Minneapolis College Library Springshare Data Analysis

Sessions

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5/2023

In [1]:
```
# Import dependencies

from datetime import datetime as dt
from scipy import stats as st

import matplotlib.pyplot as plt
import matplotlib.dates as mdates
import pandas as pd
```

In [2]:
```
sessions_df_alltime = pd.read_csv("sessions_alltime.csv")
sessions_df_alltime
```

Out[2]:

	Date	Sessions
0	2014-03	54
1	2014-04	218
2	2014-05	108
3	2014-06	92
4	2014-07	70
...	...	...
106	2023-01	1789
107	2023-02	2043
108	2023-03	1765
109	2023-04	1671
110	2023-05	169

111 rows × 2 columns

In [3]:
```
# # Remove first and last rows with minimal data

# sessions_df_alltime = sessions_df_alltime.iloc[1:-1]
# sessions_df_alltime = sessions_df_alltime.reset_index(drop=True)

# sessions_df_alltime
```

In [4]:
```
# Get basic info on this dataset

sessions_df_alltime.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 111 entries, 0 to 110
Data columns (total 2 columns):
 #   Column    Non-Null Count  Dtype 
---  ------    --------------  ----- 
 0   Date      111 non-null    object
 1   Sessions  111 non-null    int64 
dtypes: int64(1), object(1)
memory usage: 1.9+ KB
```

In [5]:
```
# Checking for null values in Views column

sessions_df_alltime["Sessions"].isna().sum()
```

Out[5]:
```
0
```

In [6]:
```
# Summary stats for Total column

sessions_df_alltime["Sessions"].describe()
```

Out[6]:
```
count     111.000000
mean     1204.297297
std       910.672045
min        47.000000
25%       294.500000
50%      1096.000000
75%      1928.000000
max      2925.000000
Name: Sessions, dtype: float64
```

In [7]:
```
sessions_df_alltime["Date"] = pd.to_datetime(sessions_df_alltime["Date"])
```

In [8]:
```
sessions_df_alltime.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 111 entries, 0 to 110
Data columns (total 2 columns):
 #   Column    Non-Null Count  Dtype         
---  ------    --------------  -----         
 0   Date      111 non-null    datetime64[ns]
 1   Sessions  111 non-null    int64         
dtypes: datetime64[ns](1), int64(1)
memory usage: 1.9 KB
```

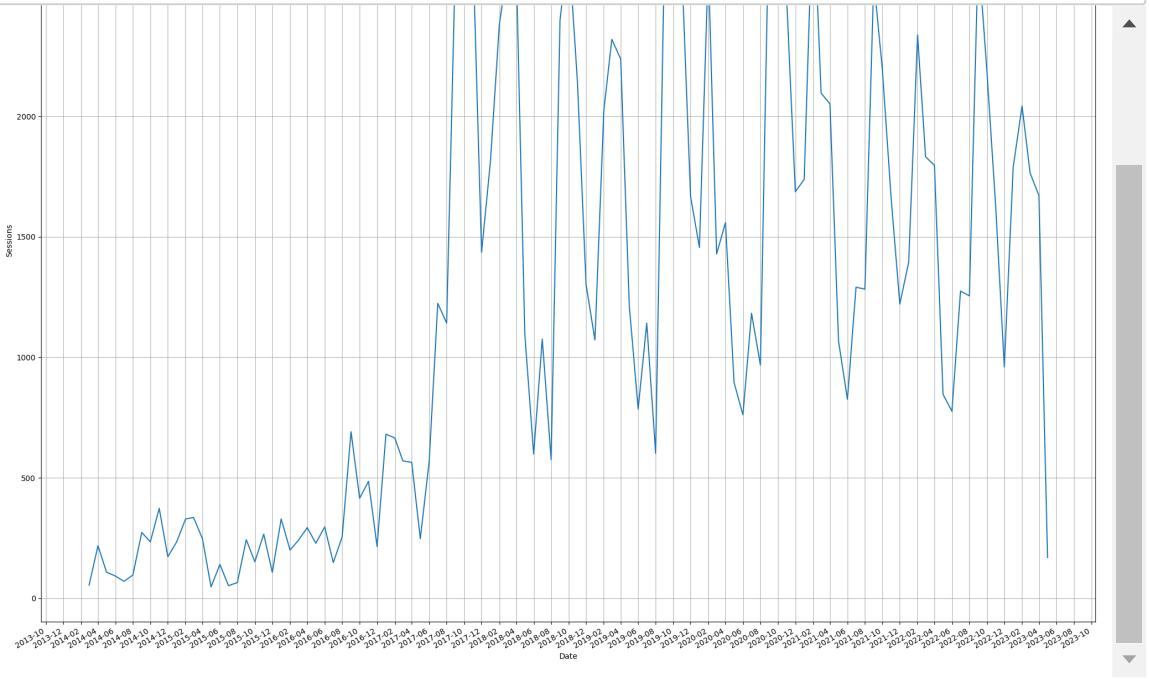
In [9]:
```
sessions_df_alltime
```

Out[9]:

	Date	Sessions
0	2014-03-01	54
1	2014-04-01	218
2	2014-05-01	108
3	2014-06-01	92
4	2014-07-01	70
...	...	...
106	2023-01-01	1789
107	2023-02-01	2043
108	2023-03-01	1765
109	2023-04-01	1671
110	2023-05-01	169

111 rows × 2 columns

In [10]:
```
fig, ax = plt.subplots(figsize=(20, 15))

ax.set_title("Sessions Views by Date (2014-present)")
ax.grid(True)
ax.set_xlabel("Date")
ax.set_ylabel("Sessions")

month_locator = mdates.MonthLocator(interval=2)
year_month_formatter = mdates.DateFormatter("%Y-%m") # four digits for year

# Same as above
ax.xaxis.set_major_locator(month_locator)
ax.xaxis.set_major_formatter(year_month_formatter)
ax.plot(sessions_df_alltime["Date"], sessions_df_alltime["Sessions"])

fig.autofmt_xdate()
plt.tight_layout()

fig.savefig("Sessions/sessions.png")
```



Analysis by Terms

In [11]:
```
sessions_summer_terms = sessions_df_alltime.loc[(sessions_df_alltime["Date"
                                                (sessions_df_alltime["Date"].dt.mont
                                                (sessions_df_alltime["Date"].dt.mont
sessions_summer_terms = sessions_summer_terms.reset_index(drop=True)

sessions_summer_terms["Formatted_Date"] = sessions_summer_terms["Date"].dt.

sessions_summer_terms
```

Out[11]:

	Date	Sessions	Formatted_Date
0	2014-05-01	108	05-2014
1	2014-06-01	92	06-2014
2	2014-07-01	70	07-2014
3	2015-05-01	47	05-2015
4	2015-06-01	140	06-2015
5	2015-07-01	52	07-2015
6	2016-05-01	228	05-2016
7	2016-06-01	296	06-2016
8	2016-07-01	148	07-2016
9	2017-05-01	247	05-2017
10	2017-06-01	568	06-2017
11	2017-07-01	1224	07-2017
12	2018-05-01	1096	05-2018
13	2018-06-01	598	06-2018
14	2018-07-01	1076	07-2018
15	2019-05-01	1213	05-2019
16	2019-06-01	785	06-2019
17	2019-07-01	1142	07-2019
18	2020-05-01	895	05-2020
19	2020-06-01	761	06-2020
20	2020-07-01	1183	07-2020
21	2021-05-01	1066	05-2021
22	2021-06-01	826	06-2021
23	2021-07-01	1291	07-2021
24	2022-05-01	846	05-2022
25	2022-06-01	776	06-2022
26	2022-07-01	1275	07-2022
27	2023-05-01	169	05-2023

In [12]:

```
sessions_fall_terms = sessions_df_alltime.loc[(sessions_df_alltime["Date"].
                                               (sessions_df_alltime["Date"].dt.mont
                                               (sessions_df_alltime["Date"].dt.mont
                                               (sessions_df_alltime["Date"].dt.mont
                                               (sessions_df_alltime["Date"].dt.mont
sessions_fall_terms = sessions_fall_terms.reset_index(drop=True)

sessions_fall_terms["Formatted_Date"] = sessions_fall_terms["Date"].dt.str

sessions_fall_terms
```

Out[12]:

	Date	Sessions	Formatted_Date
0	2014-08-01	96	08-2014
1	2014-09-01	273	09-2014
2	2014-10-01	234	10-2014
3	2014-11-01	373	11-2014
4	2014-12-01	172	12-2014
5	2015-08-01	65	08-2015
6	2015-09-01	243	09-2015
7	2015-10-01	151	10-2015
8	2015-11-01	266	11-2015
9	2015-12-01	107	12-2015
10	2016-08-01	254	08-2016
11	2016-09-01	691	09-2016
12	2016-10-01	415	10-2016
13	2016-11-01	485	11-2016
14	2016-12-01	215	12-2016
15	2017-08-01	1142	08-2017
16	2017-09-01	2671	09-2017
17	2017-10-01	2817	10-2017
18	2017-11-01	2678	11-2017
19	2017-12-01	1436	12-2017
20	2018-08-01	575	08-2018
21	2018-09-01	2400	09-2018
22	2018-10-01	2710	10-2018
23	2018-11-01	2140	11-2018
24	2018-12-01	1302	12-2018
25	2019-08-01	602	08-2019
26	2019-09-01	2698	09-2019
27	2019-10-01	2923	10-2019
28	2019-11-01	2599	11-2019
29	2019-12-01	1668	12-2019
30	2020-08-01	968	08-2020
31	2020-09-01	2917	09-2020
32	2020-10-01	2796	10-2020
33	2020-11-01	2481	11-2020
34	2020-12-01	1687	12-2020

	Date	Sessions	Formatted_Date
35	2021-08-01	1283	08-2021
36	2021-09-01	2567	09-2021
37	2021-10-01	2194	10-2021
38	2021-11-01	1655	11-2021
39	2021-12-01	1221	12-2021
40	2022-08-01	1255	08-2022
41	2022-09-01	2686	09-2022
42	2022-10-01	2191	10-2022
43	2022-11-01	1625	11-2022
44	2022-12-01	960	12-2022

In [13]:

```
sessions_spring_terms = sessions_df_alltime.loc[(sessions_df_alltime["Date"
                                                (sessions_df_alltime["Date"].dt.mont
                                                (sessions_df_alltime["Date"].dt.mont
                                                (sessions_df_alltime["Date"].dt.mont
sessions_spring_terms = sessions_spring_terms.reset_index(drop=True)

sessions_spring_terms["Formatted_Date"] = sessions_spring_terms["Date"].dt.

sessions_spring_terms
```

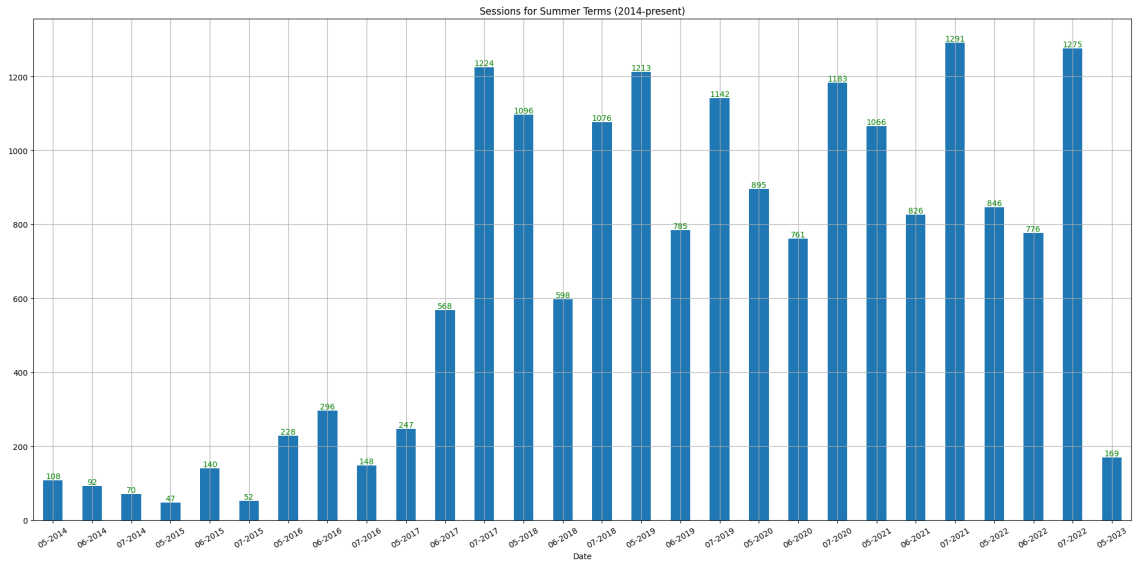
Out[13]:

	Date	Sessions	Formatted_Date
0	2014-03-01	54	03-2014
1	2014-04-01	218	04-2014
2	2015-01-01	234	01-2015
3	2015-02-01	329	02-2015
4	2015-03-01	335	03-2015
5	2015-04-01	247	04-2015
6	2016-01-01	329	01-2016
7	2016-02-01	200	02-2016
8	2016-03-01	240	03-2016
9	2016-04-01	293	04-2016
10	2017-01-01	681	01-2017
11	2017-02-01	665	02-2017
12	2017-03-01	570	03-2017
13	2017-04-01	564	04-2017
14	2018-01-01	1814	01-2018
15	2018-02-01	2380	02-2018
16	2018-03-01	2610	03-2018
17	2018-04-01	2633	04-2018
18	2019-01-01	1072	01-2019
19	2019-02-01	2024	02-2019
20	2019-03-01	2320	03-2019
21	2019-04-01	2238	04-2019
22	2020-01-01	1456	01-2020
23	2020-02-01	2635	02-2020
24	2020-03-01	1429	03-2020
25	2020-04-01	1559	04-2020
26	2021-01-01	1739	01-2021
27	2021-02-01	2925	02-2021
28	2021-03-01	2097	03-2021
29	2021-04-01	2052	04-2021
30	2022-01-01	1395	01-2022
31	2022-02-01	2338	02-2022
32	2022-03-01	1832	03-2022
33	2022-04-01	1797	04-2022
34	2023-01-01	1789	01-2023

	Date	Sessions	Formatted_Date
35	2023-02-01	2043	02-2023
36	2023-03-01	1765	03-2023
37	2023-04-01	1671	04-2023

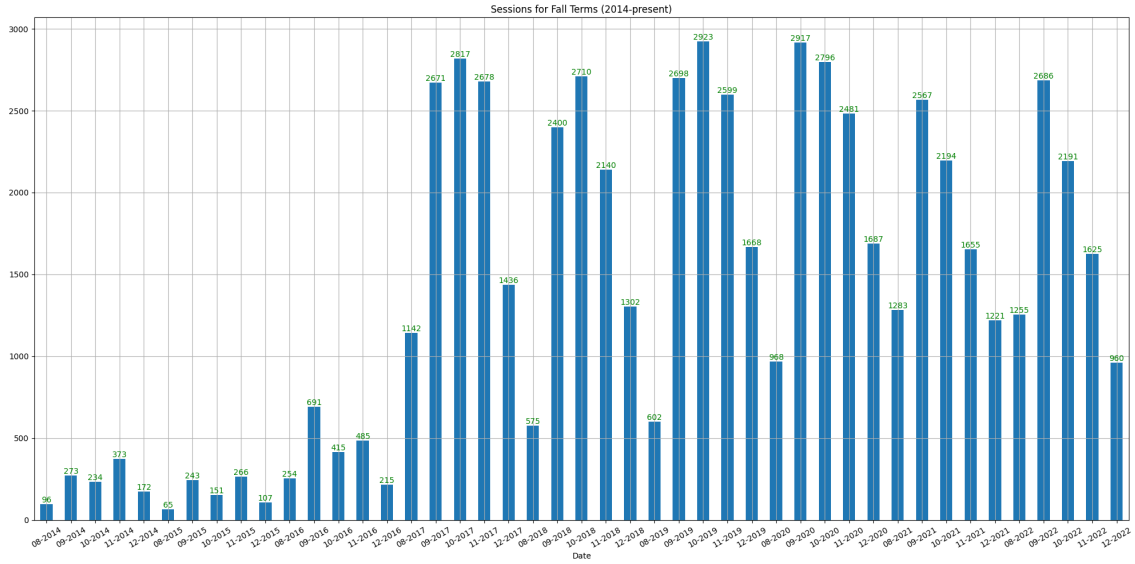
In [14]:

```
ax = sessions_summer_terms.plot(
        x="Formatted_Date",
        y="Sessions",
        figsize=(20,10),
        kind="bar",
        legend=False,
        grid=True,
        rot=30,
        xlabel="Date",
        title=f"Sessions for Summer Terms (2014-present)")

ax.bar_label(ax.containers[0], color="green")
plt.tight_layout()

plt.savefig("Sessions/sessions_summers.png")

plt.show()
```

