jupyter zbMATH Links API demo

This notebooks demonstrates some of the capabilites of the zbMATH links API.

In [40]:
```
import pandas as pd
pd.options.plotting.backend = "plotly"
```

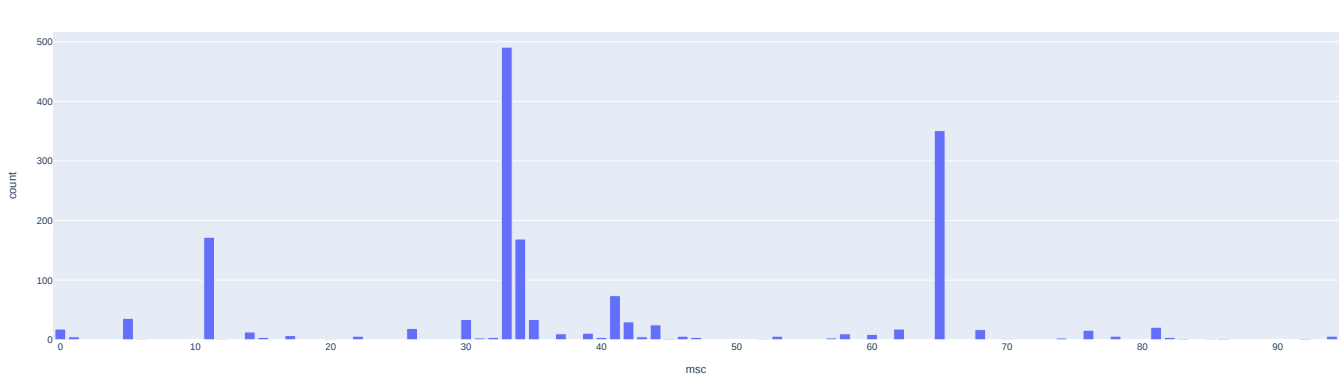
Load statics for msc distribtion.

In [50]:
```
msc = pd.read_json('https://zblink.formulasearchengine.com/links_api/statistics/msc/')
msc = msc.rename(columns={msc.columns[0]:'msc',msc.columns[1]:'count'})
msc = msc.set_index('msc')
msc.head()
```

Out[50]:

msc	count
33	491
65	351
11	172
34	169
41	74

In [42]:
```
fig=msc.plot(y='count',kind='bar')
fig.show()
```



In the same way one can derive the year distribution

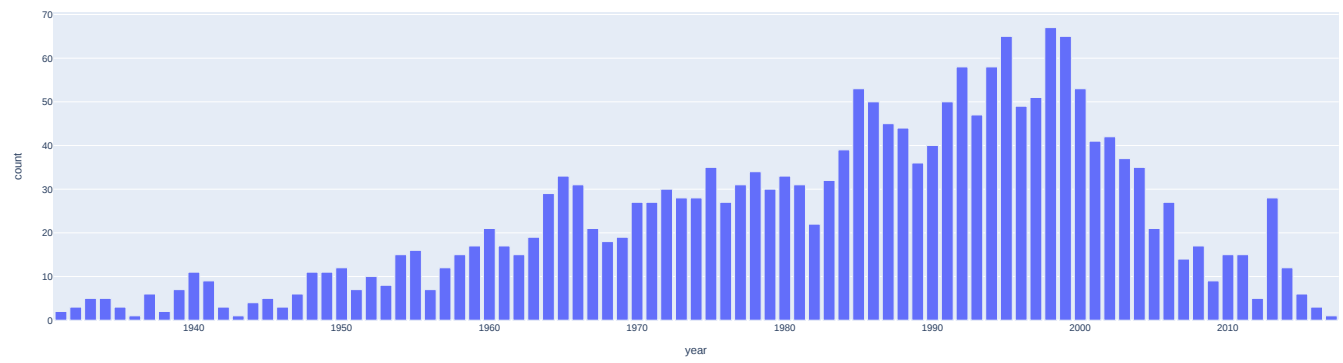
In [43]:
```
y = pd.read_json('https://zblink.formulasearchengine.com/links_api/statistics/years/')
y = y.rename(columns={y.columns[0]:'year',y.columns[1]:'count'})
y = y.set_index('year')
y
```

