In [1]:

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

In [2]:

```
%%javascript
IPython.OutputArea.prototype._should_scroll = function(lines) {
    return false;
}
```

In [3]:

```
from IPython.display import set_matplotlib_formats
set_matplotlib_formats('retina')
```

In [ ]:

In [4]:

```
top_df = pd.read_csv("/Users/adriana/Google Drive/_Learning/_DS4A/Assignments/0_Final_Project/2020_top_thirty.csv")
poli_df = pd.read_csv("/Users/adriana/Google Drive/_Learning/_DS4A/Assignments/0_Final_Project/top_thirty_poli_df.csv")
hc_df = pd.read_csv("/Users/adriana/Google Drive/_Learning/_DS4A/Assignments/0_Final_Project/top_thirty_hc_df.csv")
```

In [5]:

```
top_df.head()
```

Out[5]:

	region	city	state	popsize	pop_est	white_nonhi	black	asian	hisp_lat
0	northeast	New York City	New York	1M+	8336817	0.32	0.243	0.141	0.291
1	west	Los Angeles	California	1M+	3979576	0.29	0.089	0.116	0.485
2	midwest	Chicago	Illinois	1M+	2693976	0.33	0.296	0.066	0.288
3	southwest	Houston	Texas	1M+	2320268	0.24	0.226	0.068	0.450
4	west	Phoenix	Arizona	1M+	1680992	0.43	0.071	0.038	0.426

In [6]:
```
poli_df.head()
```

Out[6]:

	region	city	state	popsize	pop_est	white_nonhi	black	asian	hisp_lat	mayor_party	gov_party	leg_maj
0	southwest	Albuquerque	New Mexico	500k-999,999	560513	0.39	0.033	0.029	0.492	Democrat	Democrat	Democrat
1	southeast	Atlanta	Georgia	500k-999,999	506811	0.38	0.510	0.044	0.043	Democrat	Republican	Democrat
2	southwest	Austin	Texas	500k-999,999	978908	0.48	0.078	0.076	0.339	Democrat	Republican	Republican
3	northeast	Baltimore	Maryland	500k-999,999	593490	0.28	0.624	0.026	0.053	Democrat	Republican	Democrat
4	northeast	Boston	Massachusetts	500k-999,999	692600	0.45	0.252	0.097	0.198	Democrat	Republican	Democrat

In [7]:
```
hc_df.head()
```

Out[7]:

	region	city	state	popsize	pop_est	white_nonhi	black	asian	hisp_lat	hc_demo
0	southwest	Albuquerque	New Mexico	500k-999,999	560513	0.39	0.033	0.029	0.492	25.0
1	southeast	Atlanta	Georgia	500k-999,999	506811	0.38	0.510	0.044	0.043	NaN
2	southwest	Austin	Texas	500k-999,999	978908	0.48	0.078	0.076	0.339	5.0
3	northeast	Baltimore	Maryland	500k-999,999	593490	0.28	0.624	0.026	0.053	NaN
4	northeast	Boston	Massachusetts	500k-999,999	692600	0.45	0.252	0.097	0.198	113.0

Merge & Clean 2019 Hate Crimes and 2018-2021 Political Parties (Congress, Governor, & Mayor)

In [8]:

```python
# merge political and hate crime dfs to top_df

top_df = pd.merge(poli_df, hc_df, on = "city", how = "left")
top_df.head()
```

Out[8]:

	region_x	city	state_x	popsize_x	pop_est_x	white_nonhi_x	black_x	asian_x	hisp_lat_x	mayor_party	...	leg_maj	region
0	southwest	Albuquerque	New Mexico	500k-999,999	560513	0.39	0.033	0.029	0.492	Democrat	...	Democrat	southwe
1	southeast	Atlanta	Georgia	500k-999,999	506811	0.38	0.510	0.044	0.043	Democrat	...	Democrat	southea
2	southwest	Austin	Texas	500k-999,999	978908	0.48	0.078	0.076	0.339	Democrat	...	Republican	southwe
3	northeast	Baltimore	Maryland	500k-999,999	593490	0.28	0.624	0.026	0.053	Democrat	...	Democrat	northea
4	northeast	Boston	Massachusetts	500k-999,999	692600	0.45	0.252	0.097	0.198	Democrat	...	Democrat	northea

5 rows × 21 columns

In [9]:

```python
top_df.columns
```

Out[9]:

```
Index(['region_x', 'city', 'state_x', 'popsize_x', 'pop_est_x',
       'white_nonhi_x', 'black_x', 'asian_x', 'hisp_lat_x', 'mayor_party',
       'gov_party', 'leg_maj', 'region_y', 'state_y', 'popsize_y', 'pop_est_y',
       'white_nonhi_y', 'black_y', 'asian_y', 'hisp_lat_y', 'hc_demo'],
      dtype='object')
```

In [10]:

```python
# clean columns for top_df

top_df = top_df[['region_x', 'city', 'state_x', 'popsize_x', 'pop_est_x', 'white_nonhi_x',
       'black_x', 'asian_x', 'hisp_lat_x', 'mayor_party', 'gov_party','leg_maj','hc_demo']]
top_df.columns = ['region', 'city', 'state', 'popsize', 'pop_est', 'white_nonhi',
       'black', 'asian', 'hisp_lat', 'mayor_party', 'gov_party', 'cong_maj','hc_demo']
top_df.head()
```

Out[10]:

	region	city	state	popsize	pop_est	white_nonhi	black	asian	hisp_lat	mayor_party	gov_party	cong_maj	hc_demo
0	southwest	Albuquerque	New Mexico	500k-999,999	560513	0.39	0.033	0.029	0.492	Democrat	Democrat	Democrat	25.0
1	southeast	Atlanta	Georgia	500k-999,999	506811	0.38	0.510	0.044	0.043	Democrat	Republican	Democrat	NaN
2	southwest	Austin	Texas	500k-999,999	978908	0.48	0.078	0.076	0.339	Democrat	Republican	Republican	5.0
3	northeast	Baltimore	Maryland	500k-999,999	593490	0.28	0.624	0.026	0.053	Democrat	Republican	Democrat	NaN
4	northeast	Boston	Massachusetts	500k-999,999	692600	0.45	0.252	0.097	0.198	Democrat	Republican	Democrat	113.0

In [11]:

```
# sort top_df by population size estimate

top_df = top_df.sort_values(by=['pop_est'], ascending = False)
top_df.head()
```

Out[11]:

	region	city	state	popsize	pop_est	white_nonhi	black	asian	hisp_lat	mayor_party	gov_party	cong_maj	hc_demo
26	northeast	New York City	New York	1M+	8336817	0.32	0.243	0.141	0.291	Democrat	Democrat	Democrat	90.0
20	west	Los Angeles	California	1M+	3979576	0.29	0.089	0.116	0.485	Democrat	Democrat	Democrat	118.0
6	midwest	Chicago	Illinois	1M+	2693976	0.33	0.296	0.066	0.288	Democrat	Democrat	Democrat	18.0
15	southwest	Houston	Texas	1M+	2320268	0.24	0.226	0.068	0.450	Democrat	Republican	Republican	13.0
30	west	Phoenix	Arizona	1M+	1680992	0.43	0.071	0.038	0.426	Democrat	Republican	Democrat	111.0

In [12]:

```
# Create new columns for total population size estimate of black + asian + hisp/lat;
# and columns for each demographic's population size estimate

top_df["minor_pop_est"] = (top_df["black"] + top_df["asian"] + top_df["hisp_lat"]) * top_df["pop_est"]
top_df["white_pop_est"] = top_df["white_nonhi"] * top_df["pop_est"]
top_df["black_pop_est"] = top_df["black"] * top_df["pop_est"]
top_df["asian_pop_est"] = top_df["asian"] * top_df["pop_est"]
top_df["hisp_lat_pop_est"] = top_df["hisp_lat"] * top_df["pop_est"]
top_df.head()
```

Out[12]:

	region	city	state	popsize	pop_est	white_nonhi	black	asian	hisp_lat	mayor_party	gov_party	cong_maj	hc_demo	minor_pop_
26	northeast	New York City	New York	1M+	8336817	0.32	0.243	0.141	0.291	Democrat	Democrat	Democrat	90.0	5627351.
20	west	Los Angeles	California	1M+	3979576	0.29	0.089	0.116	0.485	Democrat	Democrat	Democrat	118.0	2745907.
6	midwest	Chicago	Illinois	1M+	2693976	0.33	0.296	0.066	0.288	Democrat	Democrat	Democrat	18.0	1751084.
15	southwest	Houston	Texas	1M+	2320268	0.24	0.226	0.068	0.450	Democrat	Republican	Republican	13.0	1726279.
30	west	Phoenix	Arizona	1M+	1680992	0.43	0.071	0.038	0.426	Democrat	Republican	Democrat	111.0	899330.

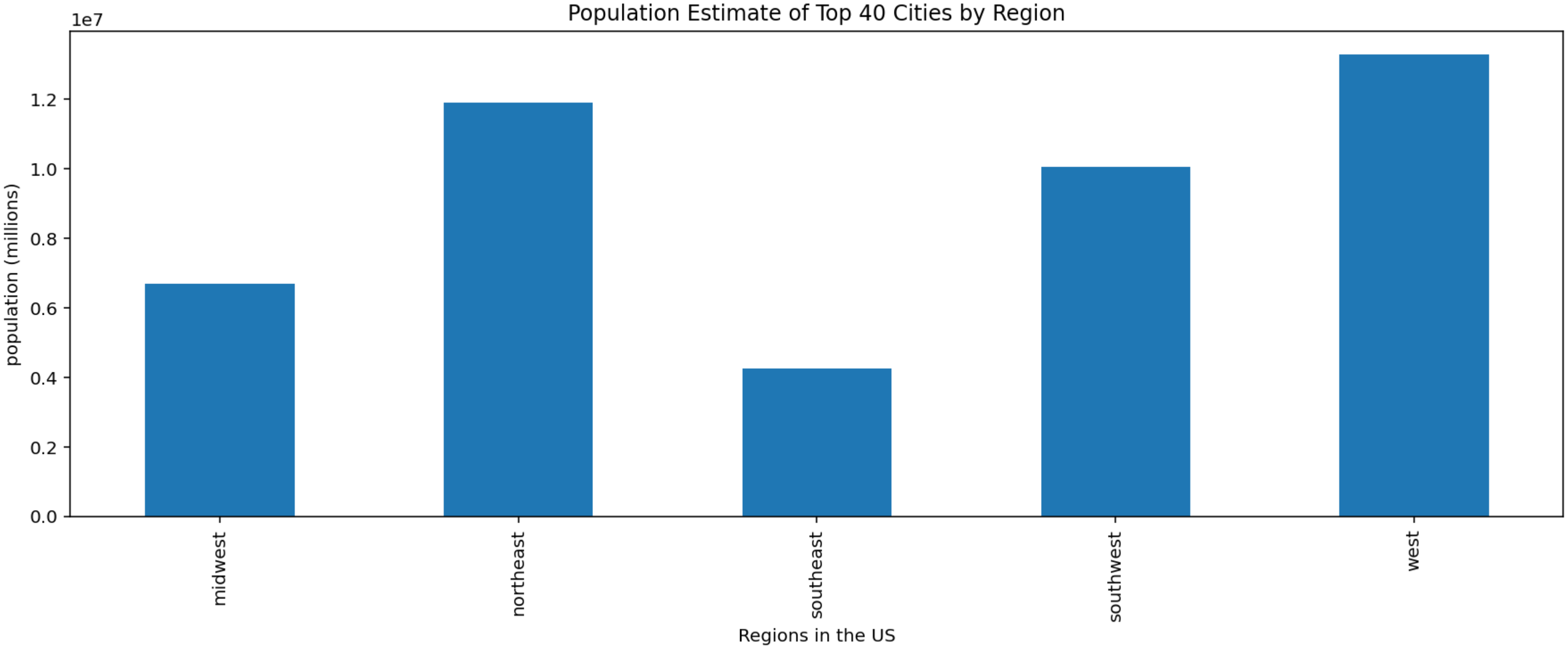
In [13]:

```
# save master df for resiliency

top_df.to_csv("/Users/adriana/Google Drive/_Learning/_DS4A/Assignments/0_Final_Project/2020_top_thirty_fina
l.csv", index = False)
```

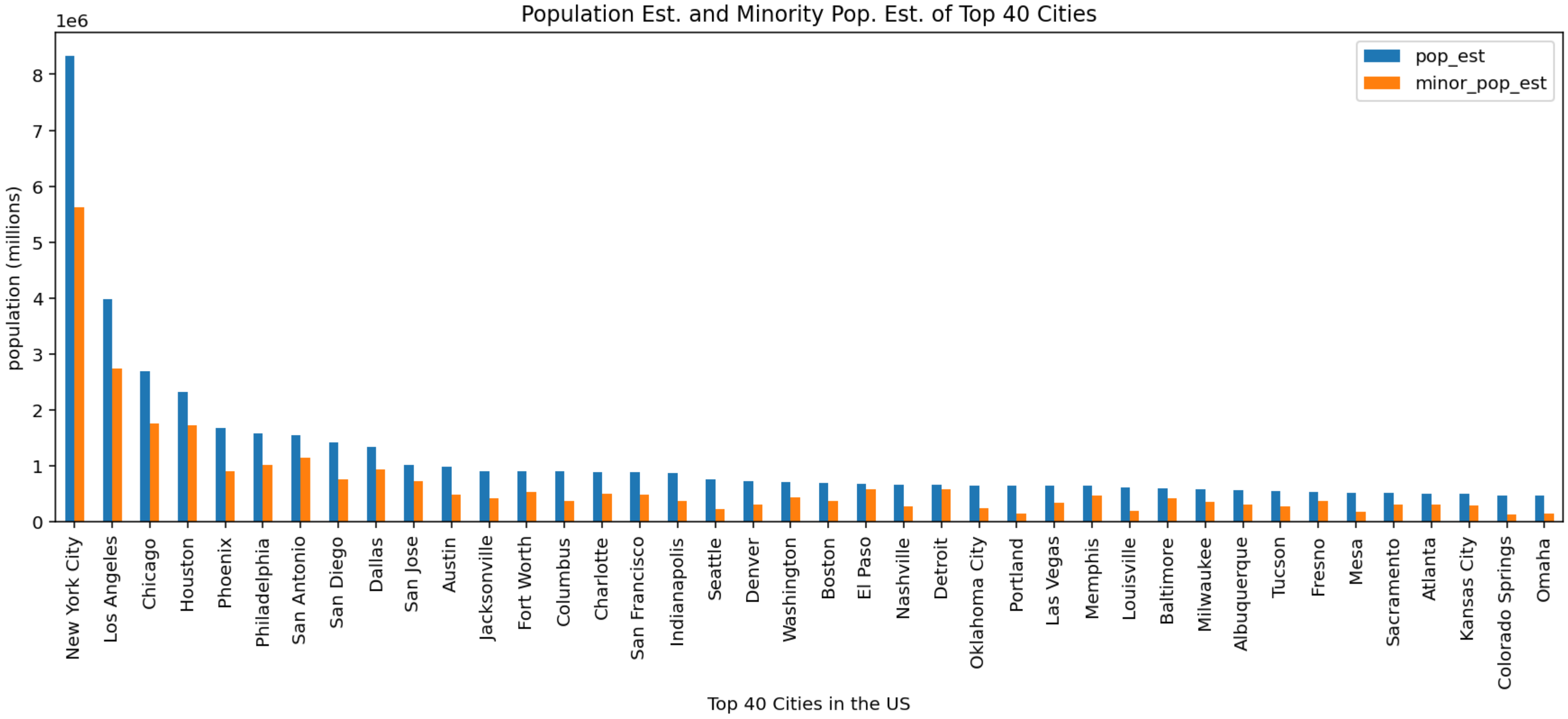
Population and Minority Demos

In [14]:

```
# Population Estimate of Top 40 Cities by Region

pop_region_plot = top_df.groupby("region")["pop_est"].sum()
pop_region_plot.plot.bar(figsize = (15,5))
plt.xlabel("Regions in the US")
plt.ylabel("population (millions)")
plt.title("Population Estimate of Top 40 Cities by Region");
```

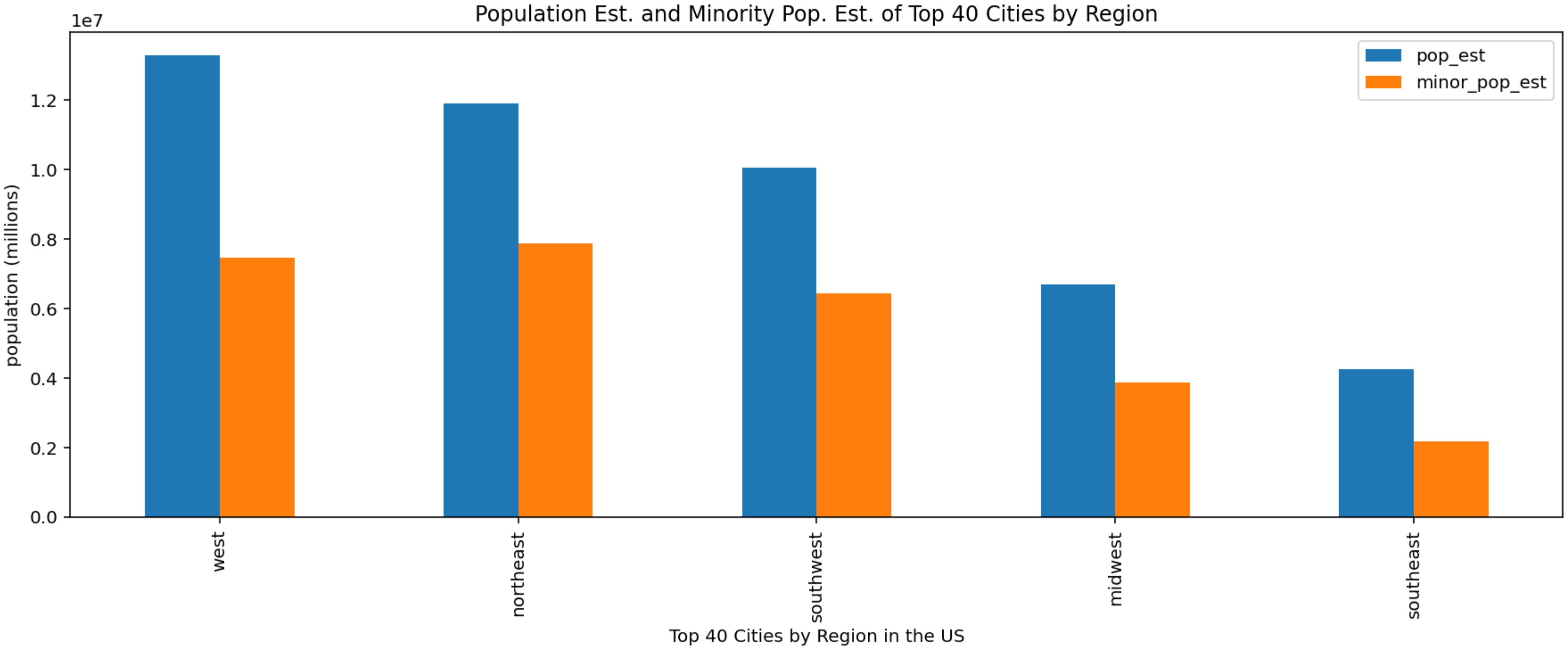


```
In [15]: # Population Est. and Minority Pop. Est. of Top 40 Cities

         pop_city_plot = top_df[["city", "pop_est", "minor_pop_est"]].sort_values(by=['pop_est'], ascending = False)
         pop_city_plot.plot.bar(x = "city", figsize = (15,5))
         plt.xlabel("Top 40 Cities in the US")
         plt.ylabel("population (millions)")
         plt.title("Population Est. and Minority Pop. Est. of Top 40 Cities");
```



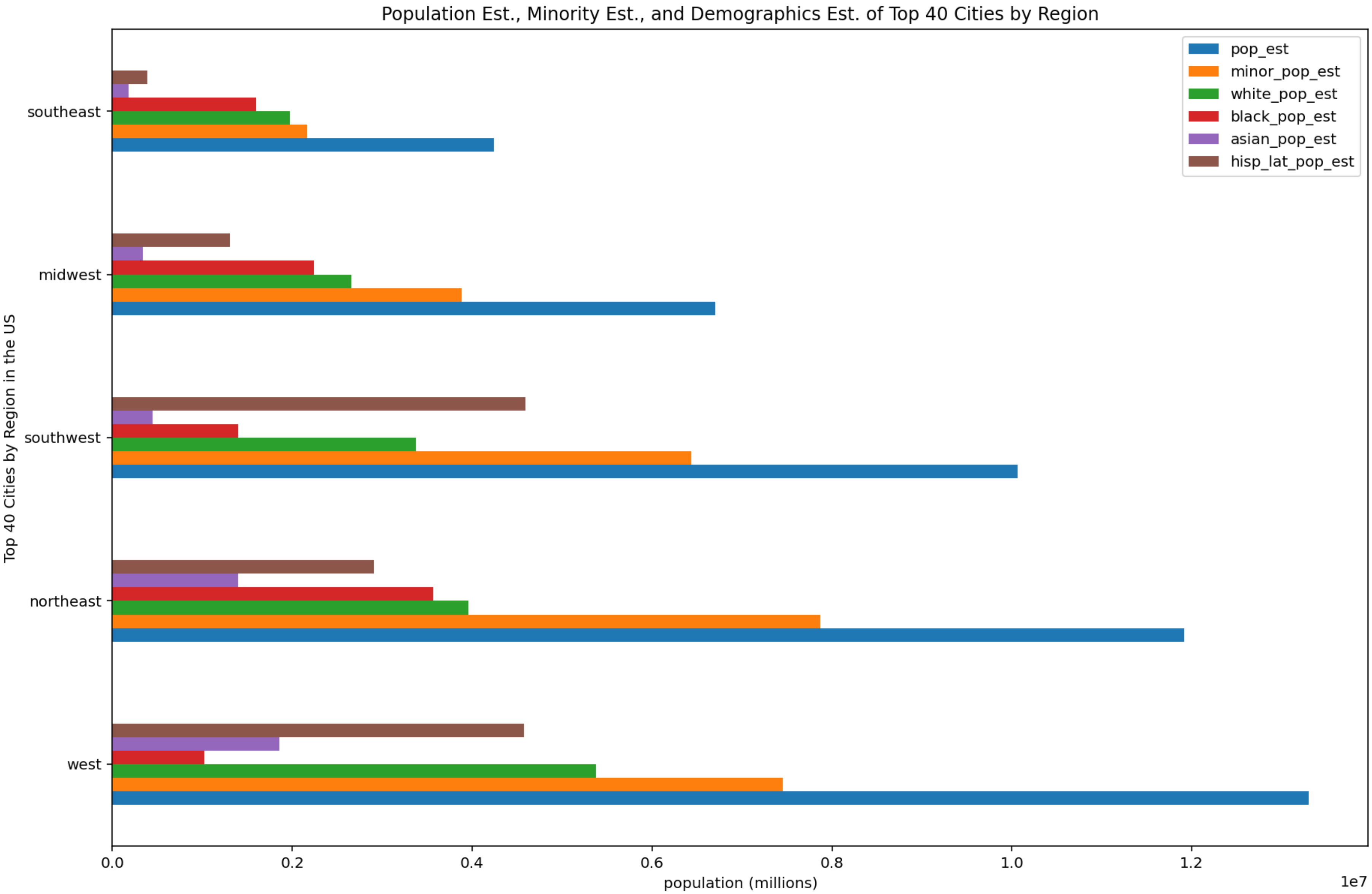
In [16]:

```
# Population Est. and Minority Pop. Est. of Top 40 Cities by Region

pop_region_plot = top_df.groupby("region")[["pop_est", "minor_pop_est"]].sum().sort_values(by=['pop_est'],
ascending = False)
pop_region_plot.plot.bar(figsize = (15,5))
plt.xlabel("Top 40 Cities by Region in the US")
plt.ylabel("population (millions)")
plt.title("Population Est. and Minority Pop. Est. of Top 40 Cities by Region");
```



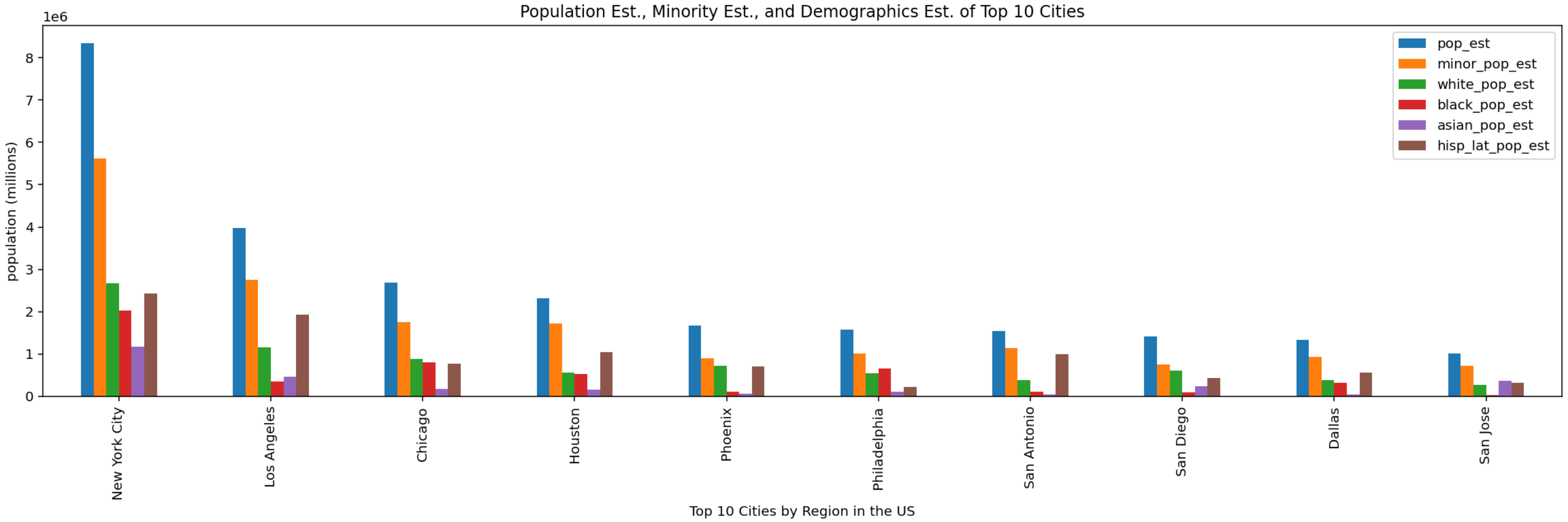
In [17]:

```python
# Population Est., Minority Est., and Demographics Est. of Top 40 Cities by Region

pop_demo_plot = top_df.groupby("region")[["pop_est", "minor_pop_est", "white_pop_est","black_pop_est","asian_pop_est", "hisp_lat_pop_est"]].sum().sort_values(by=['pop_est'], ascending = False)
pop_demo_plot.plot.barh(figsize = (15,10))
plt.xlabel("population (millions)")
plt.ylabel("Top 40 Cities by Region in the US")
plt.title("Population Est., Minority Est., and Demographics Est. of Top 40 Cities by Region");
```



In [18]:

```
# Population Est., Minority Est., and Demographics Est. of Top 10 Cities

pop_demo_plot = top_df.groupby("city")[["pop_est", "minor_pop_est", "white_pop_est","black_pop_est","asian_pop_est", "hisp_lat_pop_est"]].sum().sort_values(by=['pop_est'], ascending = False).head(10)
pop_demo_plot.plot.bar(figsize = (20,5))
plt.xlabel("Top 10 Cities by Region in the US")
plt.ylabel("population (millions)")
plt.title("Population Est., Minority Est., and Demographics Est. of Top 10 Cities");
```



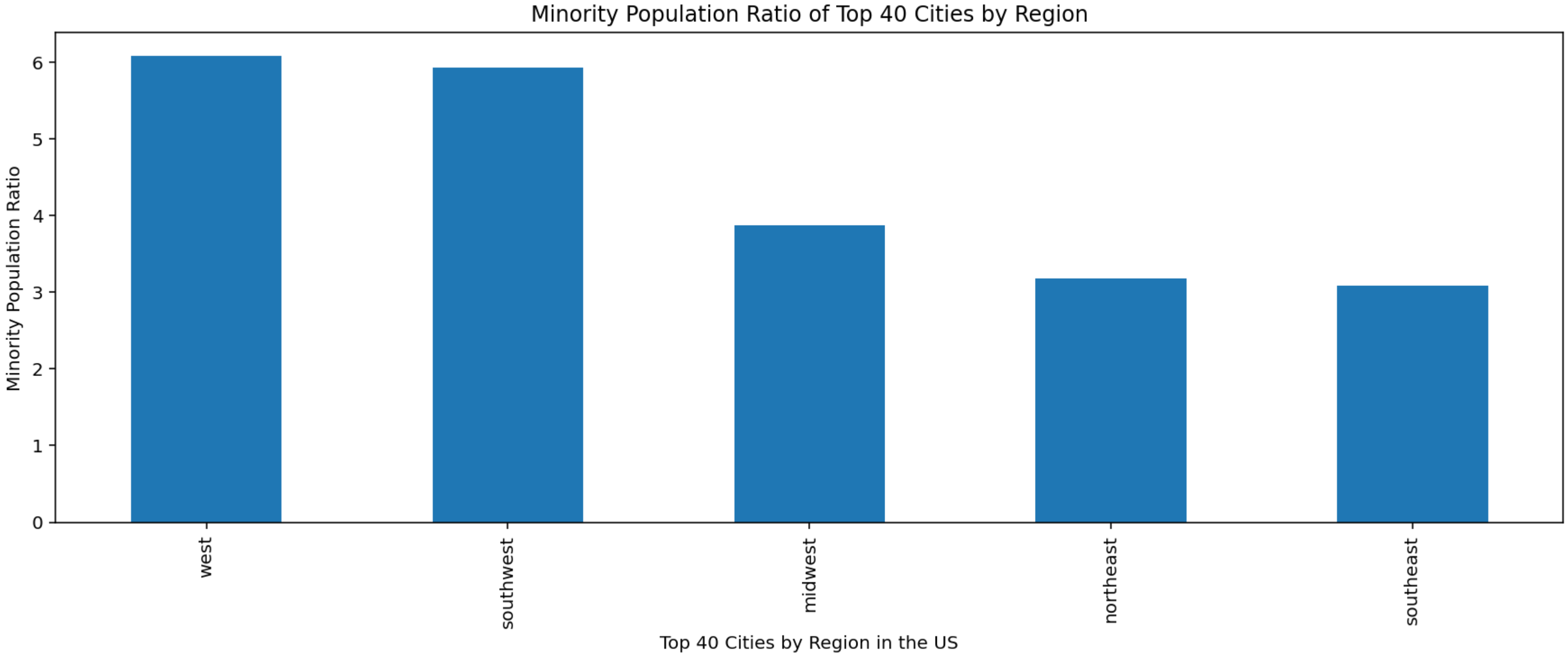
In [19]:

```
# Create new features for each total minorities
# and each demographic's percentage of the total population, for each city

top_df["minor_pop_ratio"] = top_df["minor_pop_est"]/top_df["pop_est"]
top_df["white_pop_ratio"] = top_df["white_pop_est"]/top_df["pop_est"]
top_df["black_pop_ratio"] = top_df["black_pop_est"]/top_df["pop_est"]
top_df["asian_pop_ratio"] = top_df["asian_pop_est"]/top_df["pop_est"]
top_df["hisp_lat_pop_ratio"] = top_df["hisp_lat_pop_est"]/top_df["pop_est"]
```

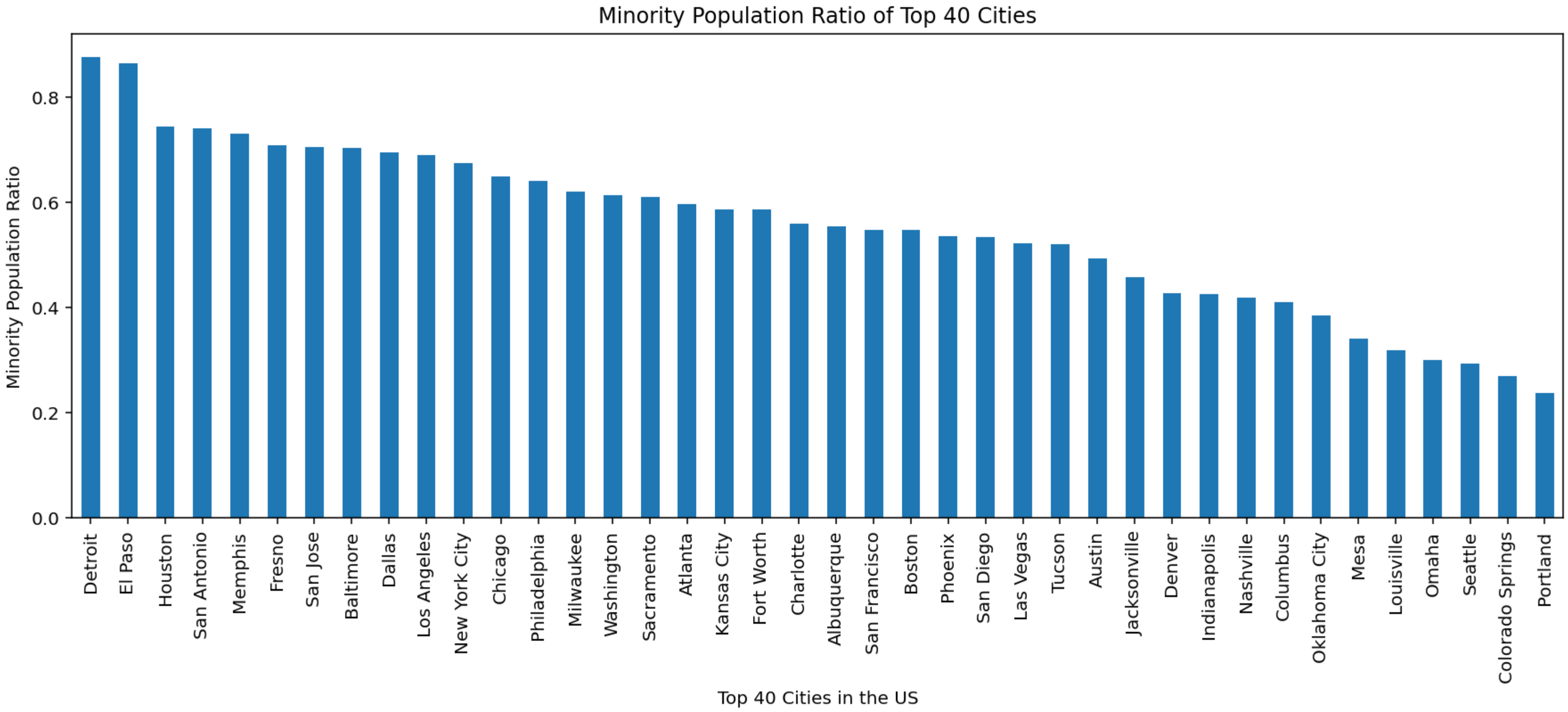
In [20]:

```
# save master df for resiliency

top_df.to_csv("/Users/adriana/Google Drive/_Learning/_DS4A/Assignments/0_Final_Project/2020_top_thirty_final.csv", index = False)
```

```
In [21]: # Minority Population Ratio of Top 40 Cities by Region

         ratio_region_plot = top_df.groupby("region")["minor_pop_ratio"].sum().sort_values(ascending = False)
         ratio_region_plot.plot.bar(figsize = (15,5))
         plt.xlabel("Top 40 Cities by Region in the US")
         plt.ylabel("Minority Population Ratio")
         plt.title("Minority Population Ratio of Top 40 Cities by Region");
```

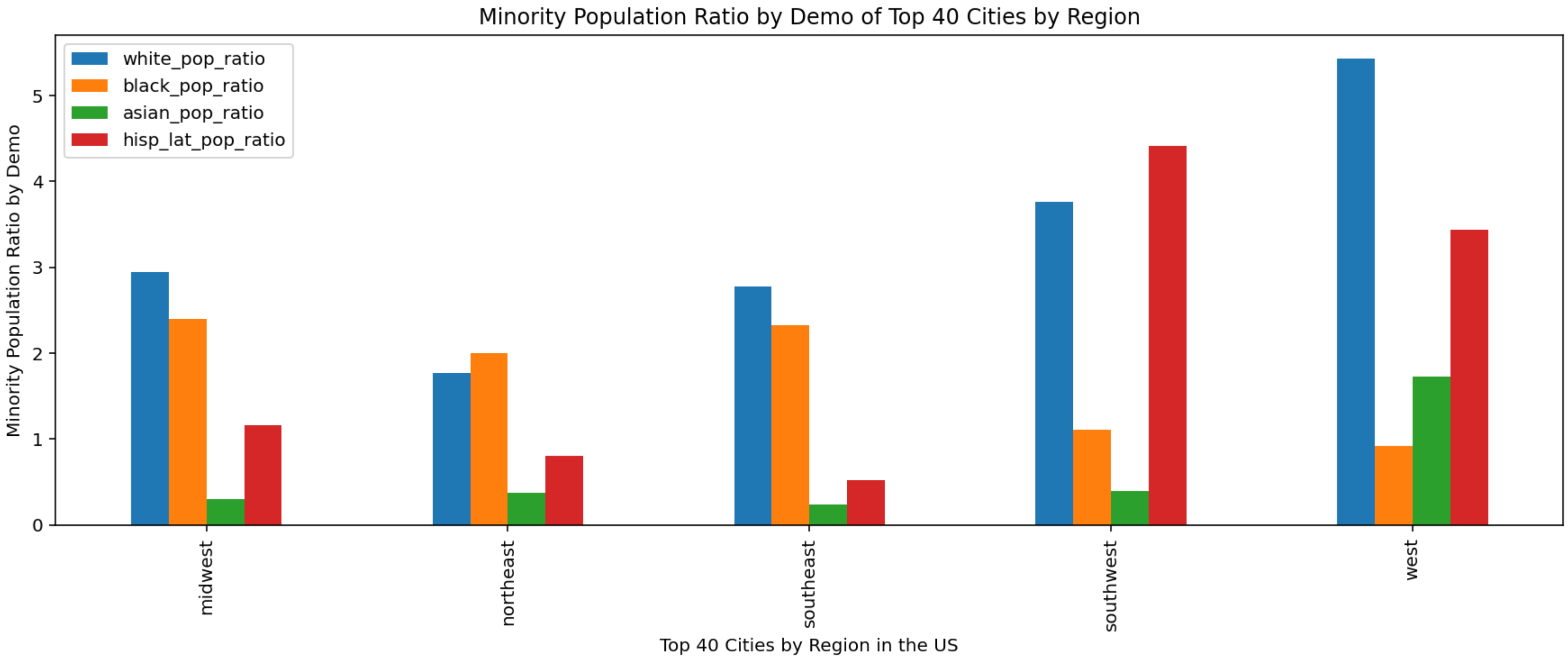


In [22]:
```
# Minority Population Ratio of Top 40 Cities

ratio_city_plot = top_df.groupby("city")["minor_pop_ratio"].sum().sort_values(ascending = False)
ratio_city_plot.plot.bar(figsize = (15,5))
plt.xlabel("Top 40 Cities in the US")
plt.ylabel("Minority Population Ratio")
plt.title("Minority Population Ratio of Top 40 Cities");
```



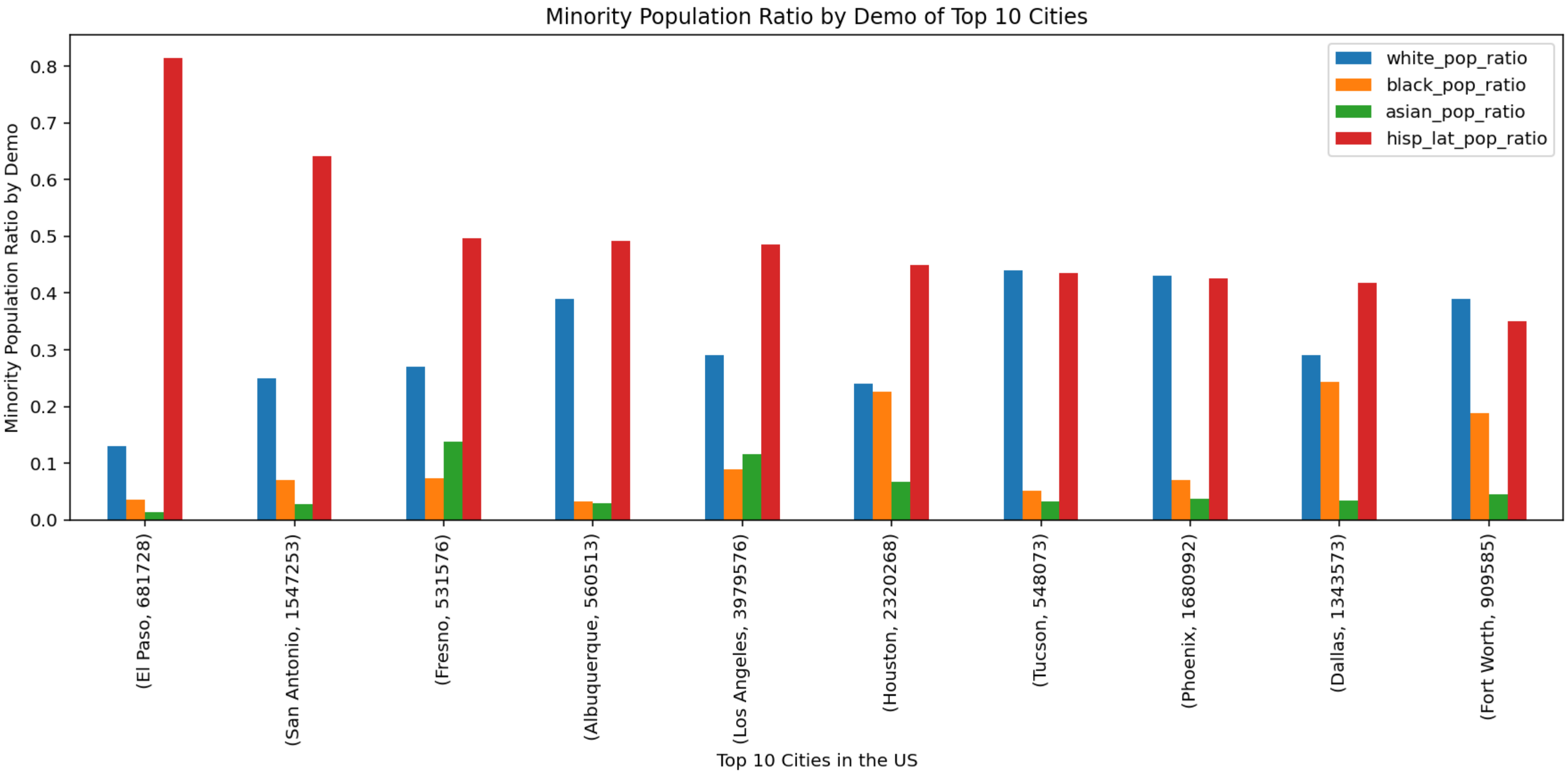
In [23]:

```
# Minority Population Ratio by Demo of Top 40 Cities by Region

dem_ratio_region_plot = top_df.groupby("region")[["white_pop_ratio", "black_pop_ratio", "asian_pop_ratio",
"hisp_lat_pop_ratio"]].sum()
dem_ratio_region_plot.plot.bar(figsize = (15,5))
plt.xlabel("Top 40 Cities by Region in the US")
plt.ylabel("Minority Population Ratio by Demo")
plt.title("Minority Population Ratio by Demo of Top 40 Cities by Region");
```



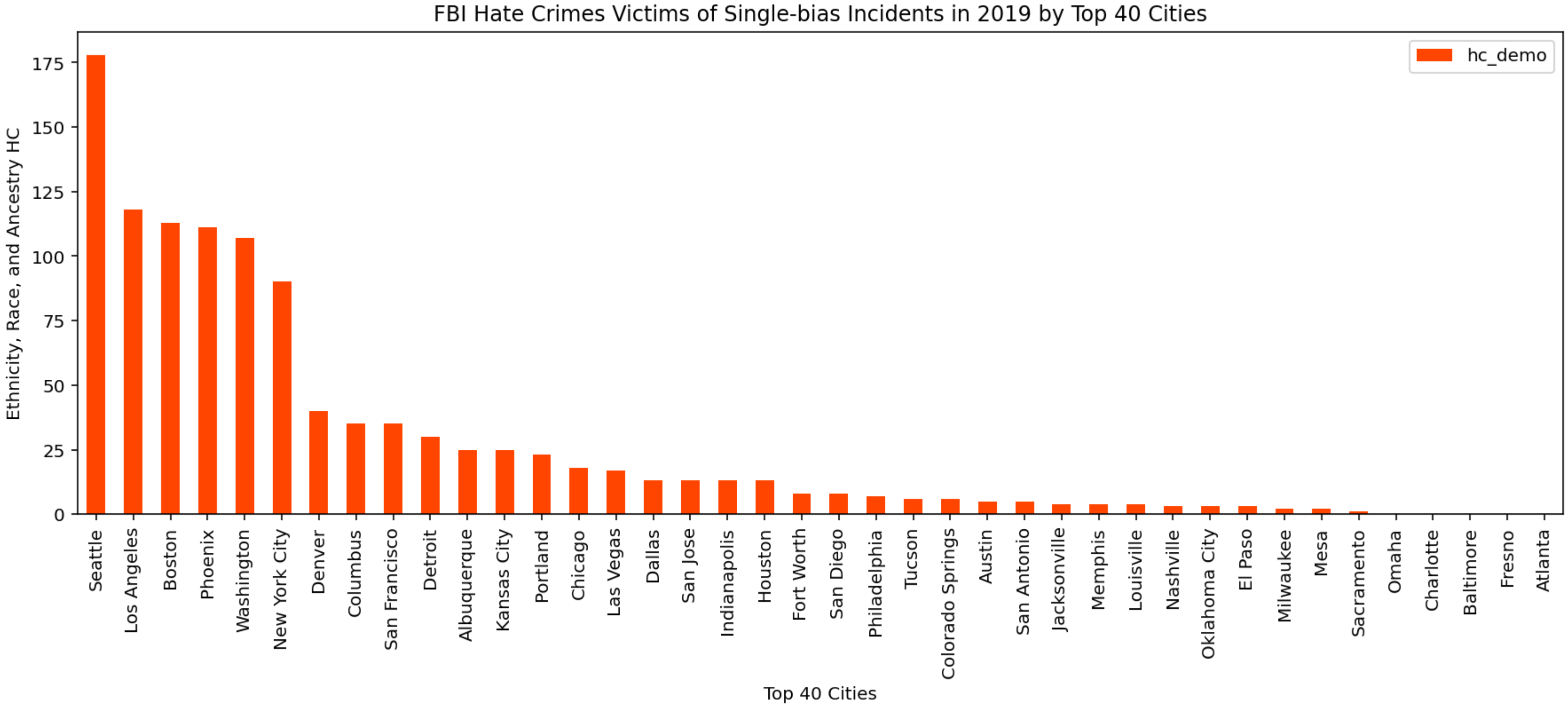
In [24]:

```
# Minority Population Ratio by Demo of Top 10 Cities

dem_ratio_city_plot = top_df.groupby(["city","pop_est"])[["white_pop_ratio", "black_pop_ratio", "asian_pop_
ratio", "hisp_lat_pop_ratio"]].sum().sort_values(by = "hisp_lat_pop_ratio", ascending = False).head(10)
dem_ratio_city_plot.plot.bar(figsize = (15,5))
plt.xlabel("Top 10 Cities in the US")
plt.ylabel("Minority Population Ratio by Demo")
plt.title("Minority Population Ratio by Demo of Top 10 Cities");
```

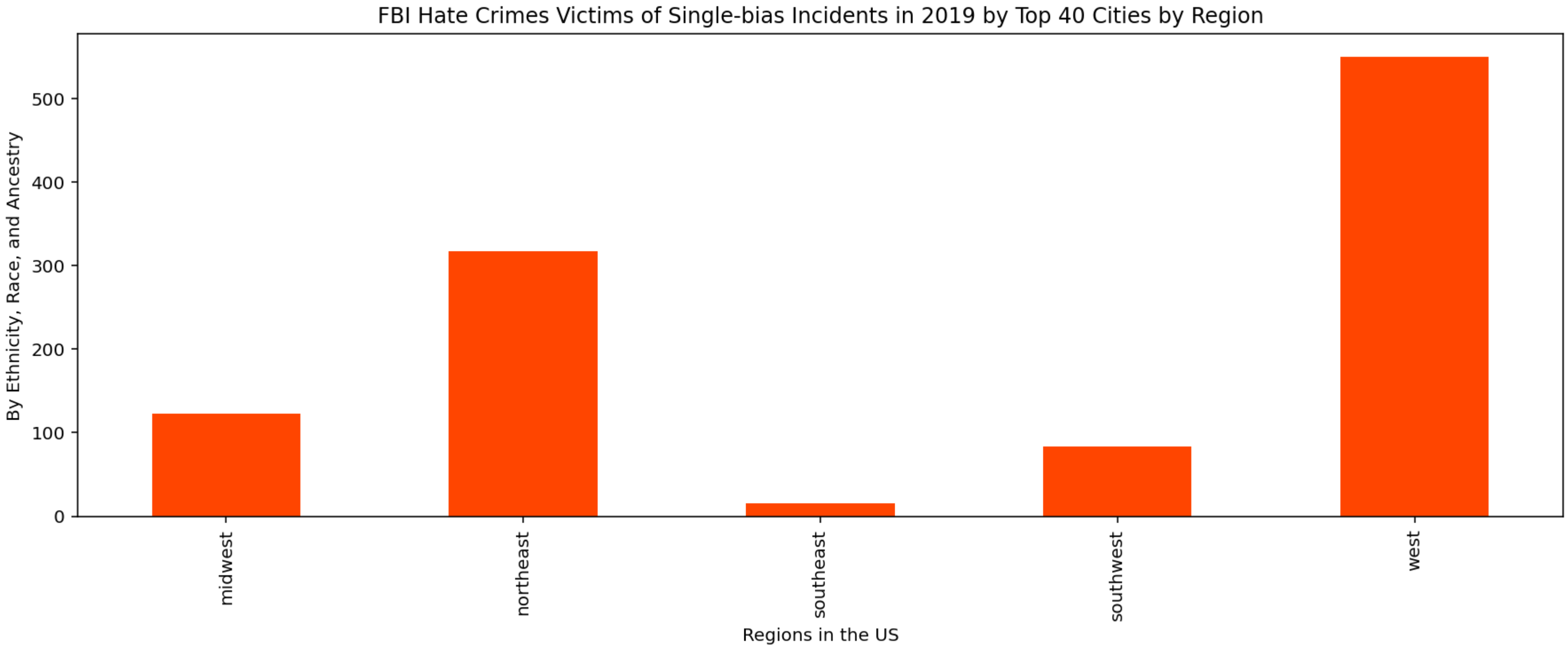


Hate Crime

```
In [25]: # FBI Hate Crimes Victims of Single-bias Incidents in 2019 by Top 40 Cities

         hc_plot = top_df[["city", "hc_demo"]].sort_values(by = "hc_demo", ascending = False)
         hc_plot.plot.bar(x = "city", y = "hc_demo", color = "orangered", figsize = (15,5))
         plt.xlabel("Top 40 Cities")
         plt.ylabel("Ethnicity, Race, and Ancestry HC")
         plt.title("FBI Hate Crimes Victims of Single-bias Incidents in 2019 by Top 40 Cities");
```



```
In [26]: # FBI Hate Crimes Victims of Single-bias Incidents in 2019 by Top 40 Cities by Region

         hc_region_plot = top_df.groupby("region")["hc_demo"].sum()
         hc_region_plot.plot.bar(color = "orangered", figsize = (15,5))
         plt.xlabel("Regions in the US")
         plt.ylabel("By Ethnicity, Race, and Ancestry")
         plt.title("FBI Hate Crimes Victims of Single-bias Incidents in 2019 by Top 40 Cities by Region");
```



Hate Crime and Population Correlations

In [27]:

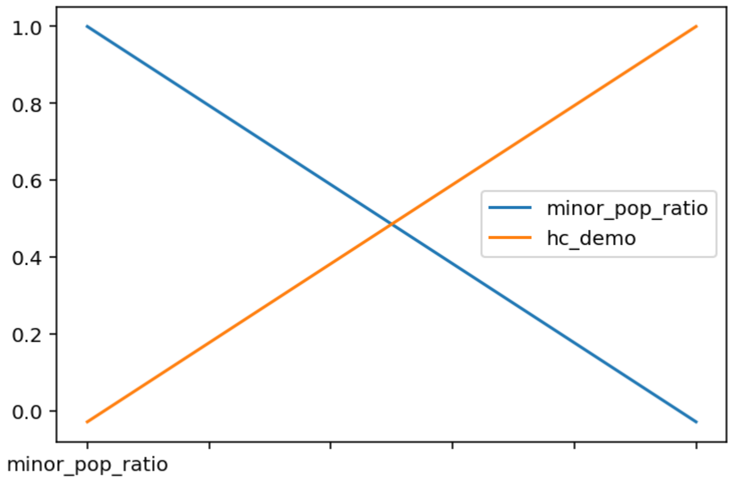
```
# Correlation of total minority population percentage to count of victims of hate crimes (race, ethnicity, ancestry)

minor_hc_corr = top_df[["minor_pop_ratio", "hc_demo"]].corr()
minor_hc_corr
```

Out[27]:

```
                 minor_pop_ratio    hc_demo
minor_pop_ratio         1.000000  -0.028896
        hc_demo        -0.028896   1.000000
```

In [28]:

```
minor_hc_corr.plot.line();
```



In [29]:

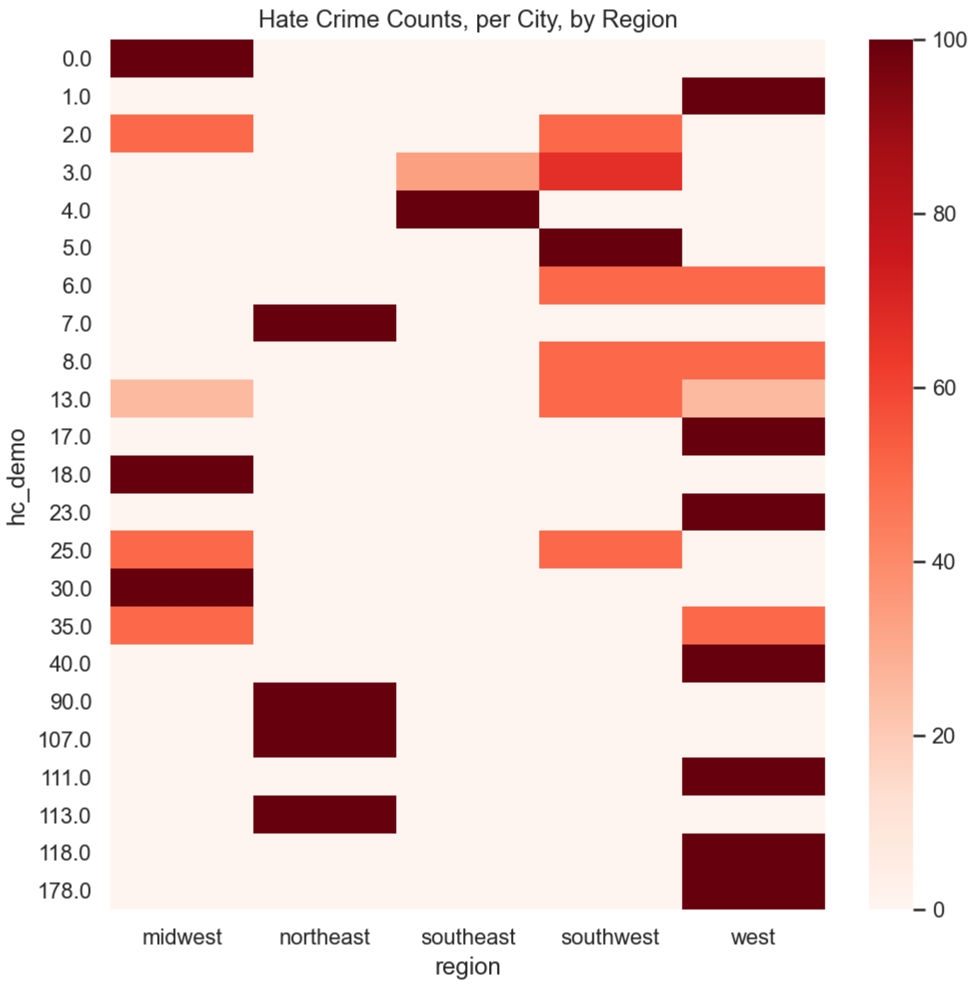
```python
# crosstab of hate crimes from each city, by region

hc_norm = pd.crosstab(index=hc_df["hc_demo"], columns=hc_df["region"], normalize="index")*100
hc_norm.head()
```

Out[29]:

region	midwest	northeast	southeast	southwest	west
hc_demo					
0.0	100.0	0.0	0.000000	0.000000	0.0
1.0	0.0	0.0	0.000000	0.000000	100.0
2.0	50.0	0.0	0.000000	50.000000	0.0
3.0	0.0	0.0	33.333333	66.666667	0.0
4.0	0.0	0.0	100.000000	0.000000	0.0

In [30]:

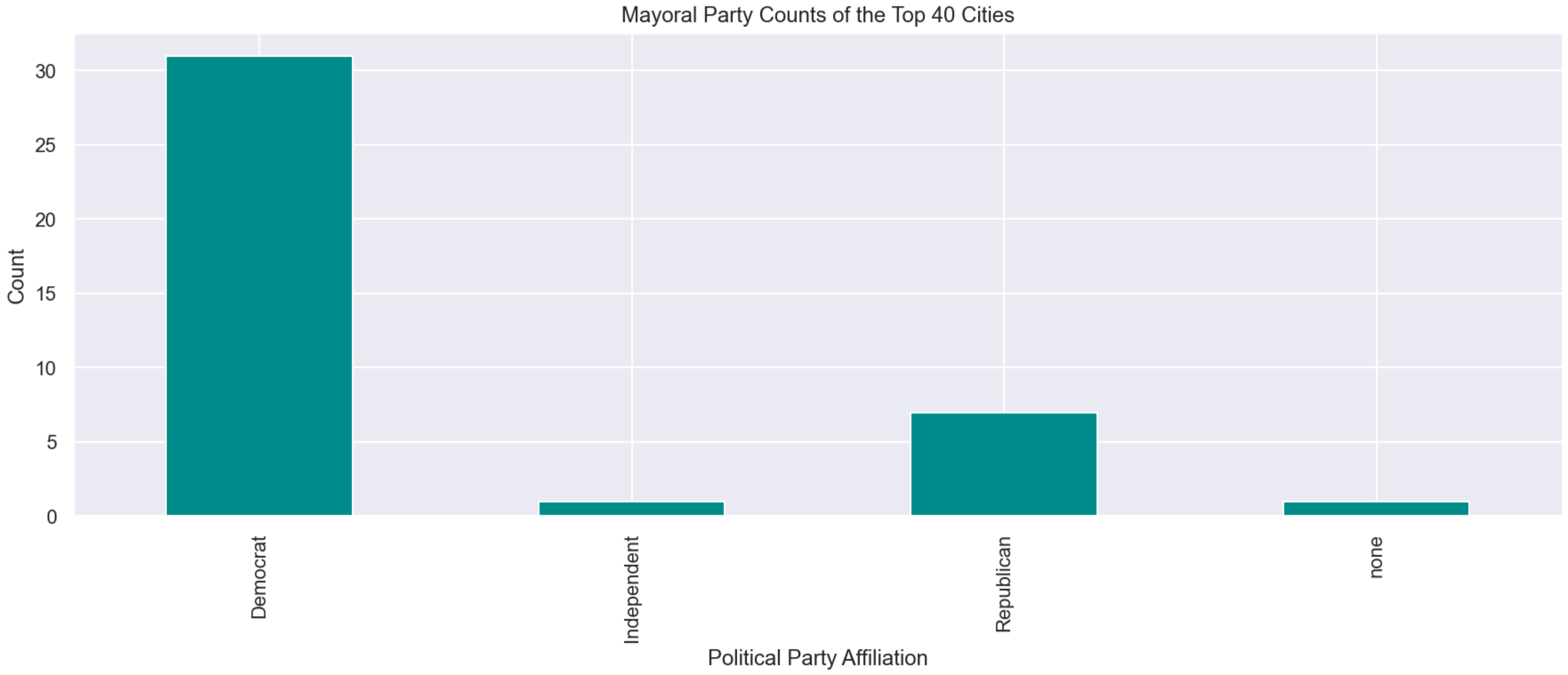
```
# heatmap of crosstab

sns.set(rc = {'figure.figsize':(8, 8)})
ax = sns.heatmap(hc_norm, cmap = "Reds")
ax.set_title("Hate Crime Counts, per City, by Region");
```



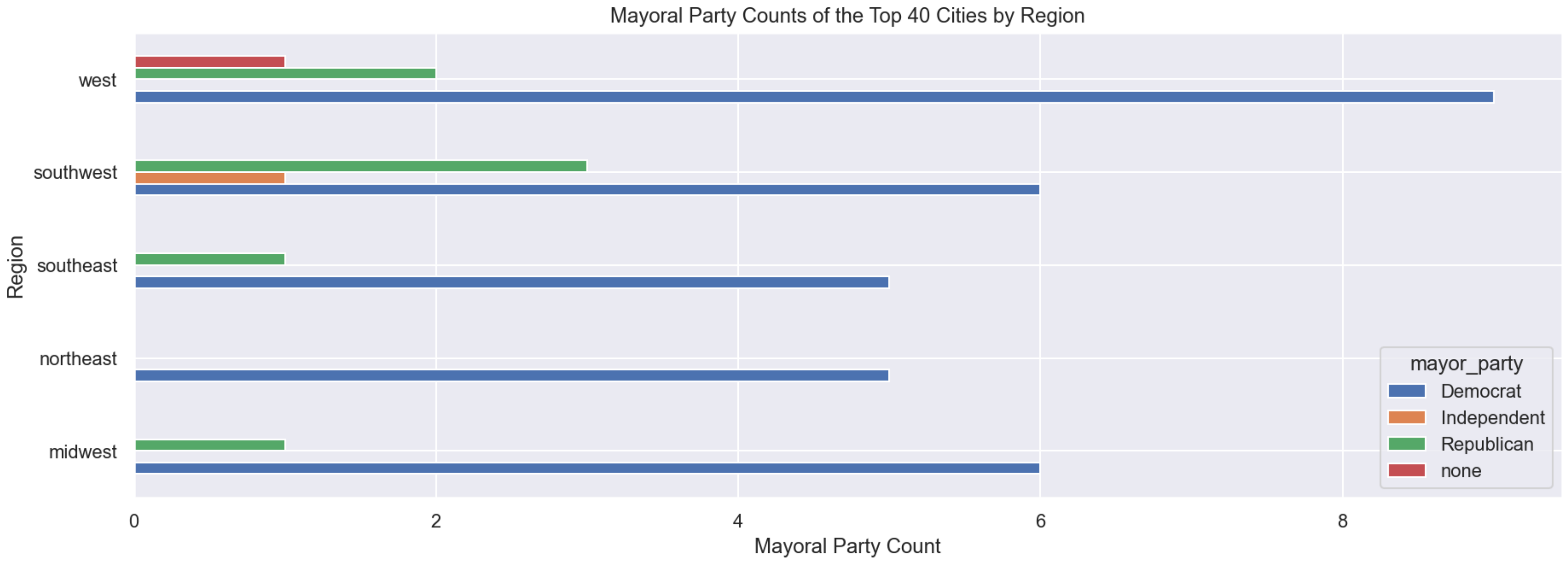
Mayor Political Party

In [31]:

```
# Mayoral Party Counts of the Top 40 Cities

mayor_plot = top_df.groupby("mayor_party")["city"].count()
mayor_plot.plot.bar(color = "darkcyan", figsize = (15,5))
plt.xlabel("Political Party Affiliation")
plt.ylabel("Count")
plt.title("Mayoral Party Counts of the Top 40 Cities");
```



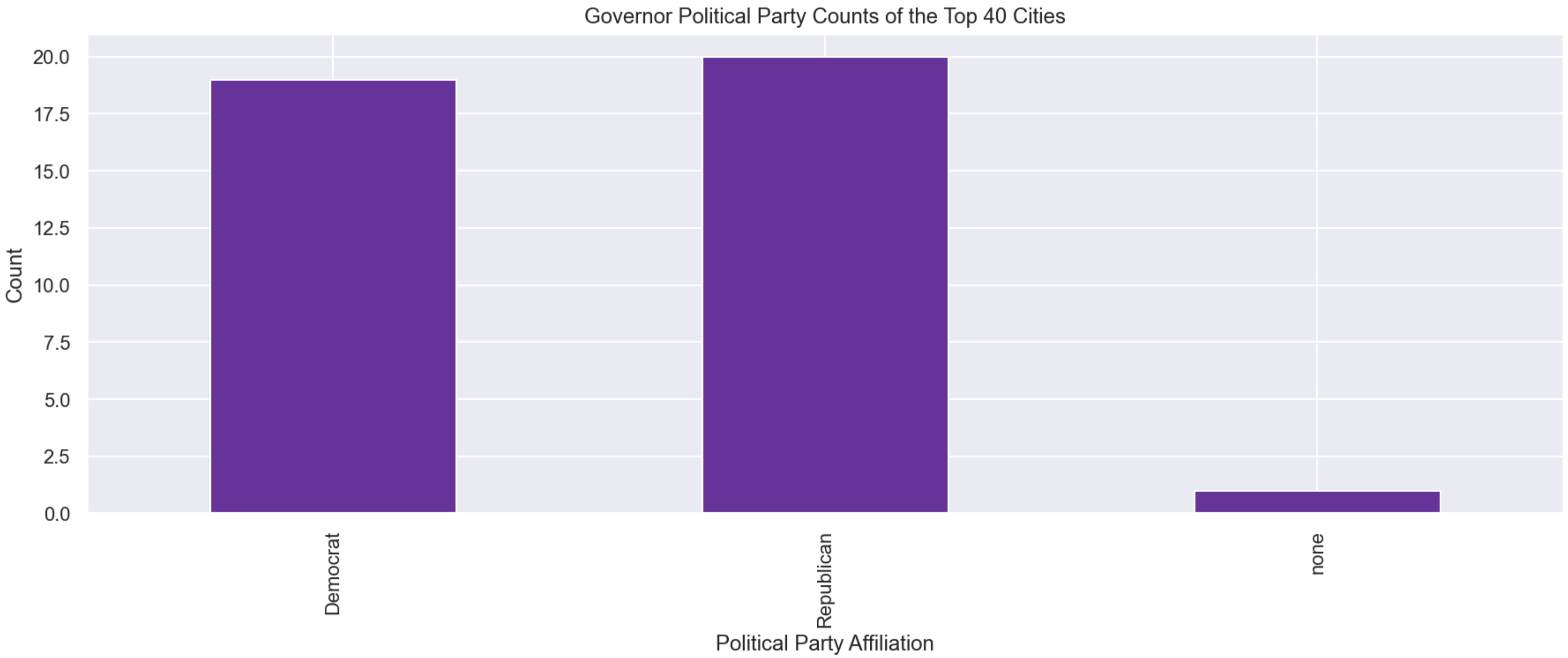
```
In [32]: # Mayoral Party Counts of the Top 40 Cities by Region

         mayor_region_plot = top_df.groupby("region")["mayor_party"].value_counts().unstack()
         mayor_region_plot.plot.barh(figsize = (15,5))
         plt.xlabel("Mayoral Party Count")
         plt.ylabel("Region")
         plt.title("Mayoral Party Counts of the Top 40 Cities by Region");
```



Governor Political Party

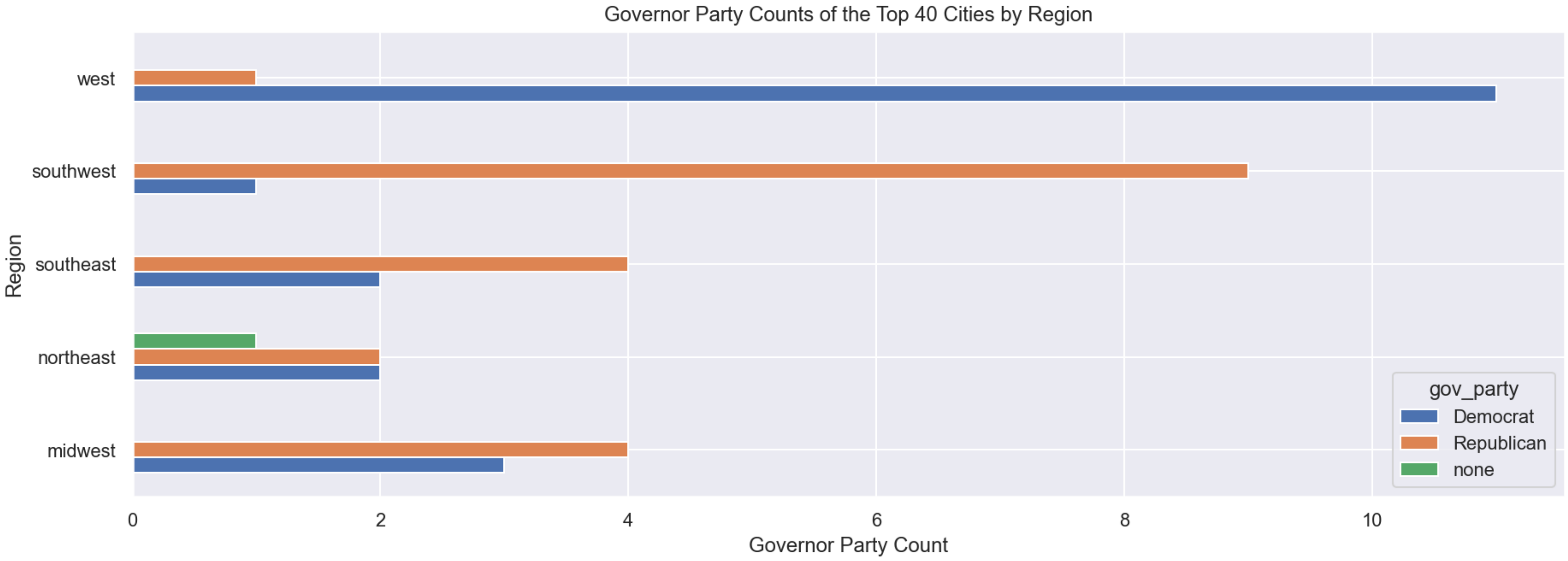
In [33]:

```python
# Governor Political Party Counts of the Top 40 Cities

gov_plot = top_df.groupby("gov_party")["city"].count()
gov_plot.plot.bar(color = "rebeccapurple", figsize = (15,5))
plt.xlabel("Political Party Affiliation")
plt.ylabel("Count")
plt.title("Governor Political Party Counts of the Top 40 Cities");
```



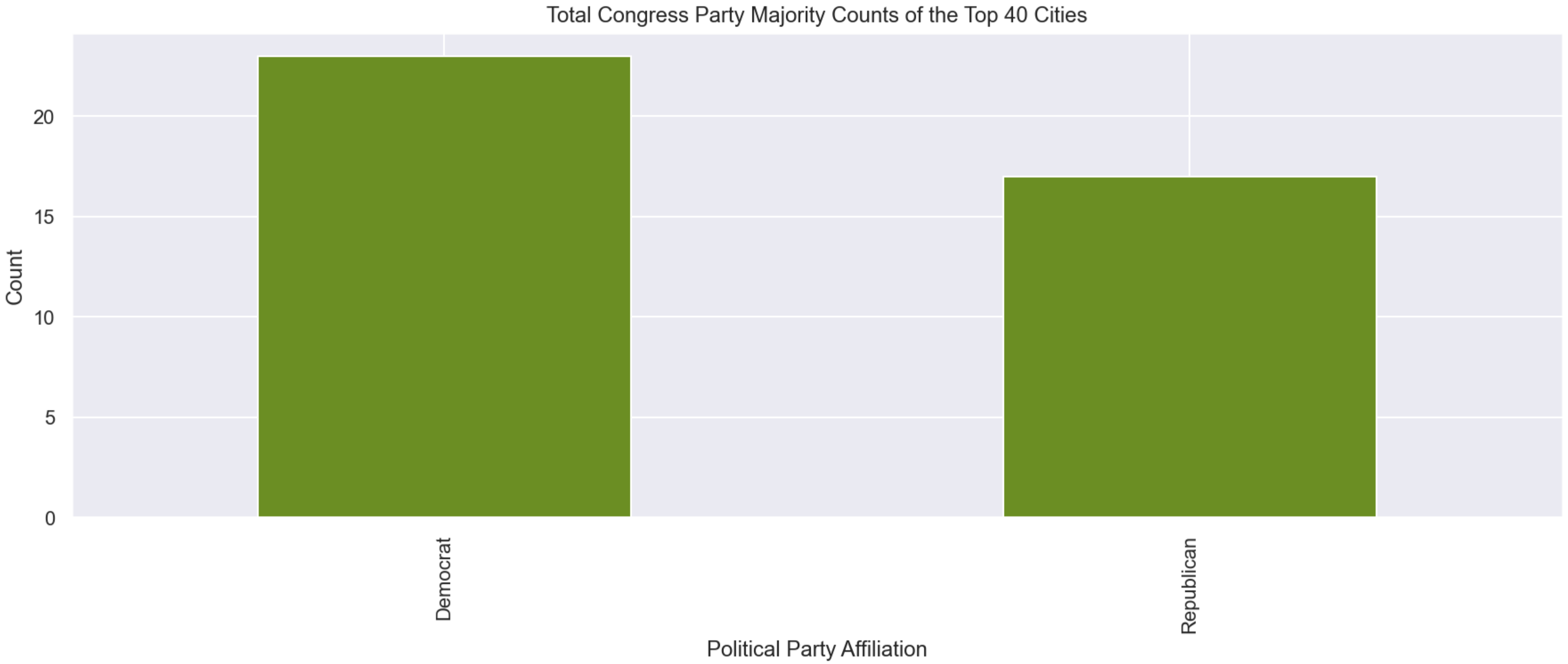
In [34]:

```
# Governor Party Counts of the Top 40 Cities by Region

gov_region_plot = top_df.groupby("region")["gov_party"].value_counts().unstack()
gov_region_plot.plot.barh(figsize = (15,5))
plt.xlabel("Governor Party Count")
plt.ylabel("Region")
plt.title("Governor Party Counts of the Top 40 Cities by Region");
```



