Factors Affecting Student Performance at the University Level

This project aims to understand how certain factors affect student performance within higher education, which I am measuring by examining the proportion of students that graduate as well as their earnings after graduation. In looking at all these factors, I hope to determine if certain elements are more influential in determining the overall success of students.

College Scorecard (https://collegescorecard.ed.gov/) draws most of its data from IPEDS (Integrated Postsecondary Education Data System), compiling statistics varying from average cost to demographics to location. The scorecard was created to increase transparency regarding higher education and to help prospective students weigh out the costs and values of each school.

The factors that I will examine are control (public, private nonprofit, private for-profit) and ranking.

This project will include:

- Basic statistics about 4-year universities from the 2016-2017 academic year
- Comparisons amongst schools based on controls, ranking, and location by state
- Visualization (graphs) of the relationship between each factor and graduation rates/earnings

Data about the schools' control, graduation rates, and students' earnings comes from College Scorecard (https://collegescorecard.ed.gov/). School rankings will come from US News & World Report (https://www.usnews.com/best-colleges/rankings/national-universities). In this project, I will only be looking at 4-year undergraduate universities.

Important Variables:

Control defines how the school is owned. The three different kinds of ownership are public, private nonprofit, and private for-profit. College Scoreboard denotes them as 1, 2, and 3, respectively.

Rankings of the universities are published by a variety of sources, but I will be using US News & World Report. I will be examining the top 25 universities and top 25 liberal arts colleges and comparing them with the rest of the universities.

Graduation rates is the completion rate for first-time, full-time students at four-year institutions (100% of expected time to completion - 4 years).

Earnings are determined by calculating the mean earnings of students working and not enrolled 10 years after entry and the Median earnings of students working and not enrolled 10 years after entry.

Data Dictionary:

Below are the names of columns I am pulling from the data and their coinciding data descriptions as provided by College Scorecard.

INSTNM: Institution name

STABBR: State postcode

PREDDEG: Predominant undergraduate degree awarded

- 0 Not classified
- 1 Predominantly certificate-degree granting

- 2 Predominantly associate's-degree granting
- 3 Predominantly bachelor's-degree granting
- 4 Entirely graduate-degree granting

CONTROL: Control of institution

- 1 Public
- 2 Private nonprofit
- 3 Private for-profit

MN_EARN_WNE_P10: Mean earnings of students working and not enrolled 10 years after entry

C100_4: Completion rate for first-time, full-time students at four-year institutions (100% of expected time to completion)

In [1]:
```
# importing necessary packages

import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import decimal
```

Reading in College Scorecard Data

In [2]:
```
# link to most recent data

file_url1 = "https://ed-public-download.app.cloud.gov/downloads/Most-Recent-Cohorts-All-Data-Elements.csv"
```

In [4]:
```
# read into pandas

scorecard = pd.read_csv(file_url1)
```

Cleaning up Scorecard Data

In [5]:
```
# narrowing data to just the columns we want

scorecard = scorecard[["INSTNM", "STABBR", "PREDDEG", "CONTROL", "MN_EARN_WNE_P10", "C100_4"]]
```

In [6]:
```
# only includes predominantly bachelor's-degree granting universities

scorecard = scorecard[scorecard["PREDDEG"] == 3]
```

In [7]:
```
# renaming columns

scorecard.rename(columns={"INSTNM":"School_Name", "STABBR": "State", "PR
EDDEG": "Degree_Type", "CONTROL":
                          "Ownership", "MN_EARN_WNE_P10": "Earnings",
                          "C100_4": "Completion_Rate"}, inplace=True)
```

In [8]:
```
# replacing missing data in "Earnings" column with NaN so that datatype
 of the column can be converted to float

scorecard.replace({"PrivacySuppressed": np.nan}, inplace = True)
```

In [9]:
```
scorecard.head()
```

Out[9]:

	School_Name	State	Degree_Type	Ownership	Earnings	Completion_Rate
0	Alabama A & M University	AL	3	1	35500	0.0643
1	University of Alabama at Birmingham	AL	3	1	48400	0.3018
2	Amridge University	AL	3	2	47600	0.1429
3	University of Alabama in Huntsville	AL	3	1	52000	0.1533
4	Alabama State University	AL	3	1	30600	0.0725

In [36]:
```
# convert "Earnings" dtype from object to float

scorecard.Earnings = scorecard.Earnings.astype("float64", inplace = True
)

scorecard.dtypes
```

Out[36]:
```
School_Name          object
State                object
Degree_Type           int64
Ownership             int64
Earnings            float64
Completion_Rate     float64
dtype: object
```

Read in Ranking Data

In [11]:
```
# read in US News ranking data for national universities and liberal art
s colleges

file_url2 = "https://github.com/claireyzhang/data_bootcamp_final_projec
t/raw/master/us_news_rankings.xlsx"

ranking = pd.read_excel(file_url2)
```

In [12]:
```
ranking.head()
```

Out[12]:

	NU_Rank	NU_School	NU_State	LA_Rank	LA_School	LA_State
0	1	Princeton University	NJ	1.0	Williams College	MA
1	2	Harvard University	MA	2.0	Amherst College	MA
2	3	Columbia University	NY	3.0	Swarthmore College	PA
3	3	Massachusetts Institute of Technology	MA	3.0	Wellesley College	MA
4	3	University of Chicago	IL	5.0	Bowdoin College	ME

