Coursera Capstone Project

IBM Applied Data Science Capstone

In [37]:
```
pip -q install folium
```

```
Note: you may need to restart the kernel to use updated packages.
```

In [38]:
```
pip -q install wget
```

```
Note: you may need to restart the kernel to use updated packages.
```

In [39]:
```
import pandas as pd
import numpy as np
import seaborn as sns
print('Hello Capstone Project Course!')
import folium
import wget
import requests # library to handle requests
from pandas.io.json import json_normalize # tranform JSON file into a pandas d
ataframe
import matplotlib.pyplot as plt
```

```
Hello Capstone Project Course!
```

Download the states geojson file for the coropleth map

In [40]:
```
wget.download('https://github.com/python-visualization/folium/raw/master/examp
les/data/us-states.json')
```

```
100%
[..................................................................
 87688 / 87688
```

Out[40]:
```
'us-states (1).json'
```

In [41]:
```
CLIENT_ID =  'xxx' # your Foursquare ID
CLIENT_SECRET =  'xxx' # your Foursquare Secret
VERSION = 'xxx' # Foursquare API version
```

In [43]:
```
#Download obesity data from CDC

df_obesity=pd.read_csv("https://chronicdata.cdc.gov/api/views/fqb7-mgjf/rows.csv?accessType=DOWNLOAD")
df_obesity.head(1)
```

Out[43]:

	Year	Locationabbr	Locationdesc	Class	Topic	Question	Response	Break_Ou
0	2018	AK	Alaska	Overweight and Obesity (BMI)	BMI Categories	Weight classification by Body Mass Index (BMI)...	Underweight (BMI 12.0-18.4)	College graduate

1 rows × 27 columns

In [44]:
```
df_obesity.columns
```

Out[44]:
```
Index(['Year', 'Locationabbr', 'Locationdesc', 'Class', 'Topic', 'Question',
       'Response', 'Break_Out', 'Break_Out_Category', 'Sample_Size',
       'Data_value', 'Confidence_limit_Low', 'Confidence_limit_High',
       'Display_order', 'Data_value_unit', 'Data_value_type',
       'Data_Value_Footnote_Symbol', 'Data_Value_Footnote', 'DataSource',
       'ClassId', 'TopicId', 'LocationID', 'BreakoutID', 'BreakOutCategoryID',
       'QuestionID', 'ResponseID', 'GeoLocation'],
      dtype='object')
```

In [45]:
```
#select only the 2018 data showiing the overall numbers for Obese patients

df_obesity=df_obesity.loc[(df_obesity['Year']==2018) & (df_obesity['Break_Out']=='Overall') & (df_obesity['Response']=='Obese (BMI 30.0 - 99.8)')]
df_obesity.rename(columns={'Locationabbr':'LocationAbbr', 'Data_value':'Data_Value', 'Locationdesc':'LocationDesc'}, inplace=True)
df_obesity=df_obesity.drop(['Confidence_limit_Low', 'Confidence_limit_High', 'Display_order', 'Data_value_unit', 'Data_value_type','Data_Value_Footnote_Symbol', 'Data_Value_Footnote', 'GeoLocation'], axis=1)
df_obesity=df_obesity.sort_values('Data_Value', ascending=False)
df_obesity.head(1)
```