Out[43]:

year	count
1998	67
1999	65
1995	65
1992	58
1994	58
...	...
1938	2
1931	2
1943	1
1936	1
2017	1

87 rows × 1 columns

In [44]:
```
f=y.plot(kind='bar',y='count')
f.show()
```



Instead of the preprocessed statistics one can also access the uderling data in the scholix format. In the example below we filter for links that point to a MSC class 14.

In [51]:
```
import requests, json
alg_geo_json = requests.get('https://zblink.formulasearchengine.com/links_api/link/?msc%20classification%20code=14')
alg_geo_data = json.loads(alg_geo_json.text)
df = pd.json_normalize(alg_geo_data)
df
```

Out[51]:

	LinkPublicationDate	RelationshipType	Source.Identifier.ID	Source.Identifier.IDScheme	Source.Identifier.IDURL	Source.Type	Source.Title	Source.Publisher.Name	Source.Publisher.Identifier.ID	Source.Publisher.Identifier.IDScheme	...	Target.Type.Name	Target.Type.Subtype	Target.Title	Target.Creator	Target.PublicationDate	Target.Publisher	LinkProvider.provider_name	LinkProvider.identifier.ID	LinkProvider.identifier.IDScheme	LinkProvid
0	1900-01-01T00:00:00	none	21.7#ii.info	DLMF scheme	https://dlmf.nist.gov/21.7#ii.info	{'Name': 'DLMF bibliographic entry'}	§21.7(ii) Fay's Trisecant Identity ‣ §21.7 Rie...	DLMF	DLMF	name of partner	...	book	14K25 14K30 58J60 14-02 33E05 14H40 58J15 35Q99	Tata lectures on theta. II: Jacobian theta fun...	[{'Name': 'Mumford, David'}]	1984	Progress in Mathematics, Vol. 43. Boston-Basel...	zbMATH	zbMATH	zbMATH scheme	
1	1900-01-01T00:00:00	none	32.2#iv.p1	DLMF scheme	https://dlmf.nist.gov/32.2#iv.p1	{'Name': 'DLMF bibliographic entry'}	§32.2(iv) Elliptic Form ‣ §32.2 Differential E...	DLMF	DLMF	name of partner	...	book_article	14H52 34M55 34M15 14N35 14K20	Sixth Painlevé equation, universal elliptic cu...	[{'Name': 'Manin, Yu. I.'}]	1998	Khovanskij, A. (ed.) et al., Geometry of diffe...	zbMATH	zbMATH	zbMATH scheme	
2	1900-01-01T00:00:00	none	32.7#viii.p1	DLMF scheme	https://dlmf.nist.gov/32.7#viii.p1	{'Name': 'DLMF bibliographic entry'}	§32.7(viii) Affine Weyl Groups ‣ §32.7 Bäcklun...	DLMF	DLMF	name of partner	...	serial_article	37J99 14E05	Studies on the Painlevé equations. IV: Third P...	[{'Name': 'Okamoto, Kazuo'}]	1987	Funkc. Ekvacioj, Ser. Int. 30, 305-332 (1987).	zbMATH	zbMATH	zbMATH scheme	
3	1900-01-01T00:00:00	none	about/bio/AIBobenko#p2	DLMF scheme	https://dlmf.nist.gov/about/bio/AIBobenko#p2	{'Name': 'DLMF bibliographic entry'}	Profile Alexander I. Bobenko ‣ About the Project	DLMF	DLMF	name of partner	...	book	35-02 35Q53 35Q51 37J35 37K10 35Q58 14H42 30F10	Algebro-geometric approach to nonlinear integr...	[{'Name': 'Belokolos, E. D.'}, {'Name': 'Boben...	1994	Springer Series in Nonlinear Dynamics. Berlin:...	zbMATH	zbMATH	zbMATH scheme	