Control

In [37]:
```
# group dataframe by type of ownership

control_grad = scorecard.groupby(["Ownership"])
```

In [38]:
```
# creates dataframe of just public universities

public = control_grad.get_group(1)

public.head()
```

Out[38]:

	School_Name	State	Degree_Type	Ownership	Earnings	Completion_Rate
0	Alabama A & M University	AL	3	1	35500.0	0.0643
1	University of Alabama at Birmingham	AL	3	1	48400.0	0.3018
3	University of Alabama in Huntsville	AL	3	1	52000.0	0.1533
4	Alabama State University	AL	3	1	30600.0	0.0725
5	The University of Alabama	AL	3	1	51600.0	0.4385

In [39]:
```
# creates dataframe of just private non-profit universities

nonprof = control_grad.get_group(2)

nonprof.head()
```

Out[39]:

	School_Name	State	Degree_Type	Ownership	Earnings	Completion_Rate
2	Amridge University	AL	3	2	47600.0	0.1429
10	Birmingham Southern College	AL	3	2	53100.0	0.6196
12	Concordia College Alabama	AL	3	2	25400.0	0.0056
16	Faulkner University	AL	3	2	40700.0	0.1810
23	Huntingdon College	AL	3	2	43600.0	0.2620

In [40]:
```
# creates dataframe of just for-profit universities

forprof = control_grad.get_group(3)

forprof.head()
```

Out[40]:

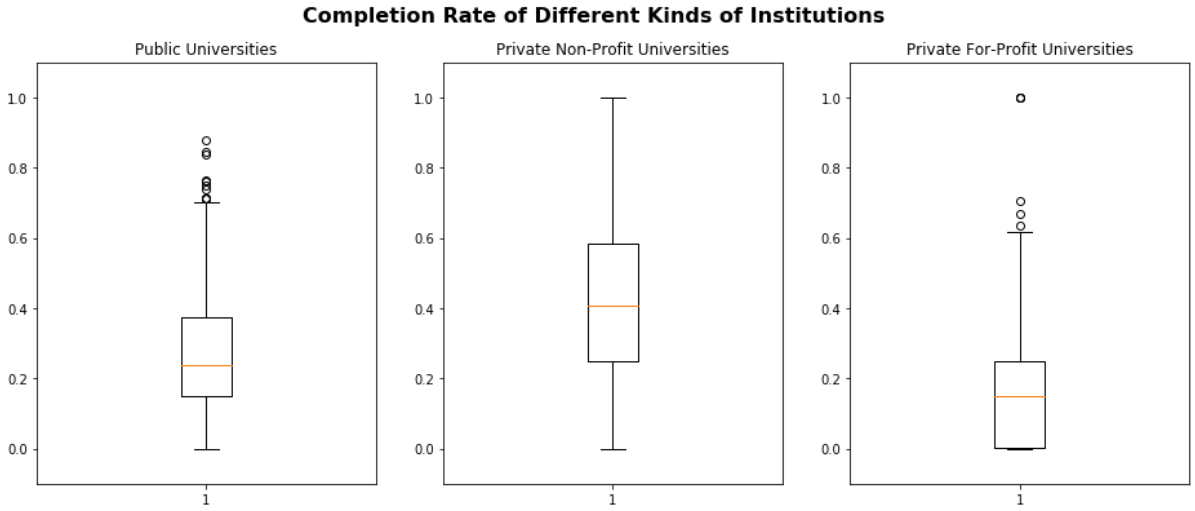
	School_Name	State	Degree_Type	Ownership	Earnings	Completion_Rate
13	South University-Montgomery	AL	3	3	40200.0	0.1053
82	Southwest University of Visual Arts-Tucson	AZ	3	3	32600.0	0.7059
95	Grand Canyon University	AZ	3	3	58500.0	0.3566
120	Western International University	AZ	3	3	42500.0	0.0049
184	Academy of Art University	CA	3	3	47300.0	0.0488

Public, Private Nonprofit, For-Profit Universities: Graduation Rates

In [41]:
```
# converting series into numpy arrays

pub_cr = public.Completion_Rate.get_values()

nonprof_cr = nonprof.Completion_Rate.get_values()

forprof_cr = forprof.Completion_Rate.get_values()
```

In [42]:
```
# removing NaN values

filtered_pub_cr = pub_cr[~np.isnan(pub_cr)]

filtered_nonprof_cr = nonprof_cr[~np.isnan(nonprof_cr)]

filtered_forprof_cr = forprof_cr[~np.isnan(forprof_cr)]
```

In [43]:
```
# plotting completion rates by type of institution

fig, ax = plt.subplots(nrows = 1, ncols = 3, figsize = (16, 6))

fig.suptitle("Completion Rate of Different Kinds of Institutions", fonts
ize = 16, fontweight = "bold")

ax[0].boxplot(filtered_pub_cr)
ax[0].set_title("Public Universities")

ax[1].boxplot(filtered_nonprof_cr)
ax[1].set_title("Private Non-Profit Universities")

ax[2].boxplot(filtered_forprof_cr)
ax[2].set_title("Private For-Profit Universities")

for var in ax:
    var.set_ylim(-0.1, 1.1)


plt.show()
```