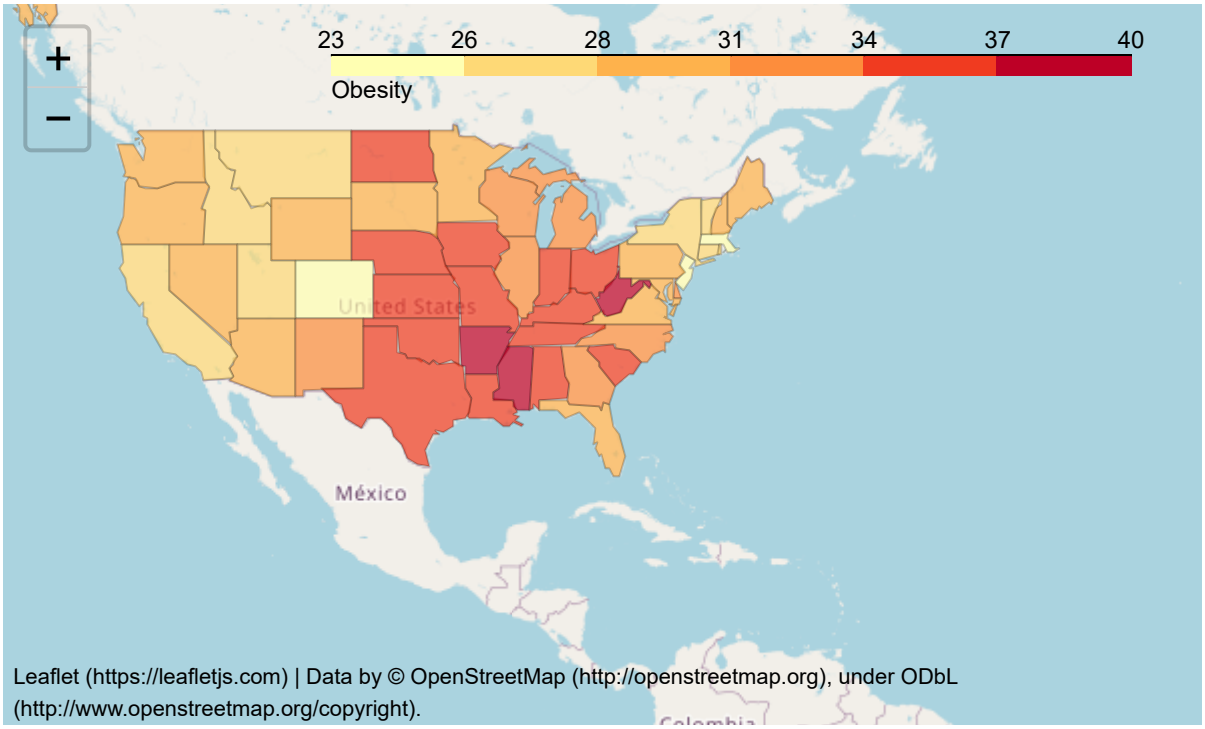
Out[45]:

	Year	LocationAbbr	LocationDesc	Class	Topic	Question	Response	Break_C
5327	2018	WV	West Virginia	Overweight and Obesity (BMI)	BMI Categories	Weight classification by Body Mass Index (BMI)...	Obese (BMI 30.0 - 99.8)	Ove

In [46]:
```
us_geo = r'us-states.json' # geojson file

# create a map
us_map=folium.Map(location=[38.34774030000045, -98.20078122699965], zoom_start=4)
```

In [47]:
```
#Let's generate a state map with the obesity prevalence

us_map.choropleth(
    geo_data=us_geo,
    data=df_obesity,
    columns=['LocationAbbr', 'Data_Value'],
    nan_fill_color='purple',
    key_on='feature.id',
    fill_color='YlOrRd',
    fill_opacity=0.7,
    line_opacity=0.2,
    legend_name='Obesity',

)

# display map
us_map
```

Out[47]:



In [48]:
```
#Download risk factors data from CDC
df_risk_factors=pd.read_csv("https://chronicdata.cdc.gov/api/views/k8w5-7ju6/rows.csv?accessType=DOWNLOAD")
df_risk_factors.head(1)
```

Out[48]:

	YearStart	YearEnd	LocationAbbr	LocationDesc	Datasource	Class	Topic	Q
0	2014	2014	TX	Texas	Breastfeeding Surveillance Sources	Breastfeeding	Breastfeeding - Environmental or Policy Supports	p

1 rows × 25 columns

We will get only the data for 2018 that relates to the proximity to oooprtunities for physical activity

In [49]:
```
df_phys_act_opp=df_risk_factors.loc[(df_risk_factors['Question']=="Percent of U.S. population living within 1/2 mile of a park")]
df_phys_act_opp.head(1)
```

Out[49]:

	YearStart	YearEnd	LocationAbbr	LocationDesc	Datasource	Class	Topic	Que
668	2015	2015	AZ	Arizona	National Environmental Public Health Tracking ...	Physical Activity	Physical Activity - Environmental or Policy Su...	Perc popu with