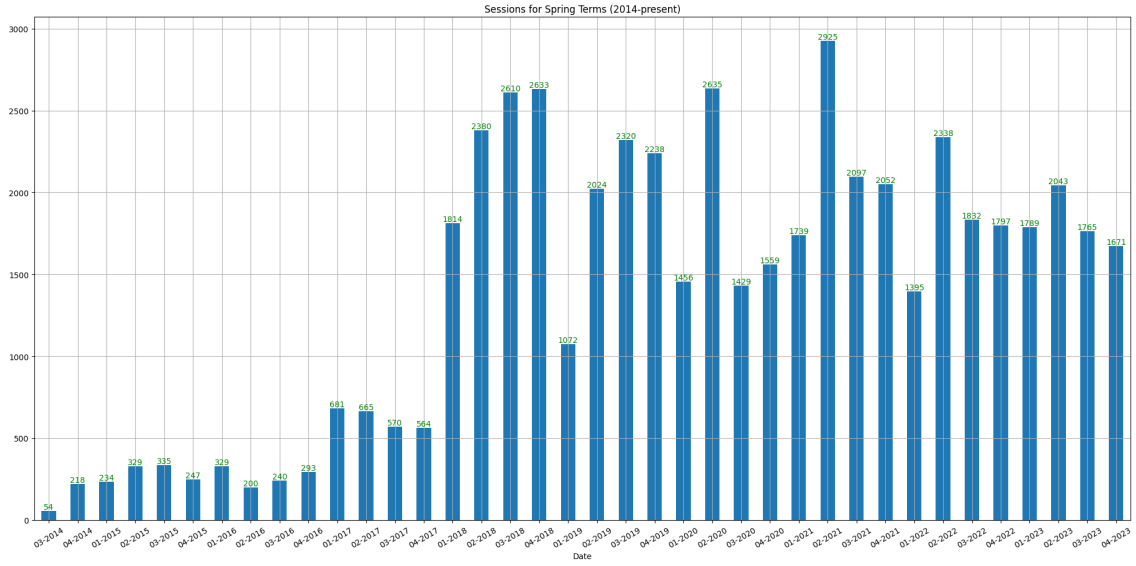


In [15]:

```
ax = sessions_fall_terms.plot(
        x="Formatted_Date",
        y="Sessions",
        figsize=(20,10),
        kind="bar",
        legend=False,
        grid=True,
        rot=30,
        xlabel="Date",
        title=f"Sessions for Fall Terms (2014-present)")

ax.bar_label(ax.containers[0], color="green")
plt.tight_layout()

plt.savefig("Sessions/sessions_fall.png")

plt.show()
```



In [16]:
```
ax = sessions_spring_terms.plot(
        x="Formatted_Date",
        y="Sessions",
        figsize=(20,10),
        kind="bar",
        legend=False,
        grid=True,
        rot=30,
        xlabel="Date",
        title=f"Sessions for Spring Terms (2014-present)")

ax.bar_label(ax.containers[0], color="green")
plt.tight_layout()

plt.savefig("Sessions/sessions_spring.png")

plt.show()
```

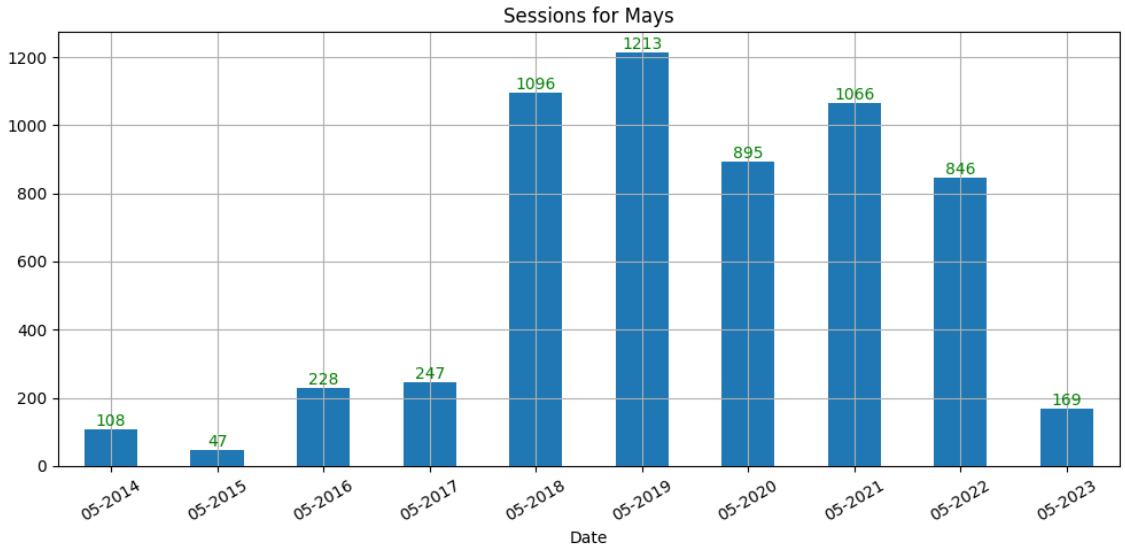


In [17]:
```
sessions_summer_bymonth = sessions_summer_terms.sort_values(by="Formatted_D
sessions_summer_bymonth

mays = sessions_summer_bymonth.loc[ (sessions_summer_bymonth["Formatted_Dat
junes = sessions_summer_bymonth.loc[ (sessions_summer_bymonth["Formatted_Da
julys = sessions_summer_bymonth.loc[ (sessions_summer_bymonth["Formatted_Da
```

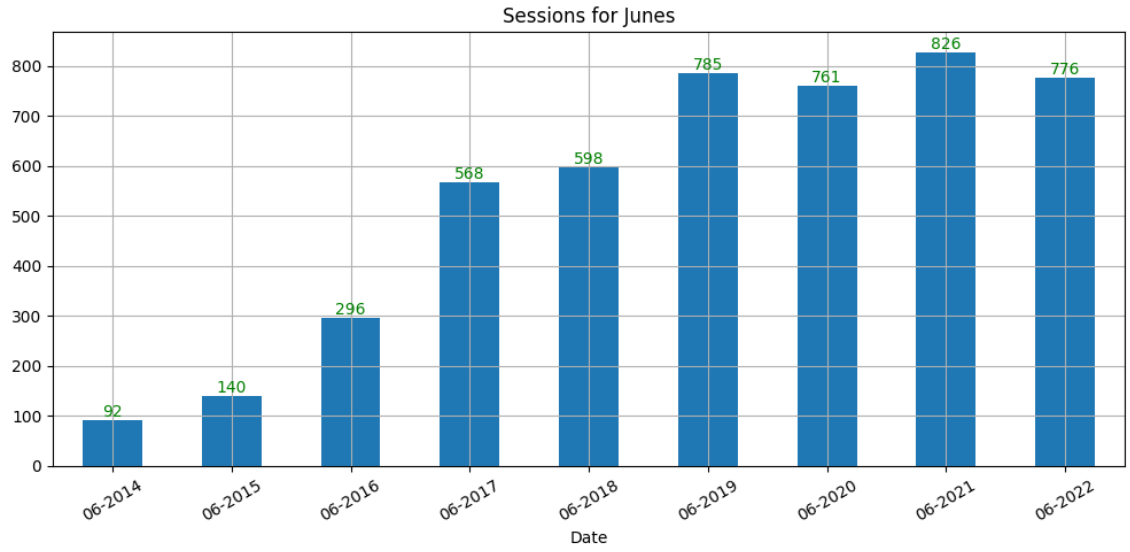
In [18]:
```
sessions_fall_bymonth = sessions_fall_terms.sort_values(by="Formatted_Date"
sessions_fall_bymonth = sessions_fall_bymonth.reset_index(drop=True)
sessions_fall_bymonth

augusts = sessions_fall_bymonth.loc[ (sessions_fall_bymonth["Formatted_Date
septembers = sessions_fall_bymonth.loc[ (sessions_fall_bymonth["Formatted_D
octobers = sessions_fall_bymonth.loc[ (sessions_fall_bymonth["Formatted_Dat
novembers = sessions_fall_bymonth.loc[ (sessions_fall_bymonth["Formatted_Da
decembers = sessions_fall_bymonth.loc[ (sessions_fall_bymonth["Formatted_Da
```

In [19]:
```
sessions_spring_bymonth = sessions_spring_terms.sort_values(by="Formatted_D
sessions_spring_bymonth = sessions_spring_bymonth.reset_index(drop=True)
sessions_spring_bymonth

januarys = sessions_spring_bymonth.loc[ (sessions_spring_bymonth["Formatted
februarys = sessions_spring_bymonth.loc[ (sessions_spring_bymonth["Formatte
marchs = sessions_spring_bymonth.loc[ (sessions_spring_bymonth["Formatted_D
aprils = sessions_spring_bymonth.loc[ (sessions_spring_bymonth["Formatted_D
```

In [20]:
```
ax5 = mays.plot(
        x="Formatted_Date",
        y="Sessions",
        figsize=(10,5),
        kind="bar",
        legend=False,
        grid=True,
        rot=30,
        xlabel="Date",
        title=f"Sessions for Mays"
)

ax5.bar_label(ax5.containers[0], color="green")
plt.tight_layout()

plt.savefig("Sessions/mays.png")
```