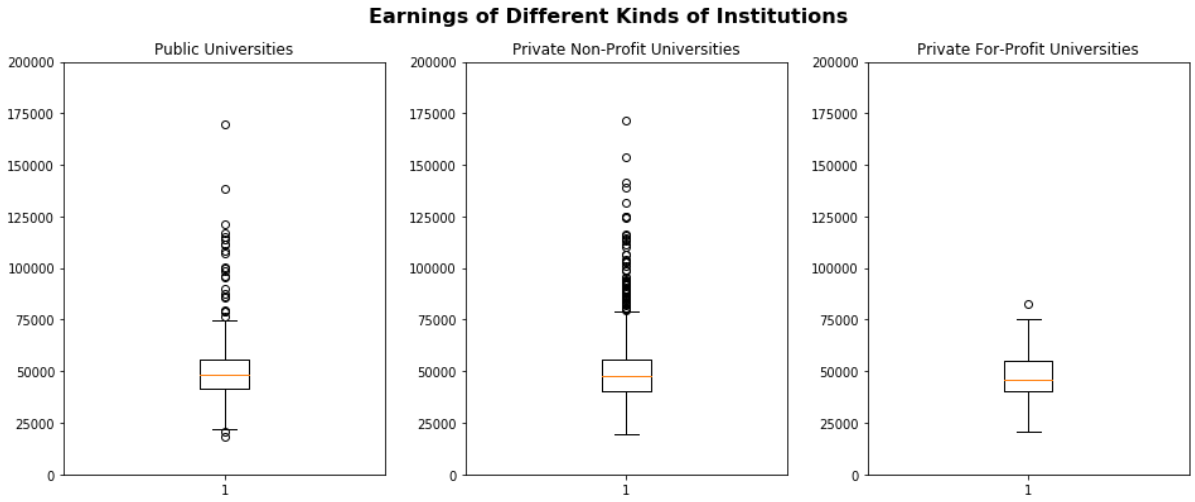


Public, Private Nonprofit, For-Profit Universities: Earnings

In [44]:
```
# converting series into numpy arrays

pub_earn = public.Earnings.get_values()

nonprof_earn = nonprof.Earnings.get_values()

forprof_earn = forprof.Earnings.get_values()
```

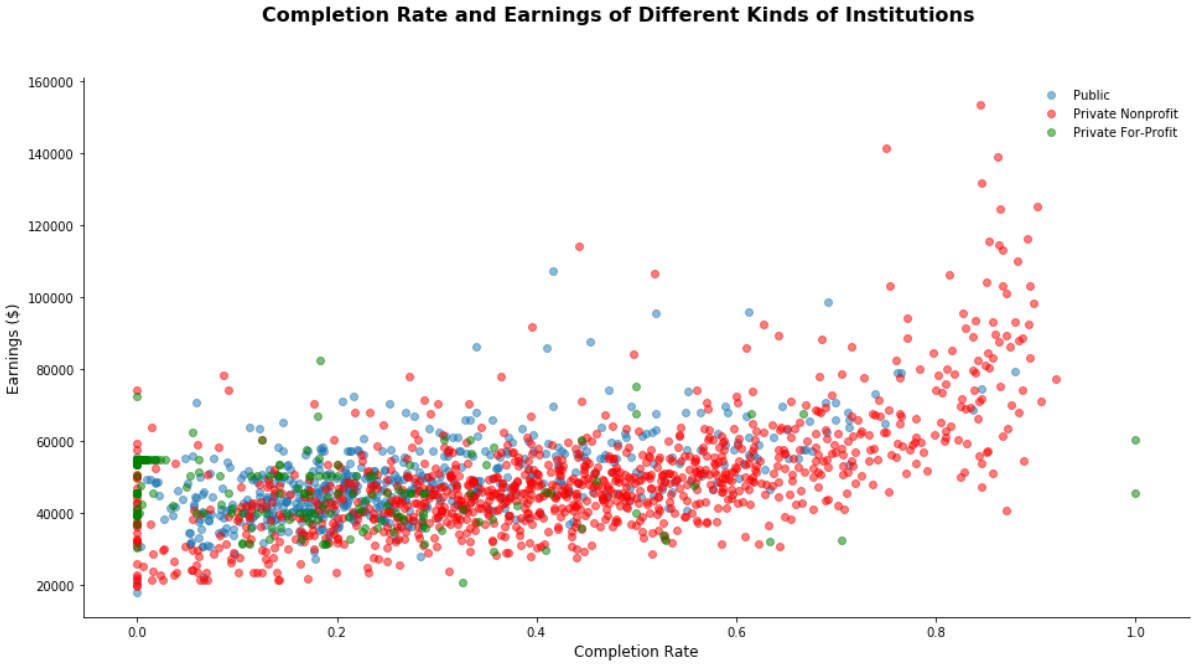
In [45]:
```
# removing NaN values

filtered_pub_earn = pub_earn[~np.isnan(pub_earn)]

filtered_nonprof_earn = nonprof_earn[~np.isnan(nonprof_earn)]

filtered_forprof_earn = forprof_earn[~np.isnan(forprof_earn)]
```