1 rows × 25 columns

Removing unnecessary columns, removing the row that has the National data and the row(s) that have NaN for the value we need to analyze

In [50]:
```
df_phys_act_opp=df_phys_act_opp.drop(['YearEnd',  'Datasource',
       'Class', 'Topic', 'Question', 'Data_Value_Unit', 'Data_Value_Type',
        'Data_Value_Alt','Data_Value_Footnote_Symbol',
       'Data_Value_Footnote',
        'DataValueTypeID',  'StratificationCategory1',
       'Stratification1', 'StratificationCategoryId1', 'StratificationID1'], a
xis=1)
df_phys_act_opp=df_phys_act_opp[df_phys_act_opp["LocationDesc"]!='National']
df_phys_act_opp.dropna(subset=["Data_Value"], axis=0, inplace=True)
df_phys_act_opp.sort_values('Data_Value', ascending=False, inplace=True)
df_phys_act_opp.head(1)
```

Out[50]:

	YearStart	LocationAbbr	LocationDesc	Data_Value	Total	GeoLocation	ClassID	TopicID
994	2015	DC	District of Columbia	95.7	Total	(38.890371385, -77.031961127)	PA	PA2

Sorting the values

In [51]:
```
# converting the access to proximity to a park to its inverse value
df_lack_of_phys_act_opp=df_phys_act_opp.copy()
df_lack_of_phys_act_opp["Data_Value"]=100-df_lack_of_phys_act_opp["Data_Value"
].astype('float')
df_lack_of_phys_act_opp=df_lack_of_phys_act_opp.sort_values('Data_Value', asce
nding=False)
df_lack_of_phys_act_opp.head()
```

Out[51]:

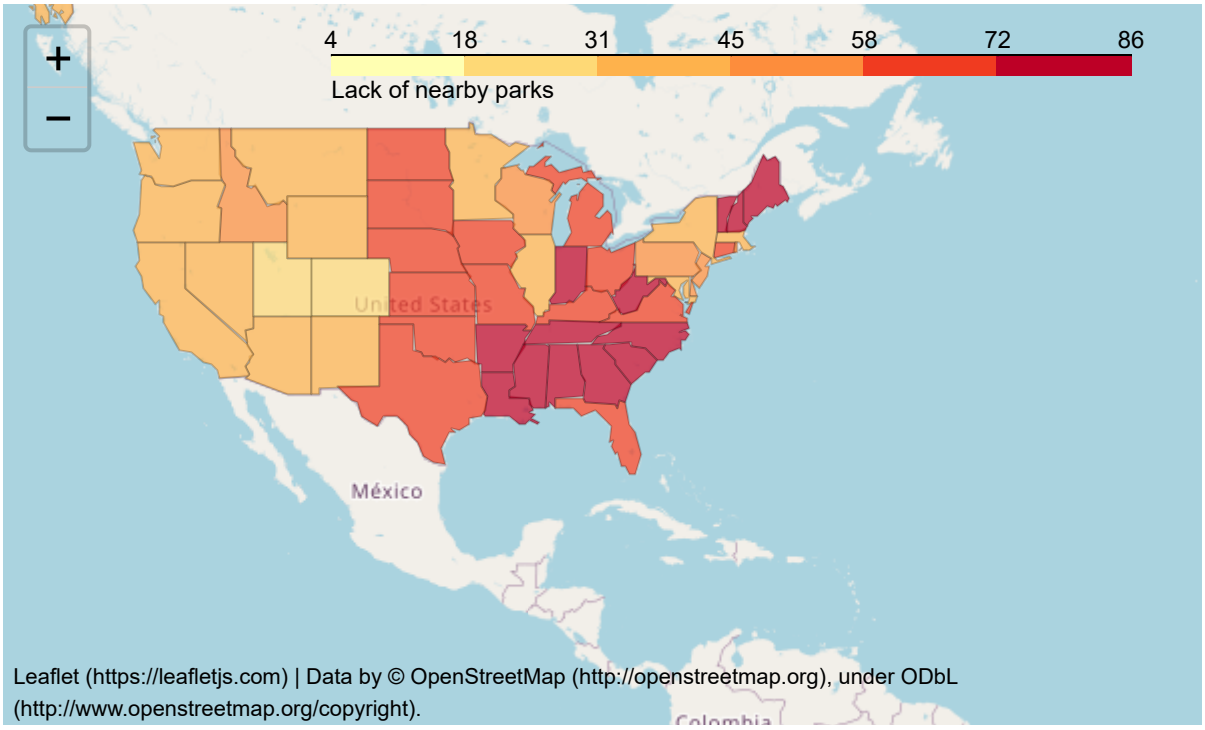
	YearStart	LocationAbbr	LocationDesc	Data_Value	Total	GeoLocation	ClassID	Top
736	2015	WV	West Virginia	85.6	Total	(38.665510202, -80.712640135)	PA	
811	2015	SC	South Carolina	83.1	Total	(33.998821303, -81.045371207)	PA	
978	2015	NH	New Hampshire	82.8	Total	(43.655950113, -71.50036092)	PA	
1296	2015	ME	Maine	82.6	Total	(45.254228894001, -68.985031336)	PA	
948	2015	AR	Arkansas	77.9	Total	(34.748650124, -92.274490743)	PA	