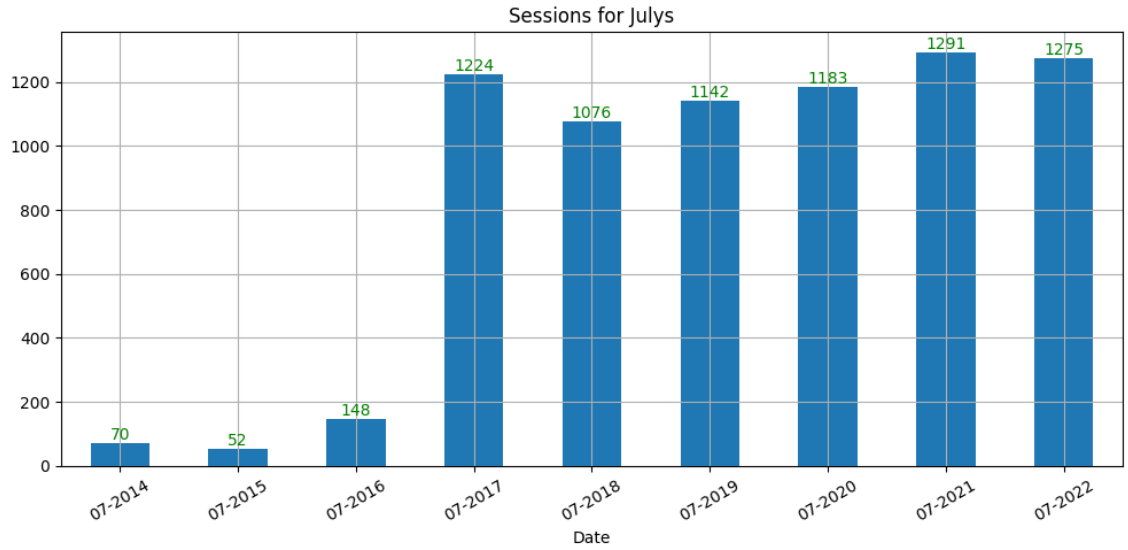


In [21]:
```
ax6 = junes.plot(
        x="Formatted_Date",
        y="Sessions",
        figsize=(10,5),
        kind="bar",
        legend=False,
        grid=True,
        rot=30,
        xlabel="Date",
        title=f"Sessions for Junes")

ax6.bar_label(ax6.containers[0], color="green")
plt.tight_layout()

plt.savefig("Sessions/junes.png")
```



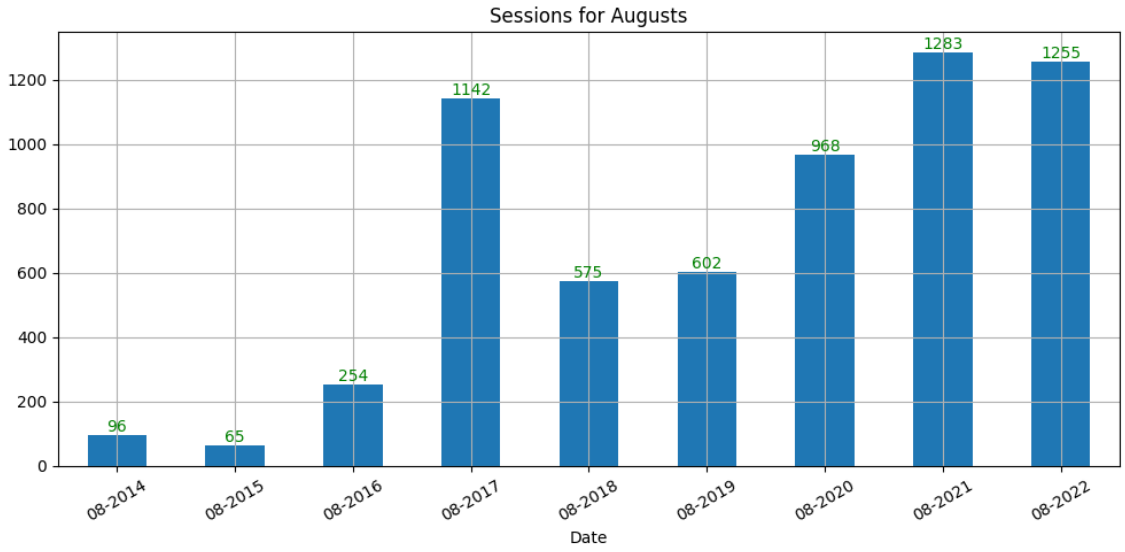
In [22]:

```
ax7 = julys.plot(
        x="Formatted_Date",
        y="Sessions",
        figsize=(10,5),
        kind="bar",
        legend=False,
        grid=True,
        rot=30,
        xlabel="Date",
        title=f"Sessions for Julys")

ax7.bar_label(ax7.containers[0], color="green")
plt.tight_layout()

plt.savefig("Sessions/julys.png")
```

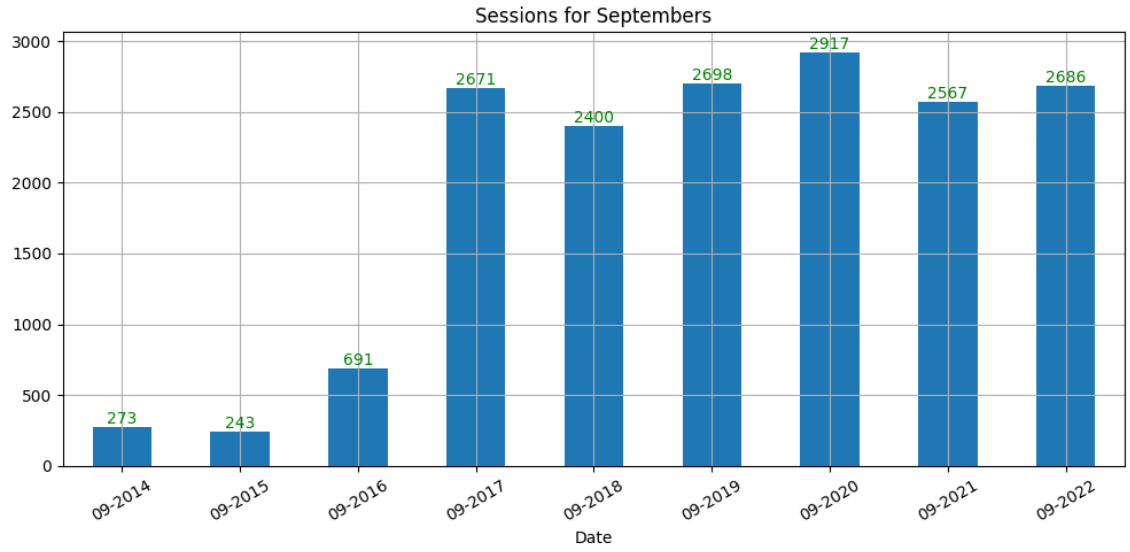


In [23]:

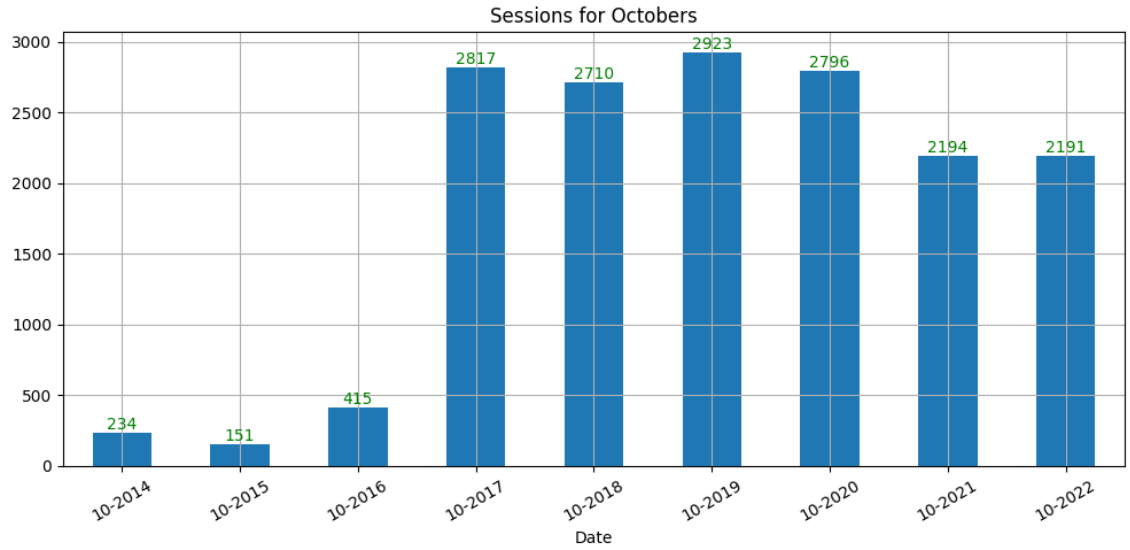
```
ax8 = augusts.plot(
        x="Formatted_Date",
        y="Sessions",
        figsize=(10,5),
        kind="bar",
        legend=False,
        grid=True,
        rot=30,
        xlabel="Date",
        title=f"Sessions for Augusts"
)

ax8.bar_label(ax8.containers[0], color="green")
plt.tight_layout()

plt.savefig("Sessions/augusts.png")
```