In [46]:
```
# plotting earnings by type of institution

fig, ax = plt.subplots(nrows = 1, ncols = 3, figsize = (16, 6))

fig.suptitle("Earnings of Different Kinds of Institutions", fontsize = 1
6, fontweight = "bold")

plt.subplots_adjust(left = None, bottom = None, right = None, top = None
, wspace = 0.25, hspace = None)

ax[0].boxplot(filtered_pub_earn)
ax[0].set_title("Public Universities")

ax[1].boxplot(filtered_nonprof_earn)
ax[1].set_title("Private Non-Profit Universities")

ax[2].boxplot(filtered_forprof_earn)
ax[2].set_title("Private For-Profit Universities")

for var in ax:
    var.set_ylim(0, 200000)

plt.show()
```



Public, Private Nonprofit, For-Profit Universities: Earnings and Completion Rate

In [47]:
```
# scatterplot comparing earnings and completion rates of each kind of in
stitution

fig, ax = plt.subplots(figsize = (16, 8))

fig.suptitle("Completion Rate and Earnings of Different Kinds of Institu
tions", fontsize = 16,
             fontweight = "bold")

ax.scatter(public["Completion_Rate"], public["Earnings"], alpha = 0.5, l
abel = "Public") # public
ax.scatter(nonprof["Completion_Rate"], nonprof["Earnings"], color = "r",
alpha = 0.5,
           label = "Private Nonprofit") # nonprofit
ax.scatter(forprof["Completion_Rate"], forprof["Earnings"], color = "g",
alpha = 0.5,
          label = "Private For-Profit") # for-profit

# legend
ax.legend(frameon = False)

# formatting
ax.set_xlabel("Completion Rate", fontsize = 12)
ax.set_ylabel("Earnings ($)", fontsize = 12)

ax.spines["right"].set_visible(False)
ax.spines["top"].set_visible(False)


plt.show()
```



Rankings

In this part, I want to examine whether or not rankings really matter for student success. To do so, I refer to US News & World Report's rankings, pulling the top 50 national universities and top 50 liberal arts colleges. By comparing the graduation rates and earnings data of these top institutions with rankings, I hope to understand the relationship between rankings and student success.

In [48]:
```
# creating new dataframe out of scorecard with the just the top 50 natio
nally ranked universities

nu_rank = scorecard[scorecard.School_Name.isin(ranking.NU_School)]
```

In [50]:
```
# rename column

nu_rank.rename(columns = {"School_Name": "NU_School"}, inplace = True)
```

In [51]:
```
# merging scorecard and nu_rank dataframes to compare school ranking wit
h earnings and completion rate

nu_rank_merged = pd.merge(nu_rank, ranking[["NU_School", "NU_Rank"]], on
= "NU_School", how = 'inner')


nu_rank_merged
```

Out[51]:

	NU_School	State	Degree_Type	Ownership	Earnings	Completion_Rate	NU_Rank
0	California Institute of Technology	CA	3	2	106300.0	0.8136	12
1	University of California-Berkeley	CA	3	1	79000.0	0.7618	22
2	University of California-Davis	CA	3	1	68100.0	0.5491	38
3	University of California-Irvine	CA	3	1	65800.0	0.7132	33
4	University of California-Los Angeles	CA	3	1	73200.0	0.7392	19
5	University of California-San Diego	CA	3	1	69600.0	0.5888	41
6	University of California-Santa Barbara	CA	3	1	62400.0	0.6907	30
7	Pepperdine University	CA	3	2	77600.0	0.7638	46
8	University of Southern California	CA	3	2	88800.0	0.7708	22
9	Yale University	CT	3	2	124400.0	0.8645	3
10	Georgetown University	DC	3	2	125200.0	0.9012	22
11	University of Florida	FL	3	1	65700.0	0.6738	35
12	Emory University	GA	3	2	84400.0	0.8516	21
13	University of Georgia	GA	3	1	59100.0	0.6220	46
14	University of Chicago	IL	3	2	103000.0	0.8944	3
15	University of Illinois at Urbana-Champaign	IL	3	1	70900.0	0.6988	46
16	Northwestern University	IL	3	2	93400.0	0.8396	10
17	University of Notre Dame	IN	3	2	98400.0	0.8979	18
18	Johns Hopkins University	MD	3	2	89300.0	0.8699	10
19	Boston College	MA	3	2	92500.0	0.8929	38
20	Boston University	MA	3	2	75900.0	0.8096	42
21	Brandeis University	MA	3	2	69000.0	0.8294	35
22	Harvard University	MA	3	2	139100.0	0.8623	2
23	Massachusetts Institute of Technology	MA	3	2	153600.0	0.8448	3
24	Northeastern University	MA	3	2	74200.0	0.0000	44

