2 - Reshaping

Rearranging Data

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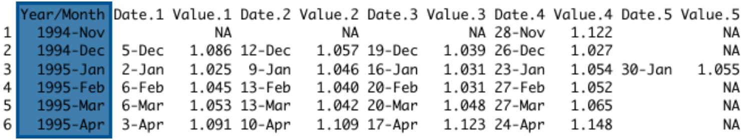
Outline

- Reshaping Data Using Spreadsheets
- `reshapeGUI`
- melt and cast in the command line

Mac users should be using the terminal server for this session.

Reshaping Data

- What do we want to do?



```
  Year/Month Date.1 Value.1 Date.2 Value.2 Date.3 Value.3 Date.4 Value.4 Date.5 Value.5
1   1994-Nov             NA             NA             NA 28-Nov   1.122             NA
2   1994-Dec  5-Dec   1.086 12-Dec   1.057 19-Dec   1.039 26-Dec   1.027             NA
3   1995-Jan  2-Jan   1.025  9-Jan   1.046 16-Jan   1.031 23-Jan   1.054 30-Jan   1.055
4   1995-Feb  6-Feb   1.045 13-Feb   1.040 20-Feb   1.031 27-Feb   1.052             NA
5   1995-Mar  6-Mar   1.053 13-Mar   1.042 20-Mar   1.048 27-Mar   1.065             NA
6   1995-Apr  3-Apr   1.091 10-Apr   1.109 17-Apr   1.123 24-Apr   1.148             NA
```

We have five blocks of weekly dates and gas prices next to each other

Reshaping Data

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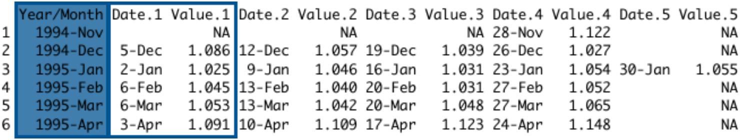

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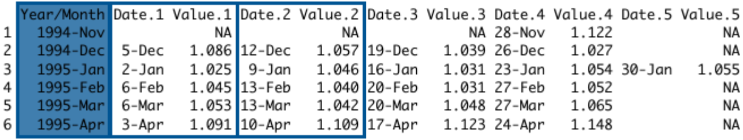

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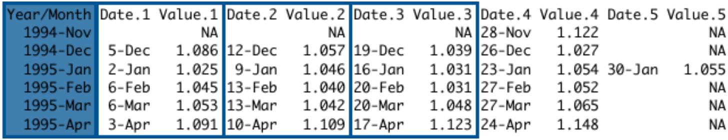

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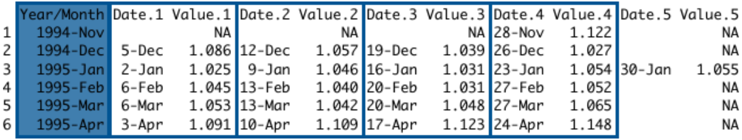

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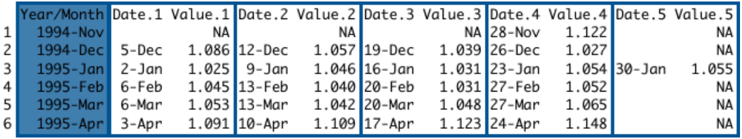

