Obtaining data, raw and tidy data

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What you wish data looked like

solutions-jun3.csv

id	problem_id	subject_id	start	stop	time_left	answer
1	498	17	1307119989	1307120016	2369	A
2	150	15	1307119991	1307120009	2376	D
3	313	16	1307119994	1307120009	2376	E
4	12	13	1307119995	1307120019	2366	B
5	273	14	1307119996	1307120028	2357	A
6	101	19	1307119996	1307120021	2364	B
7	105	18	1307119998	1307120048	2337	B
8	162	12	1307120004	1307120042	2343	C
9	70	15	1307120011	1307120038	2347	C
10	300	16	1307120012	1307120092	2293	B
11	494	17	1307120017	1307120075	2310	D
12	357	13	1307120021	1307120118	2267	A
13	522	19	1307120025	1307120152	2233	D
14	232	14	1307120030	1307120158	2227	C
15	344	15	1307120041	1307120117	2268	B
16	160	17	1307120079	1307120249	2136	D
17	516	16	1307120094	1307120159	2226	B
18	472	12	1307120119	1307120170	2215	A
19	43	15	1307120122	1307120140	2245	C
20	353	13	1307120144	1307120199	2186	C
21	218	15	1307120152	1307120272	2113	E
22	69	16	1307120163	1307120188	2197	D
23	562	16	1307120190	1307120301	2084	D
24	121	19	1307120253	1307120294	2091	E
25	297	15	1307120277	1307120342	2043	B
26	495	13	1307120281	1307120353	2032	E
27	94	14	1307120288	1307120343	2042	E
28	22	18	1307120310	1307120365	2020	C
29	64	19	1307120310	1307120385	2000	B
30	502	16	1307120323	1307120336	2049	B
31	44	16	1307120339	1307120352	2033	A
32	315	14	1307120348	1307120362	2023	B
33	385	15	1307120352	1307120553	1832	E
34	550	13	1307120356	1307120444	1941	B
35	92	14	1307120368	1307120397	1988	B
36	395	16	1307120377	1307120426	1959	D
37	267	17	1307120382	1307120515	1870	E
38	257	14	1307120401	1307120427	1958	C
39	312	19	1307120407	1307120548	1837	D
40	321	18	1307120431	1307120449	1936	A
41	220	16	1307120437	1307120510	1875	A

What does data really look like?

```
@HWI-EAS121:4:100:1783:550#0/1
CGTTACGAGATCGGAAGAGCGGTTCAGCAGGAATGCCGAGACGGATCTCGTATGCGGTCTGCTGCGTGACAAGACAGGGG
+HWI-EAS121:4:100:1783:550#0/1
aaaaa`b_aa`aa`YaX]aZ`aZM^Z]YRa]YSG[[ZREQLHESDHNDDHNMEEDDMPENITKFLFEEDDDHEJQMEDDD
@HWI-EAS121:4:100:1783:1611#0/1
GGGTGGGCATTTCCACTCGCAGTATGGGTTGCCGCACGACAGGCAGCGGTCAGCCTGCGCTTTGGCCTGGCCTTCGGAAA
+HWI-EAS121:4:100:1783:1611#0/1
a``^\__`_```^a``a`^a_^__]a_]\]`a______`_^^`]X]_]XTV_\]]NX_XVX]]_TTTTG[VTHPN]VFDZ
@HWI-EAS121:4:100:1783:322#0/1
CGTTTATGTTTTTGAATATGTCTTATCTTAACGGTTATATTTTAGATGTTGGTCTTATTCTAACGGTCATATATTTTCTA
+HWI-EAS121:4:100:1783:322#0/1
abaa`^aaaaabbbaababbbbbb`bbbb_bbbbbbbb`bbbaV^_a``a``]``aT]a__V\]]_]^a`]a_abbaV__
@HWI-EAS121:4:100:1783:1394#0/1
GGGTCTTTATTGGTCTGGTGATCCCCCATATTCTCCGGTTGTGTGGTTTAACCGATCATCGCGCATTACTTCCCGGCTGC
+HWI-EAS121:4:100:1783:1394#0/1
```[aa\b^^[]aabbb][`a_abbb`a``bbbbbabaabaaaab_VZa_^___bab_X`[a\HV_[_]_[^_X\T_VQQ
@HWI-EAS121:4:100:1783:207#0/1
CCCTGGGAGATCGGAAGAGCGGTTCAGCAGGAATGCCGAGACCGATCTCGTATGCCGTCTTCTGCTTGAAAAAAAAAACA
+HWI-EAS121:4:100:1783:207#0/1
abba`Xa\^\\`aa]ba__bba[a_O_a`aa`aa`a]^V]X_a^YS\R_\H_[]\ZTDUZZUSOPX]]POP\GS\WSHHD
@HWI-EAS121:4:100:1783:455#0/1
GGGTAATTCAGGGACAATGTAATGGCTGCACAAAAAAATACATCTTTCATGTTCCATTGCACCATTGACAAATACATATT
+HWI-EAS121:4:100:1783:455#0/1
abb_babbabaabbbbbbbbbbbbbbba\`b`\abbbabbbbabbbbbbaabbbbb`bb`ab_O_bab_Q_bbabaa_a
```
```