	NU_School	State	Degree_Type	Ownership	Earnings	Completion_Rate	NU_Rank
25	Tufts University	MA	3	2	103300.0	0.8667	27
26	University of Michigan-Ann Arbor	MI	3	1	79000.0	0.7650	27
27	Washington University in St Louis	MO	3	2	87900.0	0.8833	19
28	Dartmouth College	NH	3	2	110200.0	0.8812	12
29	Princeton University	NJ	3	2	116300.0	0.8917	1
30	Cornell University	NY	3	2	101200.0	0.8711	16
31	New York University	NY	3	2	78600.0	0.8186	30
32	Rensselaer Polytechnic Institute	NY	3	2	86000.0	0.6102	49
33	University of Rochester	NY	3	2	74300.0	0.0920	33
34	Duke University	NC	3	2	114500.0	0.8634	8
35	University of North Carolina at Chapel Hill	NC	3	1	68800.0	0.8365	30
36	Wake Forest University	NC	3	2	79600.0	0.8373	27
37	Case Western Reserve University	OH	3	2	89300.0	0.6428	42
38	Carnegie Mellon University	PA	3	2	103000.0	0.7540	25
39	University of Pennsylvania	PA	3	2	131600.0	0.8460	8
40	Villanova University	PA	3	2	87600.0	0.8634	49
41	Brown University	RI	3	2	89100.0	0.8368	14
42	Vanderbilt University	TN	3	2	86200.0	0.8742	14
43	Rice University	TX	3	2	91600.0	0.8294	16
44	The University of Texas at Austin	TX	3	1	73900.0	0.5512	49
45	College of William and Mary	VA	3	1	74500.0	0.8453	38
46	University of Wisconsin-Madison	WI	3	1	68000.0	0.5637	49
47	Stanford University	CA	3	2	141300.0	0.7500	7

In [52]:
```
# creating new dataframe out of scorecard with the just the top 50 liber
al arts colleges

la_rank = scorecard[scorecard.School_Name.isin(ranking.LA_School)]
```

In [53]:
```
# same as nu_rank
la_rank.rename(columns = {"School_Name": "LA_School", "State": "LA_Stat
e"}, inplace = True)
```

In [55]:
```
#same as la_rank_merged

la_rank_merged = pd.merge(la_rank, ranking[["LA_School", "LA_Rank"]], on
= "LA_School", how = 'inner')

la_rank_merged
```

Out[55]:

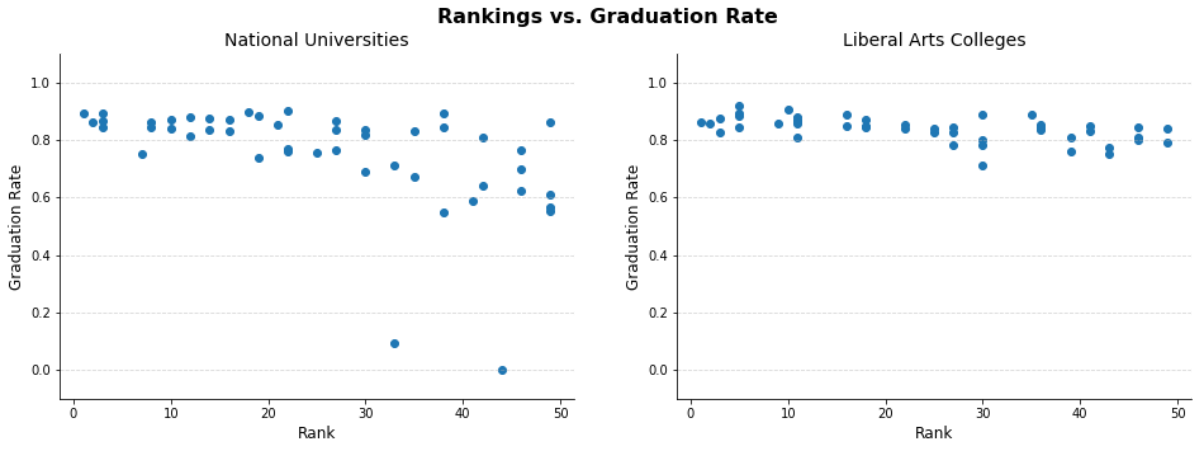
	LA_School	LA_State	Degree_Type	Ownership	Earnings	Completion_Rate	LA_Rank
0	Claremont McKenna College	CA	3	2	93200.0	0.8567	9.0
1	Harvey Mudd College	CA	3	2	104200.0	0.8505	18.0
2	Occidental College	CA	3	2	59400.0	0.7609	39.0
3	Pitzer College	CA	3	2	51500.0	0.8285	41.0
4	Pomona College	CA	3	2	77300.0	0.9202	5.0
5	Scripps College	CA	3	2	61800.0	0.7985	30.0
6	Thomas Aquinas College	CA	3	2	45900.0	0.7529	43.0
7	Colorado College	CO	3	2	49900.0	0.8243	27.0
8	Connecticut College	CT	3	2	62900.0	0.8094	46.0
9	Trinity College	CT	3	2	74300.0	0.8003	46.0
10	Wesleyan University	CT	3	2	63400.0	0.8717	18.0
11	Grinnell College	IA	3	2	61000.0	0.8096	11.0
12	Centre College	KY	3	2	53800.0	0.8455	46.0
13	Union College	KY	3	2	36400.0	0.2602	39.0
14	Union College	NE	3	2	47700.0	0.2338	39.0
15	Union College	NY	3	2	80200.0	0.8105	39.0
16	Bates College	ME	3	2	74300.0	0.8384	22.0
17	Bowdoin College	ME	3	2	83300.0	0.8935	5.0
18	Colby College	ME	3	2	71000.0	0.8430	18.0
19	Amherst College	MA	3	2	83300.0	0.8569	2.0
20	College of the Holy Cross	MA	3	2	88600.0	0.8872	35.0
21	Mount Holyoke College	MA	3	2	53900.0	0.7805	30.0
22	Smith College	MA	3	2	51100.0	0.8571	11.0
23	Wellesley College	MA	3	2	71800.0	0.8257	3.0
24	Williams College	MA	3	2	89800.0	0.8595	1.0
25	Carleton College	MN	3	2	67900.0	0.8826	5.0
26	Macalester College	MN	3	2	55800.0	0.8427	27.0
27	Barnard College	NY	3	2	69700.0	0.8246	25.0
28	Colgate University	NY	3	2	81100.0	0.8492	16.0
29	Hamilton College	NY	3	2	74300.0	0.8865	16.0