In [24]:
```
ax9 = septembers.plot(
        x="Formatted_Date",
        y="Sessions",
        figsize=(10,5),
        kind="bar",
        legend=False,
        grid=True,
        rot=30,
        xlabel="Date",
        title=f"Sessions for Septembers"
)

ax9.bar_label(ax9.containers[0], color="green")
plt.tight_layout()

plt.savefig("Sessions/septembers.png")
```

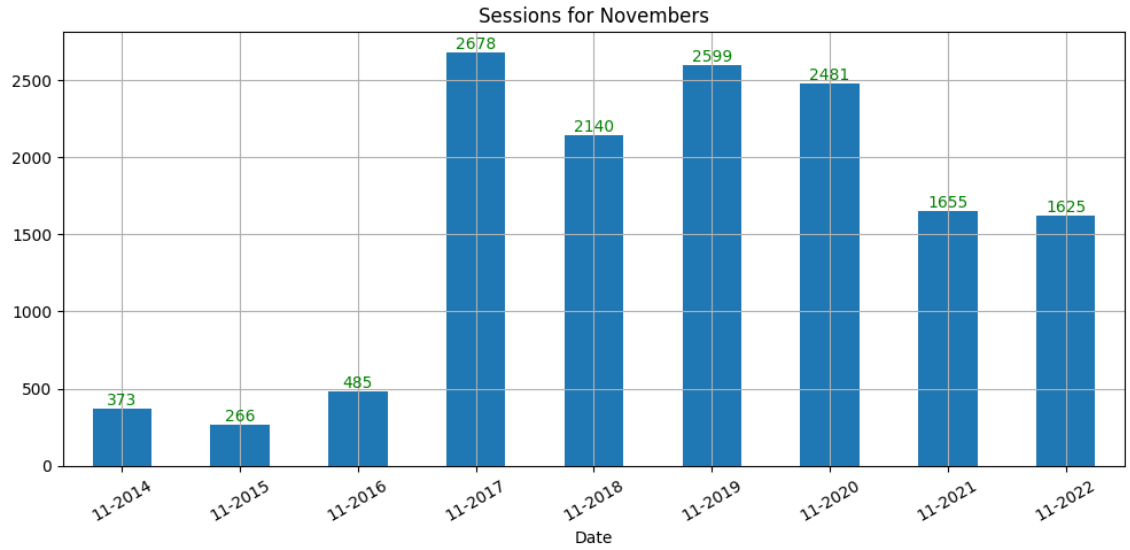


In [25]:
```
ax10 = octobers.plot(
        x="Formatted_Date",
        y="Sessions",
        figsize=(10,5),
        kind="bar",
        legend=False,
        grid=True,
        rot=30,
        xlabel="Date",
        title=f"Sessions for Octobers"
)

ax10.bar_label(ax10.containers[0], color="green")
plt.tight_layout()

plt.savefig("Sessions/octobers.png")
```



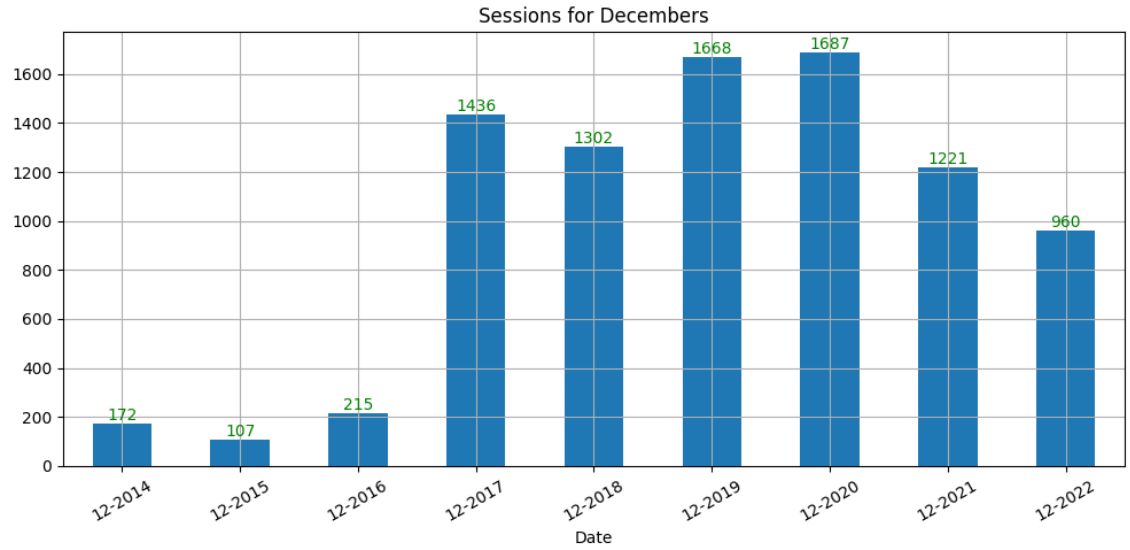
In [26]:

```
ax11 = novembers.plot(
        x="Formatted_Date",
        y="Sessions",
        figsize=(10,5),
        kind="bar",
        legend=False,
        grid=True,
        rot=30,
        xlabel="Date",
        title=f"Sessions for Novembers"
)

ax11.bar_label(ax11.containers[0], color="green")
plt.tight_layout()

plt.savefig("Sessions/novembers.png")
```



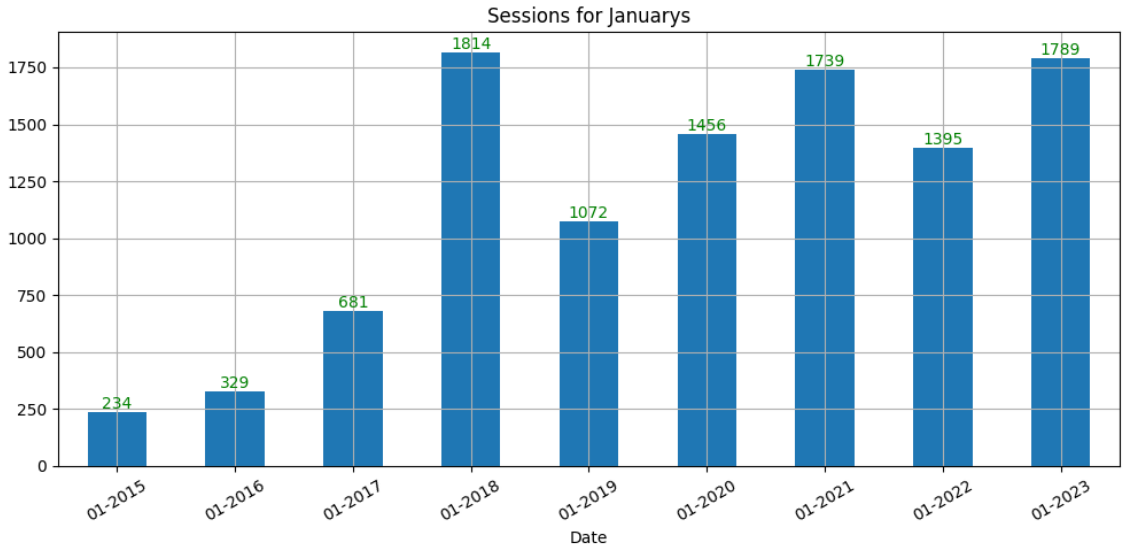
In [27]:

```
ax12 = decembers.plot(
        x="Formatted_Date",
        y="Sessions",
        figsize=(10,5),
        kind="bar",
        legend=False,
        grid=True,
        rot=30,
        xlabel="Date",
        title=f"Sessions for Decembers"
)

ax12.bar_label(ax12.containers[0], color="green")
plt.tight_layout()

plt.savefig("Sessions/decembers.png")
```