What does data really look like?


```
–<breakfast_menu>
  –<food>
      <name>Belgian Waffles</name>
      <price>$5.95</price>
    –<description>
        Two of our famous Belgian Waffles with plenty of real maple syrup
      </description>
      <calories>650</calories>
    </food>
  –<food>
      <name>Strawberry Belgian Waffles</name>
      <price>$7.95</price>
    –<description>
        Light Belgian waffles covered with strawberries and whipped cream
      </description>
      <calories>900</calories>
    </food>
  –<food>
      <name>Berry-Berry Belgian Waffles</name>
      <price>$8.95</price>
    –<description>
        Light Belgian waffles covered with an assortment of fresh berries and whipped cream
      </description>
      <calories>900</calories>
    </food>
  –<food>
```

What does data really look like?

```
---------------------------   ALLERGIES   -------------------------

ast Updated: 01 Dec 2011 @ 0851

llergy Name:        TRIMETHOPRIM
ocation:            DAYT29
ate Entered:        09 Mar 2011
eaction:
llergy Type:        DRUG
A Drug Class:       ANTI-INFECTIVES,OTHER
bserved/Historical: HISTORICAL
omments:            The reaction to this allergy was MILD (NO SQUELAE)

llergy Name:        TRAMADOL
ocation:            DAYT29
ate Entered:        09 Mar 2011
eaction:            URINARY RETENTION
llergy Type:        DRUG
A Drug Class:       NON-OPIOID ANALGESICS
bserved/Historical: HISTORICAL
omments:            gradually worsening difficulty emptying bladder
```