	LA_School	LA_State	Degree_Type	Ownership	Earnings	Completion_Rate	LA_Rank
30	Skidmore College	NY	3	2	57000.0	0.8503	41.0
31	Vassar College	NY	3	2	61500.0	0.8662	11.0
32	Davidson College	NC	3	2	71100.0	0.9058	10.0
33	Denison University	OH	3	2	57600.0	0.7737	43.0
34	Kenyon College	OH	3	2	54500.0	0.8882	30.0
35	Oberlin College	OH	3	2	45500.0	0.7110	30.0
36	Bryn Mawr College	PA	3	2	61000.0	0.7805	27.0
37	Bucknell University	PA	3	2	82400.0	0.8418	36.0
38	Franklin and Marshall College	PA	3	2	69200.0	0.8347	36.0
39	Gettysburg College	PA	3	2	66300.0	0.8417	49.0
40	Haverford College	PA	3	2	75100.0	0.8646	11.0
41	Lafayette College	PA	3	2	80500.0	0.8534	36.0
42	Swarthmore College	PA	3	2	70000.0	0.8760	3.0
43	Sewanee-The University of the South	TN	3	2	51700.0	0.7905	49.0
44	Middlebury College	VT	3	2	71900.0	0.8458	5.0
45	University of Richmond	VA	3	2	78900.0	0.8395	25.0
46	Washington and Lee University	VA	3	2	93300.0	0.8787	11.0
47	Soka University of America	CA	3	2	NaN	0.8544	22.0

In [56]:
```
# dropping the wrong Union Colleges

la_rank_merged = la_rank_merged.drop([13, 14], axis = 0)
```

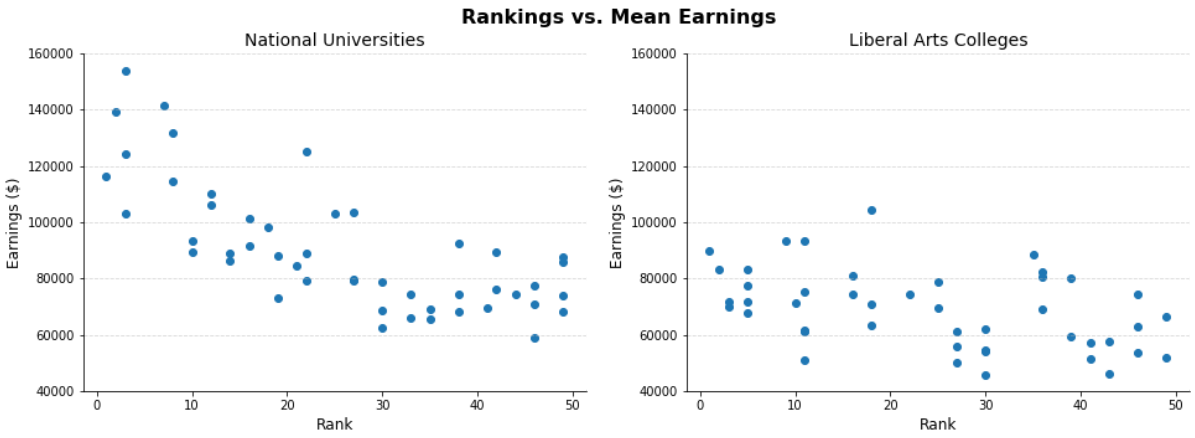
Rankings vs. Graduation Rate

In [57]:
```
# examining the relationship with rankings and graduation rates
# Does ranking really matter?

fig, ax = plt.subplots(nrows = 1, ncols = 2, figsize = (16, 5))

fig.suptitle("Rankings vs. Graduation Rate", fontsize = 16, fontweight =
"bold")

# NATIONAL UNIVERSITY RANK VS. GRADUATION RATE
ax[0].scatter(nu_rank_merged["NU_Rank"], nu_rank_merged["Completion_Rat
e"])

ax[0].set_title("National Universities", fontsize = 14)


# LIBERAL ARTS COLLEGE RANK VS. GRADUATION RATE
ax[1].scatter(la_rank_merged["LA_Rank"], la_rank_merged["Completion_Rat
e"])

ax[1].set_title("Liberal Arts Colleges", fontsize = 14)

# formatting
for var in ax:

    var.set_ylim(-0.1, 1.1)
    var.set_xlabel("Rank", fontsize = 12)
    var.set_ylabel("Graduation Rate", fontsize = 12)

    var.spines["right"].set_visible(False)
    var.spines["top"].set_visible(False)

    var.yaxis.grid(alpha= 0.5, linestyle= "--")

plt.show()

# note:  the two data points on the National Universities scatter plot a
re seemingly outliers.
# upon further examination, the data pulled from College Scorecard may o
r may not have mistakes.
```