Create a choropleth map

In [52]:
```
# create a map
us_map_phys=folium.Map(location=[38.34774030000045, -98.20078122699965], zoom_
start=4)
```

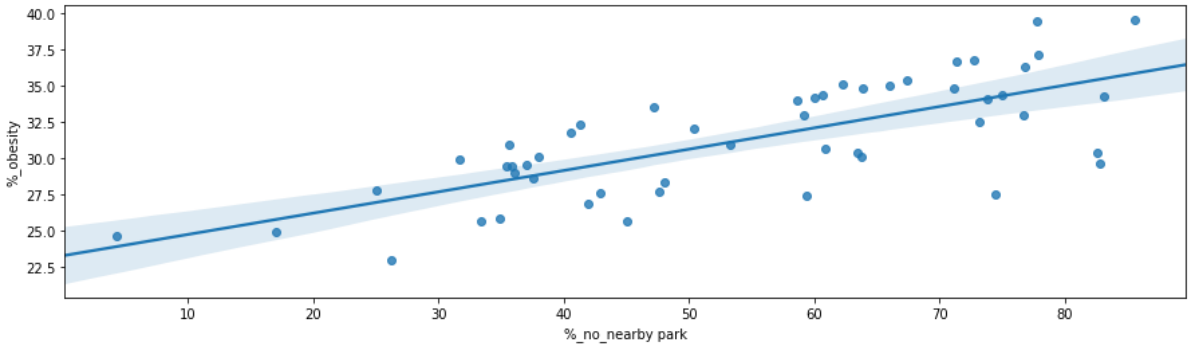
In [53]:
```
#Let's generate a map with the prevalence of people who say they don't have ac
cess to a park within 1/2 mile radius

us_map_phys.choropleth(
    geo_data=us_geo,
    data=df_lack_of_phys_act_opp,
    columns=['LocationAbbr', 'Data_Value'],
    nan_fill_color='purple',
    key_on='feature.id',
    fill_color='YlOrRd',
    fill_opacity=0.7,
    line_opacity=0.2,
    legend_name='Lack of nearby parks',

)

# display map
us_map_phys
```

Out[53]:



In [54]:
```
#create a dataframe to plot to llo at obesity versus access to parks
plt.figure(figsize=(15,4))
df_for_plot=df_obesity.merge(df_lack_of_phys_act_opp, on="LocationAbbr", suffi
xes=('_obesity', '_no_nearby park'))
df_for_plot.rename(columns={'Data_Value_obesity':'%_obesity', 'Data_Value_no_n
earby park':'%_no_nearby park'}, inplace=True)
sns.regplot(data=df_for_plot, x='%_no_nearby park', y='%_obesity')
```

Out[54]: <matplotlib.axes._subplots.AxesSubplot at 0x16abc31e9c8>



Create a list of the top and bottom states in terms of proximity to activity

In [55]:
```
df_phys_act_opp_tb=df_phys_act_opp.iloc[[0,1,2,-1,-2,-3]]
df_phys_act_opp_tb
```

Out[55]:

	YearStart	LocationAbbr	LocationDesc	Data_Value	Total	GeoLocation	ClassID	TopicI
994	2015	DC	District of Columbia	95.7	Total	(38.890371385, -77.031961127)	PA	PA
1001	2015	HI	Hawaii	82.9	Total	(21.304850435, -157.857749403)	PA	PA
828	2015	UT	Utah	74.9	Total	(39.360700171, -111.587130635)	PA	PA
736	2015	WV	West Virginia	14.4	Total	(38.665510202, -80.712640135)	PA	PA
811	2015	SC	South Carolina	16.9	Total	(33.998821303, -81.045371207)	PA	PA
978	2015	NH	New Hampshire	17.2	Total	(43.655950113, -71.50036092)	PA	PA

In [56]:
```
df_obesity_tb=df_obesity.iloc[[0,1,2,-1,-2,-3]]
df_obesity_tb
```

Out[56]:

	Year	LocationAbbr	LocationDesc	Class	Topic	Question	Response	Break_C
5327	2018	WV	West Virginia	Overweight and Obesity (BMI)	BMI Categories	Weight classification by Body Mass Index (BMI)...	Obese (BMI 30.0 - 99.8)	Ove
2715	2018	MS	Mississippi	Overweight and Obesity (BMI)	BMI Categories	Weight classification by Body Mass Index (BMI)...	Obese (BMI 30.0 - 99.8)	Ove
252	2018	AR	Arkansas	Overweight and Obesity (BMI)	BMI Categories	Weight classification by Body Mass Index (BMI)...	Obese (BMI 30.0 - 99.8)	Ove
544	2018	CO	Colorado	Overweight and Obesity (BMI)	BMI Categories	Weight classification by Body Mass Index (BMI)...	Obese (BMI 30.0 - 99.8)	Ove
822	2018	DC	District of Columbia	Overweight and Obesity (BMI)	BMI Categories	Weight classification by Body Mass Index (BMI)...	Obese (BMI 30.0 - 99.8)	Ove
1282	2018	HI	Hawaii	Overweight and Obesity (BMI)	BMI Categories	Weight classification by Body Mass Index (BMI)...	Obese (BMI 30.0 - 99.8)	Ove

Some of the 3 states that appear at the ends of the list of obesity by states are very different, in terms of size and population. I need a list of states similar in population, so I will be using data from https://worldpopulationreview.com/states/ (https://worldpopulationreview.com/states/) which I downloaded as us_state_pop.csv

In [57]:
```
df_pop=pd.read_csv("us_state_pop.csv")
df_pop.head()
```

Out[57]:

	rank	State	Pop	Growth	Pop2018	Pop2010	growthSince2010	Percent	dens
0	1	California	39937489	0.0096	39557045	37320903	0.0701	0.1194	256.37
1	2	Texas	29472295	0.0268	28701845	25242679	0.1676	0.0881	112.82
2	3	Florida	21992985	0.0326	21299325	18845785	0.1670	0.0658	410.12
3	4	New York	19440469	-0.0052	19542209	19400080	0.0021	0.0581	412.52
4	5	Pennsylvania	12820878	0.0011	12807060	12711158	0.0086	0.0383	286.54

Let's see what the population stats look like:

In [58]:
```
df_pop['Pop'].describe()
```

Out[58]:
```
count    5.200000e+01
mean     6.429830e+06
std      7.392876e+06
min      5.670250e+05
25%      1.814134e+06
50%      4.400390e+06
75%      7.483144e+06
max      3.993749e+07
Name: Pop, dtype: float64
```

The 25th percentile is about 1.8 Million and the 75th percentile is about 7.5 Million. We will try to get the obesity for the states that fall in this group

In [59]:
```
df_pop25_75=df_pop[df_pop['Pop']>df_pop['Pop'].describe().iloc[4]]
df_pop25_75=df_pop25_75[df_pop['Pop']<df_pop['Pop'].describe().iloc[6]]
```

```
C:\ProgramData\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: UserWarni
ng: Boolean Series key will be reindexed to match DataFrame index.
```

In [60]:
```
df_pop25_75['State'].head()
```

Out[60]:
```
13          Arizona
14    Massachusetts
15        Tennessee
16          Indiana
17         Missouri
Name: State, dtype: object
```