	Year/Month	Date.1	Value.1	Date.2	Value.2	Date.3	Value.3	Date.4	Value.4	Date.5	Value.5
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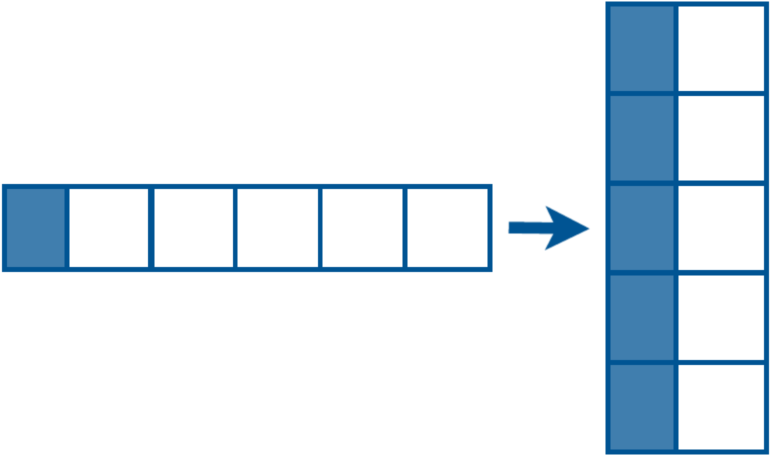
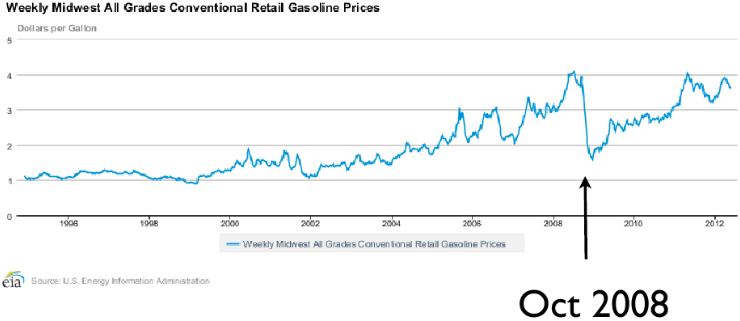


Reshaping Data

- Earlier we read the midwest gas prices



Weekly Midwest All Grades Conventional Retail Gasoline Prices

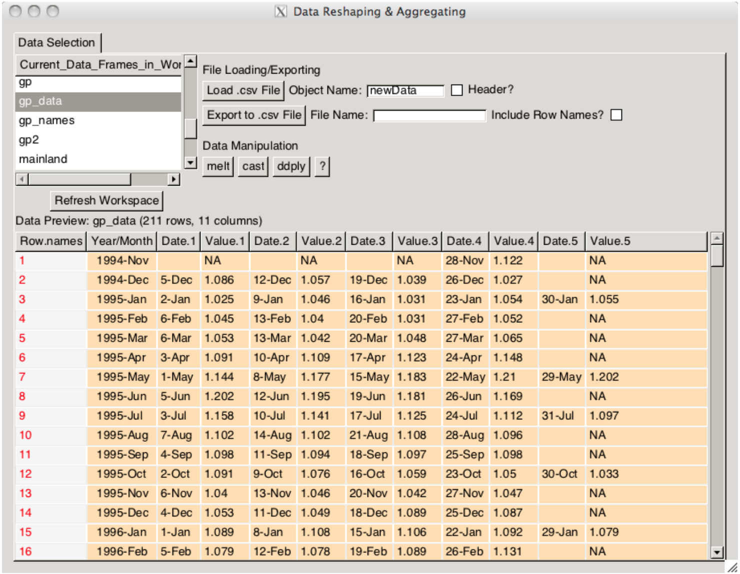
Source: U.S. Energy Information Administration

Oct 2008

Your Turn

- Use a spreadsheet program to reshape the Midwest Gas Price data from “wide” form to “long” form

The reshape GUI



Object Name: newData □ Header?

File Name: □ Include Row Names?

Data Preview: gp_data (211 rows, 11 columns)