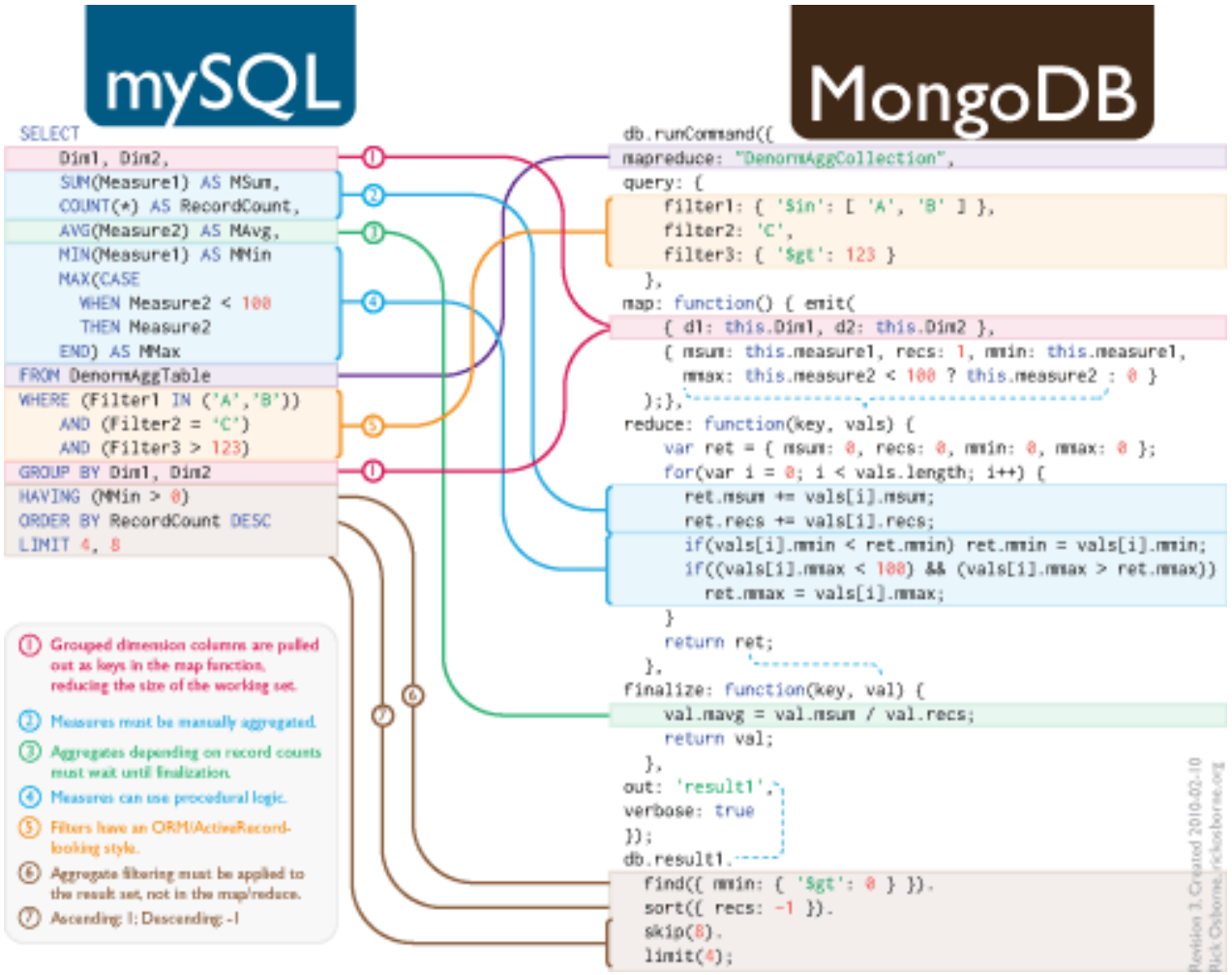
```
---------------------------   MEDICATION HISTORY   ----------------

Last Updated: 11 Apr 2011 @ 1737

Medication: AMLODIPINE BESYLATE 10MG TAB
Instructions: TAKE ONE TABLET BY MOUTH TAKE ONE-HALF TABLET FOR 
GRAPEFRUIT JUICE--
Status: Active
Refills Remaining: 3
Last Filled On: 20 Aug 2010
Initially Ordered On: 13 Aug 2010
Quantity: 45
Days Supply: 90
Pharmacy: DAYTON
Prescription Number: 2718953

Medication: IBUPROFEN 600MG TAB
Instructions: TAKE ONE TABLET BY MOUTH FOUR TIMES A DAY WITH FOOD
Status: Active
Refills Remaining: 3
Last Filled On: 20 Aug 2010
Initially Ordered On: 01 Jul 2010
```

Where is data?



Where is data?

GET blocks/blocking | Twitte

https://dev.twitter.com/docs/api/1/get/blocks/blocking

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cursor to be -1 if it isn't supplied.

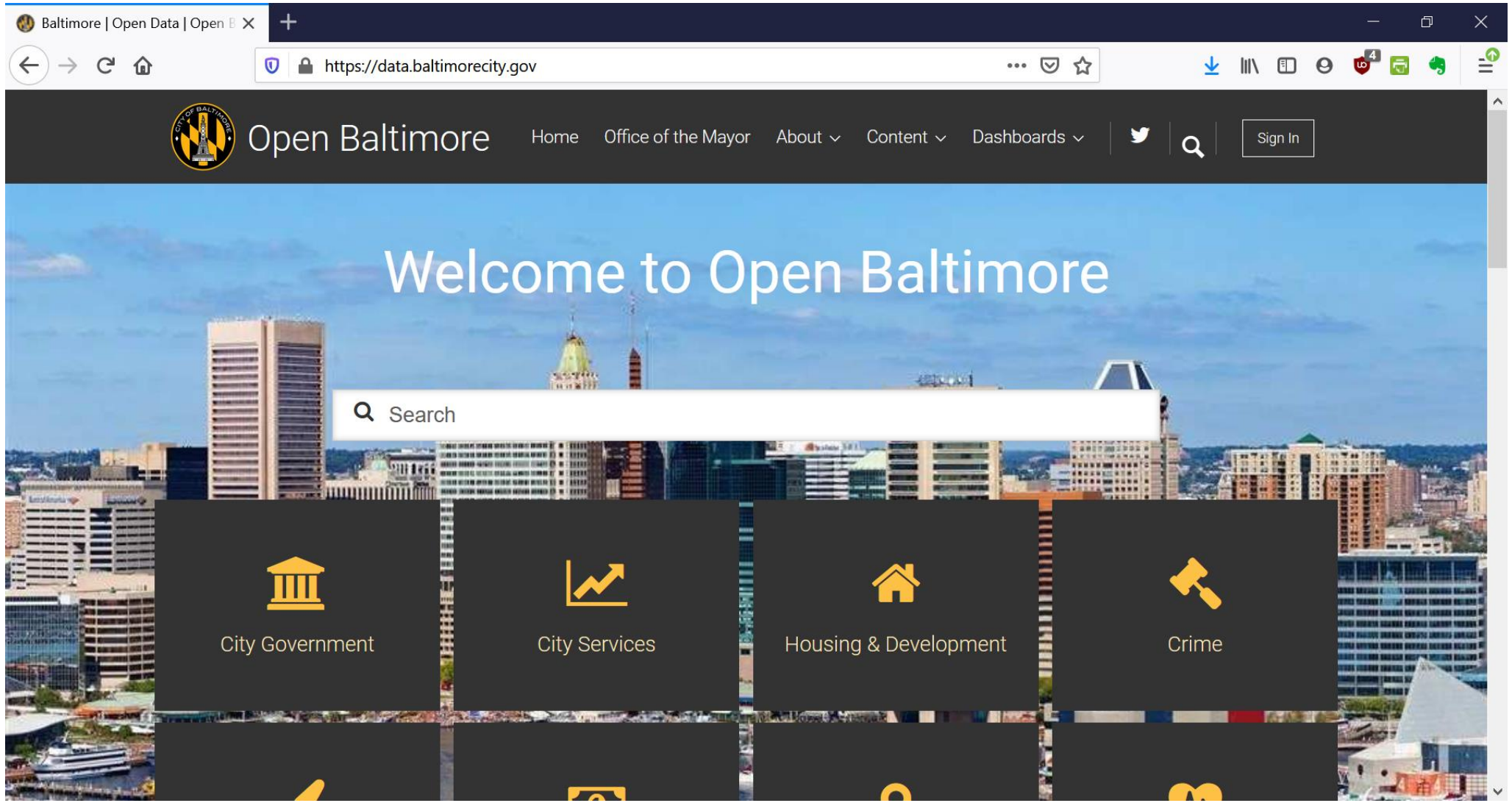
Example Values: 12893764510938

Example Request

GET *https://api.twitter.com/1/blocks/blocking.json?cusor=-1&include_entities=true*


```
1. {
2.   "previous_cursor": 0,
3.   "previous_cursor_str": "0",
4.   "next_cursor": 0,
5.   "users": [
6.     {
7.       "profile_sidebar_border_color": "C0DEED",
8.       "name": "Javier Heady \r",
9.       "profile_sidebar_fill_color": "DDEEF6",
10.      "profile_background_tile": false,
11.      "location": null,
12.      "created_at": "Thu Mar 01 00:16:47 +0000 2012",
13.      "profile_image_url":
    "http://a0.twimg.com/sticky/default_profile_images/default_profile_4_normal.png",
14.      "is_translator": false,
15.      "id_str": "509466276",
16.      "profile_link_color": "0084B4",
17.      "follow_request_sent": false,
18.      "contributors_enabled": false,
19.      "default_profile": true,
20.      "url": null,
21.      "favourites_count": 0,
22.      "utc_offset": null,
23.      "id": 509466276,
24.      "profile_image_url_https":
    "https://si0.twimg.com/sticky/default_profile_images/default_profile_4_normal.png",
25.      "listed_count": 0,
26.      "profile_use_background_image": true,
27.      "profile_text_color": "333333",
28.      "lang": "en",
29.      "protected": false,
30.      "followers_count": 0,
31.      "geo_enabled": false,
32.      "description": null,
```

Where is data?



Data science pipeline

Raw data -> Processing script -> tidy data -> data analysis -> data communication

Definition of Data

Data are a set of values of qualitative or quantitative variables about one or more persons or objects

https://en.wikipedia.org/wiki/Data

One or more persons or objects: Sometimes called the population; the set of objects you are interested in.

Variables: A measurement or characteristic of an item.

- **Qualitative**: Country of origin, sex, treatment
- **Quantitative**: Height, weight, blood pressure

Raw versus processed data

Raw data

- The original source of the data
- Often hard to use for data analyses
- Data analysis *includes* processing
- Raw data may only need to be processed once

http://en.wikipedia.org/wiki/Raw_data

Processed data

- Data that is ready for analysis
- Processing can include merging, subsetting, transforming, etc.
- There may be standards for processing
- All steps should be recorded

