

CMPU 101 § 54 · Computer Science I

Designing Programs for Tables

6 February 2023



Where are we?

docs.google.com/spreadsheets/d/1DU-4daAJsHVRybRIUC-_SaVkBWf1sOaC

New York municipalities ☆ 📁 ☁

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A1 Municipality

	A	B	C	D
1	Municipality	Class	2010	2020
2	Adams	Town	5,143	4,973
3	Adams	Village	1,775	1,633
4	Addison	Town	2,595	2,397
5	Addison	Village	1,763	1,561
6	Afton	Town	2,851	2,769
7	Afton	Village	822	794
8	Airmont	Village	8,628	10,166
9	Akron	Village	2,868	2,888
10	Alabama	Town	1,869	1,602
11	Albany	City	97,856	99,224
12	Albion	Town	8,468	7,639
13	Albion	Town	2,073	2,009
14	Albion	Village	6,056	5,637
15	Alden	Town	10,865	9,706
16	Alden	Village	2,605	2,604
17	Alexander	Town	2,534	2,491
18	Alexander	Village	509	518
19	Alexandria	Town	4,061	3,741
20	Alexandria Bay	Village	1,078	924
21	Alfred	Town	5,237	5,157
22	Alfred	Village	4,174	4,026
23	Allegany	Town	8,004	7,493
24	Allegany	Village	1,816	1,544

+ municipalities Explore

```
include gdrive-sheets
```

```
include shared-gdrive("dcic-2021",  
  "1wyQZj_L0qqV9Ekgr9au6RX2iqt2Ga8Ep")
```

```
ssid = "1DU-4daAJsHVRybRIUC-_SaVkBWf1sOaGIfrWfgktlls"
```

```
spreadsheet = load-spreadsheet(ssid)
```

```
municipalities =
```

```
  load-table:
```

```
    name, kind, pop-2010, pop-2020
```

```
    source:
```

```
      spreadsheet.sheet-by-name("municipalities",  
        true)
```

```
  end
```

Now we can work with this table the same as if we'd entered it manually:

››› **municipalities**

name	kind	pop-2010	pop-2020
"Adams"	"Town"	5143	4973
"Adams"	"Village"	1775	1633
"Addison"	"Town"	2595	2397
"Addison"	"Village"	1763	1561
"Afton"	"Town"	2851	2769
"Afton"	"Village"	822	794
"Airmont"	"Village"	8628	10166

What can we do with a table of data?

Get a row

Get a column in a row

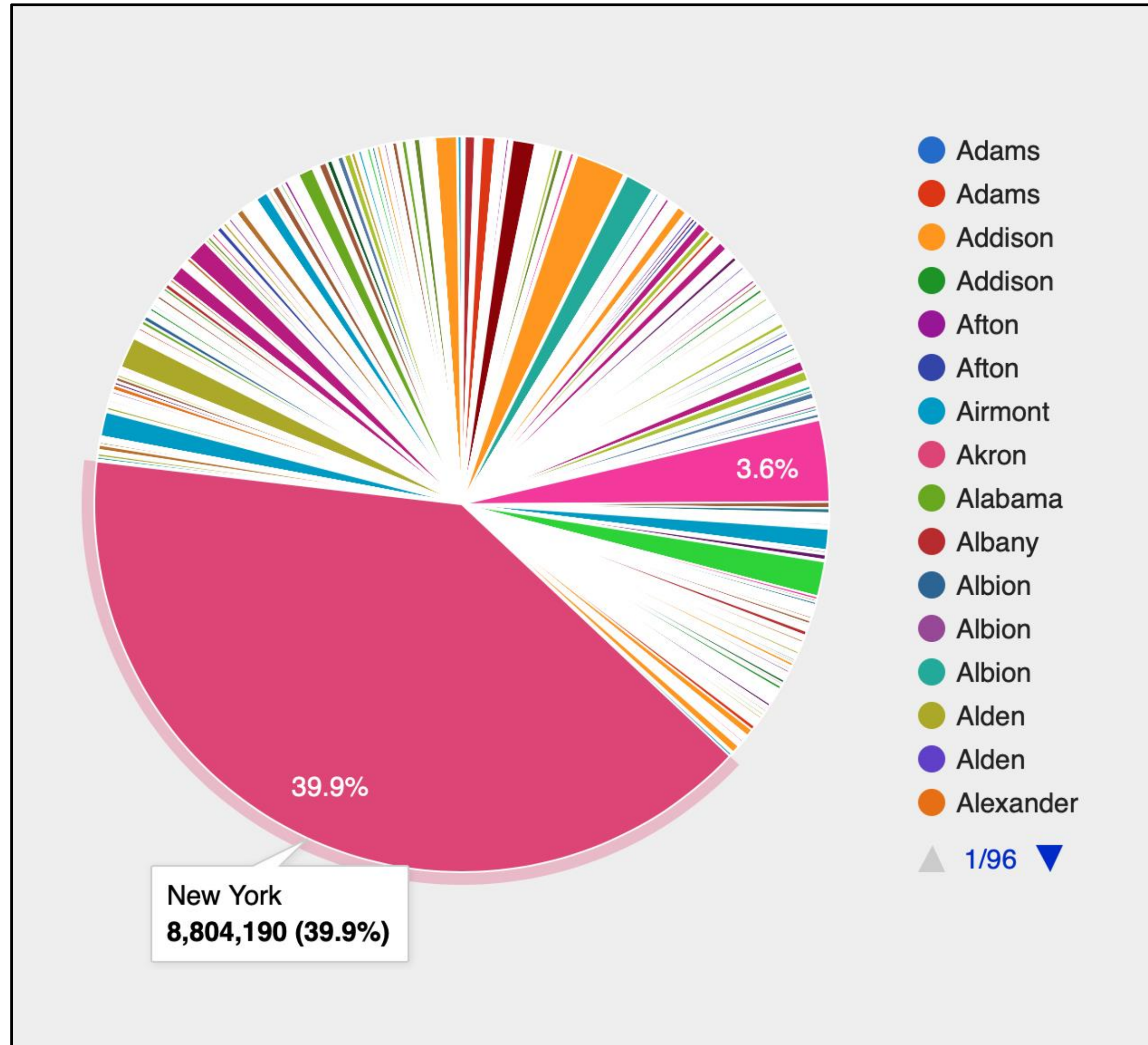
Order by the values in a column

Filter by asking a question about each row

Add a column, computing a value for each row

How is population distributed in the state?

