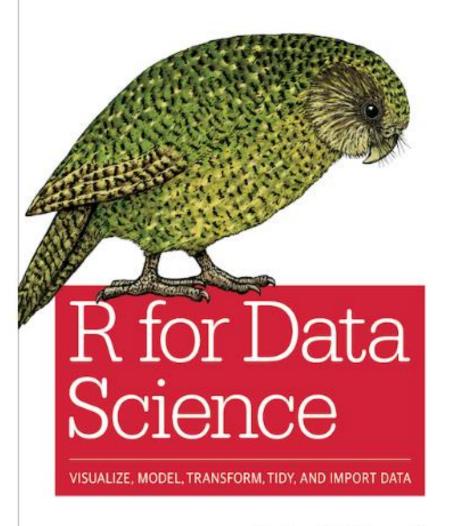
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Hadley Wickham & Garrett Grolemund

# Data Wrangling (Part 1)

Quantfish woRkshop 3 November 27, 2018

# Getting your data the way you want it

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9 MMFSRP MMFSRP-/ Carcharod white shar NJ1/2017 CBS CBS CBS175 250508 A69-9001 pinger 9/15/2016 0:54 UTC -60.0181 47.271   10 MMFSRP MMFSRP-/ Carcharod white shar NJ1/2017 CBS CBS CBS175 250508 A69-9001 pinger 9/15/2016 0:53 UTC -60.0181 47.271   11 MMFSRP MMFSRP-/ Carcharod white shar NJ1/2017 CBS CBS CBS175 250508 A69-9001 pinger 9/15/2016 0:53 UTC -60.0181 47.271   12 MMFSRP MMFSRP-/ Carcharod white shar 8/11/2017 CBS CBS CBS175 250508 A69-9001 pinger 9/15/2016 0:52 UTC -60.0181 47.271   13 MMFSRP MMFSRP-/ Carcharod white shar 8/11/2017 CBS CBS CBS175 250508 A69-9001 pinger 9/15/2016 0:52 UTC -60.0181 47.271   14 MMFSRP MMFSRP-/ Carcharod white shar 8/11/2017 CBS CBS CBS175 250508 A69-9001 pinger 9/15/2016 0:50 UTC -60.0181 47.271   15 MMFSRP MMFSRP-/ Carcharod white shar 8/11/2017 CBS CBS CBS175 250508 A69-9001 A69-9001 pinger 9/15/2016 0:50 UTC -60.0181 47.271   16 MMFSRP MMFSRP-/ Carcharod white shar 8/11/2017 CBS CBS CBS175 250508 A69-9001 A69-9001 pinger 9/15/2016 0:50 UTC -60.0181 47.271   16 MMFSRP MMFSRP-/ Carcharod white shar 8/11/2017 CBS CBS CBS175 250508 A69-9001 A69-9001 pinger 9/15/2016 0:50 UTC -60.0181 47.271   17 MMFSRP MMFSRP-/ Carcharod white shar 11/21/2016 CBS CBS CBS175 250508 A69-9001 A69-9001 pinger 9/15/2016 0:50 UTC -60.0181 47.271   18 MMFSRP MMFSRP-/ Carcharod white shar 11/21/2016 CBS CBS CBS175 250508 A69-9001 A69-9001 pinger 9/15/2016 0:50 UTC -60.0181 47.271   18 MMFSRP MMFSRP-/ Carcharod white shar 11/21/2016 CBS CBS CBS165 250026 176 171 A69-9001 A69-9001 pinger 9/15/2016 0:50 UTC -60.0181 47.271   19 MMFSRP MMFSRP-/ Carcharod white shar 11/21/2016 CBS CBS CBS267 128550 A69-9001 pinger 9/15/2016 0:10 UTC -60.2759 47.101   19 MMFSRP MMFSRP-/ Carcharod white shar 6/5/2017 CBS CBS CBS267 128550 A69-9001 pinger 9/15/2016 0:00 UTC -60.3203 43.815   10/15/2016 2:00 UTC -60.3203 43.815   10/15/2	8 MMFSRP	MMFSRP-/ Carcharod white	te shar	8/11/2017	CBS	CBS	CBS175	250508		Į.	A69-9001-	A69-9001		р	inger			9/15/2016 0:45	UTC	-60.0181	47.278
10 MMFSRP MMFSRP / Carcharod white shar MFSRP / Carcharod white shar 8/11/2017 CBS CBS CBS175 250508 A69-9001 A69-9001 pinger 9/15/2016 0:53 UTC -60.0181 47.271 A69-9001 pinger 9/15/2016 0:53 UTC -60.0181 47.271 A69-9001 pinger 9/15/2016 0:52 UTC -60.0181 47.271 A69-9001 pinger 9/15/2016 0:52 UTC -60.0181 47.271 A69-9001 pinger 9/15/2016 0:52 UTC -60.0181 47.271 A69-9001 pinger 9/15/2016 0:59 UTC -60.0181 47.291 A69-9001 pinger 9/15/2016 0:59 UTC -60.0181 47.291 A69-9001 pinger 9/15/2016 0:59 UTC -60.0181 47.29	9 MMFSRP	MMFSRP-/ Carcharod whit	te shar	8/11/2017	CBS	CBS	CBS175	250508		1	\69-900 <b>1</b> -	A69-9001		-	_			9/15/2016 0:54	UTC		
11 MMFSRP MMFSRP-/Carcharod white shar MFSRP-/Carcharod white shar 8/11/2017 CBS CBS CBS175 250508 A69-9001-A69-9001 pinger 9/15/2016 0:53 UTC -60.0181 47.278 MFSRP-/Carcharod white shar 8/11/2017 CBS CBS CBS175 250508 A69-9001-A69-9001 pinger 9/15/2016 0:59 UTC -60.0181 47.278 MFSRP-/Carcharod white shar 8/11/2017 CBS CBS CBS175 250508 A69-9001-A69-9001 pinger 9/15/2016 0:49 UTC -60.0181 47.278 MFSRP-/Carcharod white shar 8/11/2017 CBS CBS CBS175 250508 A69-9001-A69-9001 pinger 9/15/2016 0:50 UTC -60.0181 47.278 MFSRP-/Carcharod white shar 8/11/2017 CBS CBS CBS175 250508 A69-9001-A69-9001 pinger 9/15/2016 0:50 UTC -60.0181 47.278 MFSRP-/Carcharod white shar 8/11/2017 CBS CBS CBS175 