Row.names	Year/Month	Date.1	Value.1	Date.2	Value.2	Date.3	Value.3	Date.4	Value.4	Date.5	Value.5
1	1994-Nov		NA		NA		NA	28-Nov	1.122		NA
2	1994-Dec	5-Dec	1.086	12-Dec	1.057	19-Dec	1.039	26-Dec	1.027		NA
3	1995-Jan	2-Jan	1.025	9-Jan	1.046	16-Jan	1.031	23-Jan	1.054	30-Jan	1.055
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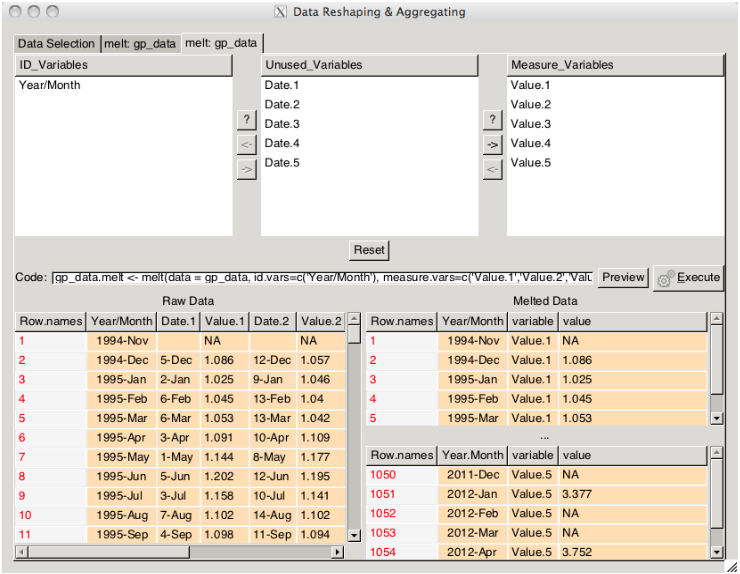
5	1995-Mar	6-Mar	1.053	13-Mar	1.042	20-Mar	1.048	27-Mar	1.065		NA
6	1995-Apr	3-Apr	1.091	10-Apr	1.109	17-Apr	1.123	24-Apr	1.148		NA
7	1995-May	1-May	1.144	8-May	1.177	15-May	1.183	22-May	1.21	29-May	1.202
8	1995-Jun	5-Jun	1.202	12-Jun	1.195	19-Jun	1.181	26-Jun	1.169		NA
9	1995-Jul	3-Jul	1.158	10-Jul	1.141	17-Jul	1.125	24-Jul	1.112	31-Jul	1.097
10	1995-Aug	7-Aug	1.102	14-Aug	1.102	21-Aug	1.108	28-Aug	1.096		NA
11	1995-Sep	4-Sep	1.098	11-Sep	1.094	18-Sep	1.097	25-Sep	1.098		NA
12	1995-Oct	2-Oct	1.091	9-Oct	1.076	16-Oct	1.059	23-Oct	1.05	30-Oct	1.033
13	1995-Nov	6-Nov	1.04	13-Nov	1.046	20-Nov	1.042	27-Nov	1.047		NA
14	1995-Dec	4-Dec	1.053	11-Dec	1.049	18-Dec	1.089	25-Dec	1.087		NA
15	1996-Jan	1-Jan	1.089	8-Jan	1.108	15-Jan	1.106	22-Jan	1.092	29-Jan	1.079
16	1996-Feb	5-Feb	1.079	12-Feb	1.078	19-Feb	1.089	26-Feb	1.131		NA

The reshape GUI



ID_Variables

- Year/Month

Unused_Variables

- Date.1
- Date.2
- Date.3
- Date.4
- Date.5

Measure_Variables

- Value.1
- Value.2
- Value.3
- Value.4
- Value.5

Code:

```
gp_data.melt <- melt(data = gp_data, id.vars=c('Year/Month'), measure.vars=c('Value.1','Value.2','Valu
```

Raw Data

Row.names	Year/Month	Date.1	Value.1	Date.2	Value.2
1	1994-Nov		NA		NA
2	1994-Dec	5-Dec	1.086	12-Dec	1.057
3	1995-Jan	2-Jan	1.025	9-Jan	1.046
4	1995-Feb	6-Feb	1.045	13-Feb	1.04
5	1995-Mar	6-Mar	1.053	13-Mar	1.042
6	1995-Apr	3-Apr	1.091	10-Apr	1.109
7	1995-May	1-May	1.144	8-May	1.177
8	1995-Jun	5-Jun	1.202	12-Jun	1.195
9	1995-Jul	3-Jul	1.158	10-Jul	1.141
10	1995-Aug	7-Aug	1.102	14-Aug	1.102
11	1995-Sep	4-Sep	1.098	11-Sep	1.094

Melted Data

Row.names	Year/Month	variable	value
1	1994-Nov	Value.1	NA
2	1994-Dec	Value.1	1.086
3	1995-Jan	Value.1	1.025
4	1995-Feb	Value.1	1.045
5	1995-Mar	Value.1	1.053

...