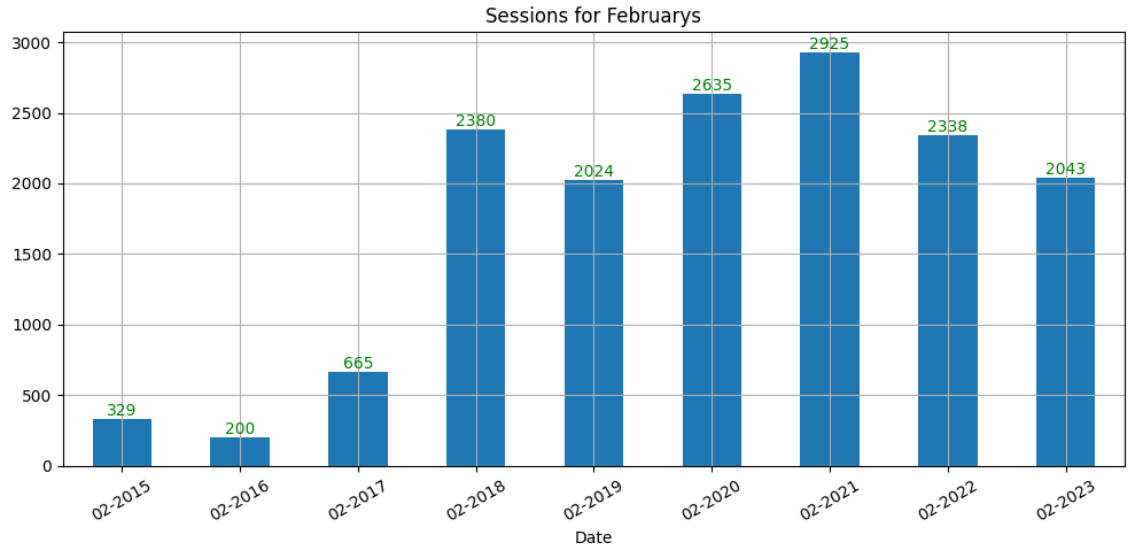
In [28]:

```
ax1 = januarys.plot(
        x="Formatted_Date",
        y="Sessions",
        figsize=(10,5),
        kind="bar",
        legend=False,
        grid=True,
        rot=30,
        xlabel="Date",
        title=f"Sessions for Januarys"
)

ax1.bar_label(ax1.containers[0], color="green")
plt.tight_layout()

plt.savefig("Sessions/januarys.png")
```



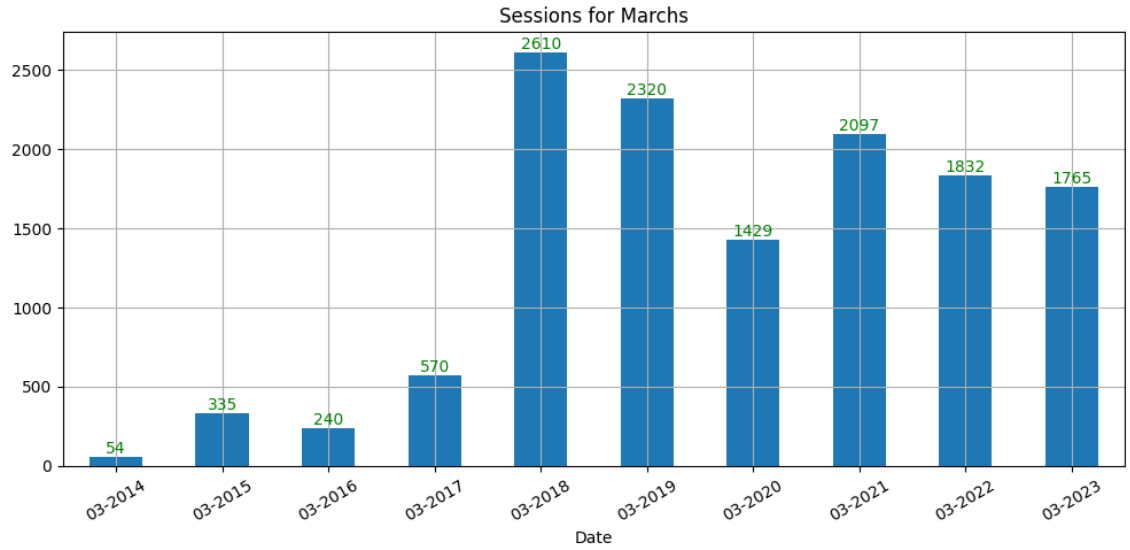
In [29]:

```
ax2 = februarys.plot(
        x="Formatted_Date",
        y="Sessions",
        figsize=(10,5),
        kind="bar",
        legend=False,
        grid=True,
        rot=30,
        xlabel="Date",
        title=f"Sessions for Februarys"
)

ax2.bar_label(ax2.containers[0], color="green")
plt.tight_layout()

plt.savefig("Sessions/februarys.png")
```

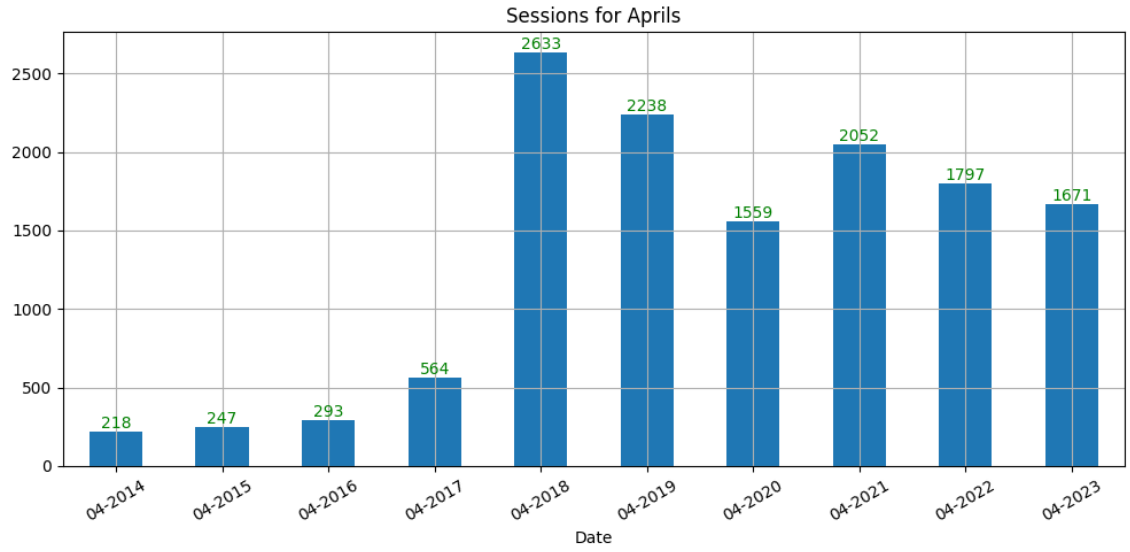


In [30]:

```
ax3= marchs.plot(
        x="Formatted_Date",
        y="Sessions",
        figsize=(10,5),
        kind="bar",
        legend=False,
        grid=True,
        rot=30,
        xlabel="Date",
        title=f"Sessions for Marchs"
)

ax3.bar_label(ax3.containers[0], color="green")
plt.tight_layout()

plt.savefig("Sessions/marchs.png")
```



In [31]:
```
ax4 = aprils.plot(
        x="Formatted_Date",
        y="Sessions",
        figsize=(10,5),
        kind="bar",
        legend=False,
        grid=True,
        rot=30,
        xlabel="Date",
        title=f"Sessions for Aprils"
)

ax4.bar_label(ax4.containers[0], color="green")
plt.tight_layout()

plt.savefig("Sessions/aprils.png")
```



Inferences

In [32]:
```
sessions_summer_bymonth["Month"] = sessions_summer_bymonth["Formatted_Date"
sessions_summer_bymonth = sessions_summer_bymonth.reset_index(drop=True)

sessions_summer_bymonth
```

Out[32]:

	Date	Sessions	Formatted_Date	Month
0	2014-05-01	108	05-2014	05
1	2015-05-01	47	05-2015	05
2	2016-05-01	228	05-2016	05
3	2017-05-01	247	05-2017	05
4	2018-05-01	1096	05-2018	05
5	2019-05-01	1213	05-2019	05
6	2020-05-01	895	05-2020	05
7	2021-05-01	1066	05-2021	05
8	2022-05-01	846	05-2022	05
9	2023-05-01	169	05-2023	05
10	2014-06-01	92	06-2014	06
11	2015-06-01	140	06-2015	06
12	2016-06-01	296	06-2016	06
13	2017-06-01	568	06-2017	06
14	2018-06-01	598	06-2018	06
15	2019-06-01	785	06-2019	06
16	2020-06-01	761	06-2020	06
17	2021-06-01	826	06-2021	06
18	2022-06-01	776	06-2022	06
19	2014-07-01	70	07-2014	07
20	2015-07-01	52	07-2015	07
21	2016-07-01	148	07-2016	07
22	2017-07-01	1224	07-2017	07
23	2018-07-01	1076	07-2018	07
24	2019-07-01	1142	07-2019	07
25	2020-07-01	1183	07-2020	07
26	2021-07-01	1291	07-2021	07
27	2022-07-01	1275	07-2022	07