250508 A69-9001-A69-9001 pinger 9/15/2016 0:55 UTC -60.0181 47.278 MFSRP-/Carcharod white shar 8/11/2017 CBS CBS CBS175 250508 A69-9001-A69-9001 pinger 9/15/2016 0:55 UTC -60.0181 47.278 MFSRP-/Carcharod white shar 11/21/2016 CBS CBS CBS175 250508 A69-9001-A69-9001 pinger 9/15/2016 0:55 UTC -60.0181 47.278 MFSRP-/Carcharod white shar 11/21/2016 CBS CBS CBS175 250508 A69-9001-A69-9001 pinger 9/15/2016 0:55 UTC -60.0181 47.278 MFSRP-/Carcharod white shar 11/21/2016 CBS CBS CBS175 250508 A69-9001-A69-9001 pinger 9/15/2016 0:55 UTC -60.0181 47.278 MFSRP-/Carcharod white shar 11/21/2016 CBS CBS CBS175 250508 A69-9001-A69-9001 pinger 9/15/2016 0:55 UTC -60.0181 47.278 MFSRP-/Carcharod white shar 11/21/2016 CBS CBS CBS175 250508 A69-9001-A69-9001 pinger 9/15/2016 0:55 UTC -60.0181 47.278 MFSRP-/Carcharod white shar 5/2/2017 CBS CBS CBS175 250508 A69-9001-A69-9001 pinger 9/15/2016 0:55 UTC -60.0181 47.278 MFSRP-/Carcharod white shar 5/2/2017 CBS CBS CBS267 128550 A69-9001-A69-9001 pinger 9/15/2016 0:15 UTC -60.2759 47.106 MFSRP-/Carcharod white shar 5/2/2017 HFX HFX HFX302 250182 136 128 A69-9001-A69-9001 pinger 10/25/2016 21:07 UTC -63.3203 43.815 128 MFSRP-/Carcharod white shar 5/2/2017 HFX HFX HFX303 250126 126 118 A69-9001-A69-9001 pinger 10/25/2016 21:12 UTC -63.3203 43.815 128 MFSRP MMFSRP-/Carcharod white shar 5/2/2017 HFX HFX HFX303	10 MMFSRP	MMFSRP-/ Carcharod whit	te shar	8/11/2017	CBS	CBS	CBS175	250508		Į.	A69-9001-	A69-9001		р	inger			9/15/2016 0:58	UTC	-60.0181	47.278
13 MMFSRP MMFSRP-/ Carcharod white shar MFSRP-/ Carcharod white shar MFSRP	11 MMFSRP	MMFSRP-/ Carcharod white	te shar	8/11/2017	CBS	CBS	CBS175	250508		Į.	A69-9001-	A69-9001		р	inger			9/15/2016 0:53	UTC	-60.0181	47.278
14 MMFSRP MMFSRP / Carcharod white shar 8/11/2017 CBS CBS CBS175 250508 A69-9001 A69-9001 pinger 9/15/2016 0:50 UTC -60.0181 47.278   15 MMFSRP MMFSRP / Carcharod white shar 8/11/2017 CBS CBS CBS175 250508 A69-9001 A69-9001 pinger 9/15/2016 0:55 UTC -60.0181 47.278   16 MMFSRP MMFSRP / Carcharod white shar 11/21/2016 CBS CBS CBS175 250508 A69-9001 A69-9001 pinger 9/15/2016 0:56 UTC -60.0181 47.278   17 MMFSRP MMFSRP / Carcharod white shar 11/21/2016 CBS CBS CBS175 250508 A69-9001 A69-9001 pinger 9/15/2016 0:156 UTC -60.0181 47.278   18 MMFSRP MMFSRP-1 Carcharod white shar 11/21/2016 CBS CBS CBS16 250026 176 171 A69-9001 A69-9001 pinger 10/20/2016 10:15 UTC -60.2759 47.108   19 MMFSRP MMFSRP-1 Carcharod white shar 6/5/2017 CBS CBS CBS016 250026 176 174 A69-9001 A69-9001 pinger 9/15/2016 2:50 UTC -60.1341 47.290   19 MMFSRP MMFSRP-1 Carcharod white shar 6/5/2017 CBS CBS CBS263 128522 A69-9001 A69-9001 pinger 9/15/2016 2:50 UTC -60.1341 47.290   10 MMFSRP MMFSRP-1 Carcharod white shar 6/5/2017 CBS CBS CBS263 128520 A69-9001 A69-9001 pinger 9/15/2016 2:50 UTC -60.1341 47.290   10 MMFSRP MMFSRP-1 Carcharod white shar 6/5/2017 CBS CBS CBS263 128500 A69-9001 A69-9001 pinger 10/4/2016 7:31 UTC -60.1612 47.31.   11 MMFSRP MMFSRP-1 Carcharod white shar 5/2/2017 CBS CBS CBS263 128500 A69-9001 A69-9001 pinger 10/25/2016 21:00 UTC -63.3203 43.81.   12 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX302 250182 136 128 A69-9001 A69-9001 pinger 10/25/2016 21:12 UTC -63.3203 43.81.   12 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX303 250126 126 118 A69-9001 A69-9001 pinger 10/25/2016 21:12 UTC -63.325 43.81.   13 MMFSRP MMFSRP AMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX303 250126 126 118 A69-9001 A69-9001 pinger 10/25/2016 21:12 UTC -63.325 43.81.   14 MMFSRP MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX303 250126 126 118 A69-9001 A69-9001 pinger 10/25/2016 21:12 UTC -63.325 43.81.   15 MMFSRP MMFSRP Carcharod white shar 5/2/2017 HFX HFX HFX303 250126 126 118 A69-9001 A69-9001 pinger 10/	12 MMFSRP	MMFSRP-/ Carcharod white	te shar	8/11/2017	CBS	CBS	CBS175	250508		Į.	A69-9001-	A69-9001		р	inger			9/15/2016 0:52	UTC	-60.0181	47.278
14 MMFSRP MMFSRP / Carcharod white shar M/1/2017 CBS CBS CBS175 250508 A69-9001 pinger 9/15/2016 0:50 UTC -60.0181 47.278 15 MMFSRP MMFSRP / Carcharod white shar 8/11/2017 CBS CBS CBS175 250508 A69-9001 A69-9001 pinger 9/15/2016 0:55 UTC -60.0181 47.278 16 MMFSRP MMFSRP / Carcharod white shar 8/11/2017 CBS CBS CBS175 250508 A69-9001 A69-9001 pinger 9/15/2016 0:55 UTC -60.0181 47.278 17 MMFSRP MMFSRP / Carcharod white shar 11/21/2016 CBS CBS CBS175 250508 A69-9001 A69-9001 pinger 9/15/2016 0:50 UTC -60.0181 47.278 18 MMFSRP MMFSRP-1 Carcharod white shar 11/21/2016 CBS CBS CBS175 250508 A69-9001 A69-9001 pinger 10/20/2016 10:17 UTC -60.02159 47.108 18 MMFSRP MMFSRP-1 Carcharod white shar 11/21/2016 CBS CBS CBS016 250026 176 171 A69-9001 A69-9001 pinger 10/20/2016 10:15 UTC -60.2759 47.108 19 MMFSRP MMFSRP-1 Carcharod white shar 6/5/2017 CBS CBS CBS263 128522 A69-9001 A69-9001 pinger 9/15/2016 2:50 UTC -60.1341 47.290 20 MMFSRP MMFSRP-1 Carcharod white shar 6/5/2017 CBS CBS CBS267 128550 A69-9001 A69-9001 pinger 10/4/2016 7:31 UTC -60.1612 47.31. 21 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX302 250182 136 128 A69-9001 A69-9001 pinger 10/25/2016 21:08 UTC -63.3203 43.815 23 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX302 250182 136 128 A69-9001 A69-9001 pinger 10/25/2016 21:12 UTC -63.3203 43.815 24 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX302 250182 136 128 A69-9001 A69-9001 pinger 10/25/2016 21:12 UTC -63.3203 43.815 25 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX303 250126 126 118 A69-9001 A69-9001 pinger 10/25/2016 21:12 UTC -63.325 43.81. 26 MMFSRP MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX303 250126 126 118 A69-9001 A69-9001 pinger 10/25/2016 21:12 UTC -63.325 43.81. 27 MMFSRP MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX303 250126 126 118 A69-9001 A69-9001 pinger 10/25/2016 21:12 UTC -63.325 43.81. 28 MMFSRP MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX303 250126 126 118 A69-9001 A69-9001 pinger 10/25/2016 21:12 U	13 MMFSRP	MMFSRP-/ Carcharod whit	te shar	8/11/2017	CBS	CBS	CBS175	250508		Į.	A69-9001-	A69-9001		р	inger			9/15/2016 0:49	UTC	-60.0181	47.278
16 MMFSRP MMFSRP-/ Carcharod white shar MFSRP-/ Carcharod white shar 11/21/2016 CBS CBS CBS016 250026 176 171 A69-9001 pinger 9/15/2016 0:56 UTC -60.0181 47.278   17 MMFSRP MMFSRP-/ Carcharod white shar 11/21/2016 CBS CBS CBS016 250026 176 171 A69-9001 pinger 10/20/2016 10:17 UTC -60.2759 47.108   18 MMFSRP MMFSRP-/ Carcharod white shar 11/21/2016 CBS CBS CBS016 250026 176 171 A69-9001 pinger 10/20/2016 10:15 UTC -60.2759 47.108   19 MMFSRP MMFSRP-/ Carcharod white shar 6/5/2017 CBS CBS CBS03 128522 A69-9001 A69-9001 pinger 9/15/2016 2:50 UTC -60.134 47.298   10 MMFSRP MMFSRP-/ Carcharod white shar 5/2/2017 HFX HFX HFX302 250182 136 128 A69-9001 A69-9001 pinger 10/25/2016 21:07 UTC -63.3203 43.819   12 MMFSRP MMFSRP-/ Carcharod white shar 5/2/2017 HFX HFX HFX302 250182 136 128 A69-9001 A69-9001 pinger 10/25/2016 21:08 UTC -63.3203 43.819   12 MMFSRP MMFSRP-/ Carcharod white shar 5/2/2017 HFX HFX HFX302 250182 136 128 A69-9001 A69-9001 pinger 10/25/2016 21:08 UTC -63.3203 43.819   12 MMFSRP MMFSRP-/ Carcharod white shar 5/2/2017 HFX HFX HFX302 250182 136 128 A69-9001 A69-9001 pinger 10/25/2016 21:12 UTC -63.3203 43.819   12 MMFSRP MMFSRP-/ Carcharod white shar 5/2/2017 HFX HFX HFX303 250126 126 118 A69-9001 A69-9001 pinger 10/25/2016 21:12 UTC -63.3203 43.819   12 MMFSRP MMFSRP-/ Carcharod white shar 5/2/2017 HFX HFX HFX303 250126 126 118 A69-9001 A69-9001 pinger 10/25/2016 21:12 UTC -63.325 43.81;   13 MMFSRP MMFSRP-/ Carcharod white shar 5/2/2017 HFX HFX HFX303 250126 126 118 A69-9001 A69-9001 pinger 10/25/2016 21:12 UTC -63.325 43.81;   14 MMFSRP MMFSRP-/ Carcharod white shar 5/2/2017 HFX HFX HFX303 250126 126 118 A69-9001 A69-9001 pinger 10/25/2016 21:15 UTC -63.325 43.81;   15 MMFSRP MMFSRP-/ Carcharod white shar 5/2/2017 HFX HFX HFX303 250126 126 118 A69-9001 A69-9001 pinger 10/25/2016 21:16 UTC -63.325 43.81;   16 MMFSRP MMFSRP-/ Carcharod white shar 5/2/2017 HFX HFX HFX303 250126 126 118 A69-9001 A69-9001 pinger 10/25/2016 21:16 UTC -63.325 43.81;   17 MMFSRP MMFSRP-/ Carcharod white shar 5/2/2017 HFX HF	14 MMFSRP			8/11/2017	CBS	CBS	CBS175	250508		1	\69-900 <b>1</b> -	A69-9001		р	inger			9/15/2016 0:50	UTC	-60.0181	47.278
16 MMFSRP MMFSRP- Carcharod white shar 8/11/2017 CBS CBS CBS175 250508	15 MMFSRP	MMFSRP-/ Carcharod whit	te shar	8/11/2017	CBS	CBS	CBS175	250508		1	\69-900 <b>1</b> -	A69-9001		р	inger			9/15/2016 0:5	UTC	-60.0181	47.278
18 MMFSRP MMFSRP-1 Carcharod white shar	16 MMFSRP	MMFSRP-/ Carcharod whit	te shar	8/11/2017	CBS	CBS	CBS175	250508		Į.	A69-9001-	A69-9001		р	inger			9/15/2016 0:50	UTC	-60.0181	47.278
18 MMFSRP MMFSRP-1 Carcharod white shar	17 MMFSRP	MMFSRP-1 Carcharod whit	te shar	11/21/2016	CBS	CBS	CBS016	250026	176	171 /	\69-900 <b>1</b> -	A69-9001		р	inger			10/20/2016 10:1	UTC	-60.2759	47.106
19 MMFSRP MMFSRP-Carcharod white shar 6/5/2017 CBS CBS CBS263 128522 A69-9001 pinger 9/15/2016 2:50 UTC -60.1341 47.290 A69-9001 pinger 10/4/2016 7:31 UTC -60.1612 47.31; UTC -60.1612 47	18 MMFSRP	MMFSRP-1 Carcharod whit	te shar	11/21/2016	CBS	CBS	CBS016	250026	176	171 /	\69-900 <b>1</b> -	A69-9001		р	inger					-60.2759	47.106
20 MMFSRP MMFSRP-1 Carcharod white shar 6/5/2017 CBS CBS CBS267 128550 A69-9001 pinger 10/4/2016 7:31 UTC -60.1612 47.31. 21 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX302 250182 136 128 A69-9001 pinger 10/25/2016 21:07 UTC -63.3203 43.819	19 MMFSRP	MMFSRP-/ Carcharod whit	te shar	6/5/2017	CBS	CBS	CBS263	128522		1	\69-900 <b>1</b> -	A69-9001		-	_			9/15/2016 2:50	UTC	-60.1341	47.290
21 MMFSRP MMFSRP-Carcharod white shar 5/2/2017 HFX HFX HFX302 250182 136 128 A69-9001- A69-9001 pinger 10/25/2016 21:07 UTC -63.3203 43.819 22 MMFSRP MMFSRP-Carcharod white shar 5/2/2017 HFX HFX HFX302 250182 136 128 A69-9001- A69-9001 pinger 10/25/2016 21:08 UTC -63.3203 43.819 23 MMFSRP MMFSRP-Carcharod white shar 5/2/2017 HFX HFX HFX302 250182 136 128 A69-9001- A69-9001 pinger 10/25/2016 21:12 UTC -63.3203 43.819 24 MMFSRP MMFSRP-Carcharod white shar 5/2/2017 HFX HFX HFX303 250126 126 118 A69-9001- A69-9001 pinger 10/25/2016 21:12 UTC -63.325 43.819 25 MMFSRP MMFSRP-Carcharod white shar 5/2/2017 HFX HFX HFX303 250126 126 118 A69-9001- A69-9001 pinger 10/25/2016 21:14 UTC -63.325 43.819 26 MMFSRP MMFSRP-Carcharod white shar 5/2/2017 HFX HFX HFX303 250126 126 118 A69-9001- A69-9001 pinger 10/25/2016 21:15 UTC -63.325 43.819 26 MMFSRP MMFSRP-Carcharod white shar 5/2/2017 HFX HFX HFX303 250126 126 118 A69-9001- A69-9001 pinger 10/25/2016 21:15 UTC -63.325 43.819 27 MMFSRP MMFSRP-Carcharod white shar 5/2/2017 HFX HFX HFX303 250126 126 118 A69-9001- A69-9001 pinger 10/25/2016 21:15 UTC -63.325 43.819 28 MMFSRP MMFSRP-Carcharod white shar 5/2/2017 HFX HFX HFX304 250173 123 115 A69-9001- A69-9001 pinger 10/25/2016 21:22 UTC -63.3295 43.806	20 MMFSRP	MMFSRP-1 Carcharod whit	te shar	6/5/2017	CBS	CBS	CBS267	128550		1	\69-900 <b>1</b> -	A69-9001		-	_			10/4/2016 7:3:	UTC	-60.1612	47.312
22 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX302 250182 136 128 A69-9001 A69-9001 pinger 10/25/2016 21:08 UTC -63.3203 43.819   23 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX302 250182 136 128 A69-9001 A69-9001 pinger 10/25/2016 21:12 UTC -63.3203 43.819   24 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX303 250126 126 118 A69-9001 A69-9001 pinger 10/25/2016 21:12 UTC -63.325 43.819   25 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX303 250126 126 118 A69-9001 pinger 10/25/2016 21:14 UTC -63.325 43.819   26 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX303 250126 126 118 A69-9001 pinger 10/25/2016 21:15 UTC -63.325 43.819   27 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX303 250126 126 118 A69-9001 pinger 10/25/2016 21:15 UTC -63.325 43.819   28 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX HFX304 250173 123 115 A69-9001 pinger 10/25/2016 21:22 UTC -63.325 43.806   28 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX HFX304 250173 123 115 A69-9001 pinger 10/25/2016 21:22 UTC -63.325 43.806   29 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX304 250173 123 115 A69-9001 pinger 10/25/2016 21:22 UTC -63.325 43.806   20 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX304 250173 123 115 A69-9001 pinger 10/25/2016 21:22 UTC -63.325 43.806   20 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX304 250173 123 115 A69-9001 pinger 10/25/2016 21:22 UTC -63.325 43.806   20 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX304 250173 123 115 A69-9001 pinger 10/25/2016 21:22 UTC -63.325 43.806   20 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX304 250173 123 115 A69-9001 pinger 10/25/2016 21:22 UTC -63.325 43.806   20 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX304 250173 123 115 A69-9001 pinger 10/25/2016 21:22 UTC -63.325 43.806   20 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX304 250173 123 115 A69-9001 pinger 10/25/2016 21:22 UTC -63.325 43.806   20 MMFSRP MMFS	21 MMFSRP	MMFSRP-2 Carcharod whit	te shar	5/2/2017	HFX	HFX	HFX302	250182	136	128 /	\69-900 <b>1</b> -	A69-9001		-	_			10/25/2016 21:0	UTC	-63.3203	43.819
23 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX302 250182 136 128 A69-9001 A69-9001 pinger 10/25/2016 21:12 UTC -63.3203 43.815   24 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX303 250126 126 118 A69-9001 pinger 10/25/2016 21:12 UTC -63.3203 43.815   25 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX303 250126 126 118 A69-9001 pinger 10/25/2016 21:12 UTC -63.325 43.815   26 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX303 250126 126 118 A69-9001 pinger 10/25/2016 21:15 UTC -63.325 43.815   27 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX303 250126 126 118 A69-9001 pinger 10/25/2016 21:15 UTC -63.325 43.815   28 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX304 250173 123 115 A69-9001 pinger 10/25/2016 21:22 UTC -63.325 43.806   28 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX304 250173 123 115 A69-9001 pinger 10/25/2016 21:22 UTC -63.325 43.806   29 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX304 250173 123 115 A69-9001 pinger 10/25/2016 21:22 UTC -63.325 43.806   20 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX304 250173 123 115 A69-9001 pinger 10/25/2016 21:22 UTC -63.325 43.806   20 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX304 250173 123 115 A69-9001 pinger 10/25/2016 21:22 UTC -63.325 43.806   20 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX304 250173 123 115 A69-9001 pinger 10/25/2016 21:22 UTC -63.325 43.806   20 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX304 250173 123 115 A69-9001 Pinger 10/25/2016 21:22 UTC -63.325 43.806   20 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX304 250173 123 115 A69-9001 Pinger 10/25/2016 21:22 UTC -63.325 43.806   20 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX304 250173 123 115 A69-9001 Pinger 10/25/2016 21:22 UTC -63.325 43.806   20 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX304 250173 123 115 A69-9001 Pinger 10/25/2016 21:22 UTC -63.325 43.806   20 MMFSRP MMFSRP-2 Carcharod white shar	22 MMFSRP	MMFSRP-2 Carcharod whit	te shar	5/2/2017	HFX	HFX	HFX302	250182	136	128 /	\69-900 <b>1</b> -	A69-9001		-	_			10/25/2016 21:08	UTC	-63.3203	43.819
24 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX303 250126 126 118 A69-9001 pinger 10/25/2016 21:12 UTC -63.325 43.812   25 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX303 250126 126 118 A69-9001 pinger 10/25/2016 21:14 UTC -63.325 43.812   26 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX303 250126 126 118 A69-9001 pinger 10/25/2016 21:15 UTC -63.325 43.812   27 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX303 250126 126 118 A69-9001 pinger 10/25/2016 21:15 UTC -63.325 43.812   28 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX304 250173 123 115 A69-9001 pinger 10/25/2016 21:22 UTC -63.325 43.806	23 MMFSRP			5/2/2017	HFX	HFX	HFX302	250182	136	128 /	\69-900 <b>1</b> -	A69-9001						10/25/2016 21:12	UTC	-63.3203	43.819
25 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX303 250126 126 118 A69-9001 pinger 10/25/2016 21:14 UTC -63.325 43.812   26 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX303 250126 126 118 A69-9001 pinger 10/25/2016 21:15 UTC -63.325 43.812   27 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX303 250126 126 118 A69-9001 pinger 10/25/2016 21:16 UTC -63.325 43.812   28 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX HFX304 250173 123 115 A69-9001 pinger 10/25/2016 21:22 UTC -63.325 43.806	24 MMFSRP	MMFSRP-2 Carcharod whit	te shar			HFX															
26 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX MFX303 250126 126 118 A69-9001 pinger 10/25/2016 21:15 UTC -63.325 43.812   27 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX MFX303 250126 126 118 A69-9001 pinger 10/25/2016 21:16 UTC -63.325 43.812   28 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX MFX304 250173 123 115 A69-9001 pinger 10/25/2016 21:22 UTC -63.325 43.806	25 MMFSRP	MMFSRP-2 Carcharod whit	te shar			HFX	HFX303	250126	126	118 /	\69-9001-	A69-9001									
27 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX 033 250126 126 118 A69-9001 A69-9001 pinger 10/25/2016 21:16 UTC -63.325 43.812   28 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX 04 250173 123 115 A69-9001 pinger 10/25/2016 21:22 UTC -63.325 43.80€	26 MMFSRP	MMFSRP-2 Carcharod whit	te shar	5/2/2017	HFX	HFX	HFX303	250126	126	118 /	\69-9001-	A69-9001						10/25/2016 21:15	UTC	-63.325	43.812
28 MMFSRP MMFSRP-2 Carcharod white shar 5/2/2017 HFX HFX 304 250173 123 115 A69-9001 Pinger 10/25/2016 21:22 UTC -63.3295 43.806	27 MMFSRP					HFX	HFX303							-	_						
29 MMFSRP MMFSRP-1Carcharod white shar 12/13/2016 HFX HFX 204 250313 164 159 A69-9001 pinger 10/26/2016 14:14 UTC -63.5 43.21:	28 MMFSRP	MMFSRP-2 Carcharod whit	te shar	5/2/2017	HFX	HFX	HFX304	250173	123	115 /	\69-9001-	A69-9001		p	inger			10/25/2016 21:22	UTC	-63.3295	43.800
	29 MMFSRP	MMFSRP-1 Carcharod whit	te shar	12/13/2016	HFX	HFX	HFX204	250313	164	159 A	A69-9001-	A69-9001		p	inger			10/26/2016 14:14	UTC	-63.5	43.211

# Things we'll learn today

```
filter() Pick observations by their values
distinct() Remove duplicate rows
arrange( ) Reorder rows
select() Pick variables by their names
mutate( ) Create new variables with existing variables
%>% Combining multiple operations with the pipe
```

# To R!

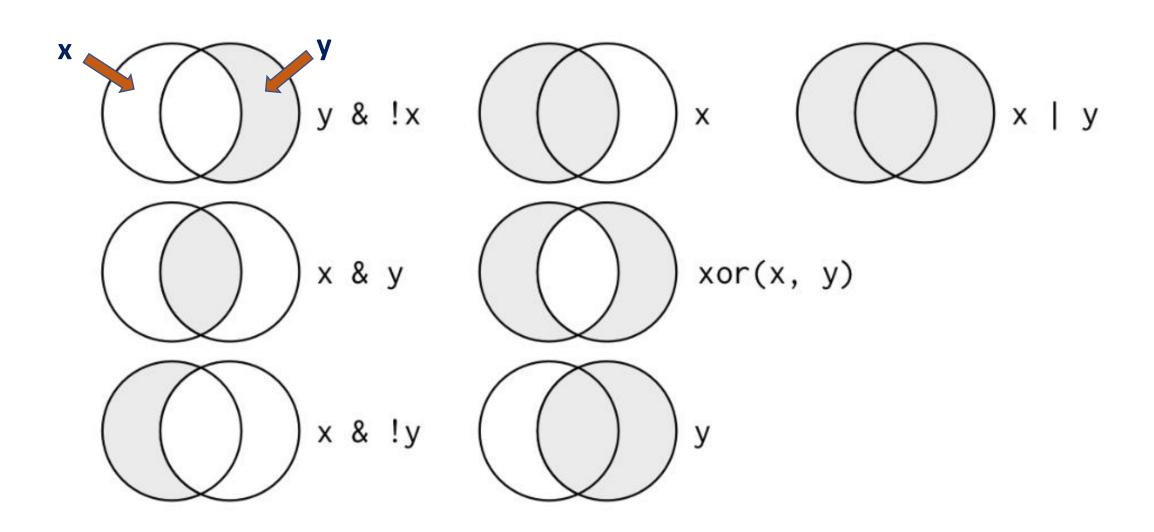
#### Filter rows with filter()

```
filter(flights, month == 1, day == 1)
#> # A tibble: 842 x 19
    year month day dep time sched dep time dep delay arr time
#> <int> <int> <int> <int>
                               <int>
                                                 <dbL>
                                                         (int)
#> 1 2013
                          517
                                         515
                                                    2
                                                           830
#> 2 2013
                          533
                                         529
                                                           850
#> 3 2013
                          542
                                        540
                                                           923
#> 4 2013
                                        545
                          544
                                                   -1
                                                          1004
#> 5 2013
                          554
                                         600
                                                           812
                                                    -6
#> 6 2013
                          554
                                        558
              1
                                                    -4
                                                           740
#> # ... with 836 more rows, and 12 more variables: sched_arr_time <int>,
      arr_delay <dbl>, carrier <chr>, flight <int>, tailnum <chr>,
      origin <chr>, dest <chr>, air time <dbl>, distance <dbl>, hour <dbl>,
      minute <dbl>, time_hour <dttm>
```

#### Comparisons

- Select values greater than
- Select values less than
- >= Selects values greater than or equal to
- Selects values less than or equal to
- ! = Selects values not equal to
- Selects values equal to

# Logical operators



# Identifying and excluding missing values

Identify whether values are missing or not:

```
is.na(x) Determine if a value is missing
     !is.na(x) Determine if a value is not missing
Use filter() to select missing or not-missing values:
     filter(data, is.na(x))
    filter(data,!is.na(x))
```

## Identifying and excluding duplicate rows

Identify and remove rows with duplicate values:

```
distinct(data)
```

Remove duplicate rows based on certain variables:

```
distinct(data, variable)
```

```
distinct(data, variable, .keep_all=TRUE)
```

## Sort rows with arrange ( )

```
arrange(flights, year, month, day)
#> # A tibble: 336,776 x 19
    year month day dep_time sched_dep_time dep_delay arr_time
   <int> <int> <int> <int>
                         <int>
                                         <dbL>
                                                <int>
#> 1 2013
              1 517
                                  515
                                                 830
#> 2 2013 1 1 533
                                  529
                                                 850
#> 3 2013 1 1 542
                                  540 2
                                                  923
#> 4 2013 1 1 544
                                  545
                                                 1004
#> 5 2013 1 1 554
                                  600
                                          -6 812
#> 6 2013
                      554
                                  558
                                           -4
                                                 740
#> # ... with 3.368e+05 more rows, and 12 more variables:
     sched_arr_time <int>, arr_delay <dbl>, carrier <chr>, flight <int>,
     tailnum <chr>, origin <chr>, dest <chr>, air_time <dbl>,
     distance <dbl>, hour <dbl>, minute <dbl>, time hour <dttm>
```

<sup>\*</sup> Missing values will always be sorted at the end!

#### Select columns with select()

```
# Select columns by name
select(flights, year, month, day)
#> # A tibble: 336,776 x 3
  year month day
#> <int> <int> <int>
#> 1 2013 1 1
#> 2 2013 1 1
#> 3 2013 1 1
#> 4 2013 1 1
#> 5 2013 1 1
#> 6 2013 1 1
#> # ... with 3.368e+05 more rows
```

#### Select columns with select()

There are a number of helper functions you can use within select():

- starts\_with("abc"): matches names that begin with "abc".
- ends\_with("xyz"): matches names that end with "xyz".
- contains("ijk"): matches names that contain "ijk".
- matches("(.)\\1") : selects variables that match a regular expression. This one matches any variables that contain repeated characters. You'll learn more about regular expressions in strings.
- num\_range("x", 1:3): matches x1, x2 and x3.

See ?select for more details.

#### Add new variables with mutate()

```
mutate(flights_sml,
 gain = dep_delay - arr_delay,
 speed = distance / air_time * 60
#> # A tibble: 336,776 x 9
    year month day dep delay arr delay distance air time gain speed
    <int> <int> <int> <int> <dbl> <dbl>
                                          <dbL>
                                                   <dbl> <dbl> <dbl>
#> 1 2013
                                      11
                                            1400
                                                             -9 370.
#> 2 2013
                                      20
                                            1416
                                                            -16 374.
                                                            -31 408.
#> 3 2013
                                      33
                                             1089
                                                      160
#> 4 2013
                                     -18
                                             1576
                                                      183
                                                             17 517.
#> 5 2013
                                     -25
                                              762
                                                      116
                                                             19 394.
#> 6 2013
                            -4
                                      12
                                              719
                                                      150
                                                            -16 288.
#> # ... with 3.368e+05 more rows
```

#### Useful creation functions

Logical operators	>,<,>=,<=,!=,==								
Arithmetic operators	+,-,*,/,^,log,sin,cos								
Modular arithmetic	%/%, %%								
Offsets	<pre>lead( ),lag( )</pre>								
Cumulative/rolling	<pre>cumsum(), cumprod()</pre>								
Ranking	<pre>min_rank( )</pre>								

#### Combining multiple operations with the pipe

```
Instead of this (clunky): flights_sml <- select(flights,</pre>
                                                  vear:day.
                                                  ends_with("delay"),
                                                  distance,
                                                  air_time)
                            flights_sub <- mutate(flights_sml,
                                                  gain = dep_delay - arr_delay,
                                                  hours = air_time / 60,
                                                  gain_per_hour = gain / hours)
We can achieve the
                            flights_sub <- flights %>%
                                           select(year:day,
same thing using %>%:
                                                  ends_with("delay").
                                                  distance,
                                                   air_time) %>%
                                           mutate(gain = dep_delay - arr_delay,
                                                  hours = air_time / 60,
                                                  gain_per_hour = gain / hours)
```