Rankings vs. Mean Earnings

In [58]:
```
# examining the relationship with rankings and earnings
# Does ranking really matter?

fig, ax = plt.subplots(nrows = 1, ncols = 2, figsize = (16, 5))

fig.suptitle("Rankings vs. Mean Earnings", fontsize = 16, fontweight =
"bold")

# NATIONAL UNIVERSITY RANK VS. EARNINGS
ax[0].scatter(nu_rank_merged["NU_Rank"], nu_rank_merged["Earnings"])

ax[0].set_title("National Universities", fontsize = 14)

# LIBERAL ARTS COLLEGE RANK VS. EARNINGS
ax[1].scatter(la_rank_merged["LA_Rank"], la_rank_merged["Earnings"])

ax[1].set_title("Liberal Arts Colleges", fontsize = 14)

# formatting
for var in ax:

    var.set_ylim(40000, 160000)

    var.set_xlabel("Rank", fontsize = 12)
    var.set_ylabel("Earnings ($)", fontsize = 12)

    var.spines["right"].set_visible(False)
    var.spines["top"].set_visible(False)

    var.yaxis.grid(alpha= 0.5, linestyle= "--")


plt.show()
```



Graduation and Earnings Based on State

In [59]:

```
# grouping schools by state

state_group = scorecard.groupby(["State"])

transform_dict = {"Earnings": "mean", "Completion_Rate": "mean"}

# aggregating data to find the mean earnings and mean completion rate fo
r each state

state_agg = state_group.agg(transform_dict)

# dropping Guam and Puerto Rico from the data

state_agg = state_agg.drop(["GU", "PR"], axis = 0)

state_agg
```

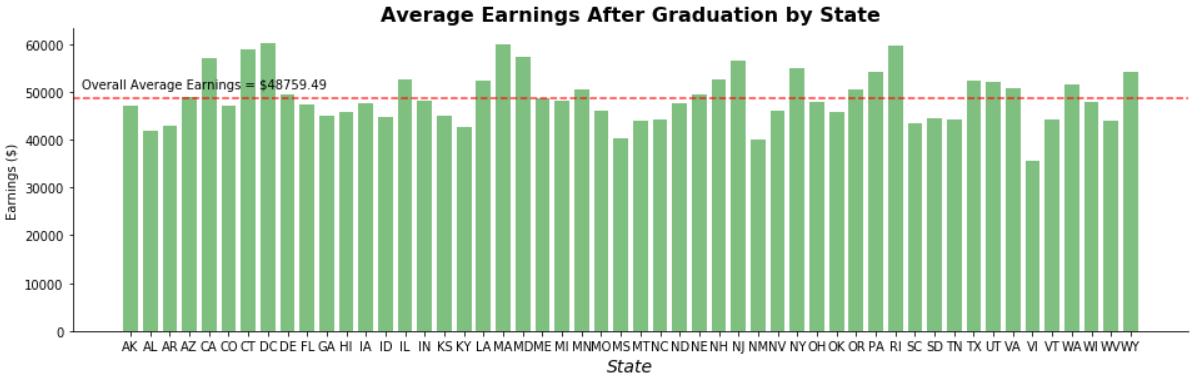
Out[59]:

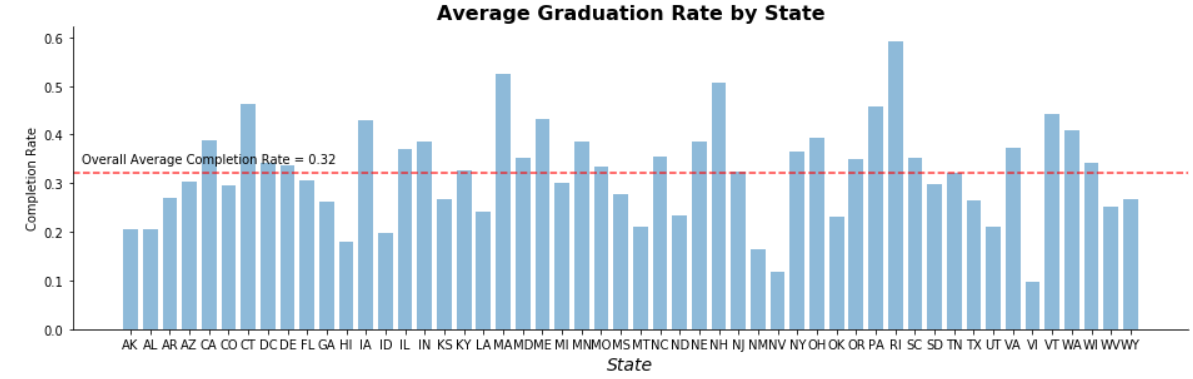
State	Earnings	Completion_Rate
AK	47200.000000	0.206333
AL	41990.625000	0.206650
AR	42950.000000	0.269490
AZ	48973.913043	0.302918
CA	57203.225806	0.389475
CO	47203.448276	0.294607
CT	58920.000000	0.463604
DC	60300.000000	0.343167
DE	49500.000000	0.336900
FL	47304.615385	0.305798
GA	45092.857143	0.262621
HI	45877.777778	0.180422
IA	47741.176471	0.429836
ID	44755.555556	0.198456
IL	52506.493506	0.370362
IN	48238.000000	0.385044
KS	45026.666667	0.268055
KY	42625.000000	0.325504
LA	52244.000000	0.242250
MA	59910.810811	0.525924
MD	57332.142857	0.351042
ME	48805.555556	0.431372
MI	48286.666667	0.301528
MN	50619.512195	0.385839
MO	45941.509434	0.335465
MS	40225.000000	0.278700
MT	43888.888889	0.210556
NC	44322.807018	0.355398
ND	47644.444444	0.233478
NE	49533.333333	0.386305
NH	52723.076923	0.506473
NJ	56629.411765	0.323189
NM	40000.000000	0.163514