Let's get the top and bottom states for obesity rates from the list of states that have a population between 25-75 percentile

In [61]:
```
df_phys_act_opp_tb=df_phys_act_opp[df_phys_act_opp['LocationDesc'].isin(df_pop
25_75['State'])].iloc[[0,1,2,3,4, -1, -2, -3, -4, -5]]
df_phys_act_opp_tb.to_csv('df_phys_act_opp_tb.csv')
```

In [62]:
```
df_obesity_tb=df_obesity[df_obesity['LocationDesc'].isin(df_pop25_75['State'
])].iloc[[0,1,2,3,4, -1, -2, -3, -4, -5]]
df_obesity_tb.to_csv('df_obesity_tb.csv')
```

In [63]:
```
#This function will get all venues (subject to foursquare limits) in a list of
locatsions, such as zip codes and states

def getVenuesByState(locations):
    venues_list=[]
    for location in locations:



        # create the API request URL
        url = 'https://api.foursquare.com/v2/venues/explore?&client_id={}&clie
nt_secret={}&v={}&near={}'.format(
            CLIENT_ID,
            CLIENT_SECRET,
            VERSION,
            location)


        # make the GET request

        raw_results = requests.get(url).json()
        #print(raw_results)
        print(".", end="")
        if raw_results['meta']['code']==200:
            results=raw_results["response"]['groups'][0]['items']


            # return only relevant information for each nearby venue
            venues_list.append([(
                location,
                v['venue']['name'],
                v['venue']['location']['lat'],
                v['venue']['location']['lng'],
                v['venue']['categories'][0]['name']) for v in results])

    nearby_venues = pd.DataFrame([item for venue_list in venues_list for item
in venue_list])

    nearby_venues.columns = ['Location',
                  'Name',
                  'Longitude',
                  'Latitude',
                  'Venue Category']

    return(nearby_venues)
```

In [64]:
```
#We will be running the data for the states we select here, then we will be co
pying and isnerting the graphs into the report
State='Utah'
ST='UT'
```

In [65]:
```
#Data was downloaded separately from Robert Wood Johnson FOundation Program, f
or example  https://www.countyhealthrankings.org/app/utah/2020/downloads

df_county_data=pd.read_excel(f'2020 County Health Rankings {State} Data - v1_
0.xlsx', sheet_name='Ranked Measure Data', header=1)[['State', 'County', '% Ad
ults with Obesity']]
df_county_population=pd.read_excel(f'2020 County Health Rankings {State} Data
 - v1_0.xlsx', sheet_name='Additional Measure Data', header=1)[['State', 'Coun
ty', 'Population']]
df_county_data.dropna(subset=["County"], axis=0, inplace=True)
df_county_population.dropna(subset=["County"], axis=0, inplace=True)
#merge the data obtained from the worksdheets
df_county_data=df_county_data.join(df_county_population, lsuffix="", rsuffix=
"_pop")
#Drop the similar columns
df_county_data=df_county_data.drop(['State_pop', 'County_pop'], axis=1)

df_county_data['Population'].describe()
```

Out[65]:
```
count    2.900000e+01
mean     1.090036e+05
std      2.408495e+05
min      9.800000e+02
25%      9.764000e+03
50%      2.026900e+04
75%      5.495000e+04
max      1.152633e+06
Name: Population, dtype: float64
```