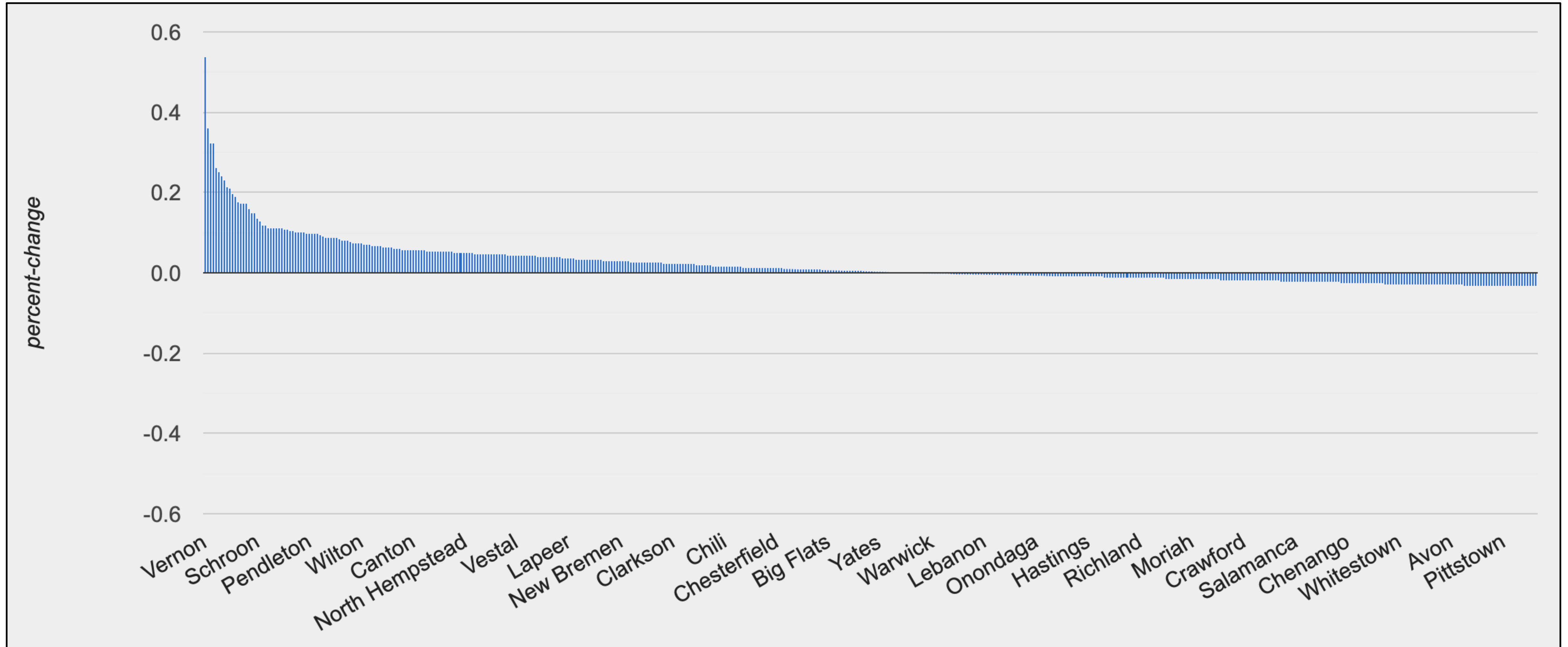
pie-chart(municipalities, "name", "pop-2020")



ft = fastest-growing-towns(municipalities)

Visually present the growth data

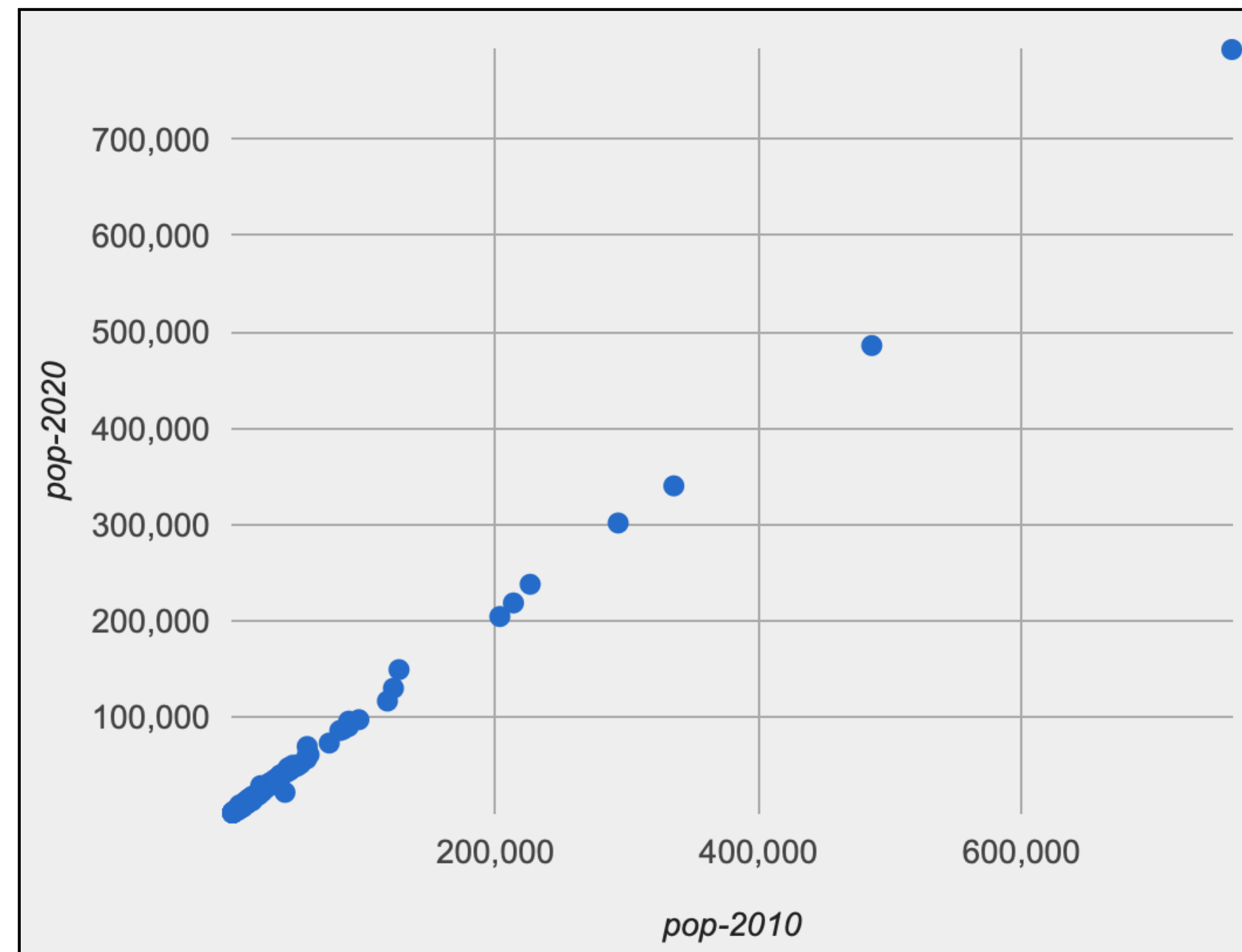
bar-chart(*ft*, "name", "percent-change")



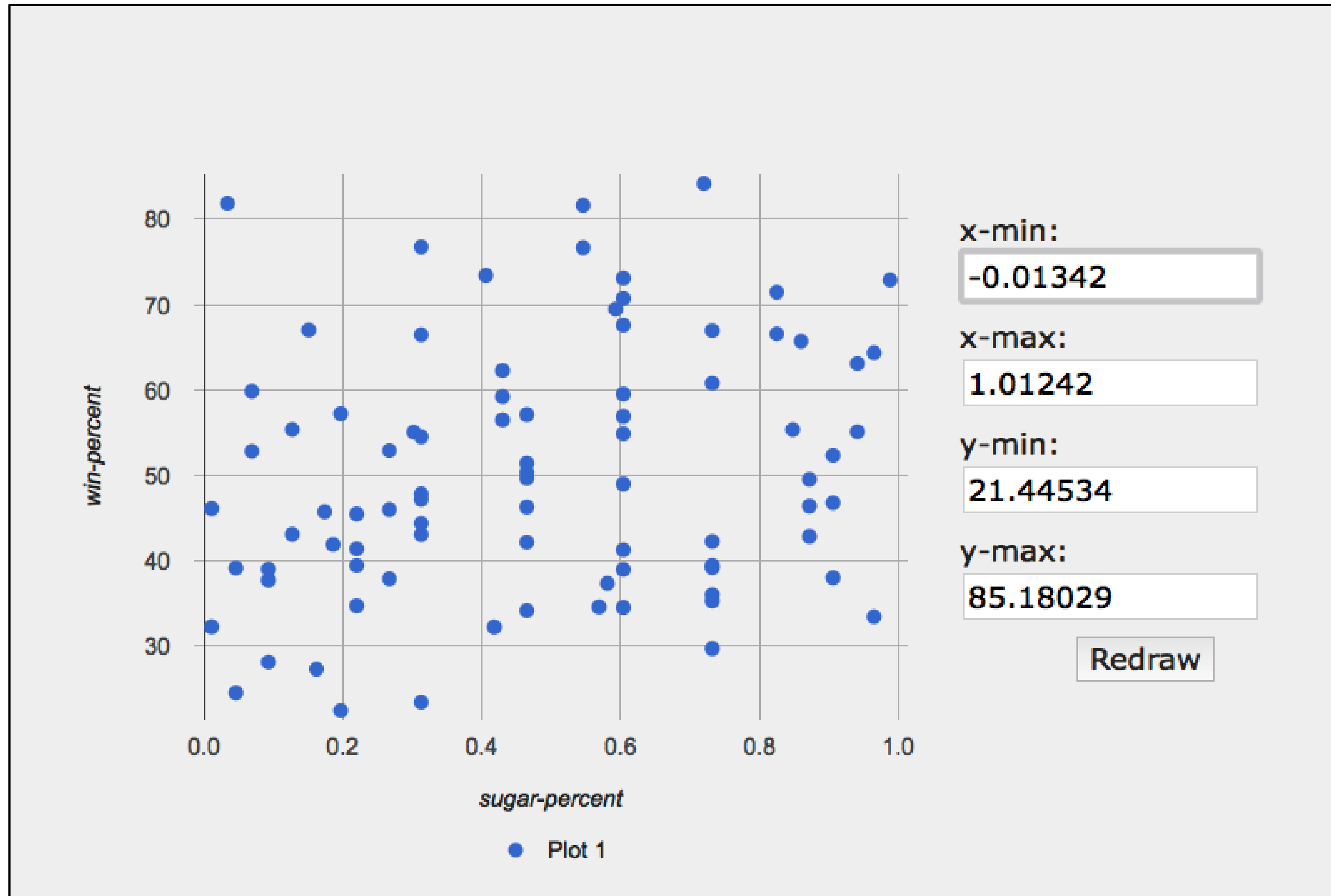
ft = fastest-growing-towns(municipalities)

*# Is a town's population in 2010 correlated with
its population in 2020?*

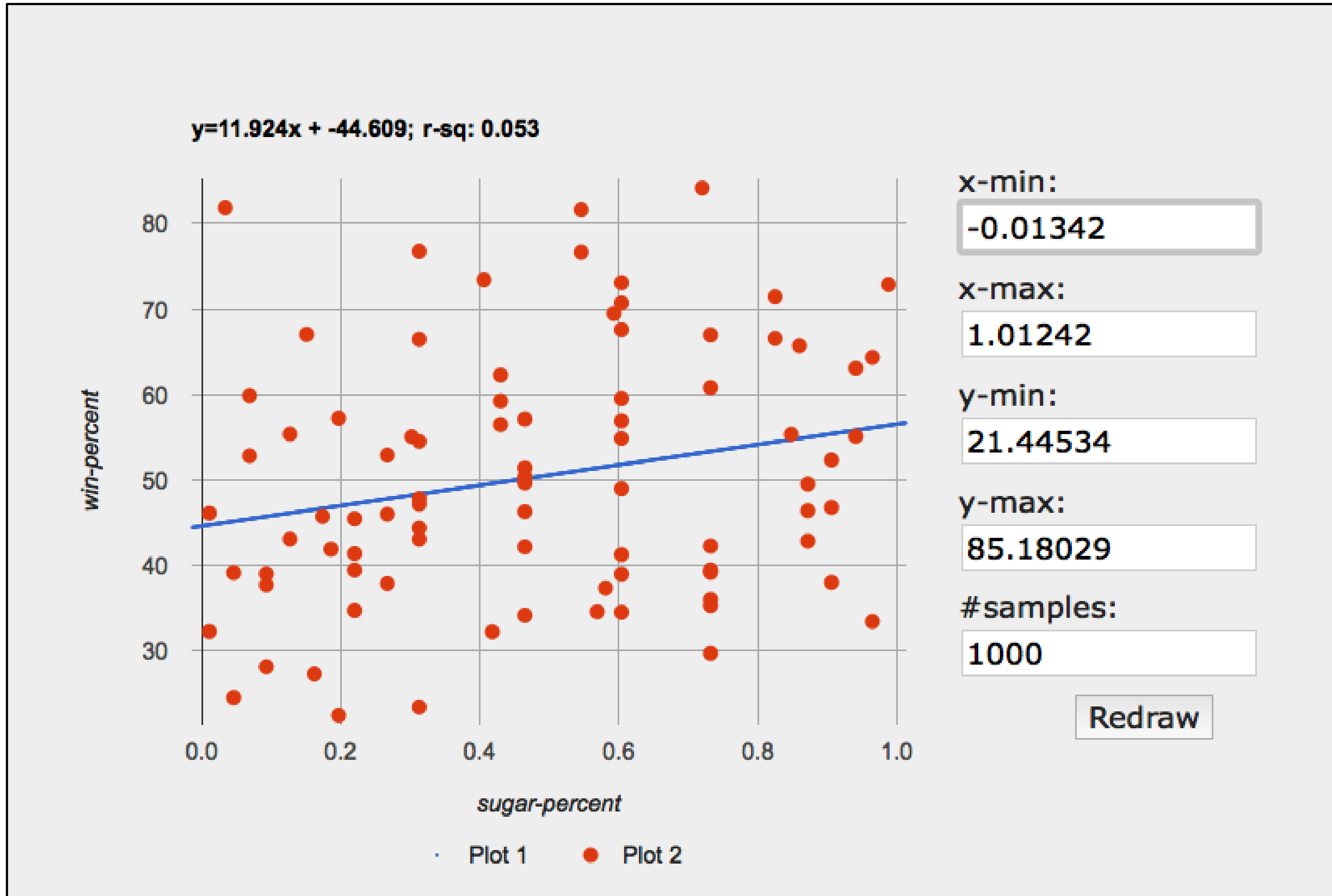
scatter-plot(*ft*, "pop-2010", "pop-2020")



```
scatter-plot(candy-data,  
            "sugar-percent", "win-percent")
```



```
lr-plot(candy-data,  
"sugar-percent", "win-percent")
```



Exercise: Loading data



WNBA

Step 0: Get data.



Enter Person, Team, Section, etc

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[Jared Rhoden](#) (DET), [Alondes Williams](#) (BRK), [Josh Minott](#) (MIN), [Kendall Brown](#) (IND), [Julian Champagne](#) (PHI) and [Michael Foster](#) (PHI)

Every NBA Team

2022-23 NBA Standings

[Summary](#) · [Schedule](#) · [Scores](#) · [Leaders](#) · [Rookies](#)

East				West			
		W	L			W	L
BOS (1)	F	\$	37 16	DEN (1)	F	\$	37 16
MIL (2)	F	\$	36 17	MEM (2)	F	\$	32 20
PHI (3)	F	\$	34 17	SAC (3)	F	\$	29 22
BRK (4)	F	\$	32 20	LAC (4)	F	\$	30 26
CLE (5)	F	\$	32 22	PHO (5)	F	\$	29 26
MIA (6)	F	\$	29 25	DAL (6)	F	\$	28 26
NYK (7)	F	\$	28 26	GSW (7)	F	\$	27 26
ATL (8)	F	\$	27 27	MIN (8)	F	\$	28 27
CHI (9)	F	\$	25 27	UTA (9)	F	\$	27 27
IND (10)	F	\$	25 29	NOP (10)	F	\$	27 27
WAS (11)	F	\$	24 28	POR (11)	F	\$	26 27
TOR (12)	F	\$	24 30	OKC (12)	F	\$	25 27
ORL (13)	F	\$	21 32	LAL (13)	F	\$	25 29
CHO (14)	F	\$	15 39	SAS (14)	F	\$	14 39
DET (15)	F	\$	14 40	HOU (15)	F	\$	13 40

Playoff Probabilities:

East: [BOS](#) - Div (88.6%), Conf (34.7%), Win Finals (23.0%)

West: [DEN](#) - Div (100.0%), Conf (32.8%), Win Finals (17.4%)

Projected Draft Order: [SAS](#) [HOU](#) [DET](#) [CHO](#) [ORL](#) ...

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Find individual or groups of games matching a variety of criteria. Includes every game in NBA/BAA regular season and postseason history.

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Team Game Finder

www.basketball-reference.com/wnba/years/2022_totals.html

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2022 WNBA Player Stats - Totals

WNBA | « Previous Season

League Champion: [Las Vegas Aces](#)
 Most Valuable Player: [A'ja Wilson](#)
 PPG Leader: [Breanna Stewart](#) (21.8)
 RPG Leader: [Sylvia Fowles](#) (9.8)
 APG Leader: [Natasha Cloud](#) (7.0)
 WS Leader: [Breanna Stewart](#) (7.4)

*via Sports Logos.net
About logos*

WNBA ▼ | 2022 WNBA Season | Standings | Schedule and Results | Leaders | Coaches | Transactions | Player Stats ▼ | Playoffs Summary

Dunk by Wendell Carter Jr.

Dunk by Wendell Carter Jr. NBA | 0:11

Dunk by Jonathan Isaac NBA | 0:12

3-pointer by LaMelo Ball NBA | 0:11

Game Recap: Bucks 123, Heat 115 NBA | 2:50

Totals *-Hall of Famer; **Bold**=Active Player

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Player	Team	Pos	G	MP	G	GS	MP	FG	F	FT	R	ORB	AST	STL	BLK	TOV	PF	PTS										
Natalie Achonwa	MIN	F	22	332	22	0	0	15	25	90	37	9	7	22	36	116												
Julie Allemand	CHI	G	25	402	25	4	4	33	9	39	85	14	3	33	23	74												
Lindsay Allen	MIN	G	9	134	9	0	134	0	14	31	2	0	7	11	60													
Rebecca Allen	NYL	G	25	523	25	19	523	64	169	.379	26	83	.313	38	86	.442	20	24	.833	8	84	31	21	24	24	48	174	
Yvonne Anderson	CON	G	11	101	11	0	101	12	26	.462	4	10	.400	8	16	.500	7	7	1.000	3	9	12	3	2	11	14	35	
Kristine Anigwe	PHO	F-C	10	65	10	1	65	5	10	.500	0	0	.5	10	.500	5	10	.500	5	13	2	1	2	6	12	15		
Ariel Atkins	WAS	G	36	1081	36	36	1081	185	440	.420	70	192	.365	115	248	.464	87	103	.845	34	117	83	49	9	51	99	527	
Amy Atwell	LAS	F	4	32	4	1	32	1	9	.111	1	6	.167	0	3	.000	0	0	.1	2	2	0	0	2	1	3		
Shakira Austin	WAS	C-F	36	776	36	32	776	122	223	.547	0	1	.000	122	222	.550	68	109	.624	63	233	33	26	30	54	84	312	
Rachel Banham	MIN	G	36	630	36	5	630	101	235	.430	57	149	.383	44	86	.512	24	30	.800	3	48	81	9	4	48	62	283	
Kierstan Bell	LVA	G	21	121	21	1	121	10	33	.303	3	22	.136	7	11	.636	4	4	1.000	4	19	7	2	3	5	10	27	
Katie Benzan	WAS	G	3	27	3	0	27	5	9	.556	5	7	.714	0	2	.000	3	4	.750	1	2	1	0	1	2	7	18	
Monique Billings	ATL	F	23	401	23	8	401	55	117	.470	0	1	.000	55	116	.474	39	51	.765	45	146	26	19	8	31	54	149	
Sue Bird	SEA	G	31	818	31	31	818	85	211	.403	56	144	.389	29	67	.433	16	16	1.000	6	59	186	38	4	60	23	242	
DeWanna Bonner	CON	F-G	33	991	33	33	991	156	355	.439	46	140	.329	110	215	.512	86	104	.827	25	156	91	41	11	52	59	444	
Lexie Brown	LAS	G	34	850	34	16	850	93	211	.441	53	133	.398	40	78	.513	4	6	.667	8	78	70	34	7	28	44	243	
Kennedy Burke	WAS	G-F	16	222	16	4	222	33	74	.446	11	32	.344	22	42	.524	10	17	.588	8	35	7	16	4	8	17	87	
Rae Burrell	LAS	G-F	3	44	3	1	44	1	9	.111	1	6	.167	0	3	.000	2	2	1.000	1	3	1	2	0	1	4	5	
Veronica Burton	DAL	G	36	548	36	6	548	25	76	.329	12	43	.279	13	33	.394	32	32	1.000	18	54	68	34	11	35	51	94	
Maya Caldwell	ATL	G	9	214	9	7	214	38	74	.514	18	32	.563	20	42	.476	4	5	.800	5	22	20	7	2	14	15	98	
Liz Cambage	LAS	C	25	584	25	24	584	117	230	.509	4	14	.286	113	216	.523	87	111	.784	33	160	52	16	41	57	79	325	
Jordin Canada	LAS	G	32	865	32	25	865	104	271	.384	7	50	.140	97	221	.439	79	98	.806	7	73	176	44	5	75	58	294	
Bridget Carleton	MIN	F	36	606	36	2	606	54	134	.403	29	82	.354	25	52	.481	19	26	.731	12	77	40	16	5	23	56	156	
DiJonai Carrington	CON	G-F	36	631	36	2	631	84	203	.414	19	62	.306	65	141	.461	57	76	.750	38	111	38	30	3	59	70	244	
Chennedy Carter	LAS	G	24	393	24	2	393	85	189	.450	2	10	.200	83	179	.464	41	55	.745	9	45	46	15	9	43	52	213	
Kaila Charles	ATL	G-F	1	2	1	0	2	0	0	.0	0	0	.0	0	0	.0	0	0	.0	0	0	0	0	0	0	0	1	0
Alysha Clark	WAS	F	29	766	29	29	766	91	196	.464	30	99	.303	61	97	.629	21	23	.913	23	131	59	27	8	38	55	233	
Natasha Cloud	WAS	G	34	1065	34	34	1065	123	308	.399	43	135	.319	80	173	.462	75	91	.824	16	122	239	34	10	94	55	364	
Nia Clouden	CON	G	28	250	28	0	250	18	53	.340	12	29	.414	6	24	.250	10	17	.588	2	23	21	6	1	12	26	58	
Alaina Coates	IND	C	8	75	8	0	75	7	11	.636	0	0	.7	11	.636	14	15	.933	6	16	2	2	3	5	18	28		
Nia Coffey	ATL	F	16	226	16	16	226	25	101	.247	0	21	.200	26	70	.271	22	21	.742	7	82	12	10	2	25	25	102	

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A1:A199 fx Player,Team,Pos,G,MP,G

	A	B	G	H	I	J	K
1	Player,Team,Pos,G,MP,G,GS,MP,FG,		ORB,TRB,AST,STL,BLK,TOV,PF,PTS				
2	Natalie Achonwa,MIN,F,22,332,22,0,		5,90,37,9,7,22,36,116				
3	Julie Allemand,CHI,G,25,402,25,4,40		39,85,14,3,33,23,74				
4	Lindsay Allen,MIN,G,9,134,9,0,134,2		11,2,0,7,11,60				
5	Rebecca Allen,NYL,G,25,523,25,19,5		3,8,84,31,21,24,24,48,174				
6	Yvonne Anderson,CON,G,11,101,11,1		1,9,12,3,2,11,14,35				
7	Kristine Anigwe,PHO,F-C,10,65,10,1,		6,12,15				
8	Ariel Atkins,WAS,G,36,1081,36,36,10		103,.845,34,117,83,49,9,51,99,527				
9	Amy Atwell,LAS,F,4,32,4,1,32,1,9,.11						
10	Shakira Austin,WAS,C-F,36,776,36,3		9,.624,63,233,33,26,30,54,84,312				
11	Rachel Banham,MIN,G,36,630,36,5,6		800,3,48,81,9,4,48,62,283				
12	Kierstan Bell,LVA,G,21,121,21,1,121,		2,3,5,10,27				
13	Katie Benzan,WAS,G,3,27,3,0,27,5,9						
14	Monique Billings,ATL,F,23,401,23,8,4		45,146,26,19,8,31,54,149				
15	Sue Bird,SEA,G,31,818,31,31,818,85		59,186,38,4,60,23,242				
16	DeWanna Bonner,CON,F-G,33,991,3		2,86,104,.827,25,156,91,41,11,52,59,444				
17	Lexie Brown,LAS,G,34,850,34,16,85		78,70,34,7,28,44,243				
18	Kennedy Burke,WAS,G-F,16,222,16,		38,8,35,7,16,4,8,17,87				
19	Rae Burrell,LAS,G-F,3,44,3,1,44,1,9,						
20	Veronica Burton,DAL,G,36,548,36,6,548,25,76,.329,12,43,.279,13,33,.394,32,32,1.000,18,54,68,34,11,35,51,94						
21	Maya Caldwell,ATL,G,9,214,9,7,214,38,74,.514,18,32,.563,20,42,.476,4,5,.800,5,22,20,7,2,14,15,98						
22	Liz Cambage,LAS,C,25,584,25,24,584,117,230,.509,4,14,.286,113,216,.523,87,111,.784,33,160,52,16,41,57,79,325						
23	Jordin Canada,	2,865,32,25,865,104,271,.384,7,50,.140,97,221,.439,79,98,.806,7,73,176,44,5,75,58,294					
24	Bridget Carleton,	36,606,36,2,606,54,134,.403,29,82,.354,25,52,.481,19,26,.731,12,77,40,16,5,23,56,156					
25	Dilani Carrington,CON,C,F,26,621,26,2,621,84,202,.414,19,62,.206,65,141,.461,57,76,.750,28,111,28,20,2,50,70,244						

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A1 fx Player

	A	B	C	D	E	F	G	H	I	J	K	
1	Player	Team	Pos	G	MP	G	GS	MP	FG	FGA	FG%	3P
2	Natalie Achon	MIN	F	22	332	22	0	332	47	91	0.516	
3	Julie Allemand	CHI	G	25	402	25	4	402	25	60	0.417	
4	Lindsay Allen	MIN	G	9	134	9	0	134	20	38	0.526	
5	Rebecca Allen	NYL	G	25	523	25	19	523	64	169	0.379	
6	Yvonne Anders	CON	G	11	101	11	0	101	12	26	0.462	
7	Kristine Anigwa	PHO	F-C	10	65	10	1	65	5	10	0.5	
8	Ariel Atkins	WAS	G	36	1081	36	36	1081	185	440	0.42	
9	Amy Atwell	LAS	F	4	32	4	1	32	1	9	0.111	
10	Shakira Austin	WAS	C-F	36	776	36	32	776	122	223	0.547	
11	Rachel Banham	MIN	G	36	630	36	5	630	101	235	0.43	
12	Kierstan Bell	LVA	G	21	121	21	1	121	10	33	0.303	
13	Katie Benzan	WAS	G	3	27	3	0	27	5	9	0.556	
14	Monique Billing	ATL	F	23	401	23	8	401	55	117	0.47	
15	Sue Bird	SEA	G	31	818	31	31	818	85	211	0.403	
16	DeWanna Bonner	CON	F-G	33	991	33	33	991	156	355	0.439	
17	Lexie Brown	LAS	G	34	850	34	16	850	93	211	0.441	
18	Kennedy Burke	WAS	G-F	16	222	16	4	222	33	74	0.446	
19	Rae Burrell	LAS	G-F	3	44	3	1	44	1	9	0.111	
20	Veronica Burton	DAL	G	36	548	36	6	548	25	76	0.329	
21	Maya Caldwell	ATL	G	9	214	9	7	214	38	74	0.514	
22	Liz Cambage	LAS	C	25	584	25	24	584	117	230	0.509	
23	Jordin Canada	LAS	G	32	865	32	25	865	104	271	0.384	
24	Bridget Carleton	MIN	F	36	606	36	2	606	54	134	0.403	
25	Dijana Carrion	CON	C-F	26	621	26	0	621	84	202	0.414	

+ Sheet1 Explore

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WNBA stats

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	A	B	C	D	E	F	G	H	I	J	K	
1	Player	Team	Pos						FG	FGA	FG%	
2	Natalie Achonwa	MIN	F						332	47	91	0.51
3	Julie Allemand	CHI	G						402	25	60	0.41
4	Lindsay Allen	MIN	G						134	20	38	0.52
5	Rebecca Allen	NYL	G						523	64	169	0.37
6	Yvonne Anderson	CON	G						101	12	26	0.46
7	Kristine Anigwe	PHO	F-C						65	5	10	0.
8	Ariel Atkins	WAS	G						1081	185	440	0.4
9	Amy Atwell	LAS	F						32	1	9	0.11
10	Shakira Austin	WAS	C-F						776	122	223	0.54
11	Rachel Banham	MIN	G						630	101	235	0.4
12	Kierstan Bell	LVA	G						121	10	33	0.30
13	Katie Benzan	WAS	G						27	5	9	0.55
14	Monique Billings	ATL	F						401	55	117	0.4
15	Sue Bird	SEA	G						818	85	211	0.40
16	DeWanna Bonner	CON	F-G						991	156	355	0.43
17	Lexie Brown	LAS	G						850	93	211	0.44
18	Kennedy Burke	WAS	G-F						222	33	74	0.44
19	Rae Burrell	LAS	G-F						44	1	9	0.11
20	Veronica Burton	DAL	G						548	25	76	0.32
21	Maya Caldwell	ATL	G		9	214	9	7	214	38	74	0.51
22	Liz Cambage	LAS	C		25	584	25	24	584	117	230	0.50
23	Jordin Canada	LAS	G		32	865	32	25	865	104	271	0.38
24	Bridget Carleton	MIN	F		36	606	36	2	606	54	134	0.40

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+ Marc Smith

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Jonathan Gordon (you)
jgordon@vassar.edu Owner

General access

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wnba-stats Explore

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dsheets/d/15QrIChqLouVS5jsC6-BCjc8KpM0lcYUmswFIHgWG-kl/edit?gid=0

WNBA stats

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C7 fx F-C

	A	B	C	D	E	F	G	H	I	J	K	
1	Player	Team	Pos	G	MP	G	GS	MP	FG	FGA	FG%	
2	Natalie Achonwa	MIN	F		22	332	22	0	332	47	91	0.51
3	Julie Allemand	CHI	G		25	402	25	4	402	25	60	0.41
4	Lindsay Allen	MIN	G		9	134	9	0	134	20	38	0.52
5	Rebecca Allen	NYL	G		25	523	25	19	523	64	169	0.37
6	Yvonne Anderson	CON	G		11	101	11	0	101	12	26	0.46
7	Kristine Anigwe	PHO	F-C		10	65	10	1	65	5	10	0.
8	Ariel Atkins	WAS	G		36	1081	36	36	1081	185	440	0.4
9	Amy Atwell	LAS	F		4	32	4	1	32	1	9	0.11
10	Shakira Austin	WAS	C-F		36	776	36	32	776	122	223	0.54
11	Rachel Banham	MIN	G		36	630	36	5	630	101	235	0.4
12	Kierstan Bell	LVA	G		21	121	21	1	121	10	33	0.30
13	Katie Benzan	WAS	G		3	27	3	0	27	5	9	0.55
14	Monique Billings	ATL	F		23	401	23	8	401	55	117	0.4
15	Sue Bird	SEA	G		31	818	31	31	818	85	211	0.40
16	DeWanna Bonner	CON	F-G		33	991	33	33	991	156	355	0.43
17	Lexie Brown	LAS	G		34	850	34	16	850	93	211	0.44
18	Kennedy Burke	WAS	G-F		16	222	16	4	222	33	74	0.44
19	Rae Burrell	LAS	G-F		3	44	3	1	44	1	9	0.11
20	Veronica Burton	DAL	G		36	548	36	6	548	25	76	0.32
21	Maya Caldwell	ATL	G		9	214	9	7	214	38	74	0.51
22	Liz Cambage	LAS	C		25	584	25	24	584	117	230	0.50
23	Jordin Canada	LAS	G		32	865	32	25	865	104	271	0.38
24	Bridget Carleton	MIN	F		36	606	36	2	606	54	134	0.40

wnba-stats Explore

```
include gdrive-sheets
```

```
include shared-gdrive("dcic-2021",  
"1wyQZj_L0qqV9Ekgr9au6RX2iqt2Ga8Ep")
```

```
#
```

```
# Load spreadsheet as a table
```

```
#
```

```
ssid = "15QrIChqLouVS5jsC6-BCjc8KpM0IcYUmswFIHgWG-kl"
```

```
spreadsheet = load-spreadsheet(ssid)
```

docs.google.com/spreadsheets/d/15QrlChqLouVS5jsC6-BCjc8KpM0lcYU

WNBA stats

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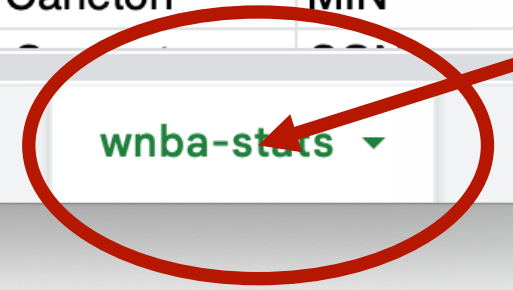
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A1 fx Player

	A	B	C	D	E	F	G	H
1	Player	Team	Pos	G	MP	G	GS	MP
2	Natalie Achonwa	MIN	F		22	332	22	0
3	Julie Allemand	CHI	G		25	402	25	4
4	Lindsay Allen	MIN	G		9	134	9	0
5	Rebecca Allen	NYL	G		25	523	25	19
6	Yvonne Anderson	CON	G		11	101	11	0
7	Kristine Anigwe	PHO	F-C		10	65	10	1
8	Ariel Atkins	WAS	G		36	1081	36	36
9	Amy Atwell	LAS	F		4	32	4	1
10	Shakira Austin	WAS	C-F		36	776	36	32
11	Rachel Banham	MIN	G		36	630	36	5
12	Kierstan Bell	LVA	G		21	121	21	1
13	Katie Benzan	WAS	G		3	27	3	0
14	Monique Billings	ATL	F		23	401	23	8
15	Sue Bird	SEA	G		31	818	31	31
16	DeWanna Bonner	CON	F-G		33	991	33	33
17	Lexie Brown	LAS	G		34	850	34	16
18	Kennedy Burke	WAS	G-F		16	222	16	4
19	Rae Burrell	LAS	G-F		3	44	3	1
20	Veronica Burton	DAL	G		36	548	36	6
21	Maya Caldwell	ATL	G		9	214	9	7
22	Liz Cambage	LAS	C		25	584	25	24
23	Jordin Canada	LAS	G		32	865	32	25
24	Bridget Carleton	MIN	F		36	606	36	2

+ wnba-stats

>>> spreadsheet
 spreadsheet("wnba-stats")




```
include gdrive-sheets
```

```
include shared-gdrive("dcic-2021",  
  "1wyQZj_L0qqV9Ekgr9au6RX2iqt2Ga8Ep")
```

```
#
```

```
# Load spreadsheet as a table
```

```
#
```

```
ssid = "15QrlChqLouVS5jsC6-BCjc8KpM0lcYUmswFlHgWG-kl"
```

```
spreadsheet = load-spreadsheet(ssid)
```

```
stats =
```

```
  load-table:
```

```
    ...
```

```
    source: spreadsheet.sheet-by-name("wnba-stats", true)
```

```
  end
```

WNBA stats

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C7 fx F-C

	A	B	C	D	E	F	G	H	I	J	K
1	Player	Team	Pos	G	MP	G	GS	MP	FG	FGA	FG%
2	Natalie Achonwa	MIN	F	22	332	22	0	332	47	91	0.51
3	Julie Allemand	CHI	G								
4	Lindsay Allen	MIN	G								
5	Rebecca Allen	NYL	G								
6	Yvonne Anderson	CON	G								
7	Kristine Anigwe	PHO	F-C								
8	Ariel Atkins	WAS	G								
9	Amy Atwell	LAS	F								
10	Shakira Austin	WAS	C-F								
11	Rachel Banham	MIN	G	36	630	36	5	630	101	235	0.4
12	Kierstan Bell	LVA	G	21	121	21	1	121	10	33	0.30
13	Katie Benzan	WAS	G	3	27	3	0	27	5	9	0.55
14	Monique Billings	ATL	F	23	401	23	8	401	55	117	0.4
15	Sue Bird	SEA	G	31	818	31	31	818	85	211	0.40
16	DeWanna Bonner	CON	F-G	33	991	33	33	991	156	355	0.43
17	Lexie Brown	LAS	G	34	850	34	16	850	93	211	0.44
18	Kennedy Burke	WAS	G-F	16	222	16	4	222	33	74	0.44
19	Rae Burrell	LAS	G-F	3	44	3	1	44	1	9	0.11
20	Veronica Burton	DAL	G	36	548	36	6	548	25	76	0.32
21	Maya Caldwell	ATL	G	9	214	9	7	214	38	74	0.51
22	Liz Cambage	LAS	C	25	584	25	24	584	117	230	0.50
23	Jordin Canada	LAS	G	32	865	32	25	865	104	271	0.38
24	Bridget Carleton	MIN	F	36	606	36	2	606	54	134	0.40

wnba-stats Explore

This is a lot of columns, and we don't actually care about most of them, so we don't need to load them into our table.

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WNBA stats ☆ 📁 Saved to Drive 📈 💬 Share 👤

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A1 fx Player

	A	B	C	D	E	F	G	H	I	J	K	
1	Player	Team	Pos	G	MP	G	GS	MP	FG	FGA	FG%	
2	Natalie Achonwa	MIN	F		22	332	22	0	332	47	91	0.51
3	Julie Allemand	CHI	G		25	402	25	4	402	25	60	0.41
4	Lindsay Allen	MIN	G		9	134	9	0	134	20	38	0.52
5	Rebecca Allen	NYL	G		25	523	25	19	523	64	169	0.37
6	Yvonne Anderson	CON	G		11	101	11	0	101	12	26	0.46
7	Kristine Anigwe	PHO	F-C		10	65	10	1	65	5	10	0.
8	Ariel Atkins	WAS	G		36	1081	36	36	1081	185	440	0.4
9	Amy Atwell	LAS	F		4	32	4	1	32	1	9	0.11
10	Shakira Austin	WAS	C-F		36	776	36	32	776	122	223	0.54
11	Rachel B...		G		36	630	36	5	630	101	235	0.4
12	Kierstan E...		G		21	121	21	1	121	10	33	0.30
13	Katie Bern...		G		3	27	3	0	27	5	9	0.55
14	Monique E...		F		23	401	23	8	401	55	117	0.4
15	Sue Bird		G		31	818	31	31	818	85	211	0.40
16	DeWanna		F-G		33	991	33	33	991	156	355	0.43
17	Lexie Bro...		G		34	850	34	16	850	93	211	0.44
18	Kennedy I...		G-F		16	222	16	4	222	33	74	0.44
19	Rae Burre...		G-F		3	44	3	1	44	1	9	0.11
20	Veronica E...		G		36	548	36	6	548	25	76	0.32
21	Maya Cal...		G		9	214	9	7	214	38	74	0.51
22	Liz Camb...		C		25	584	25	24	584	117	230	0.50
23	Jordin Car...		G		32	865	32	25	865	104	271	0.38
24	Bridget Ca...		F		36	606	36	2	606	54	134	0.40

Context menu for row 12:

- Delete
- Duplicate**
- Copy to
- Rename
- Change color
- Protect sheet
- Hide sheet
- View comments
- Move right
- Move left

wnba-stats + ☰ Explore

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WNBA stats

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A1 fx Player

	A	B	C	D	E	F	G	H	I	J	K	
1	Player	Team	Pos	G	MP	G	GS	MP	FG	FGA	FG%	
2	Natalie Achonwa	MIN	F		22	332	22	0	332	47	91	0.51
3	Julie Allemand	CHI	G		25	402	25	4	402	25	60	0.41
4	Lindsay Allen	MIN	G		9	134	9	0	134	20	38	0.52
5	Rebecca Allen	NYL	G		25	523	25	19	523	64	169	0.37
6	Yvonne Anderson	CON	G		11	101	11	0	101	12	26	0.46
7	Kristine Anigwe	PHO	F-C		10	65	10	1	65	5	10	0.
8	Ariel Atkins	WAS	G		36	1081	36	36	1081	185	440	0.4
9	Amy Atwell	LAS	F		4	32	4	1	32	1	9	0.11
10	Shakira Austin	WAS	C-F		36	776	36	32	776	122	223	0.54
11	Rachel Banham	MIN			36	630	36	5	630	101	235	0.4
12	Kierstan Bell	LVA			21	121	21	1	121	10	33	0.30
13	Katie Benzan	WAS			3	27	3	0	27	5	9	0.55
14	Monique Billings	ATL			23	401	23	8	401	55	117	0.4
15	Sue Bird	SEA			31	818	31	31	818	85	211	0.40
16	DeWanna Bonner	CON			33	991	33	33	991	156	355	0.43
17	Lexie Brown	LAS			34	850	34	16	850	93	211	0.44
18	Kennedy Burke	WAS			16	222	16	4	222	33	74	0.44
19	Rae Burrell	LAS			3	44	3	1	44	1	9	0.11
20	Veronica Burton	DAL			36	548	36	6	548	25	76	0.32
21	Maya Caldwell	ATL			9	214	9	7	214	38	74	0.51
22	Liz Cambage	LAS			25	584	25	24	584	117	230	0.50
23	Jordin Canada	LAS			32	865	32	25	865	104	271	0.38
24	Bridget Carleton	MIN			36	606	36	2	606	54	134	0.40

Context menu for cell A15 (Sue Bird):

- Delete
- Duplicate
- Copy to
- Rename
- Change color
- Protect sheet
- Hide sheet
- View comments
- Move right
- Move left

wnba-stats Copy of wnba-stats Explore

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WNBA stats

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Undo ⌘Z
Redo ⌘Y
Cut ⌘X
Copy ⌘C
Paste ⌘V
Paste special
Move
Delete
Find and replace ⌘+Shift+H

Values
Columns E - AA
Notes

	V	W	X	Y	Z	AA	AB				
	TRB	AST	STL	BLK	TOV	PF	PTS				
1	25	90	37	9	7	22	36	116			
2	9	39	85	14	3	33	23	74			
3	0	14	31	2	0	7	11	60			
4	8	84	31	21	24	24	48	174			
5	3	9	12	3	2	11	14	35			
6	5	13	2	1	2	6	12	15			
7	24	117	22	49	9	51	99	527			
8	0	0	0	0	0	2	1	3			
9	26	30	54	84	312	283	27				
10	9	4	48	62	283	27	18				
11	4	4	1	1	2	7	18				
12	39	51	0.765	45	146	26	19	8	31	54	149
13	16	16	1	6	59	186	38	4	60	23	242
14	86	104	0.827	25	156	91	41	11	52	59	444
15	4	6	0.667	8	78	70	34	7	28	44	243
16	10	17	0.588	8	35	7	16	4	8	17	87
17	2	2	1	1	3	1	2	0	1	4	5
18	32	32	1	18	54	68	34	11	35	51	94
19	4	5	0.8	5	22	20	7	2	14	15	98
20	87	111	0.784	33	160	52	16	41	57	79	325
21	79	98	0.806	7	73	176	44	5	75	58	294
22	19	26	0.731	12	77	40	16	5	23	56	156

wnba-stats wnba-stats-simple Sum: 3404... Explore

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WNBA stats

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A1 fx Player

	A	B	C	D	E
1	Player	Team	Pos	G	PTS
2	Natalie Achonwa	MIN	F	22	116
3	Julie Allemand	CHI	G	25	74
4	Lindsay Allen	MIN	G	9	60
5	Rebecca Allen	NYL	G	25	174
6	Yvonne Anderson	CON	G	11	35
7	Kristine Anigwe	PHO	F-C	10	15
8	Ariel Atkins	WAS	G	36	527
9	Amy Atwell	LAS	F	4	3
10	Shakira Austin	WAS	C-F	36	312
11	Rachel Banham	MIN	G	36	283
12	Kierstan Bell	LVA	G	21	27
13	Katie Benzan	WAS	G	3	18
14	Monique Billings	ATL	F	23	149
15	Sue Bird	SEA	G	31	242
16	DeWanna Bonner	CON	F-G	33	444
17	Lexie Brown	LAS	G	34	243
18	Kennedy Burke	WAS	G-F	16	87
19	Rae Burrell	LAS	G-F	3	5
20	Veronica Burton	DAL	G	36	94
21	Maya Caldwell	ATL	G	9	98
22	Liz Cambage	LAS	C	25	325
23	Jordin Canada	LAS	G	32	294
24	Bridget Carleton	MIN	F	36	156

+ wnba-stats wnba-stats-simple Explore

```
include gdrive-sheets
```

```
include shared-gdrive("dcic-2021",  
  "1wyQZj_L0qqV9Ekgr9au6RX2iqt2Ga8Ep")
```

```
#
```

```
# Load spreadsheet as a table
```

```
#
```

```
ssid = "15QrlChqLouVS5jsC6-BCjc8KpM0lcYUmswFlHgWG-kl"
```

```
spreadsheet = load-spreadsheet(ssid)
```

```
stats =
```

```
  load-table:
```

```
    ...
```

```
    source: spreadsheet.sheet-by-name("wnba-stats", true)
```

```
  end
```

```
include gdrive-sheets
```

```
include shared-gdrive("dcic-2021",  
  "1wyQZj_L0qqV9Ekgr9au6RX2iqt2Ga8Ep")
```

```
#
```

```
# Load spreadsheet as a table
```

```
#
```

```
ssid = "15QrlChqLouVS5jsC6-BCjc8KpM0lcYUmswFlHgWG-kl"
```

```
spreadsheet = load-spreadsheet(ssid)
```

```
stats =
```

```
  load-table:
```

```
    player, team, pos, games, pts
```

```
    source: spreadsheet.sheet-by-name("wnba-stats-simple", true)
```

```
  end
```


>>> stats

player	team	pos	games	pts
"Natalie Achonwa"	"MIN"	"F"	22	116
"Julie Allemand"	"CHI"	"G"	25	74
"Lindsay Allen"	"MIN"	"G"	9	60
"Rebecca Allen"	"NYL"	"G"	25	174
"Yvonne Anderson"	"CON"	"G"	11	35
"Kristine Anigwe"	"PHO"	"F-C"	10	15
"Ariel Atkins"	"WAS"	"G"	36	527

Exercise: Who scores the most points per game?

So, to compute the average points per game for each player we need to build a new column.

```
fun average-pts(r :: Row) -> Number:  
  doc: "Return the average number of points the player scored per game"  
  r["pts"] / r["games"]  
where:  
  ...  
end
```

test-table =

table: player, team, pos, games, pts

row: "A", "X", "F", 10, 100

row: "B", "X", "F", 1, 3

end

fun **average-pts**(r :: Row) -> Number:

doc: "Return the average number of points the player scored per game"

r["pts"] / r["games"]

where:

average-pts(test-table.row-n(0)) is 10

average-pts(test-table.row-n(1)) is 3

end

››› build-column(stats, "avg", average-pts)

player	team	pos	games	pts	avg
"Natalie Achonwa"	"MIN"	"F"	22	116	5.27
"Julie Allemand"	"CHI"	"G"	25	74	2.96
"Lindsay Allen"	"MIN"	"G"	9	60	6.6
"Rebecca Allen"	"NYL"	"G"	25	174	6.96
"Yvonne Anderson"	"CON"	"G"	11	35	3.18
"Kristine Anigwe"	"PHO"	"F-C"	10	15	1.5

Interlude: Introducing λ

```
››› build-column(stats, "avg",  
lam(r): r["pts"] / r["games"] end)
```

player	team	pos	games	pts	avg
"Natalie Achonwa"	"MIN"	"F"	22	116	5.27
"Julie Allemand"	"CHI"	"G"	25	74	2.96
"Lindsay Allen"	"MIN"	"G"	9	60	6.6
"Rebecca Allen"	"NYL"	"G"	25	174	6.96
"Yvonne Anderson"	"CON"	"G"	11	35	3.18
"Kristine Anigwe"	"PHO"	"F-C"	10	15	1.5

A *lambda expression* defines an anonymous function – a function that can be passed as an argument but doesn't have an associated name.

Lambda expressions can be convenient for giving to higher-order functions like `filter-with` and `build-column`.

Exercise: Back to our question

We can sort by the values in our new column, but first we need to give a name to that table:

```
>>> with-avg = build-column(stats, "avg",  
  lam(r): r["pts"] / r["games"] end)  
>>> order-by(with-avg, "avg", false)
```

player	team	pos	games	pts	avg
"Breanna Stewart"	"SEA"	"F"	34	741	21.79411764705882352
"Kelsey Plum"	"LVA"	"G"	36	726	20.1 $\bar{6}$
"Skylar Diggins-Smith"	"PHO"	"G"	30	591	19.7
"Arike Ogunbowale"	"DAL"	"G"	30	590	19.6 $\bar{6}$
"A'ja Wilson"	"LVA"	"F"	36	703	19.52 $\bar{7}$
"Kelsey Mitchell"	"IND"	"G"	31	569	18.354838709677419

```
top-scorers = order-by(with-avg, "avg", false)
```

```
filter-with(top-scorers,  
lam(r): r["team"] == "SEA" end)
```

player	team	pos	games	pts	avg
"Breanna Stewart"	"SEA"	"F"	34	741	21.79411764705882352
"Jewell Loyd"	"SEA"	"G"	36	586	16.27
"Tina Charles"	"SEA"	"C"	18	226	12.5
"Kaela Davis"	"SEA"	"F"	1	11	11
"Ezi Magbegor"	"SEA"	"C"	33	315	9.54
"Sue Bird"	"SEA"	"G"	31	242	7.806451612903225