4	1900-01-01T00:00:00	none	20.7#v.info	DLMF scheme	https://dlmf.nist.gov/20.7#v.info	{'Name': 'DLMF bibliographic entry'}	§20.7(v) Watson's Identities ‣ §20.7 Identitie...	DLMF	DLMF	name of partner	...	book	11-02 11G05 14H52 33E05 11-01 14-01 11R11 11R2...	Elliptic curves. Function theory, geometry, ar...	[{'Name': 'McKean, Henry'}, {'Name': 'Moll, Vi...	1999	Cambridge: Cambridge University Press. xiii, 2...	zbMATH	zbMATH	zbMATH scheme	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
111	1900-01-01T00:00:00	none	21.6#ii.info	DLMF scheme	https://dlmf.nist.gov/21.6#ii.info	{'Name': 'DLMF bibliographic entry'}	§21.6(ii) Addition Formulas ‣ §21.6 Products ‣...	DLMF	DLMF	name of partner	...	serial_article	58J99 35Q99 35C99 35B99 14H52 14H40 53C22 30F99	Theta-functions and non-linear equations	[{'Name': 'Dubrovin, B. A.'}]	1981	Usp. Mat. Nauk 36, No. 2(218), 11-80 (1981).	zbMATH	zbMATH	zbMATH scheme	
112	1900-01-01T00:00:00	none	21.9#info	DLMF scheme	https://dlmf.nist.gov/21.9#info	{'Name': 'DLMF bibliographic entry'}	§21.9 Integrable Equations ‣ Applications ‣ Ch...	DLMF	DLMF	name of partner	...	serial_article	58J99 35Q99 35C99 35B99 14H52 14H40 53C22 30F99	Theta-functions and non-linear equations	[{'Name': 'Dubrovin, B. A.'}]	1981	Usp. Mat. Nauk 36, No. 2(218), 11-80 (1981).	zbMATH	zbMATH	zbMATH scheme	
113	1900-01-01T00:00:00	none	20.12#i.p1	DLMF scheme	https://dlmf.nist.gov/20.12#i.p1	{'Name': 'DLMF bibliographic entry'}	§20.12(i) Number Theory ‣ §20.12 Mathematical ...	DLMF	DLMF	name of partner	...	book	11G05 14H52 11Fxx 11-02 14-02	Introduction to elliptic curves and modular fo...	[{'Name': 'Koblitz, Neal'}]	1993	Graduate Texts in Mathematics. 97. New York: S...	zbMATH	zbMATH	zbMATH scheme	
114	1900-01-01T00:00:00	none	21.7#i.p4	DLMF scheme	https://dlmf.nist.gov/21.7#i.p4	{'Name': 'DLMF bibliographic entry'}	§21.7(i) Connection of Riemann Theta Functions...	DLMF	DLMF	name of partner	...	serial_article	58J99 35Q99 35C99 35B99 14H52 14H40 53C22 30F99	Theta-functions and non-linear equations	[{'Name': 'Dubrovin, B. A.'}]	1981	Usp. Mat. Nauk 36, No. 2(218), 11-80 (1981).	zbMATH	zbMATH	zbMATH scheme	
115	1900-01-01T00:00:00	none	21.9#p2	DLMF scheme	https://dlmf.nist.gov/21.9#p2	{'Name': 'DLMF bibliographic entry'}	§21.9 Integrable Equations ‣ Applications ‣ Ch...	DLMF	DLMF	name of partner	...	serial_article	35Q53 35B15 35C05 37K10 14H42 37K20	The KP equation with quasiperiodic initial data	[{'Name': 'Deconinck, Bernard'}, {'Name': 'Seg...	1998	Physica D 123, No. 1-4, 123-152 (1998).	zbMATH	zbMATH	zbMATH scheme	

116 rows × 24 columns

From the returned articles we select only those where the primary MSC is "14".