In [33]:
```
maxs = sessions_summer_bymonth.groupby(["Month"])["Sessions"].max()
maxs.name = "Max"
maxs
```

Out[33]:
```
Month
05    1213
06     826
07    1291
Name: Max, dtype: int64
```

In [34]:
```
mins = sessions_summer_bymonth.groupby(["Month"])["Sessions"].min()
mins.name = "Min"
mins
```

Out[34]:
```
Month
05    47
06    92
07    52
Name: Min, dtype: int64
```

In [35]:
```
last = sessions_summer_bymonth.loc[ (sessions_summer_bymonth["Formatted_Dat

last.name = "Last"
last.index = mins.index

last

# last.iloc[-1]
```

Out[35]:
```
Month
05     846
06     776
07    1275
Name: Last, dtype: int64
```

In [36]:
```
summer_df = pd.concat([maxs, mins, last], axis=1)
summer_df
```

Out[36]:

Month	Max	Min	Last
05	1213	47	846
06	826	92	776
07	1291	52	1275

In [37]:
```
summer_df["Max_to_Last_%Change"] = round((summer_df["Last"] - summer_df["Ma
summer_df
```

Out[37]:

Month	Max	Min	Last	Max_to_Last_%Change
05	1213	47	846	-30.26
06	826	92	776	-6.05
07	1291	52	1275	-1.24

In [38]:
```
summer_df["Max_to_Min_%Change"] = round((summer_df["Min"] - summer_df["Max'
summer_df
```

Out[38]:

Month	Max	Min	Last	Max_to_Last_%Change	Max_to_Min_%Change
05	1213	47	846	-30.26	-96.13
06	826	92	776	-6.05	-88.86
07	1291	52	1275	-1.24	-95.97

In [39]:
```
sessions_fall_bymonth["Month"] = sessions_fall_bymonth["Formatted_Date"].ap

sessions_fall_bymonth
```

Out[39]:

	Date	Sessions	Formatted_Date	Month
0	2014-08-01	96	08-2014	08
1	2015-08-01	65	08-2015	08
2	2016-08-01	254	08-2016	08
3	2017-08-01	1142	08-2017	08
4	2018-08-01	575	08-2018	08
5	2019-08-01	602	08-2019	08
6	2020-08-01	968	08-2020	08
7	2021-08-01	1283	08-2021	08
8	2022-08-01	1255	08-2022	08
9	2014-09-01	273	09-2014	09
10	2015-09-01	243	09-2015	09
11	2016-09-01	691	09-2016	09
12	2017-09-01	2671	09-2017	09
13	2018-09-01	2400	09-2018	09
14	2019-09-01	2698	09-2019	09
15	2020-09-01	2917	09-2020	09
16	2021-09-01	2567	09-2021	09
17	2022-09-01	2686	09-2022	09
18	2014-10-01	234	10-2014	10
19	2015-10-01	151	10-2015	10
20	2016-10-01	415	10-2016	10
21	2017-10-01	2817	10-2017	10
22	2018-10-01	2710	10-2018	10
23	2019-10-01	2923	10-2019	10
24	2020-10-01	2796	10-2020	10
25	2021-10-01	2194	10-2021	10
26	2022-10-01	2191	10-2022	10
27	2014-11-01	373	11-2014	11
28	2015-11-01	266	11-2015	11
29	2016-11-01	485	11-2016	11
30	2017-11-01	2678	11-2017	11
31	2018-11-01	2140	11-2018	11
32	2019-11-01	2599	11-2019	11
33	2020-11-01	2481	11-2020	11
34	2021-11-01	1655	11-2021	11

	Date	Sessions	Formatted_Date	Month
35	2022-11-01	1625	11-2022	11
36	2014-12-01	172	12-2014	12
37	2015-12-01	107	12-2015	12
38	2016-12-01	215	12-2016	12
39	2017-12-01	1436	12-2017	12
40	2018-12-01	1302	12-2018	12
41	2019-12-01	1668	12-2019	12
42	2020-12-01	1687	12-2020	12
43	2021-12-01	1221	12-2021	12
44	2022-12-01	960	12-2022	12

In [40]:
```
maxs = sessions_fall_bymonth.groupby(["Month"])["Sessions"].max()
maxs.name = "Max"
maxs
```

Out[40]:
```
Month
08    1283
09    2917
10    2923
11    2678
12    1687
Name: Max, dtype: int64
```

In [41]:
```
mins = sessions_fall_bymonth.groupby(["Month"])["Sessions"].min()
mins.name = "Min"
mins
```

Out[41]:
```
Month
08     65
09    243
10    151
11    266
12    107
Name: Min, dtype: int64
```

In [42]:
```
last = sessions_fall_bymonth.loc[ (sessions_fall_bymonth["Formatted_Date"].

last.name = "Last"
last.index = mins.index

last

# last.iloc[-1]
```

Out[42]:
```
Month
08    1255
09    2686
10    2191
11    1625
12     960
Name: Last, dtype: int64
```

In [43]:
```
fall_df = pd.concat([maxs, mins, last], axis=1)
fall_df
```

Out[43]:

Month	Max	Min	Last
08	1283	65	1255
09	2917	243	2686
10	2923	151	2191
11	2678	266	1625
12	1687	107	960

In [44]:
```
fall_df["Max_to_Last_%Change"] = round((fall_df["Last"] - fall_df["Max"]) /
fall_df
```

Out[44]:

Month	Max	Min	Last	Max_to_Last_%Change
08	1283	65	1255	-2.18
09	2917	243	2686	-7.92
10	2923	151	2191	-25.04
11	2678	266	1625	-39.32
12	1687	107	960	-43.09

In [45]:
```
fall_df["Max_to_Min_%Change"] = round((fall_df["Min"] - fall_df["Max"]) / f
fall_df
```

Out[45]:

Month	Max	Min	Last	Max_to_Last_%Change	Max_to_Min_%Change
08	1283	65	1255	-2.18	-94.93
09	2917	243	2686	-7.92	-91.67
10	2923	151	2191	-25.04	-94.83
11	2678	266	1625	-39.32	-90.07
12	1687	107	960	-43.09	-93.66

In [46]:
```
sessions_spring_bymonth["Month"] = sessions_spring_bymonth["Formatted_Date"

sessions_spring_bymonth
```

Out[46]:

	Date	Sessions	Formatted_Date	Month
0	2015-01-01	234	01-2015	01
1	2016-01-01	329	01-2016	01
2	2017-01-01	681	01-2017	01
3	2018-01-01	1814	01-2018	01
4	2019-01-01	1072	01-2019	01
5	2020-01-01	1456	01-2020	01
6	2021-01-01	1739	01-2021	01
7	2022-01-01	1395	01-2022	01
8	2023-01-01	1789	01-2023	01
9	2015-02-01	329	02-2015	02
10	2016-02-01	200	02-2016	02
11	2017-02-01	665	02-2017	02
12	2018-02-01	2380	02-2018	02
13	2019-02-01	2024	02-2019	02
14	2020-02-01	2635	02-2020	02
15	2021-02-01	2925	02-2021	02
16	2022-02-01	2338	02-2022	02
17	2023-02-01	2043	02-2023	02
18	2014-03-01	54	03-2014	03
19	2015-03-01	335	03-2015	03
20	2016-03-01	240	03-2016	03
21	2017-03-01	570	03-2017	03
22	2018-03-01	2610	03-2018	03
23	2019-03-01	2320	03-2019	03
24	2020-03-01	1429	03-2020	03
25	2021-03-01	2097	03-2021	03
26	2022-03-01	1832	03-2022	03
27	2023-03-01	1765	03-2023	03
28	2014-04-01	218	04-2014	04
29	2015-04-01	247	04-2015	04
30	2016-04-01	293	04-2016	04
31	2017-04-01	564	04-2017	04
32	2018-04-01	2633	04-2018	04
33	2019-04-01	2238	04-2019	04
34	2020-04-01	1559	04-2020	04

	Date	Sessions	Formatted_Date	Month
35	2021-04-01	2052	04-2021	04
36	2022-04-01	1797	04-2022	04
37	2023-04-01	1671	04-2023	04

In [47]:
```
maxs = sessions_spring_bymonth.groupby(["Month"])["Sessions"].max()
maxs.name = "Max"
maxs
```

Out[47]:
```
Month
01    1814
02    2925
03    2610
04    2633
Name: Max, dtype: int64
```

In [48]:
```
mins = sessions_spring_bymonth.groupby(["Month"])["Sessions"].min()
mins.name = "Min"
mins
```

Out[48]:
```
Month
01    234
02    200
03     54
04    218
Name: Min, dtype: int64
```

In [49]:
```
last = sessions_spring_bymonth.loc[ (sessions_spring_bymonth["Formatted_Dat

last.name = "Last"
last.index = mins.index

last

# last.iloc[-1]
```

Out[49]:
```
Month
01    1395
02    2338
03    1832
04    1797
Name: Last, dtype: int64
```

In [50]:
```
spring_df = pd.concat([maxs, mins, last], axis=1)
spring_df
```

Out[50]:

Month	Max	Min	Last
01	1814	234	1395
02	2925	200	2338
03	2610	54	1832
04	2633	218	1797

In [51]:
```
spring_df["Max_to_Last_%Change"] = round((spring_df["Last"] - spring_df["Ma
spring_df
```

Out[51]:

Month	Max	Min	Last	Max_to_Last_%Change
01	1814	234	1395	-23.10
02	2925	200	2338	-20.07
03	2610	54	1832	-29.81
04	2633	218	1797	-31.75

In [52]:
```
spring_df["Max_to_Min_%Change"] = round((spring_df["Min"] - spring_df["Max'
spring_df
```

Out[52]:

Month	Max	Min	Last	Max_to_Last_%Change	Max_to_Min_%Change
01	1814	234	1395	-23.10	-87.10
02	2925	200	2338	-20.07	-93.16
03	2610	54	1832	-29.81	-97.93
04	2633	218	1797	-31.75	-91.72

In [53]:
```
year_df = pd.concat([spring_df, summer_df, fall_df], axis=0)
year_df
```

Out[53]:

Month	Max	Min	Last	Max_to_Last_%Change	Max_to_Min_%Change
01	1814	234	1395	-23.10	-87.10
02	2925	200	2338	-20.07	-93.16
03	2610	54	1832	-29.81	-97.93
04	2633	218	1797	-31.75	-91.72
05	1213	47	846	-30.26	-96.13
06	826	92	776	-6.05	-88.86
07	1291	52	1275	-1.24	-95.97
08	1283	65	1255	-2.18	-94.93
09	2917	243	2686	-7.92	-91.67
10	2923	151	2191	-25.04	-94.83
11	2678	266	1625	-39.32	-90.07
12	1687	107	960	-43.09	-93.66

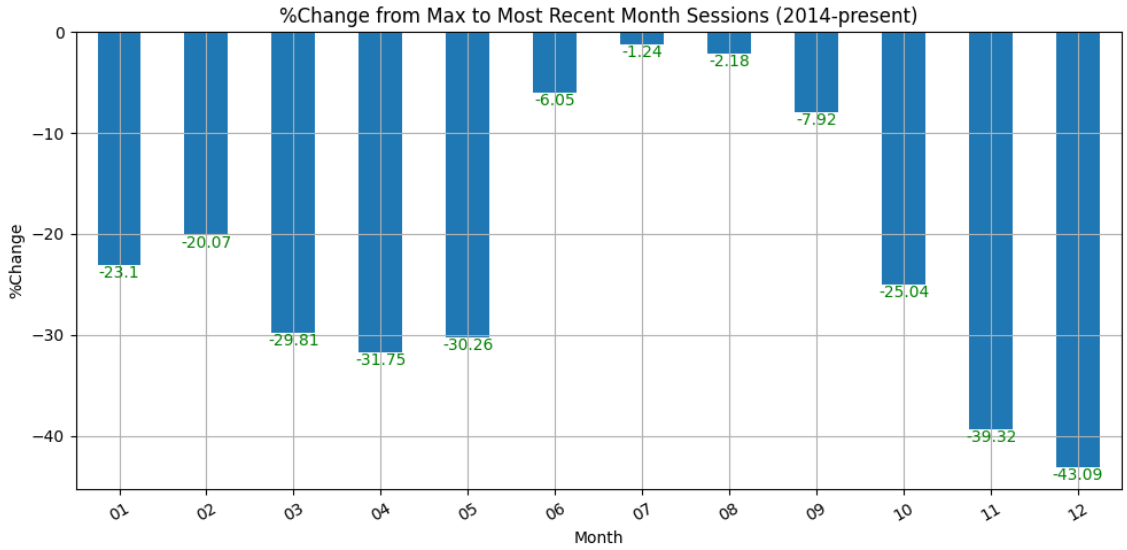
In [54]:
```
year_df.describe()
```

Out[54]:

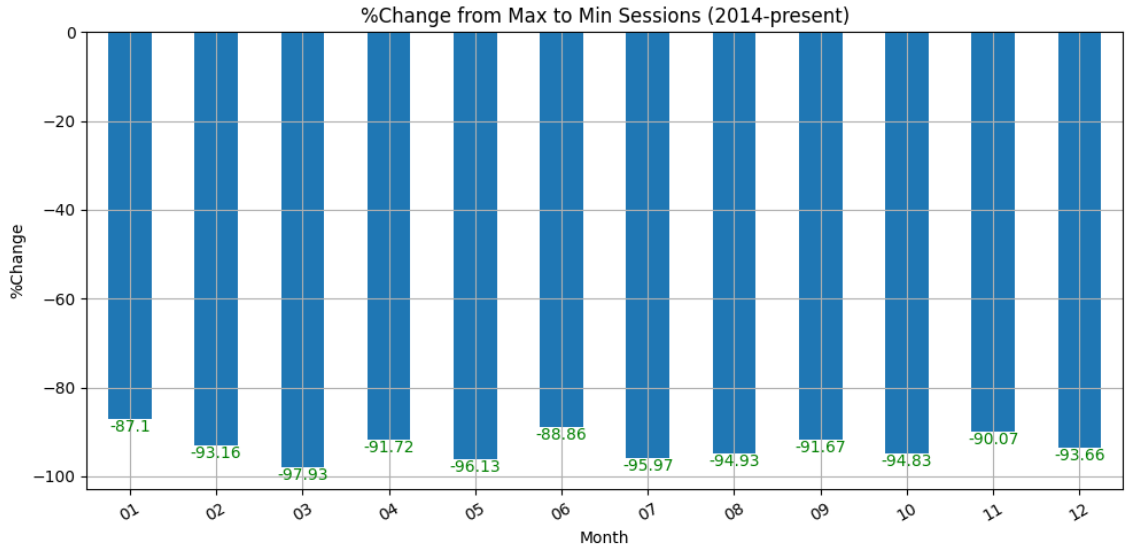
	Max	Min	Last	Max_to_Last_%Change	Max_to_Min_%Change
count	12.000000	12.000000	12.000000	12.000000	12.000000
mean	2066.666667	144.083333	1581.333333	-21.652500	-93.002500
std	790.544270	84.063243	609.482990	14.328113	3.224895
min	826.000000	47.000000	776.000000	-43.090000	-97.930000
25%	1289.000000	62.250000	1181.250000	-30.632500	-95.190000
50%	2212.000000	129.000000	1510.000000	-24.070000	-93.410000
75%	2737.750000	222.000000	1921.750000	-7.452500	-91.270000
max	2925.000000	266.000000	2686.000000	-1.240000	-87.100000

In [55]:

```
ax12_1 = year_df.plot(
        y="Max_to_Last_%Change",
        figsize=(10,5),
        kind="bar",
        legend=False,
        grid=True,
        rot=30,
        xlabel="Month",
        ylabel="%Change",
        title=f"%Change from Max to Most Recent Month Sessions (2014-preser
)

ax12_1.bar_label(ax12_1.containers[0], color="green")
plt.tight_layout()

plt.savefig("Sessions/sessions_max_to_most_recent.png")
```



In [56]:
```
ax12_2 = year_df.plot(
        y="Max_to_Min_%Change",
        figsize=(10,5),
        kind="bar",
        legend=False,
        grid=True,
        rot=30,
        xlabel="Month",
        ylabel="%Change",
        title=f"%Change from Max to Min Sessions (2014-present)"
)

ax12_2.bar_label(ax12_2.containers[0], color="green")
plt.tight_layout()

plt.savefig("Sessions/sessions_max_to_min.png")
```



In [57]:
```
print(f'Mean of sessions: {sessions_df_alltime["Sessions"].mean()}')
print(f'Median of sessions: {sessions_df_alltime["Sessions"].median()}')
print(f'Mode of sessions: {st.mode(sessions_df_alltime["Sessions"], axis=No

print(f'Min of sessions: {sessions_df_alltime["Sessions"].min()}')
print(f'Max of sessions: {sessions_df_alltime["Sessions"].max()}')
```

```
Mean of sessions: 1204.2972972972973
Median of sessions: 1096.0
Mode of sessions: ModeResult(mode=234, count=2)
Min of sessions: 47
Max of sessions: 2925
```