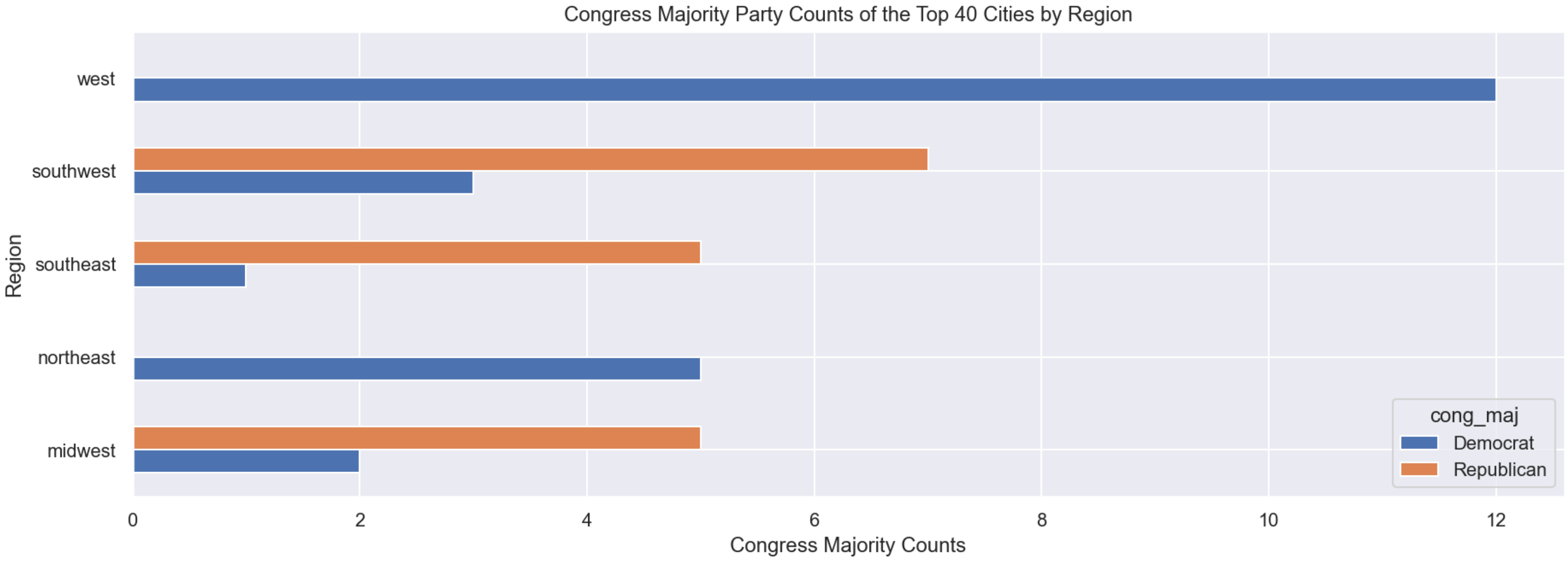
Congress Majority Party

```
In [35]: # Total Congress Party Majority Counts of the Top 40 Cities

         cong_plot = top_df.groupby("cong_maj")["city"].count()
         cong_plot.plot.bar(color = "olivedrab", figsize = (15,5))
         plt.xlabel("Political Party Affiliation")
         plt.ylabel("Count")
         plt.title("Total Congress Party Majority Counts of the Top 40 Cities");
```



In [36]:

```
# Congress Majority Party Counts of the Top 40 Cities by Region

cong_region_plot = top_df.groupby("region")["cong_maj"].value_counts().unstack()
cong_region_plot.plot.barh(figsize = (15,5))
plt.xlabel("Congress Majority Counts")
plt.ylabel("Region")
plt.title("Congress Majority Party Counts of the Top 40 Cities by Region");
```



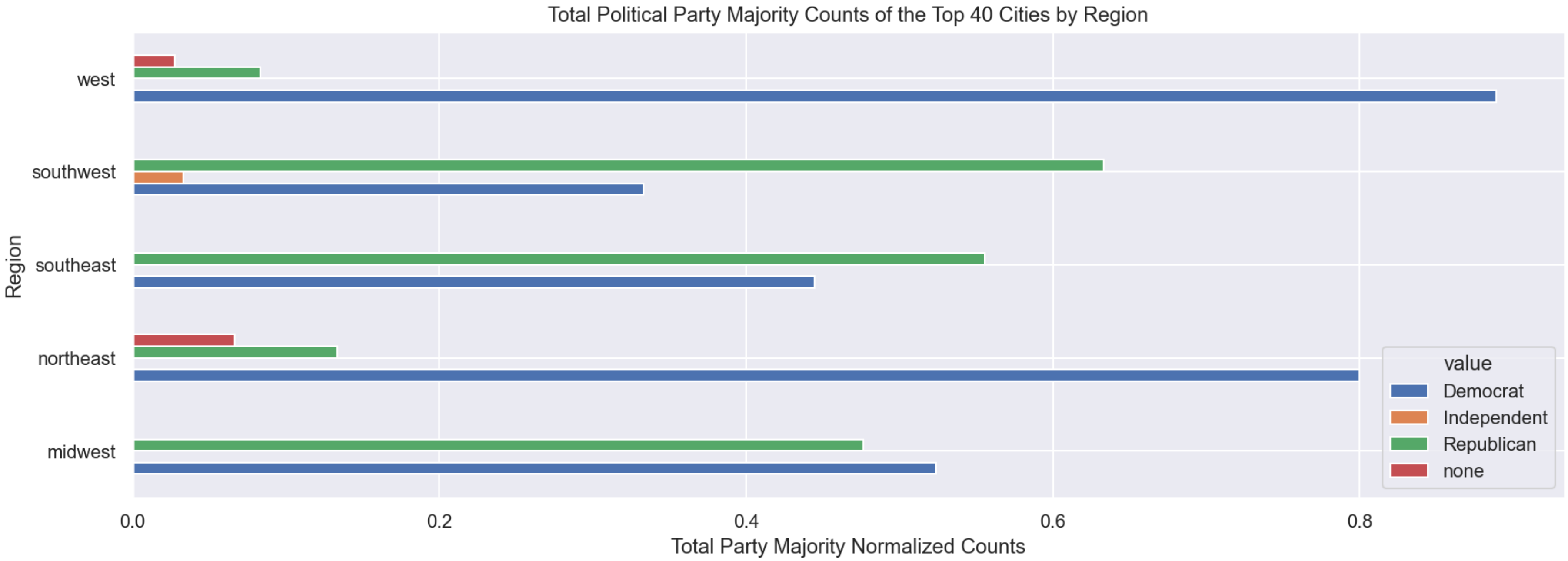
Political Sums

To-Do:

- mayor_state = how frequently mayoral party and state majority party differs

In [37]:

```
# Total Party Majority Counts of the Top 40 Cities by Region

political = top_df[["region", "city", "mayor_party", "gov_party", "cong_maj"]]
political = political.melt(id_vars = ["region","city"], value_vars = ["mayor_party", "gov_party", "cong_ma
j"])
political_gb = political.groupby("region")["value"].value_counts(normalize=True).unstack()
political_gb.plot.barh(figsize = (15,5))
plt.xlabel("Total Party Majority Normalized Counts")
plt.ylabel("Region")
plt.title("Total Political Party Majority Counts of the Top 40 Cities by Region");
```



In [38]:

```
mayor_count = top_df.groupby("mayor_party")["city"].count()
mayor_region_count = top_df.groupby("region")["mayor_party"].value_counts().unstack()
gov_count = top_df.groupby("gov_party")["city"].count()
gov_region_count = top_df.groupby("region")["gov_party"].value_counts().unstack()
cong_count = top_df.groupby("cong_maj")["city"].count()
cong_region_count = top_df.groupby("region")["cong_maj"].value_counts().unstack()
political_total_norm = political.groupby("region")["value"].value_counts(normalize=True).unstack()
```

In [39]:

```
mayor_region_count
```

Out[39]:

mayor_party	Democrat	Independent	Republican	none
region				
midwest	6.0	NaN	1.0	NaN
northeast	5.0	NaN	NaN	NaN
southeast	5.0	NaN	1.0	NaN
southwest	6.0	1.0	3.0	NaN
west	9.0	NaN	2.0	1.0

Sources

Census Data (2019-2020): https://www.census.gov/quickfacts/fact/table (https://www.census.gov/quickfacts/fact/table)

Hate Crime Data (2019 - race, ethnicity, ancestry): https://ucr.fbi.gov/hate-crime/2019 (https://ucr.fbi.gov/hate-crime/2019)

Political Data

Mayoral (2021): https://ballotpedia.org/Party_affiliation_of_the_mayors_of_the_100_largest_cities (https://ballotpedia.org/Party_affiliation_of_the_mayors_of_the_100_largest_cities)

Governor (2021): https://ballotpedia.org/Partisan_composition_of_governors (https://ballotpedia.org/Partisan_composition_of_governors)

Senate (2020): https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/PEJ5QU (https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/PEJ5QU)

House of Representatives (2018): https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/IG0UN2 (https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/IG0UN2)

In [ ]:

```
```