State	Earnings	Completion_Rate
NV	46014.285714	0.117425
NY	55055.303030	0.364510
OH	47808.219178	0.392678
OK	45750.000000	0.231889
OR	50655.172414	0.350911
PA	54228.455285	0.458384
RI	59690.000000	0.592411
SC	43319.444444	0.352375
SD	44600.000000	0.297633
TN	44328.888889	0.320578
TX	52291.208791	0.264281
UT	52153.846154	0.209677
VA	50861.111111	0.373517
VI	35500.000000	0.096200
VT	44233.333333	0.441847
WA	51540.000000	0.409210
WI	47822.500000	0.340672
WV	43925.000000	0.251979
WY	54200.000000	0.266000

In [60]:

```
fig, ax = plt.subplots(nrows = 2, ncols = 1, figsize = (16, 10))

plt.subplots_adjust(left = None, bottom = None, right = None, top = None
, wspace = None, hspace = 0.25)

# MEAN EARNINGS BY STATE
ax[0].bar(state_agg.index, state_agg["Earnings"], width = 0.75, color =
"g", alpha = 0.5)

ax[0].set_title("Average Earnings After Graduation by State", fontsize =
16, fontweight = "bold") # graph title
ax[0].set_ylabel("Earnings ($)") # y-axis label

# overall average earnings for the country
ax[0].axhline(y = state_agg["Earnings"].mean(), color = "r", alpha = 0.7
5, linestyle = "--", linewidth = 1.5)

# label for the horizontal line created in line 12
ax[0].text(-2.5, state_agg["Earnings"].mean() + 2000,
           "Overall Average Earnings = $" + str(round(state_agg["Earning
s"].mean(), 2)), fontsize = 10,
           horizontalalignment='left')


# MEAN GRADUATION RATE BY STATE
ax[1].bar(state_agg.index, state_agg["Completion_Rate"], width = 0.75, a
lpha = 0.5)

ax[1].set_title("Average Graduation Rate by State", fontsize = 16, fontw
eight = "bold") # graph title
ax[1].set_ylabel("Completion Rate") # y-axis label

# overall average graduation rate for the country
ax[1].axhline(y = state_agg["Completion_Rate"].mean(), color = "r", alph
a = 0.75, linestyle = "--",
              linewidth = 1.5)

# label for the horizontal line created in line 27
ax[1].text(-2.5, state_agg["Completion_Rate"].mean() + 0.02,
           "Overall Average Completion Rate = " + str(round(state_agg["C
ompletion_Rate"].mean(), 2)),
           fontsize = 10, horizontalalignment='left')

# formatting
for var in ax:
    var.set_xlabel("State", fontsize = 14, fontstyle = "italic")

    var.spines["right"].set_visible(False)
    var.spines["top"].set_visible(False)


plt.show()
```


Average Earnings After Graduation by State
Overall Average Earnings = $48759.49
Earnings ($)
0
10000
20000
30000
40000
50000
60000
AK AL AR AZ CA CO CT DC DE FL GA HI IA ID IL IN KS KY LA MA MD ME MI MN MO MS MT NC ND NE NH NJ NM NV NY OH OK OR PA RI SC SD TN TX UT VA VI VT WA WI WV WY
State


Average Graduation Rate by State
Overall Average Completion Rate = 0.32
Completion Rate
0.0
0.1
0.2
0.3
0.4
0.5
0.6
AK AL AR AZ CA CO CT DC DE FL GA HI IA ID IL IN KS KY LA MA MD ME MI MN MO MS MT NC ND NE NH NJ NM NV NY OH OK OR PA RI SC SD TN TX UT VA VI VT WA WI WV WY
State

Conclusion

After conducting all of the comparisons across various factors, I have found the following for each of the factors.

Control

Public and private nonprofit universities have higher median completion rates than private forprofit universities. However, the median earnings for the three kinds of universities are approximately the same. Public and private nonprofit universities have significantly higher earnings outside of the interquartile range.

Rankings

When comparing the top 50 national universities and liberal arts colleges, there seems to be a slight correlation where higher ranked universities have higher completion rates. This difference is much more pronounced for national universities than it is for liberal arts colleges. The opposite is true when it comes to earnings - higher ranked national universities have higher mean earnings than those that are ranked lower.

State

While average graduation rates of each state vary a lot, the average earnings after graduation by state vary less so. In many cases, states that have below-average graduation rates also have below-average earnings after graduation.

Final Thoughts

While some conclusions can be drawn from the data, these insights can be broken down even further. For example, I only examined 4-year graduation rates, but schools themselves often look at 6-year graduation rates. Furthermore, in the rankings comparisons, there are many other factors at play that affect graduation rates and earnings, such as students who leave school to start their own businesses, transfers, and college major.

In [ ]: