CMPU 100 · Programming with Data

Working with Tabular Data

Class 7

Tabular data	*Feb. 9*	*Feb. 11*	*Feb. 13*
– Read CIT §6–6.4 – Read CIT §7.1–7.3 – Assignment 3	**Class 6** Tables – Slides – Notebook	**Class 7** Working with tabular data	**Lab 3**
End of Part 1	*Feb. 16*	*Feb. 18*	*Feb. 20*
	Class 8 Review	Class 9 Introduction to visualization	**Exam 1**

Part 2: Data manipulation and analysis

Data cleaning	*Feb. 23*	*Feb. 25*	*Feb. 27*
– Read CIT §8.1 – Assignment 4	Class 10 Data exploration and visualization	Class 11 Data sanitizing	Lab 4

Loading tabular data

WNBA

Step 0: Get data

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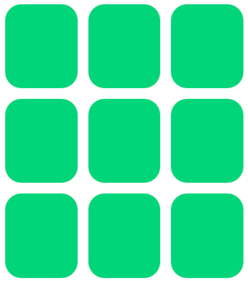

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Keshon Gilbert (WAS), Max Shulga (BOS), Tristan Enaruna (CLE), LJ Cryer (GSW), Kam Jones (IND) and Vladislav Goldin (MIA)

Every NBA Team

2025-26 NBA Standings

Summary · Schedule · Scores · Leaders · Rookies

East			W	L
DET (1)	F	$	39	13
BOS (2)	F	$	34	19
NYK (3)	F	$	34	20
CLE (4)	F	$	33	21
TOR (5)	F	$	32	22
PHI (6)	F	$	30	23
ORL (7)	F	$	28	24
MIA (8)	F	$	28	27
ATL (9)	F	$	26	29
CHO (10)	F	$	25	29
CHI (11)	F	$	24	30
MIL (12)	F	$	21	30
BRK (13)	F	$	15	37
WAS (14)	F	$	14	38
IND (15)	F	$	14	40

West			W	L
OKC (1)	F	$	41	13
SAS (2)	F	$	37	16
HOU (3)	F	$	33	19
DEN (4)	F	$	34	20
LAL (5)	F	$	32	21
MIN (6)	F	$	33	22
PHO (7)	F	$	32	22
GSW (8)	F	$	29	25
POR (9)	F	$	26	28
LAC (10)	F	$	25	28
MEM (11)	F	$	20	32
DAL (12)	F	$	19	34
UTA (13)	F	$	17	37
NOP (14)	F	$	15	40
SAC (15)	F	$	12	43

Playoff Probabilities:

East: DET - Div (99.0%), Conf (35.7%), Win Finals (12.7%)

West: OKC - Div (100.0%), Conf (69.4%), Win Finals (56.9%)

Projected Draft Order: SAC, WAS, IND, BRK, NOP, more

MVP Tracker: Nikola Jokić 78.7%, Shai Gilgeous-Alexander 16.2%, Luka Dončić 1.5%, Cade Cunningham 1.5%, Victor Wembanyama 0.6%

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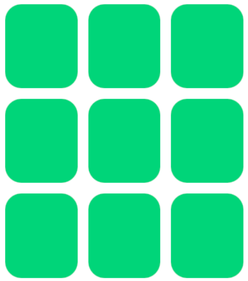

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Recent Debuts

Keshon Gilbert (WAS), Max Shulga (BOS), Tristan Enaruna (CLE), LJ Cryer (GSW), Kam Jones (IND) and Vladislav Goldin (MIA)

NYK (3)	F	$	34	20	HOU (3)	F	$	33	19
CLE (4)	F	$	33	21	DEN (4)	F	$	34	20
TOR (5)	F	$	32	22	LAL (5)	F	$	32	21
PHI (6)	F	$	30	23	MIN (6)	F	$	33	22
ORL (7)	F	$	28	24	PHO (7)	F	$	32	22
MIA (8)	F	$	28	27	GSW (8)	F	$	29	25
ATL (9)	F	$	26	29	POR (9)	F	$	26	28
CHO (10)	F	$	25	29	LAC (10)	F	$	25	28
CHI (11)	F	$	24	30	MEM (11)	F	$	20	32
MIL (12)	F	$	21	30	DAL (12)	F	$	19	34
BRK (13)	F	$	15	37	UTA (13)	F	$	17	37
WAS (14)	F	$	14	38	NOP (14)	F	$	15	40
IND (15)	F	$	14	40	SAC (15)	F	$	12	43

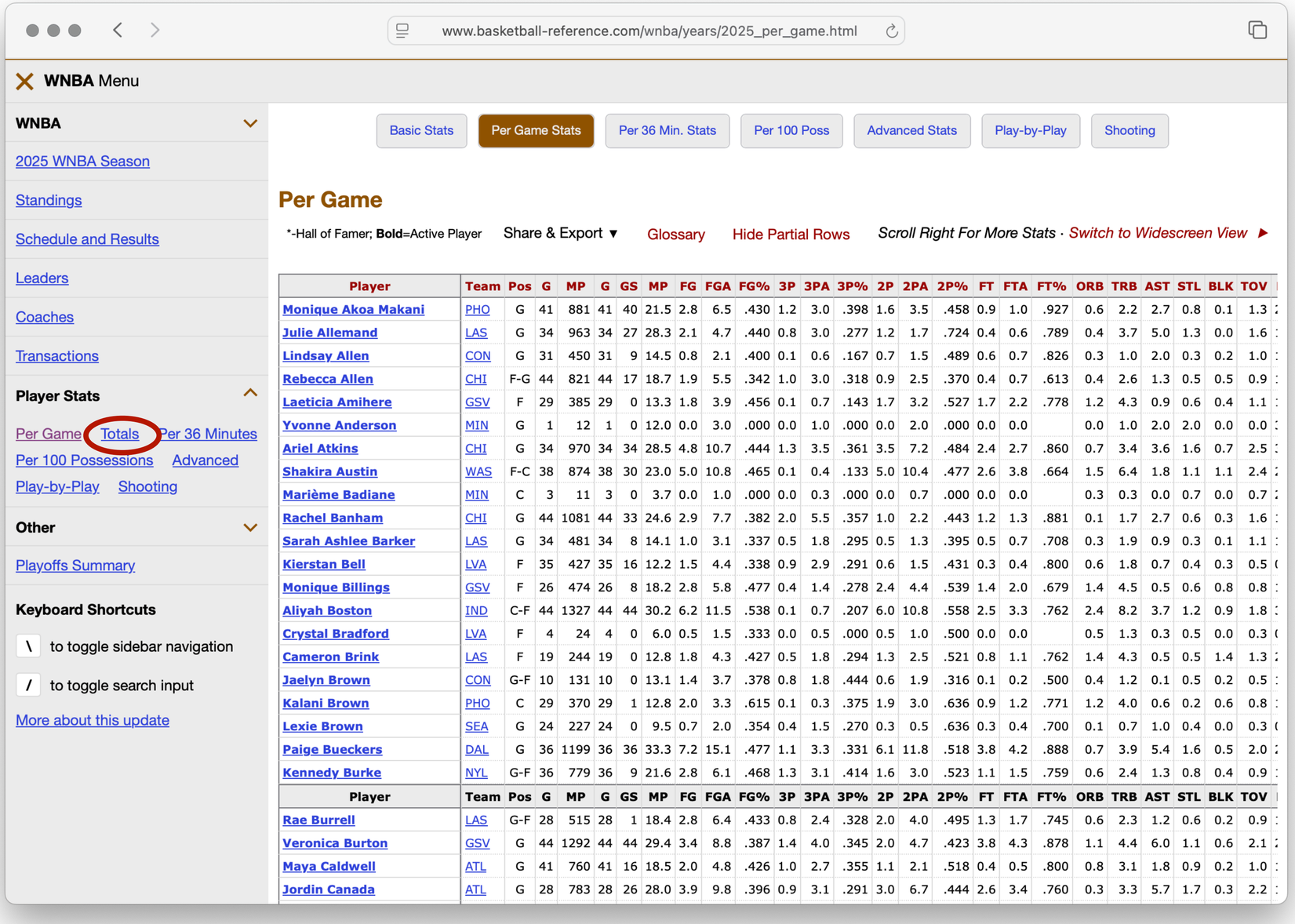
Playoff Probabilities:

East: DET - Div (99.0%), Conf (35.7%), Win Finals (12.7%)

West: OKC - Div (100.0%), Conf (69.4%), Win Finals (56.9%)

Projected Draft Order: SAC, WAS, IND, BRK, NOP, more

MVP Tracker: Nikola Jokić 78.7%, Shai Gilgeous-Alexander 16.2%, Luka Dončić 1.5%, Cade Cunningham 1.5%, Victor Wembanyama 0.6%



Player	Team	Pos	G	MP	G	GS	MP	FG	FGA	FG%	3P	3PA	3P%	2P	2PA	2P%	FT	FTA	FT%	ORB	TRB	AST	STL	BLK	TOV
Monique Akoa Makani	PHO	G	41	881	41	40	21.5	2.8	6.5	.430	1.2	3.0	.398	1.6	3.5	.458	0.9	1.0	.927	0.6	2.2	2.7	0.8	0.1	1.3
Julie Allemand	LAS	G	34	963	34	27	28.3	2.1	4.7	.440	0.8	3.0	.277	1.2	1.7	.724	0.4	0.6	.789	0.4	3.7	5.0	1.3	0.0	1.6
Lindsay Allen	CON	G	31	450	31	9	14.5	0.8	2.1	.400	0.1	0.6	.167	0.7	1.5	.489	0.6	0.7	.826	0.3	1.0	2.0	0.3	0.2	1.0
Rebecca Allen	CHI	F-G	44	821	44	17	18.7	1.9	5.5	.342	1.0	3.0	.318	0.9	2.5	.370	0.4	0.7	.613	0.4	2.6	1.3	0.5	0.5	0.9
Laeticia Amihere	GSV	F	29	385	29	0	13.3	1.8	3.9	.456	0.1	0.7	.143	1.7	3.2	.527	1.7	2.2	.778	1.2	4.3	0.9	0.6	0.4	1.1
Yvonne Anderson	MIN	G	1	12	1	0	12.0	0.0	3.0	.000	0.0	1.0	.000	0.0	2.0	.000	0.0	0.0		0.0	1.0	2.0	2.0	0.0	0.0
Ariel Atkins	CHI	G	34	970	34	34	28.5	4.8	10.7	.444	1.3	3.5	.361	3.5	7.2	.484	2.4	2.7	.860	0.7	3.4	3.6	1.6	0.7	2.5
Shakira Austin	WAS	F-C	38	874	38	30	23.0	5.0	10.8	.465	0.1	0.4	.133	5.0	10.4	.477	2.6	3.8	.664	1.5	6.4	1.8	1.1	1.1	2.4
Marième Badiane	MIN	C	3	11	3	0	3.7	0.0	1.0	.000	0.0	0.3	.000	0.0	0.7	.000	0.0	0.0		0.3	0.3	0.0	0.7	0.0	0.7
Rachel Banham	CHI	G	44	1081	44	33	24.6	2.9	7.7	.382	2.0	5.5	.357	1.0	2.2	.443	1.2	1.3	.881	0.1	1.7	2.7	0.6	0.3	1.6
Sarah Ashlee Barker	LAS	G	34	481	34	8	14.1	1.0	3.1	.337	0.5	1.8	.295	0.5	1.3	.395	0.5	0.7	.708	0.3	1.9	0.9	0.3	0.1	1.1
Kierstan Bell	LVA	F	35	427	35	16	12.2	1.5	4.4	.338	0.9	2.9	.291	0.6	1.5	.431	0.3	0.4	.800	0.6	1.8	0.7	0.4	0.3	0.5
Monique Billings	GSV	F	26	474	26	8	18.2	2.8	5.8	.477	0.4	1.4	.278	2.4	4.4	.539	1.4	2.0	.679	1.4	4.5	0.5	0.6	0.8	0.8
Aliyah Boston	IND	C-F	44	1327	44	44	30.2	6.2	11.5	.538	0.1	0.7	.207	6.0	10.8	.558	2.5	3.3	.762	2.4	8.2	3.7	1.2	0.9	1.8
Crystal Bradford	LVA	F	4	24	4	0	6.0	0.5	1.5	.333	0.0	0.5	.000	0.5	1.0	.500	0.0	0.0		0.5	1.3	0.3	0.5	0.0	0.3
Cameron Brink	LAS	F	19	244	19	0	12.8	1.8	4.3	.427	0.5	1.8	.294	1.3	2.5	.521	0.8	1.1	.762	1.4	4.3	0.5	0.5	1.4	1.3
Jaelyn Brown	CON	G-F	10	131	10	0	13.1	1.4	3.7	.378	0.8	1.8	.444	0.6	1.9	.316	0.1	0.2	.500	0.4	1.2	0.1	0.5	0.2	0.5
Kalani Brown	PHO	C	29	370	29	1	12.8	2.0	3.3	.615	0.1	0.3	.375	1.9	3.0	.636	0.9	1.2	.771	1.2	4.0	0.6	0.2	0.6	0.8
Lexie Brown	SEA	G	24	227	24	0	9.5	0.7	2.0	.354	0.4	1.5	.270	0.3	0.5	.636	0.3	0.4	.700	0.1	0.7	1.0	0.4	0.0	0.3
Paige Bueckers	DAL	G	36	1199	36	36	33.3	7.2	15.1	.477	1.1	3.3	.331	6.1	11.8	.518	3.8	4.2	.888	0.7	3.9	5.4	1.6	0.5	2.0
Kennedy Burke	NYL	G-F	36	779	36	9	21.6	2.8	6.1	.468	1.3	3.1	.414	1.6	3.0	.523	1.1	1.5	.759	0.6	2.4	1.3	0.8	0.4	0.9
Player	**Team**	**Pos**	**G**	**MP**	**G**	**GS**	**MP**	**FG**	**FGA**	**FG%**	**3P**	**3PA**	**3P%**	**2P**	**2PA**	**2P%**	**FT**	**FTA**	**FT%**	**ORB**	**TRB**	**AST**	**STL**	**BLK**	**TOV**
Rae Burrell	LAS	G-F	28	515	28	1	18.4	2.8	6.4	.433	0.8	2.4	.328	2.0	4.0	.495	1.3	1.7	.745	0.6	2.3	1.2	0.6	0.2	0.9
Veronica Burton	GSV	G	44	1292	44	44	29.4	3.4	8.8	.387	1.4	4.0	.345	2.0	4.7	.423	3.8	4.3	.878	1.1	4.4	6.0	1.1	0.6	2.1
Maya Caldwell	ATL	G	41	760	41	16	18.5	2.0	4.8	.426	1.0	2.7	.355	1.1	2.1	.518	0.4	0.5	.800	0.8	3.1	1.8	0.9	0.2	1.0
Jordin Canada	ATL	G	28	783	28	26	28.0	3.9	9.8	.396	0.9	3.1	.291	3.0	6.7	.444	2.6	3.4	.760	0.3	3.3	5.7	1.7	0.3	2.2

2025 WNBA Player Stats - Totals

« Previous Season

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Most Valuable Player: A'ja Wilson
PPG Leader: A'ja Wilson (23.4)
RPG Leader: Angel Reese (12.6)
APG Leader: Alyssa Thomas (9.2)
WS Leader: A'ja Wilson (9.5)

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Basic Stats | Per Game Stats | Per 36 Min. Stats | Per 100 Poss | Advanced Stats | Play-by-Play | Shooting

Totals

*-Hall of Famer; **Bold**=Active Player Share & Export ▾ Glossary Hide Partial Rows

Player	Team	Pos	G	MP	G	GS	MP	FG	FGA	FG%	3P	3PA	3P%	2P	2PA	2P%	FT	FTA	FT%	ORB	TRB	AST	STL	BLK	TOV	PF	PTS
Monique Akoa Makani	PHO	G	41	881	41	40	881	114	266	.429	49	124	.395	65	142	.458	38	41	.927	25	91	111	32	3	55	101	315
Julie Allemand	LAS	G	34	963	34	27	963	70	159	.440	28	101	.277	42	58	.724	15	19	.789	13	127	170	45	1	53	55	183
Lindsay Allen	CON	G	31	450	31	9	450	26	65	.400	3	18	.167	23	47	.489	19	23	.826	9	32	61	10	6	31	37	74
Rebecca Allen	CHI	F-G	44	821	44	17	821	82	240	.342	42	132	.318	40	108	.370	19	31	.613	16	113	57	23	23	39	62	225
Laeticia Amihere	GSV	F	29	384	29	0	384	52	114	.456	3	21	.143	49	93	.527	49	63	.778	35	125	27	17	13	32	36	156
Yvonne Anderson	MIN	G	1	12	1	0	12	0	3	.000	0	1	.000	0	2	.000	0	0		0	1	2	2	0	0	3	0
Ariel Atkins	CHI	G	34	971	34	34	971	162	365	.444	43	119	.361	119	246	.484	80	93	.860	23	114	122	53	24	84	102	447
Shakira Austin	WAS	F-C	38	874	38	30	874	191	411	.465	2	15	.133	189	396	.477	97	146	.664	57	242	68	41	43	92	81	481
Marième Badiane	MIN	C	3	11	3	0	11	0	3	.000	0	1	.000	0	2	.000	0	0		1	1	0	2	0	2	6	0

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Player	Team	Pos	G	MP	G	GS	MP	FG	FGA	FG%	3P	3PA	3P%	2P	2PA	2P%	FT	FTA	FT%	ORB	TRB	AST	STL	BLK	TOV	PF	PTS
Monique Akoa Makani	PHO	G	41	881	41	40	881	114	266	.429	49	124	.395	65	142	.458	38	41	.927	25	91	111	32	3	55	101	315
Julie Allemand	LAS	G	34	963	34	27	963	70	159	.440	28	101	.277	42	58	.724	15	19	.789	13	127	170	45	1	53	55	183
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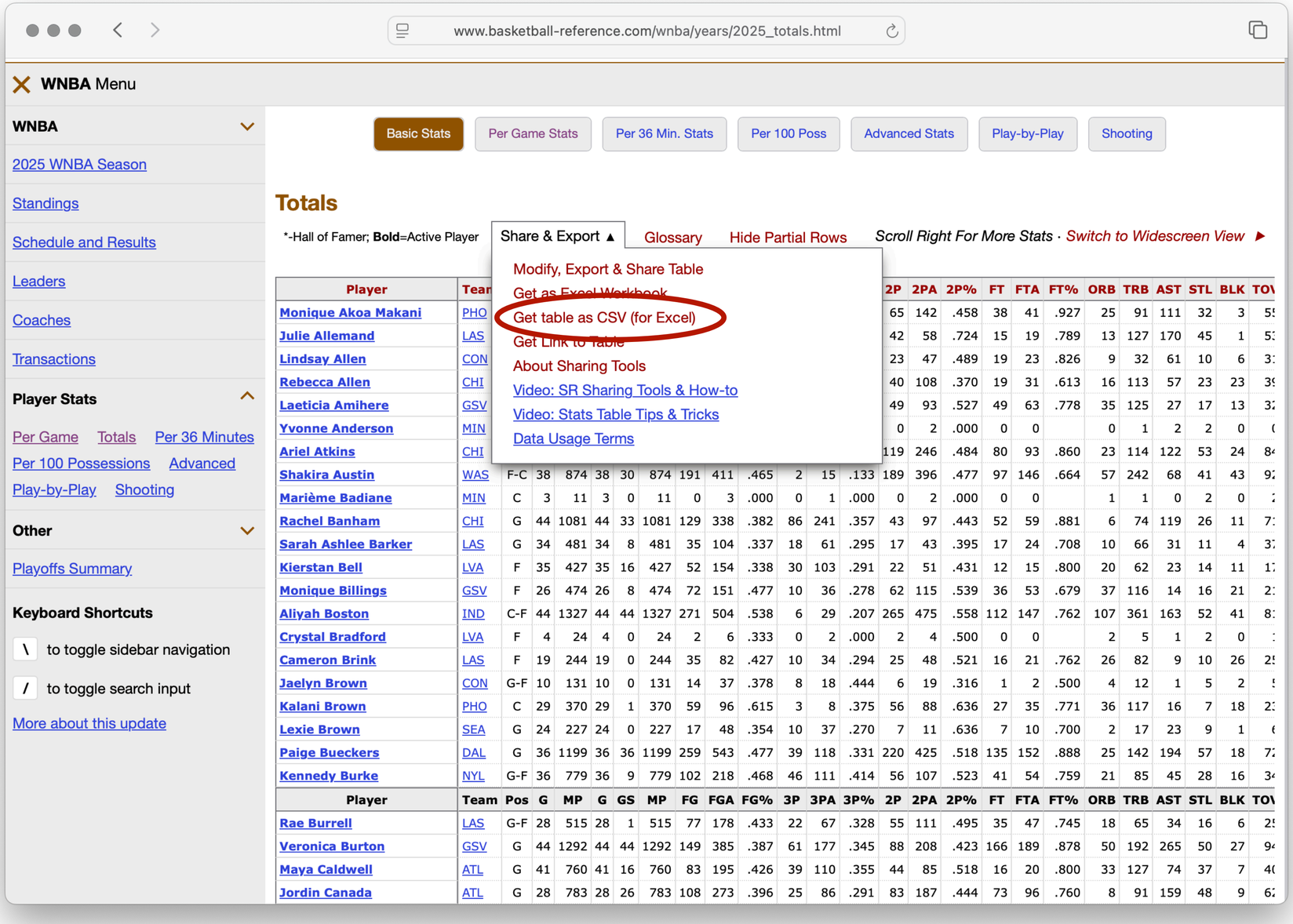
Rebecca Allen	CHI	F-G	44	821	44	17	821	82	240	.342	42	132	.318	40	108	.370	19	31	.613	16	113	57	23	23	39	62	225
Laeticia Amihere	GSV	F	29	384	29	0	384	52	114	.456	3	21	.143	49	93	.527	49	63	.778	35	125	27	17	13	32	36	156
Yvonne Anderson	MIN	G	1	12	1	0	12	0	3	.000	0	1	.000	0	2	.000	0	0		0	1	2	2	0	0	3	0
Ariel Atkins	CHI	G	34	971	34	34	971	162	365	.444	43	119	.361	119	246	.484	80	93	.860	23	114	122	53	24	84	102	447
Shakira Austin	WAS	F-C	38	874	38	30	874	191	411	.465	2	15	.133	189	396	.477	97	146	.664	57	242	68	41	43	92	81	481
Marième Badiane	MIN	C	3	11	3	0	11	0	3	.000	0	1	.000	0	2	.000	0	0		1	1	0	2	0	2	6	0



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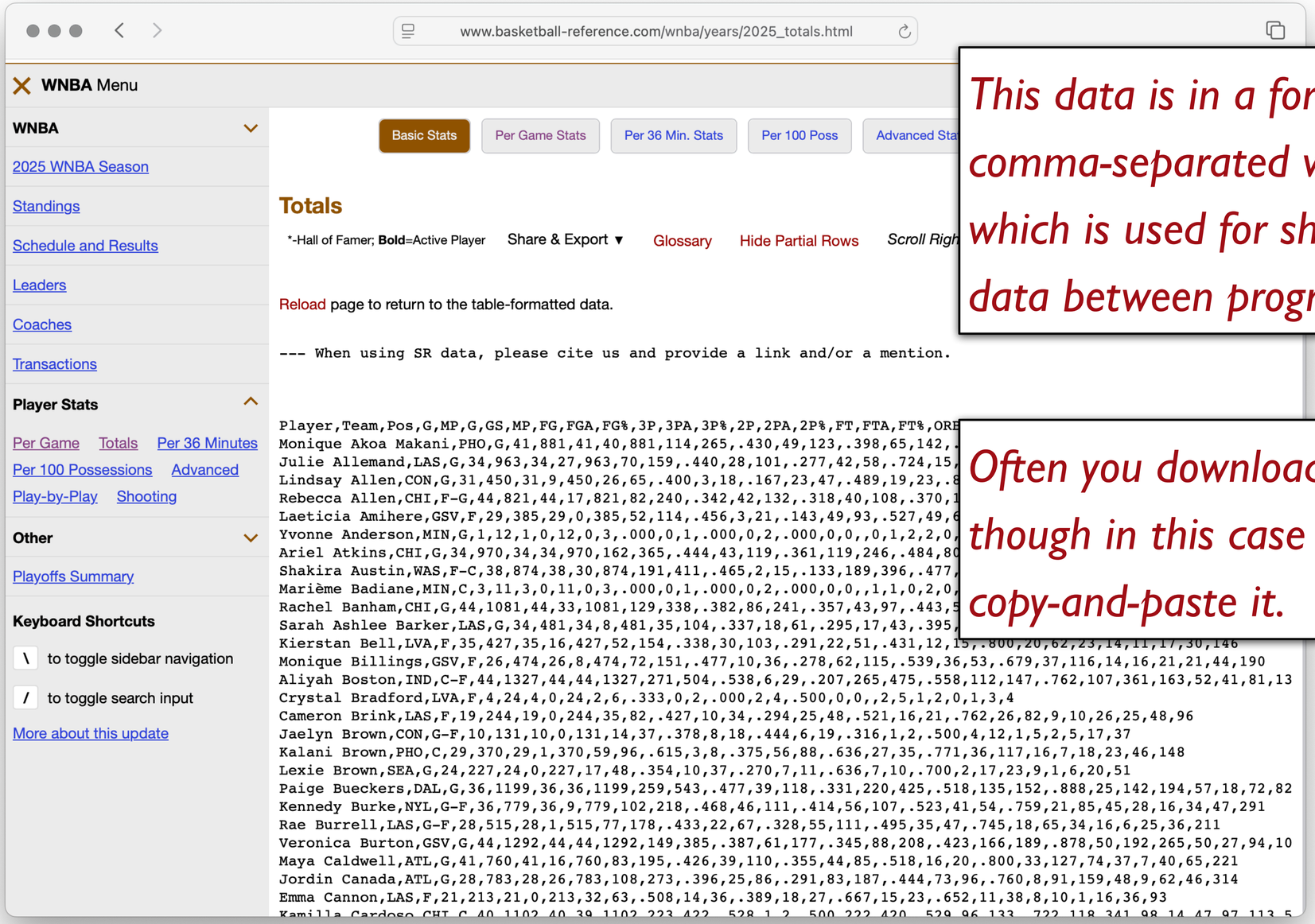
Monique Akoa Makani	PHO													65	142	.458	38	41	.927	25	91	111	32	3	5
Julie Allemand	LAS													42	58	.724	15	19	.789	13	127	170	45	1	5
Lindsay Allen	CON													23	47	.489	19	23	.826	9	32	61	10	6	3
Rebecca Allen	CHI													40	108	.370	19	31	.613	16	113	57	23	23	3
Laeticia Amihere	GSV													49	93	.527	49	63	.778	35	125	27	17	13	3
Yvonne Anderson	MIN													0	2	.000	0	0		0	1	2	2	0	
Ariel Atkins	CHI													119	246	.484	80	93	.860	23	114	122	53	24	8
Shakira Austin	WAS	F-C	38	874	38	30	874	191	411	.465	2	15	.133	189	396	.477	97	146	.664	57	242	68	41	43	9
Marième Badiane	MIN	C	3	11	3	0	11	0	3	.000	0	1	.000	0	2	.000	0	0		1	1	0	2	0	
Rachel Banham	CHI	G	44	1081	44	33	1081	129	338	.382	86	241	.357	43	97	.443	52	59	.881	6	74	119	26	11	7
Sarah Ashlee Barker	LAS	G	34	481	34	8	481	35	104	.337	18	61	.295	17	43	.395	17	24	.708	10	66	31	11	4	3
Kierstan Bell	LVA	F	35	427	35	16	427	52	154	.338	30	103	.291	22	51	.431	12	15	.800	20	62	23	14	11	1
Monique Billings	GSV	F	26	474	26	8	474	72	151	.477	10	36	.278	62	115	.539	36	53	.679	37	116	14	16	21	2
Aliyah Boston	IND	C-F	44	1327	44	44	1327	271	504	.538	6	29	.207	265	475	.558	112	147	.762	107	361	163	52	41	8
Crystal Bradford	LVA	F	4	24	4	0	24	2	6	.333	0	2	.000	2	4	.500	0	0		2	5	1	2	0	
Cameron Brink	LAS	F	19	244	19	0	244	35	82	.427	10	34	.294	25	48	.521	16	21	.762	26	82	9	10	26	2
Jaelyn Brown	CON	G-F	10	131	10	0	131	14	37	.378	8	18	.444	6	19	.316	1	2	.500	4	12	1	5	2	
Kalani Brown	PHO	C	29	370	29	1	370	59	96	.615	3	8	.375	56	88	.636	27	35	.771	36	117	16	7	18	2
Lexie Brown	SEA	G	24	227	24	0	227	17	48	.354	10	37	.270	7	11	.636	7	10	.700	2	17	23	9	1	
Paige Bueckers	DAL	G	36	1199	36	36	1199	259	543	.477	39	118	.331	220	425	.518	135	152	.888	25	142	194	57	18	7
Kennedy Burke	NYL	G-F	36	779	36	9	779	102	218	.468	46	111	.414	56	107	.523	41	54	.759	21	85	45	28	16	3
Rae Burrell	LAS	G-F	28	515	28	1	515	77	178	.433	22	67	.328	55	111	.495	35	47	.745	18	65	34	16	6	2
Veronica Burton	GSV	G	44	1292	44	44	1292	149	385	.387	61	177	.345	88	208	.423	166	189	.878	50	192	265	50	27	9
Maya Caldwell	ATL	G	41	760	41	16	760	83	195	.426	39	110	.355	44	85	.518	16	20	.800	33	127	74	37	7	4
Jordin Canada	ATL	G	28	783	28	26	783	108	273	.396	25	86	.291	83	187	.444	73	96	.760	8	91	159	48	9	6

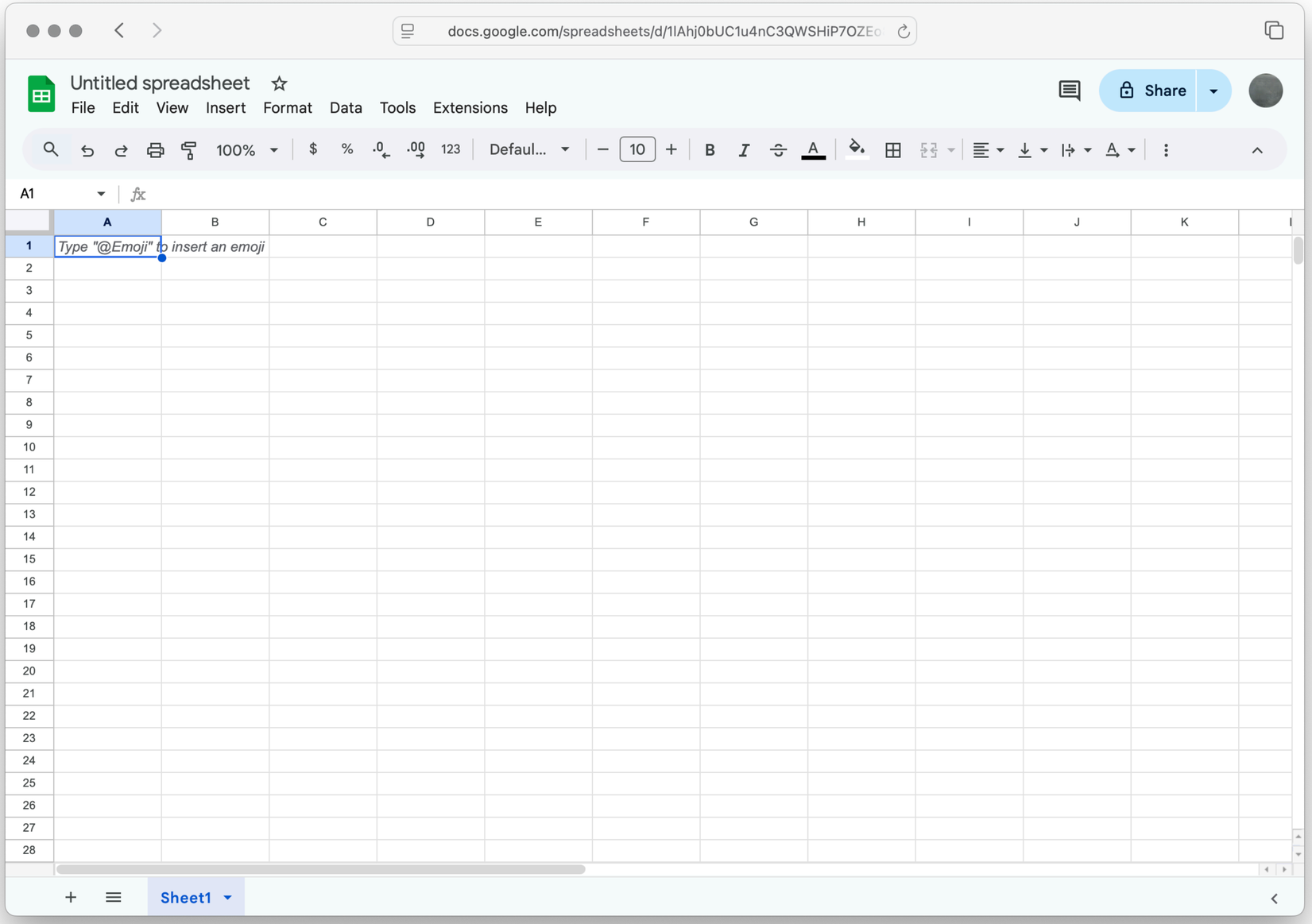


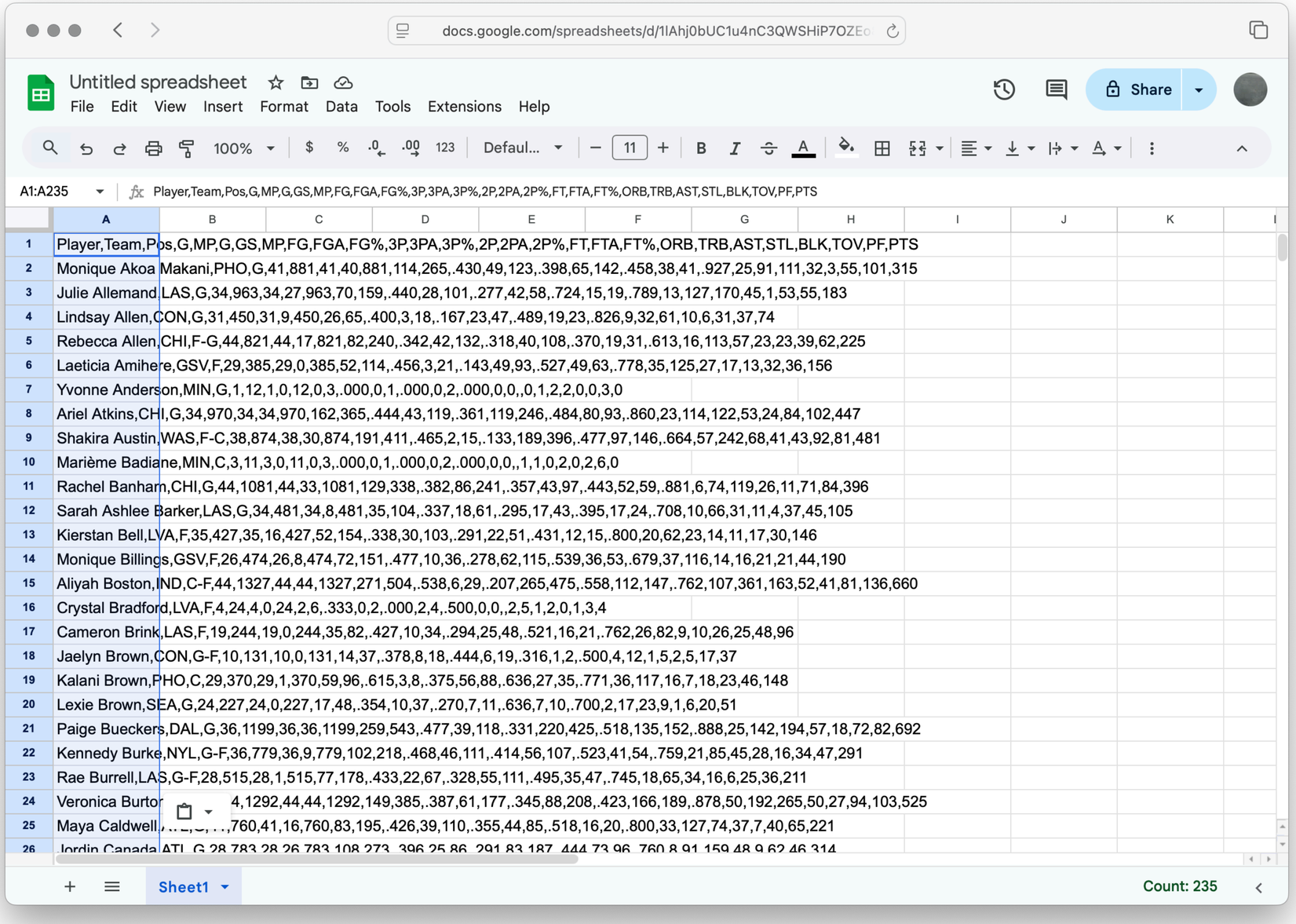
This data is in a format called comma-separated values (CSV) which is used for sharing tabular data between programs.

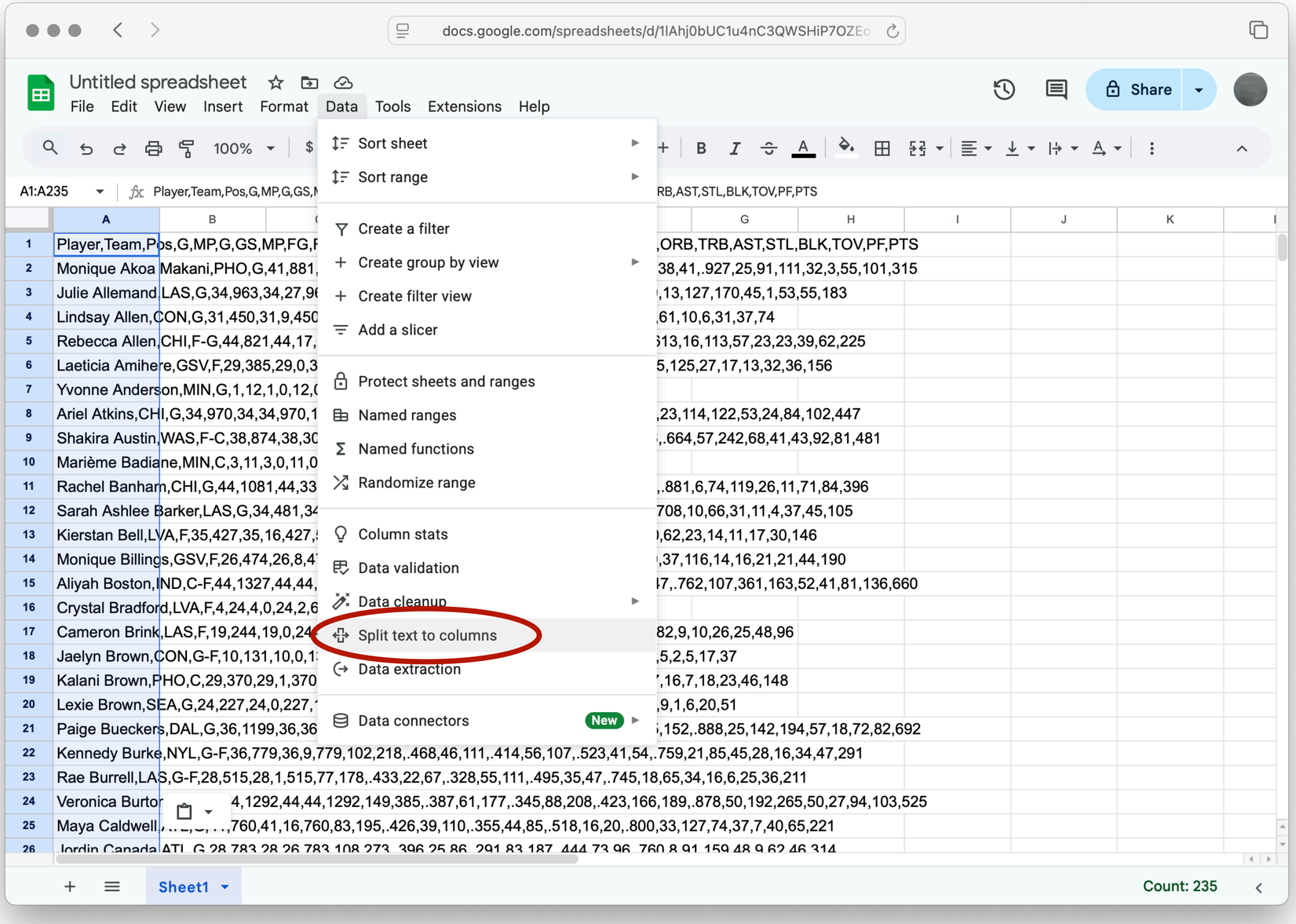
Often you download CSV files, though in this case we can just copy-and-paste it.

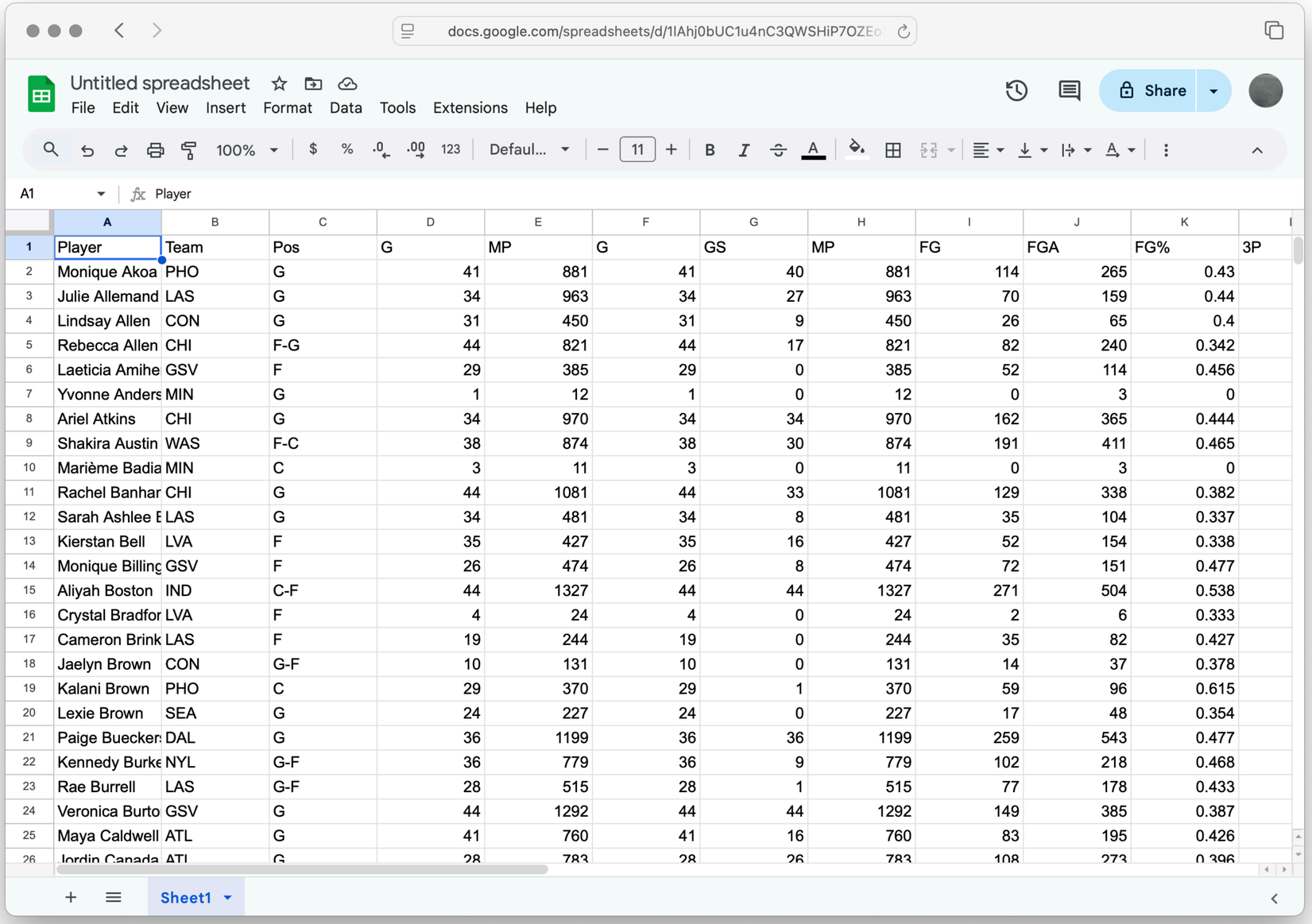
Step 0: Get data

Step 1: Make a spreadsheet


docs.google.com/spreadsheets/d/1lAhj0bUC1u4nC3QWSHiP7OZEo
Untitled spreadsheet
File Edit View Insert Format Data Tools Extensions Help
Share
100%
Defaul...
10
A1
Type "@Emoji" to insert an emoji
Sheet1

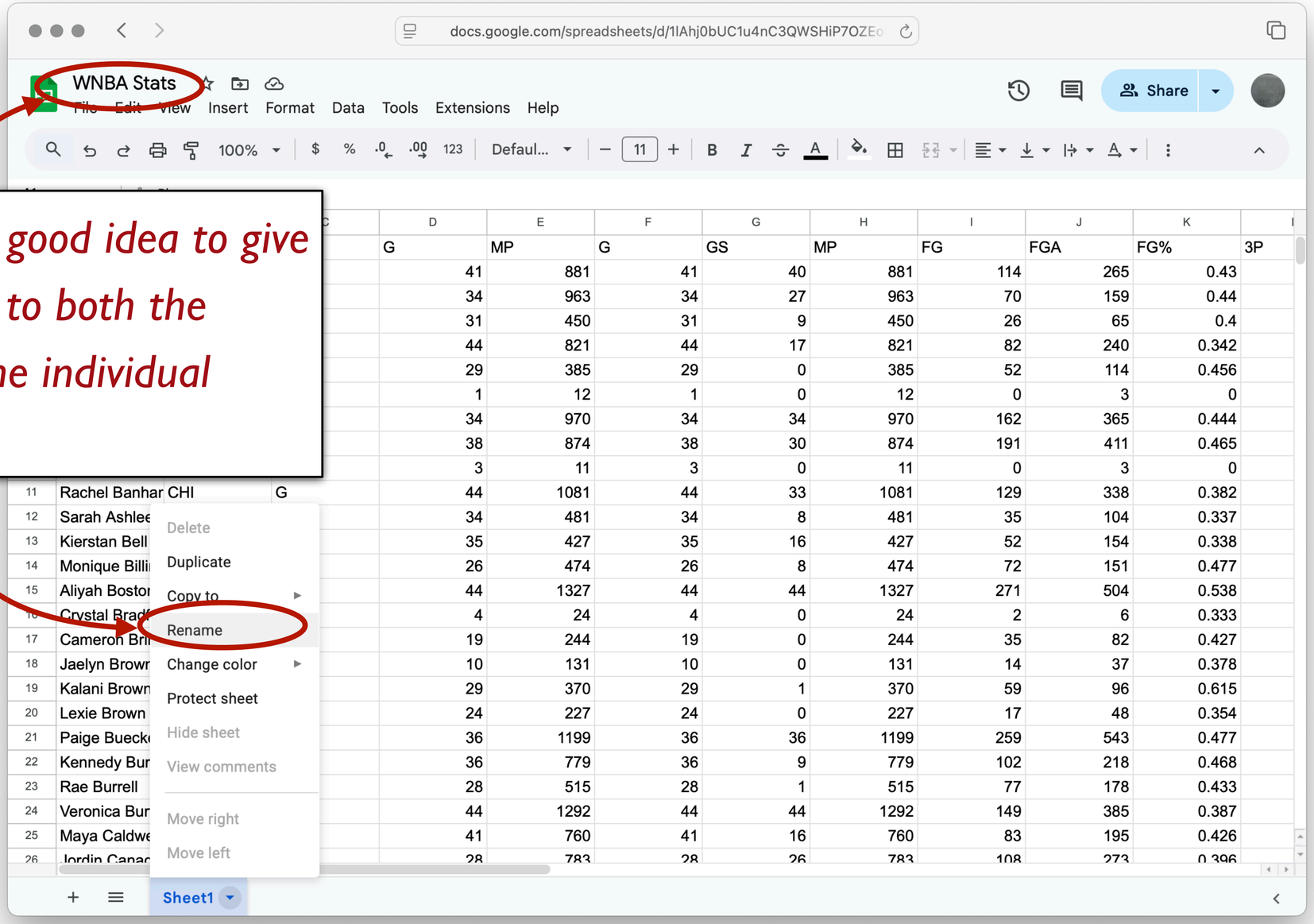

docs.google.com/spreadsheets/d/1lAhj0bUC1u4nC3QWSHiP7OZEo
Untitled spreadsheet
File Edit View Insert Format Data Tools Extensions Help
Share
A1:A235
Player,Team,Pos,G,MP,G,GS,MP,FG,FGA,FG%,3P,3PA,3P%,2P,2PA,2P%,FT,FTA,FT%,ORB,TRB,AST,STL,BLK,TOV,PF,PTS
Monique Akoa Makani,PHO,G,41,881,41,40,881,114,265,.430,49,123,.398,65,142,.458,38,41,.927,25,91,111,32,3,55,101,315
Julie Allemand,LAS,G,34,963,34,27,963,70,159,.440,28,101,.277,42,58,.724,15,19,.789,13,127,170,45,1,53,55,183
Lindsay Allen,CON,G,31,450,31,9,450,26,65,.400,3,18,.167,23,47,.489,19,23,.826,9,32,61,10,6,31,37,74
Rebecca Allen,CHI,F-G,44,821,44,17,821,82,240,.342,42,132,.318,40,108,.370,19,31,.613,16,113,57,23,23,39,62,225
Laeticia Amihere,GSV,F,29,385,29,0,385,52,114,.456,3,21,.143,49,93,.527,49,63,.778,35,125,27,17,13,32,36,156
Yvonne Anderson,MIN,G,1,12,1,0,12,0,3,.000,0,1,.000,0,2,.000,0,0,,0,1,2,2,0,0,3,0
Ariel Atkins,CHI,G,34,970,34,34,970,162,365,.444,43,119,.361,119,246,.484,80,93,.860,23,114,122,53,24,84,102,447
Shakira Austin,WAS,F-C,38,874,38,30,874,191,411,.465,2,15,.133,189,396,.477,97,146,.664,57,242,68,41,43,92,81,481
Marième Badiane,MIN,C,3,11,3,0,11,0,3,.000,0,1,.000,0,2,.000,0,0,,1,1,0,2,0,2,6,0
Rachel Banham,CHI,G,44,1081,44,33,1081,129,338,.382,86,241,.357,43,97,.443,52,59,.881,6,74,119,26,11,71,84,396
Sarah Ashlee Barker,LAS,G,34,481,34,8,481,35,104,.337,18,61,.295,17,43,.395,17,24,.708,10,66,31,11,4,37,45,105
Kierstan Bell,LVA,F,35,427,35,16,427,52,154,.338,30,103,.291,22,51,.431,12,15,.800,20,62,23,14,11,17,30,146
Monique Billings,GSV,F,26,474,26,8,474,72,151,.477,10,36,.278,62,115,.539,36,53,.679,37,116,14,16,21,21,44,190
Aliyah Boston,IND,C-F,44,1327,44,44,1327,271,504,.538,6,29,.207,265,475,.558,112,147,.762,107,361,163,52,41,81,136,660
Crystal Bradford,LVA,F,4,24,4,0,24,2,6,.333,0,2,.000,2,4,.500,0,0,,2,5,1,2,0,1,3,4
Cameron Brink,LAS,F,19,244,19,0,244,35,82,.427,10,34,.294,25,48,.521,16,21,.762,26,82,9,10,26,25,48,96
Jaelyn Brown,CON,G-F,10,131,10,0,131,14,37,.378,8,18,.444,6,19,.316,1,2,.500,4,12,1,5,2,5,17,37
Kalani Brown,PHO,C,29,370,29,1,370,59,96,.615,3,8,.375,56,88,.636,27,35,.771,36,117,16,7,18,23,46,148
Lexie Brown,SEA,G,24,227,24,0,227,17,48,.354,10,37,.270,7,11,.636,7,10,.700,2,17,23,9,1,6,20,51
Paige Bueckers,DAL,G,36,1199,36,36,1199,259,543,.477,39,118,.331,220,425,.518,135,152,.888,25,142,194,57,18,72,82,692
Kennedy Burke,NYL,G-F,36,779,36,9,779,102,218,.468,46,111,.414,56,107,.523,41,54,.759,21,85,45,28,16,34,47,291
Rae Burrell,LAS,G-F,28,515,28,1,515,77,178,.433,22,67,.328,55,111,.495,35,47,.745,18,65,34,16,6,25,36,211
Veronica Burton
Maya Caldwell
Jordin Canada ATL G 28 783 28 26 783 108 273 .396 25 86 .291 83 187 .444 73 96 .760 8 91 159 48 9 62 46 314
Sheet1
Count: 235


Untitled spreadsheet
File Edit View Insert Format Data Tools Extensions Help
Share
Sort sheet
Sort range
Create a filter
Create group by view
Create filter view
Add a slicer
Protect sheets and ranges
Named ranges
Named functions
Randomize range
Column stats
Data validation
Data cleanup
Split text to columns
Data extraction
Data connectors
New
Sheet1
Count: 235



	A	B	C	D	E	F	G	H	I	J	K	L
1	Player	Team	Pos	G	MP	G	GS	MP	FG	FGA	FG%	3P
2	Monique Akoa	PHO	G	41	881	41	40	881	114	265	0.43	
3	Julie Allemand	LAS	G	34	963	34	27	963	70	159	0.44	
4	Lindsay Allen	CON	G	31	450	31	9	450	26	65	0.4	
5	Rebecca Allen	CHI	F-G	44	821	44	17	821	82	240	0.342	
6	Laeticia Amihe	GSV	F	29	385	29	0	385	52	114	0.456	
7	Yvonne Anders	MIN	G	1	12	1	0	12	0	3	0	
8	Ariel Atkins	CHI	G	34	970	34	34	970	162	365	0.444	
9	Shakira Austin	WAS	F-C	38	874	38	30	874	191	411	0.465	
10	Marième Badia	MIN	C	3	11	3	0	11	0	3	0	
11	Rachel Banhar	CHI	G	44	1081	44	33	1081	129	338	0.382	
12	Sarah Ashlee E	LAS	G	34	481	34	8	481	35	104	0.337	
13	Kierstan Bell	LVA	F	35	427	35	16	427	52	154	0.338	
14	Monique Billing	GSV	F	26	474	26	8	474	72	151	0.477	
15	Aliyah Boston	IND	C-F	44	1327	44	44	1327	271	504	0.538	
16	Crystal Bradfor	LVA	F	4	24	4	0	24	2	6	0.333	
17	Cameron Brink	LAS	F	19	244	19	0	244	35	82	0.427	
18	Jaelyn Brown	CON	G-F	10	131	10	0	131	14	37	0.378	
19	Kalani Brown	PHO	C	29	370	29	1	370	59	96	0.615	
20	Lexie Brown	SEA	G	24	227	24	0	227	17	48	0.354	
21	Paige Buecker	DAL	G	36	1199	36	36	1199	259	543	0.477	
22	Kennedy Burke	NYL	G-F	36	779	36	9	779	102	218	0.468	
23	Rae Burrell	LAS	G-F	28	515	28	1	515	77	178	0.433	
24	Veronica Burto	GSV	G	44	1292	44	44	1292	149	385	0.387	
25	Maya Caldwell	ATL	G	41	760	41	16	760	83	195	0.426	
26	Jordin Canada	ATL	G	28	783	28	26	783	108	273	0.396	

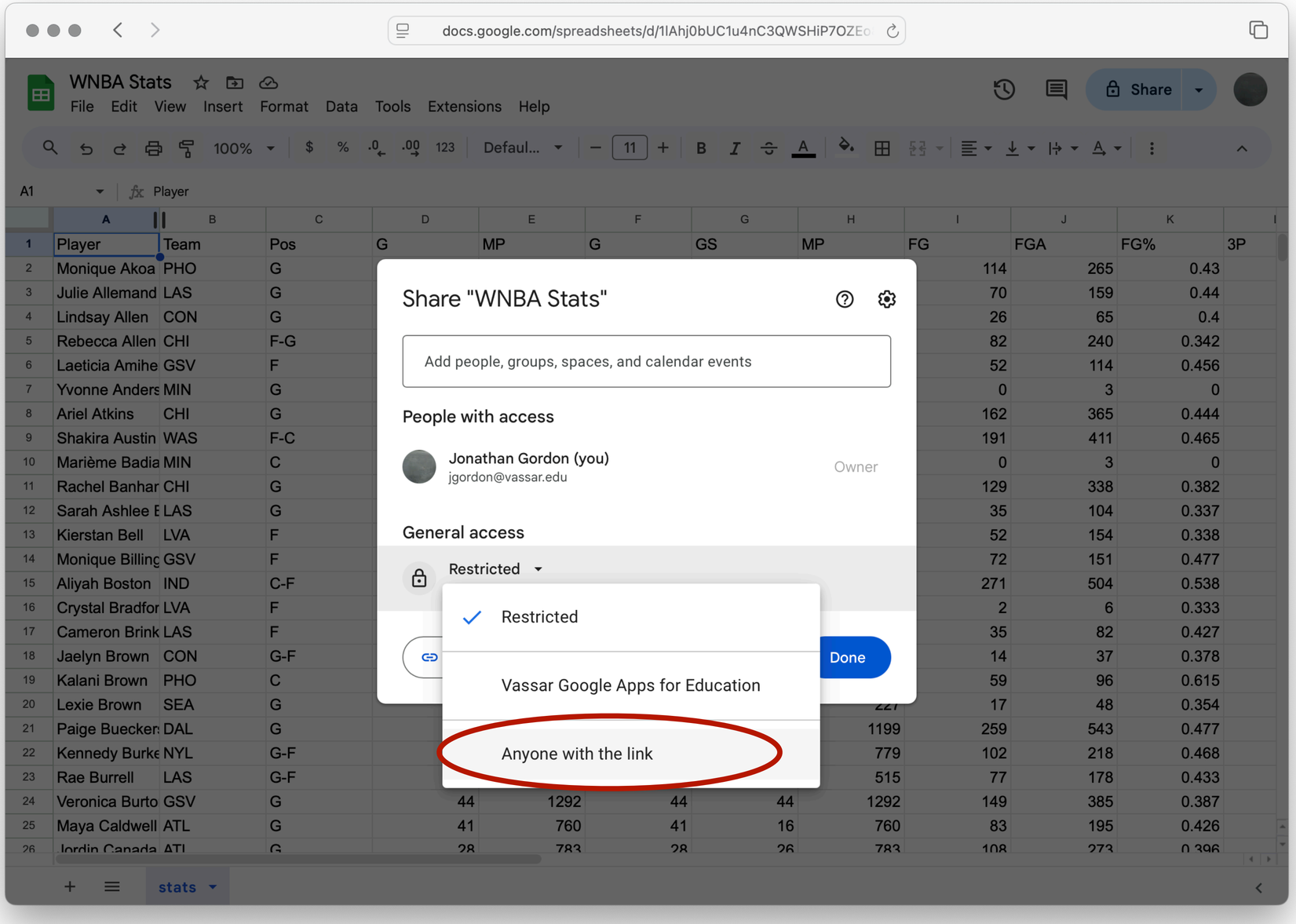
At this point, it's a good idea to give meaningful names to both the spreadsheet and the individual sheet.



Step 0: Get data

Step 1: Make a spreadsheet

Step 2: Load the spreadsheet as a table


docs.google.com/spreadsheets/d/1lAhj0bUC1u4nC3QWSHiP7OZEo
WNBA Stats
File Edit View Insert Format Data Tools Extensions Help
Share
A1 Player
Share "WNBA Stats"
Add people, groups, spaces, and calendar events
People with access
Jonathan Gordon (you)
jgordon@vassar.edu
Owner
General access
Restricted
Restricted
Vassar Google Apps for Education
Anyone with the link
Done
stats

```
from datascience import *

url = "https://docs.google.com/spreadsheets/d/
1lAhj0bUC1u4nC3QWSHiP7OZEo8_rWnmnnNzD8gLnsog/export?
format=csv"

stats = Table.read_table(url)
```

We replaced the **`edit...`** *part of the URL with* **`export?format=csv`**

This is a lot of columns!

Player	Team	Pos	G	MP	G.1	GS	MP.1	FG	FGA	FG%	3P	3PA	3P%	2P	2PA	2P%	FT	FTA	FT%	ORB	TRB	AST	STL	BLK	TOV	PF	PTS
Monique Akoa Makani	PHO	G	41	881	41	40	881	114	265	0.43	49	123	0.398	65	142	0.458	38	41	0.927	25	91	111	32	3	55	101	315
Julie Allemand	LAS	G	34	963	34	27	963	70	159	0.44	28	101	0.277	42	58	0.724	15	19	0.789	13	127	170	45	1	53	55	183
Lindsay Allen	CON	G	31	450	31	9	450	26	65	0.4	3	18	0.167	23	47	0.489	19	23	0.826	9	32	61	10	6	31	37	74
Rebecca Allen	CHI	F-G	44	821	44	17	821	82	240	0.342	42	132	0.318	40	108	0.37	19	31	0.613	16	113	57	23	23	39	62	225
Laeticia Amihere	GSV	F	29	385	29	0	385	52	114	0.456	3	21	0.143	49	93	0.527	49	63	0.778	35	125	27	17	13	32	36	156
Yvonne Anderson	MIN	G	1	12	1	0	12	0	3	0	0	1	0	0	2	0	0	0	nan	0	1	2	2	0	0	3	0
Ariel Atkins	CHI	G	34	970	34	34	970	162	365	0.444	43	119	0.361	119	246	0.484	80	93	0.86	23	114	122	53	24	84	102	447
Shakira Austin	WAS	F-C	38	874	38	30	874	191	411	0.465	2	15	0.133	189	396	0.477	97	146	0.664	57	242	68	41	43	92	81	481
Marième Badiane	MIN	C	3	11	3	0	11	0	3	0	0	1	0	0	2	0	0	0	nan	1	1	0	2	0	2	6	0
Rachel Banham	CHI	G	44	1081	44	33	1081	129	338	0.382	86	241	0.357	43	97	0.443	52	59	0.881	6	74	119	26	11	71	84	396

... (224 rows omitted)

Step 0: Get data

Step 1: Make a spreadsheet

Step 2: Load the spreadsheet as a table

Step 3: Rethink that table

Player	Team	Pos	G	MP	G.1	GS	MP.1	FG	FGA	FG%	3P	3PA	3P%	2P	2PA	2P%	FT	FTA	FT%	ORB	TRB	AST	STL	BLK	TOV	PF	PTS
Monique Akoa Makani	PHO	G	41	881	41	40	881	114	265	0.43	49	123	0.398	65	142	0.458	38	41	0.927	25	91	111	32	3	55	101	315
Julie Allemand	LAS	G	34	963	34	27	963	70	159	0.44	28	101	0.277	42	58	0.724	15	19	0.789	13	127	170	45	1	53	55	183
Lindsay Allen	CON	G	31	450	31	9	450	26	65	0.4	3	18	0.167	23	47	0.489	19	23	0.826	9	32	61	10	6	31	37	74
Rebecca Allen	CHI	F-G	44	821	44	17	821	82	240	0.342	42	132	0.318	40	108	0.37	19	31	0.613	16	113	57	23	23	39	62	225
Laeticia Amihere	GSV	F	29	385	29	0	385	52	114	0.456	3	21	0.143	49	93	0.527	49	63	0.778	35	125	27	17	13	32	36	156
Yvonne Anderson	MIN	G	1	12	1	0	12	0	3	0	0	1	0	0	2	0	0	0	nan	0	1	2	2	0	0	3	0
Ariel Atkins	CHI	G	34	970	34	34	970	162	365	0.444	43	119	0.361	119	246	0.484	80	93	0.86	23	114	122	53	24	84	102	447
Shakira Austin	WAS	F-C	38	874	38	30	874	191	411	0.465	2	15	0.133	189	396	0.477	97	146	0.664	57	242	68	41	43	92	81	481
Marième Badiane	MIN	C	3	11	3	0	11	0	3	0	0	1	0	0	2	0	0	0	nan	1	1	0	2	0	2	6	0
Rachel Banham	CHI	G	44	1081	44	33	1081	129	338	0.382	86	241	0.357	43	97	0.443	52	59	0.881	6	74	119	26	11	71	84	396

... (224 rows omitted)

```
stats = stats.select(
    "Player", "Team", "Pos", "G", "PTS"
)
```

```
stats
```

Player	Team	Pos	G	PTS
Monique Akoa Makani	PHO	G	41	315
Julie Allemand	LAS	G	34	183
Lindsay Allen	CON	G	31	74
Rebecca Allen	CHI	F-G	44	225
Laeticia Amihere	GSV	F	29	156
Yvonne Anderson	MIN	G	1	0
Ariel Atkins	CHI	G	34	447
Shakira Austin	WAS	F-C	38	481
Marième Badiane	MIN	C	3	0
Rachel Banham	CHI	G	44	396

... (224 rows omitted)

```
stats = stats.relabeled("G", "Games")
stats = stats.relabeled("PTS", "Pts")
```

```
stats
```

Player	Team	Pos	Games	Pts
Monique Akoa Makani	PHO	G	41	315
Julie Allemand	LAS	G	34	183
Lindsay Allen	CON	G	31	74
Rebecca Allen	CHI	F-G	44	225
Laeticia Amihere	GSV	F	29	156
Yvonne Anderson	MIN	G	1	0
Ariel Atkins	CHI	G	34	447
Shakira Austin	WAS	F-C	38	481
Marième Badiane	MIN	C	3	0
Rachel Banham	CHI	G	44	396

... (224 rows omitted)

Where are we?

Player	Team	Pos	Games	Pts
Monique Akoa Makani	PHO	G	41	315
Julie Allemand	LAS	G	34	183
Lindsay Allen	CON	G	31	74
Rebecca Allen	CHI	F-G	44	225
Laeticia Amihere	GSV	F	29	156
Yvonne Anderson	MIN	G	1	0
Ariel Atkins	CHI	G	34	447
Shakira Austin	WAS	F-C	38	481
Marième Badiane	MIN	C	3	0
Rachel Banham	CHI	G	44	396

... (224 rows omitted)

Rows!

stats =

Player	Team	Pos	Games	Pts
Monique Akoa Makani	PHO	G	41	315
Julie Allemand	LAS	G	34	183
Lindsay Allen	CON	G	31	74
Rebecca Allen	CHI	F-G	44	225
Laeticia Amihere	GSV	F	29	156
Yvonne Anderson	MIN	G	1	0
Ariel Atkins	CHI	G	34	447
Shakira Austin	WAS	F-C	38	481
Marième Badiane	MIN	C	3	0
Rachel Banham	CHI	G	44	396

... (224 rows omitted)

How do I get just this row from **`stats`**?

stats =

n	Player	Team	Pos	Games	Pts
0	Monique Akoa Makani	PHO	G	41	315
1	Julie Allemand	LAS	G	34	183
2	Lindsay Allen	CON	G	31	74
3	Rebecca Allen	CHI	F-G	44	225
4	Laeticia Amihere	GSV	F	29	156
5	Yvonne Anderson	MIN	G	1	0
6	Ariel Atkins	CHI	G	34	447
7	Shakira Austin	WAS	F-C	38	481
8	Marième Badiane	MIN	C	3	0
9	Rachel Banham	CHI	G	44	396

... (224 rows omitted)

How do I get just this row from **`stats`**?

stats =

n	Player	Team	Pos	Games	Pts
0	Monique Akoa Makani	PHO	G	41	315
1	Julie Allemand	LAS	G	34	183
2	Lindsay Allen	CON	G	31	74
3	Rebecca Allen	CHI	F-G	44	225
4	Laeticia Amihere	GSV	F	29	156
5	Yvonne Anderson	MIN	G	1	0
6	Ariel Atkins	CHI	G	34	447
7	Shakira Austin	WAS	F-C	38	481
8	Marième Badiane	MIN	C	3	0
9	Rachel Banham	CHI	G	44	396

... (224 rows omitted)

How do I get just this row from **`stats`**?

```
stats.rows[3]
```

stats =

Player	Team	Pos	Games	Pts
Monique Akoa Makani	PHO	G	41	315
Julie Allemand	LAS	G	34	183
Lindsay Allen	CON	G	31	74
Rebecca Allen	CHI	F-G	44	225
Laeticia Amihere	GSV	F	29	156
Yvonne Anderson	MIN	G	1	0
Ariel Atkins	CHI	G	34	447
Shakira Austin	WAS	F-C	38	481
Marième Badiane	MIN	C	3	0
Rachel Banham	CHI	G	44	396

... (224 rows omitted)

How do I get just the rows for players who are guards?

stats =

Player	Team	Pos	Games	Pts
Monique Akoa Makani	PHO	G	41	315
Julie Allemand	LAS	G	34	183
Lindsay Allen	CON	G	31	74
Rebecca Allen	CHI	F-G	44	225
Laeticia Amihere	GSV	F	29	156
Yvonne Anderson	MIN	G	1	0
Ariel Atkins	CHI	G	34	447
Shakira Austin	WAS	F-C	38	481

How do I get just the rows for players who are guards?

```
stats.where("Pos", are.containing("G"))
```

`Table.where` Predicates

All of the predicates described below can be negated by preceding the name with `not_`. For example, we can find values *not* equal to a specific value using `are.not_equal_to(value)`.

`are.equal_to()`

```
tbl.where(column, are.equal_to(value))
```

Filter leaves rows only where the value in `column` is equal to `value`.

[166]:
```
trips.where("Duration", are.equal_to(519))
```

[166]:

Trip ID	Duration	Start Date	Start Station	Start Terminal	End Date	End Station	End Terminal	Bike #	Subscriber Type	Zip Code
723352	519	4/13/2015 17:04	Howard at 2nd	63	4/13/2015 17:12	San Francisco Caltrain (Townsend at 4th)	70	629	Subscriber	94061
824979	519	6/27/2015 15:02	Japantown	9	6/27/2015 15:11	San Jose City Hall	10	660	Customer	nil
439946	519	9/5/2014 12:38	Yerba Buena Center of the Arts (3rd @ Howard)	68	9/5/2014 12:47	Civic Center BART (7th at Market)	72	452	Subscriber	94105
788261	519	6/1/2015 9:21	Powell at Post (Union Square)	71	6/1/2015 9:30	Steuart at Market	74	575	Subscriber	94108
560479	519	11/28/2014 14:20	South Van Ness at Market	66	11/28/2014 14:29	Powell at Post (Union Square)	71	609	Subscriber	94108
653797	519	2/23/2015 8:47	Market at 10th	67	2/23/2015 8:55	Yerba Buena Center of the Arts (3rd @ Howard)	68	546	Subscriber	94102
887134	519	8/12/2015 17:29	Civic Center BART (7th at Market)	72	8/12/2015 17:38	Mechanics Plaza (Market at Battery)	75	313	Subscriber	94103
482225	519	10/3/2014 16:41	Spear at Folsom	49	10/3/2014 16:50	Broadway St at Battery St	82	209	Subscriber	94133
681697	519	3/14/2015 10:19	Embarcadero at Sansome	60	3/14/2015 10:28	Harry Bridges Plaza (Ferry Building)	50	368	Customer	95120
						San Francisco				

```
def is_guard(pos: str) -> bool:
    """Return True if the player is any kind of guard,
    e.g., "G" (guard) or "C-G" (center guard).
    """
    return "G" in pos

assert is_guard("G") == True
assert is_guard("C-G") == True
assert is_guard("F") == False


stats.where("Pos", is_guard)
```

Player	Team	Pos	Games	Pts
Monique Akoa Makani	PHO	G	41	315
Julie Allemand	LAS	G	34	183
Lindsay Allen	CON	G	31	74
Rebecca Allen	CHI	F-G	44	225
Laeticia Amihere	GSV	F	29	156
Yvonne Anderson	MIN	G	1	0
Ariel Atkins	CHI	G	34	447
Shakira Austin	WAS	F-C	38	481
Marième Badiane	MIN	C	3	0
Rachel Banham	CHI	G	44	396

... (224 rows omitted)

Player	Team	Pos	Games	Pts
Monique Akoa Makani	PHO	G	41	315
Julie Allemand	LAS	G	34	183
Lindsay Allen	CON	G	31	74
Rebecca Allen	CHI	F-G	44	225
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Shakira Austin	WAS	F-C	38	481
Marième Badiane	MIN	C	3	0
Rachel Banham	CHI	G	44	396

... (224 rows omitted)

What about columns?

stats =

Player	Team	Pos	Games	Pts
Monique Akoa Makani	PHO	G	41	315
Julie Allemand	LAS	G	34	183
Lindsay Allen	CON	G	31	74
Rebecca Allen	CHI	F-G	44	225
Laeticia Amihere	GSV	F	29	156
Yvonne Anderson	MIN	G	1	0
Ariel Atkins	CHI	G	34	447
Shakira Austin	WAS	F-C	38	481
Marième Badiane	MIN	C	3	0

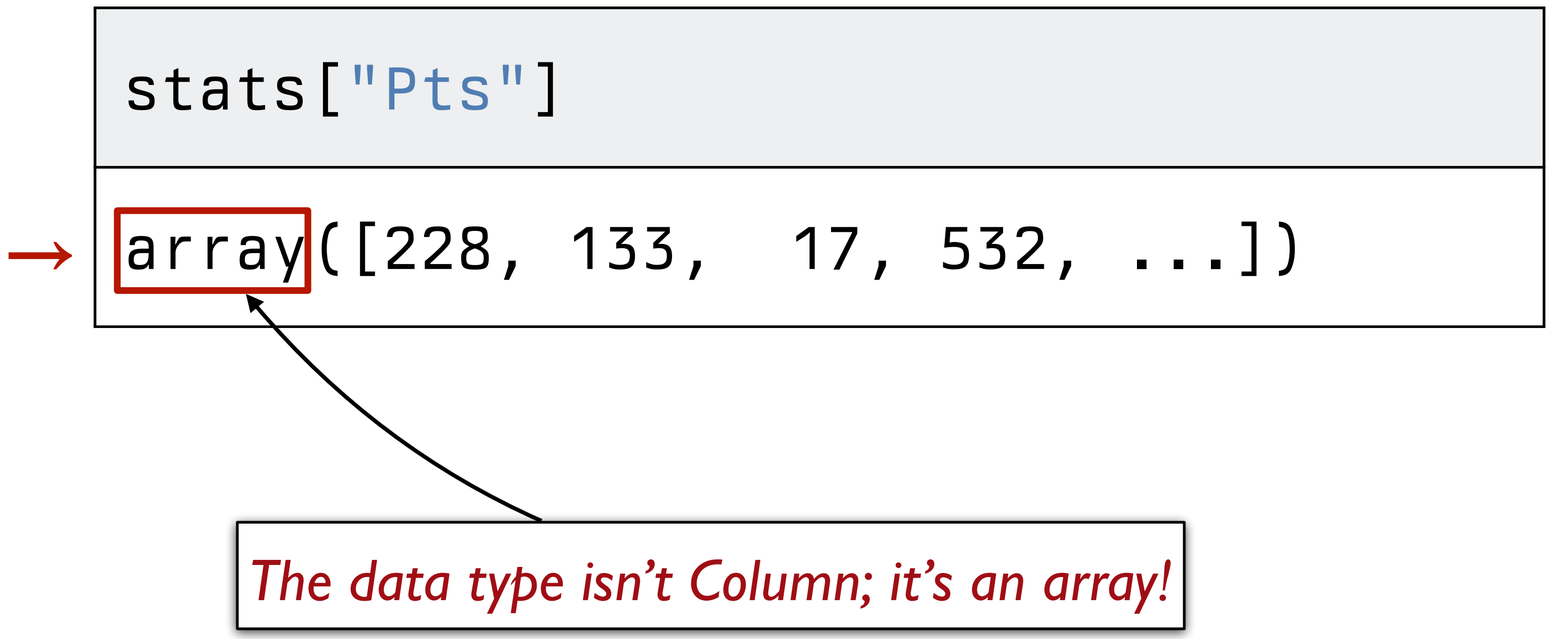
How do I get just the points column?

```
stats["Pts"]
```

```
stats["Pts"]
```

→

```
array([228, 133,  17, 532, ...])
```


stats["Pts"]
array([228, 133, 17, 532, ...])
The data type isn't Column; it's an array!

Notebook:
Exercise: Who scores the most points per game?

Changing a column

So, we've seen that we can build a new column based on the values in each row, but what if we just want to change an existing column?

Player	Team	Pos	Games	Pts
Monique Akoa Makani	PHO	G	41	315
Julie Allemand	LAS	G	34	183
Lindsay Allen	CON	G	31	74
Rebecca Allen	CHI	F-G	44	225
Laeticia Amihere	GSV	F	29	156
Yvonne Anderson	MIN	G	1	0
Ariel Atkins	CHI	G	34	447
Shakira Austin	WAS	F-C	38	481
Marième Badiane	MIN	C	3	0
Rachel Banham	CHI	G	44	396

... (224 rows omitted)

A fake WNBA fan like me can't remember what these team abbreviations stand for.

Let's fill in the actual team names.

What *are* the team names?

ESPN

WNBA | Home | Scores | Schedule | Standings | Stats | Teams | Odds | WNBA Playoffs | More

WNBA Teams

Eastern Conference

Atlanta Dream — Statistics | Schedule | Roster | Tickets

Chicago Sky — Statistics | Schedule | Roster | Tickets

Connecticut Sun — Statistics | Schedule | Roster | Tickets

Indiana Fever — Statistics | Schedule | Roster | Tickets

New York Liberty — Statistics | Schedule | Roster | Tickets

Washington Mystics — Statistics | Schedule | Roster | Tickets

Western Conference

Dallas Wings — Statistics | Schedule | Roster | Tickets

Golden State Valkyries — Statistics | Schedule | Roster | Tickets

Las Vegas Aces — Statistics | Schedule | Roster | Tickets

Los Angeles Sparks — Statistics | Schedule | Roster | Tickets

Minnesota Lynx — Statistics | Schedule | Roster | Tickets

Phoenix Mercury — Statistics | Schedule | Roster | Tickets

Seattle Storm — Statistics | Schedule | Roster | Tickets

ATL
CHI
CON
IND
NYL
WAS

DAL
GSV
LVA
LAS
MIN
PHO
SEA

```
def team_name(abbr: str) -> str:
    """Return the name of the team with the given
    abbreviation
    """
    ...

assert team_name("NYL") == "New York Liberty"
assert team_name("CHI") == "Chicago Sky"
...
```

```
def team_name(abbr: str) -> str:
    """Return the name of the team with the given
    abbreviation
    """
    if abbr == "DAL": return "Dallas Wings"
    elif abbr == "LVA": return "Las Vegas Aces"
    ...

assert team_name("NYL") == "New York Liberty"
assert team_name("CHI") == "Chicago Sky"
...
```

```
def team_name(abbr: str) -> str:
    """Return the name of the team with the given
    abbreviation
    """
    if abbr == "DAL": return "Dallas Wings"
    elif abbr == "LVA": return "Las Vegas Aces"
    ...

assert team_name("NYL") == "New York Liberty"
assert team_name("CHI") == "Chicago Sky"
...
```

This will work, but remember what we said when we introduced tables for looking up population: We want to ***separate data from computation****.*

```
teams = Table().with_columns(
    "Abbr",
    ["DAL", "GSV", ...],
    "Name",
    ["Dallas Wings", "Golden State Valkyries", ...]
)
```

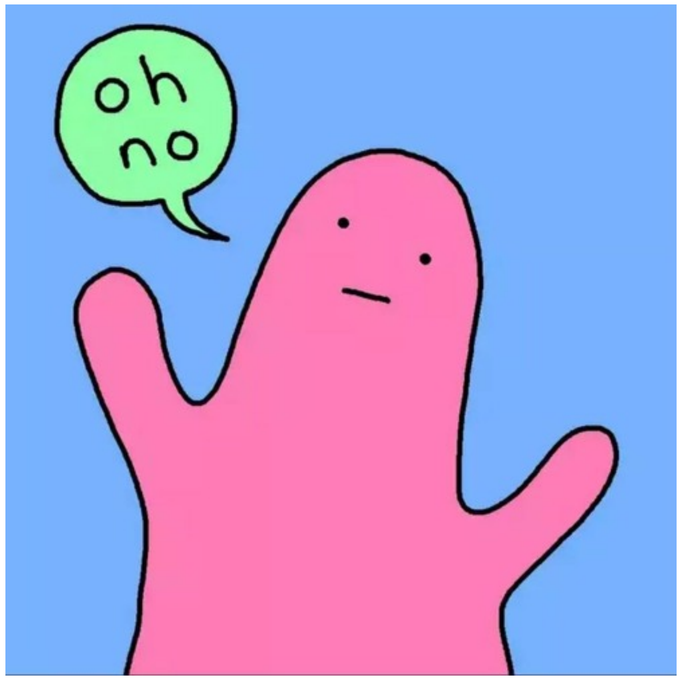
Advantage: This makes it easy to add new teams or more information about these teams, in a central place.

```python
teams = ...

def team_name(abbr: str) -> str:
    """Return the name of the team with the given abbreviation"""

    # 1. Get the row with abbreviation `abbr`
    # 2. Return the value in the `name` column

assert team_name("NYL") == "New York Liberty"
assert team_name("CHI") == "Chicago Sky"
...
```

```
teams = ...

def team_name(abbr: str) -> str:
    """Return the name of the team with the given abbreviation"""

    matches = teams.where("Abbr", abbr)
    team = matches.rows[0]
    # 2. Return the value in the `name` column

assert team_name("NYL") == "New York Liberty"
assert team_name("CHI") == "Chicago Sky"
...
```

```
teams = ...

def team_name(abbr: str) -> str:
    """Return the name of the team with the given abbreviation"""

    matches = teams.where("Abbr", abbr)
    team = matches.rows[0]
    return team.name

assert team_name("NYL") == "New York Liberty"
assert team_name("CHI") == "Chicago Sky"
...
```

```
IndexError: index 0 is out of bounds for axis 0 with size 0
```

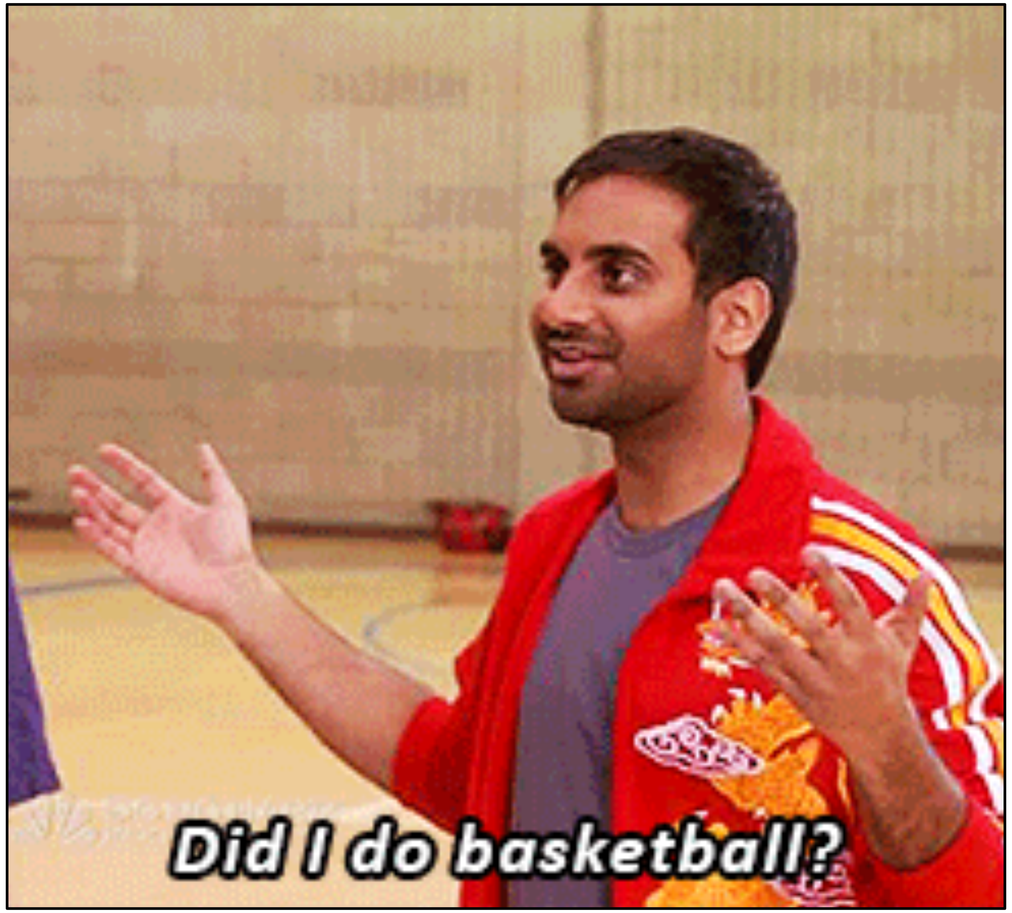


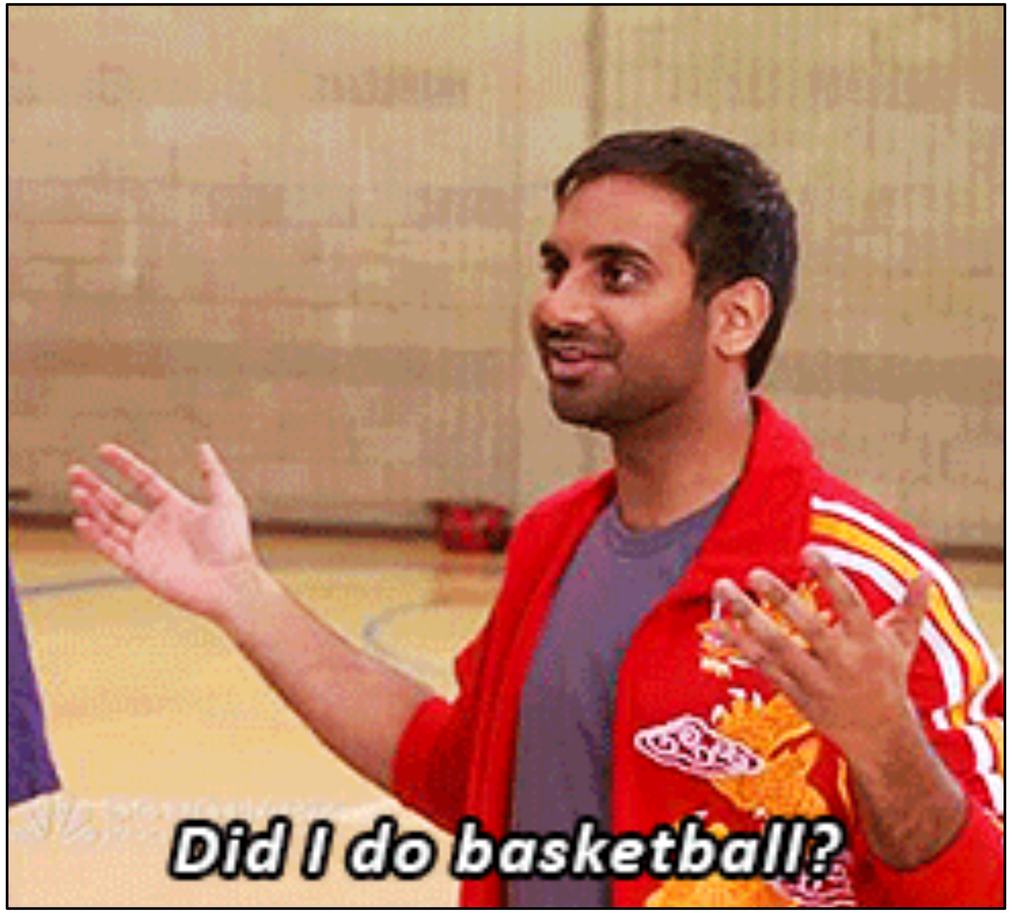
```
teams = ...

def team_name(abbr: str) -> str:
    """Return the name of the team with the given abbreviation"""

    matches = teams.where("Abbr", abbr)
    team = matches.rows[0]
    return team.name

assert team_name("NYL") == "New York Liberty"
assert team_name("CHI") == "Chicago Sky"
...
```

0 is too big? That means there were no matching rows! An abbreviation not in our table – what is it?

```
teams = ...

def team_name(abbr: str) -> str:
    """Return the name of the team with the given abbreviation"""

    if abbr == "TOT":
        return "Total"

    matches = teams.where("Abbr", abbr)
    team = matches.rows[0]
    return team.name

assert team_name("NYL") == "New York Liberty"
assert team_name("CHI") == "Chicago Sky"
...
```

```
teams = ...

def team_name(abbr: str) -> str:
    """Return the name of the team with the given abbreviation"""

    if abbr == "TOT":
        return "Total"

    matches = teams.where("Abbr", abbr)
    team = matches.rows[0]
    return team.name

assert team_name("NYL") == "New York Liberty"
assert team_name("CHI") == "Chicago Sky"
...

stats = stats.with_columns(
    "Team",
    stats.apply(team_name, "Team")
)
```


Did I do basketball?


Did I do basketball?

Acknowledgments

This class incorporates material from:

Greg Daniels & Michael Schur, *Parks and Recreation*

Kathi Fisler and colleagues, Brown University

Data 6, University of California, Berkeley (CC BY-NC-SA)

basketball-reference.com

Back to the Future Part II