http://en.wikipedia.org/wiki/Computer_data_processing

Components of tidy data

1. The raw data.
2. A tidy data set
3. A code book describing each variable and its values in the tidy data set.
4. An explicit and exact recipe you used to go from 1 -> 2,3.

The raw data

- The strange binary file your measurement machine spits out
- The unformatted Excel file with 10 worksheets the company you contracted with sent you
- The complicated JSON data you got from scraping the Twitter API
- The hand-entered numbers you collected looking through a microscope

The tidy data

1. Each variable you measure should be in one column
2. Each different observation of that variable should be in a different row
3. There should be one table for each "kind" of variable
4. If you have multiple tables, they should include a column in the table that allows them to be linked

Some other important tips

- Include a row at the top of each file with variable names.
- Make variable names human readable AgeAtDiagnosis instead of AgeDx
- In general data should be saved in one file per table.

The code book

1. Information about the variables (including units!) in the data set not contained in the tidy data
2. Information about the summary choices you made
3. Information about the experimental study design you used

Some other important tips

- A common format for this document is a Word/text file.
- There should be a section called "Study design" that has a thorough description of how you collected the data.
- There must be a section called "Code book" that describes each variable and its units.

The instruction list

- Ideally a computer script (in R :-), but I suppose Python is ok too...)
- The input for the script is the raw data
- The output is the processed, tidy data
- There are no parameters to the script

In some cases it will not be possible to script every step. In that case you should provide instructions like:

1. Step 1 - take the raw file, run version 3.1.2 of summarize software with parameters a=1, b=2, c=3
2. Step 2 - run the software separately for each sample
3. Step 3 - take column three of outputfile.out for each sample and that is the corresponding row in the output data set

https://github.com/jtleek/datasharing

This presentation is based on materials from Coursera Getting and Cleaning Data course

https://www.coursera.org/learn/data-cleaning/home/welcome