190F Foundations of Data Science

Fall 2018

Lecture 5

Working with Tables

Ways to create a table

- `Table.read_table(filename)` - reads a table from a spreadsheet
- `Table()` - an empty table
- and...

Arrays → Tables

- `Table().with_column(label, data)` - creates a table with a single column; `data` is an array
- `Table().with_columns(label1, data1, ...)` - creates a table, with an array of data for each column

Table Methods

- Extending tables:
  - `t.with_columns` and `t.read_table`

Examples

The table `students` has columns `Name`, `ID`, and `Score`.

Write one line of code that evaluates to:

a) A table consisting of only the column labeled `Name`

```
students.select('Name')
```

b) The largest score

```
students.column('Score').max()
max(students.column('Score'))
```

Lists are Generic Sequences

A list is a sequence of values (just like an array), but the values can all have different types

```
[2+3, 'four', Table().with_column('K', [3, 4])]
```

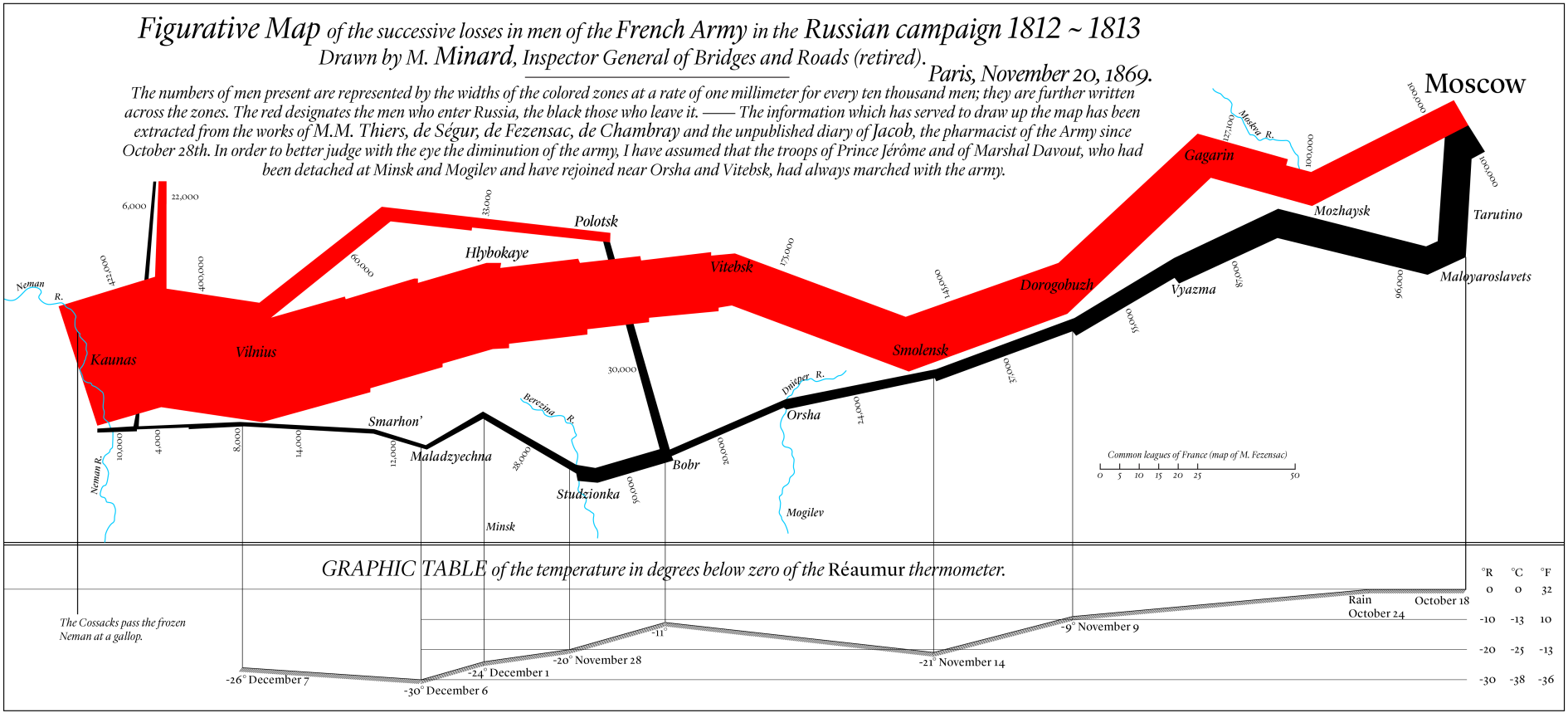
If you create a table column from a list, it will be converted to an array automatically

Minard's Map

Charles Joseph Minard, 1781-1870

- French civil engineer who some say created one of the greatest graphs of all time.
- Visualized Napoleon's 1812 invasion of Russia, including the number of soldiers, the direction of the march, names and locations of cities, temperatures, dates.

Visualization of 1812 March



Different types of data

Longitude	Latitude	City	Direction	Survivors
32	54.8	Smolensk	Advance	145000
33.2	54.9	Dorogobouge	Advance	140000
34.4	55.5	Chjat	Advance	127100
37.6	55.8	Moscou	Advance	100000
34.3	55.2	Wixma	Retreat	55000
32	54.6	Smolensk	Retreat	24000
30.4	54.4	Orscha	Retreat	20000
26.8	54.3	Moiodexno	Retreat	12000

float:
decimal number

string:
text

int:
integer

More Tables

Table Methods

- Creating new tables containing some of the original columns:
  - **`select`**, **`drop`**
- Accessing data in a column
  - **`column`** takes a label or index and returns an array
- Finding the size: **`num_rows`** and **`num_columns`**
- Referring to columns: labels, relabeling, and indices
  - **`labels`** and **`relabeled`**; column indices start at 0
- Using array methods to work with data in columns
  - **`item`**, **`sum`**, **`min`**, **`max`**, and so on

Take Rows, Select Columns

The `select` method returns a table with only some columns

The `take` method returns a table with only some rows

- Rows are numbered, starting at 0
- Taking a single number returns a one-row table
- Taking a list of numbers returns a table as well

The where method

- `t.where(label, condition)` - constructs a new table with just the rows that match the condition

Manipulating Rows

- `t.sort(column)` sorts the rows in increasing order
- `t.take(row_numbers)` keeps the numbered rows
  - Each `row` has an index, starting at 0
- `t.where(column, are.condition)` keeps all rows for which a column's value satisfies a condition
- `t.where(column, value)` keeps all rows containing a certain value in a column