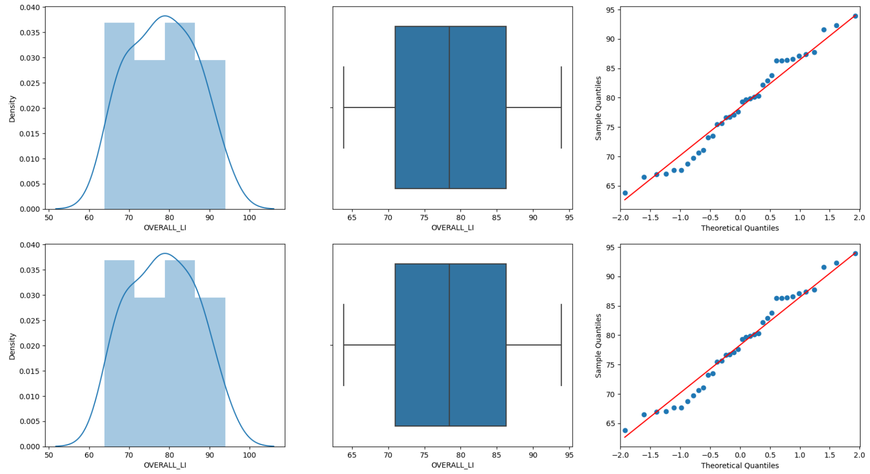
```
<BarContainer object of 8 artists>
```



```
import statsmodels.api as sm
import pylab
```

```
fig,a=plt.subplots(1,3,figsize=(20,5))
sns.distplot(data['OVERALL_LI'],hist=True,kde=True,ax=a[0])
sns.boxplot(x=data['OVERALL_LI'],ax=a[1])
sm.qqplot(data['OVERALL_LI'],line='s',ax=a[2])
```

```
<ipython-input-88-48a118d51c0b>:2: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(data['OVERALL_LI'],hist=True,kde=True,ax=a[0])
```



```
from scipy.stats import shapiro
stats,p=shapiro(data['OVERALL_LI'])
print("Stats = %.3f, p=%.3f"%(stats,p))
```

```
Stats = 0.963, p=0.270
```

```
from scipy import stats
t_value,p_value=stats.ttest_ind(data['OVERALL_LI'],data['GROWTHRATE'])
print('Test statistic is %f'%float("{:.6f}".format(t_value)))
print('p_value is %f'%p_value)
alpha=0.05
if p_value<=alpha:
  print('Conclusion','n','Since p-value(=%f)'%p_value,'<','alpha(=%.2f)'%alpha,'We reject the null hypothesis H0. ')
else:
  print('We do not reject the null hypothesis H0. ')
```

```
Test statistic is 24.778123
p_value is 0.000000
Conclusion n Since p-value(=0.000000) < alpha(=0.05) We reject the null hypothesis H0.
```

```
corr,_=stats.pearsonr(data['OVERALL_LI'],data['GROWTHRATE'])
print("Pearsons corr %.3f"%corr)
```

```
Pearsons corr 0.041
```