In [46]:
```
alg_geo_prim=df[['Source.Identifier.ID','Target.Identifier.ID','Target.Type.Subtype']][df['Target.Type.Subtype'].str.startswith('14')]
alg_geo_prim
```

Out[46]:

	Source.Identifier.ID	Target.Identifier.ID	Target.Type.Subtype
0	21.3#i.info	0509.14049	14K25 11F11 33E05 14-02 14K10 14H10 14K30
14	21.7#i.p4	0549.14014	14K25 14K30 58J60 14-02 33E05 14H40 58J15 35Q99
16	21.8#p1	0251.14016	14-02 14K25 32N05
17	21#info	0251.14016	14-02 14K25 32N05
18	21#info	0509.14049	14K25 11F11 33E05 14-02 14K10 14H10 14K30
20	21.10#l1.i1.p1	0964.14047	14Q15 30F10 14H55 32G20 14-04
24	21.7#iii.info	0549.14014	14K25 14K30 58J60 14-02 33E05 14H40 58J15 35Q99
28	21.3#ii.info	0509.14049	14K25 11F11 33E05 14-02 14K10 14H10 14K30
30	21.5#ii.info	0251.14016	14-02 14K25 32N05
33	21.5#i.info	0509.14049	14K25 11F11 33E05 14-02 14K10 14H10 14K30
37	21#info	0549.14014	14K25 14K30 58J60 14-02 33E05 14H40 58J15 35Q99
38	21.6#i.info	0509.14049	14K25 11F11 33E05 14-02 14K10 14H10 14K30
47	21.7#ii.info	0549.14014	14K25 14K30 58J60 14-02 33E05 14H40 58J15 35Q99
52	21.6#ii.p1	0347.14023	14K25
60	22.18#iv.p1	0615.14018	14Hxx 14-02 11-02 11R58 11F03 14H05 11G15 14K2...
61	19#info	1105.14001	14-02 33-02 14K25 33E05 11E25 14-01 33-01 14K2...

	Source.Identifier.ID	Target.Identifier.ID	Target.Type.Subtype
73	21.10#l1.i3.p1	1054.14079	14Q05 14H70 30-04 30F30 35B10
74	32.2#iv.p1	0948.14025	14H52 34M55 34M15 14N35 14K20
75	21.8#p1	0743.14033	14K20 14H05 33E05 14-01 32N05
77	21.7#i.p4	0588.14019	14Hxx 14-02 14-03 14H20 30F10 14-01 58C15 51N1...
79	22#info	1105.14001	14-02 33-02 14K25 33E05 11E25 14-01 33-01 14K2...
83	20#info	1105.14001	14-02 33-02 14K25 33E05 11E25 14-01 33-01 14K2...
103	20.9#ii.p2	0848.14012	14H05 14H42 14-02 14K25
107	23.20#ii.p6	0872.14041	14Q05 14H52 11Y16 68W30 14G35 14-04

We group by target article to account for articles that are linked multiple times.

In [47]:
```
alg_geo_prim.groupby('Target.Identifier.ID').count()
```

Out[47]:

Target.Identifier.ID	Source.Identifier.ID	Target.Type.Subtype
0251.14016	3	3
0347.14023	1	1
0509.14049	5	5
0549.14014	4	4
0588.14019	1	1
0615.14018	1	1
0743.14033	1	1
0848.14012	1	1
0872.14041	1	1
0948.14025	1	1
0964.14047	1	1
1054.14079	1	1
1105.14001	4	4

In the end, we get the same number as in the statistics output.

In [48]:
```
_.count()
```

Out[48]:
```
Source.Identifier.ID    13
Target.Type.Subtype     13
dtype: int64
```