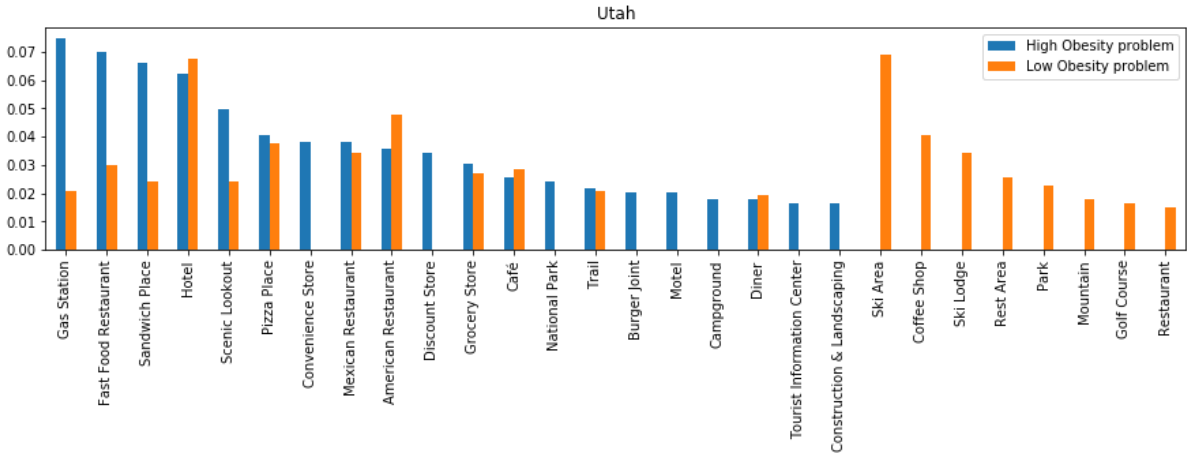
In [66]:
```
# selecting only the counties that are in the middle quartiles and sorting in
df_county_pop25_75=df_county_data[df_county_data['Population']>df_county_data[
'Population'].describe().iloc[4]]
df_county_pop25_75=df_county_pop25_75[df_county_pop25_75['Population']<df_coun
ty_data['Population'].describe().iloc[6]]
```

In [67]:
```
#let's get the top and bottom counties in terms of access and add a column to
 qualify the county as top or bottom in the list
df_state_tb=df_county_pop25_75.sort_values(['% Adults with Obesity']).iloc[[0,
1,2,3,4, -1, -2, -3, -4, -5]]
df_state_tb['% Obesity']=['b','b','b','b','b','t', 't', 't','t', 't']

df_states_zips=pd.read_csv('zip_county_fips_2018_03.csv')
#limit the seqarch to state and search for the zipcodes of the top and bottom
 counties in terms of access to exercise

df_state_tb['state']=ST
df_state_tb['County']=df_state_tb['County']+' County'
df_state_tb.rename(columns={'County':'countyname'}, inplace=True)


df_state_zips=df_states_zips[df_states_zips['state']==ST]
#df_state_zips=df_state_zips[df_state_zips['countyname'].isin(df_state_tb['Cou
nty']+' County')]
df_state_zips=df_state_zips.merge(df_state_tb, on=['countyname','state'])

#build a column named "locations" to hold the zip code, State for the venues s
earch
df_state_zips['locations']=df_state_zips['state']+', '+df_state_zips['zip'].as
type(str)

#Let's verify the function for a location in NY City. We will use the state an
d zipcode as location.

#We need the list of zipcodes for each county in the states that we want to in
vestigate. I found the dataset here https://data.world/niccolley/us-zipcode-to
-county-state and saved it to the working directory

#let's now assemble two lists of locations with   state and zip for areas with
high and low access

locations_state_t=df_state_zips[df_state_zips['% Obesity']=='t']['locations']
locations_state_b=df_state_zips[df_state_zips['% Obesity']=='b']['locations']

venuesLists_t=[]
venuesByState=getVenuesByState(list(locations_state_t))
venuesLists_t.append(venuesByState)

venuesLists_b=[]
venuesByState=getVenuesByState(list(locations_state_b))
venuesLists_b.append(venuesByState)



vstatet=pd.DataFrame(venuesLists_t[0]['Venue Category'].value_counts(normalize
=True, sort=True, ascending=False, bins=None, dropna=True).head(20))
vstatet=vstatet.reset_index()


vstateb=venuesLists_b[0]['Venue Category'].value_counts(normalize=True, sort=T
rue, ascending=False, bins=None, dropna=True).head(20)
vstateb=vstateb.reset_index()
```

```
venues_state_tb=vstatet.merge(vstateb, on='index', how='outer')
venues_state_tb=venues_state_tb.rename(columns={'index':'Category','Venue Cate
gory_x':'High Obesity problem', 'Venue Category_y':'Low Obesity problem'})
```

.....

In [68]:
```
ax=venues_state_tb.plot(kind='bar', figsize=(15,3))
ax.set_xticklabels(venues_state_tb['Category'])
ax.set_title(State)
plt.show()
```



In [ ]:
```
```