Row.names	Year.Month	variable	value
1050	2011-Dec	Value.5	NA
1051	2012-Jan	Value.5	3.377
1052	2012-Feb	Value.5	NA
1053	2012-Mar	Value.5	NA
1054	2012-Apr	Value.5	3.752

Melting Gas Prices

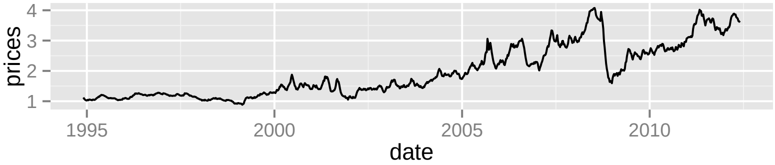
```
library(reshape2)
gp_data.melt <- melt(data=gp_data, id.vars="YM",
  measure.vars=c("Value.1", "Value.2", "Value.3", "Value.4", "Value.5"))
gp_prices <- gp_data.melt
head(gp_prices)
##         YM variable value
## 1 1994-Nov  Value.1    NA
## 2 1994-Dec  Value.1 1.086
## 3 1995-Jan  Value.1 1.025
## 4 1995-Feb  Value.1 1.045
## 5 1995-Mar  Value.1 1.053
## 6 1995-Apr  Value.1 1.091
```

Your Turn

- Open the reshapeGUI
- load gp_data
- use melt to get one column of dates, similar to how we got a single column of weekly gas prices
- export the data as ‘gp_dates’

Piecing datasets together

```
gasprices <- gp_dates
gasprices$prices <- gp_prices$value
#--
tmp <- with(gasprices, paste(YM, value, sep="/"))
gasprices$date <- as.Date(tmp, format="%Y-%b/%d-%b")
#--
qplot(date, prices, data=gasprices, geom="line")
```



A Closer Look at reshape

First, melt

- First we need to melt the data into a long form
- This form is useful for “casting” it into new formats
- When melting, you need to specify the **measured** variables and the **identifiers**

```
melt(data, measure.var=..., id.var=...)
```

Measured variables & identifiers

Identifiers/Keys:

- Identify a record (must be unique)
- Example: Indices on an random variable
- Fixed by design of experiment (known in advance)
- May be single or composite (may have one or more variables)

Measured Variables:

- Collected during the experiment (not known in advance)
- Usually numeric quantities

Example: French Fries

During a ten week sensory experiment, 12 individuals were asked to assess taste of french fries on several scales (how potato-y, buttery, grassy, rancid, paint-y do the fries taste?)

French fries were fried in one of three different oils, and each week individuals had to assess six batches of french fries (all three oils, replicated twice)

What are the identifiers?

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French fries were fried in one of three different oils, and each week individuals had to assess six batches of french fries (all three oils, replicated twice)

Example: French Fries

```
library("reshape2")
head(french_fries)
##    time treatment subject rep potato buttery grassy rancid painty
## 61    1         1       3   1    2.9     0.0    0.0    0.0    5.5
## 25    1         1       3   2   14.0     0.0    0.0    1.1    0.0
## 62    1         1      10   1   11.0     6.4    0.0    0.0    0.0
## 26    1         1      10   2    9.9     5.9    2.9    2.2    0.0
## 63    1         1      15   1    1.2     0.1    0.0    1.1    5.1
## 27    1         1      15   2    8.8     3.0    3.6    1.5    2.3
```

```
ffm <- melt(french_fries, id.vars=1:4)
head(ffm)
##   time treatment subject rep variable value
## 1    1         1       3   1   potato   2.9
## 2    1         1       3   2   potato  14.0
## 3    1         1      10   1   potato  11.0
## 4    1         1      10   2   potato   9.9
## 5    1         1      15   1   potato   1.2
## 6    1         1      15   2   potato   8.8
```

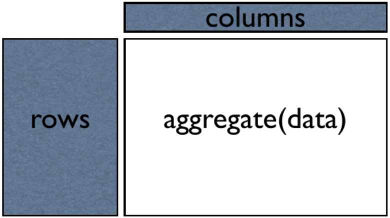
```
summary(ffm)
##       time      treatment    subject          rep         variable       value
##  1      : 360   1:1160    10     : 300   Min.   :1.0   potato :696   Min.   : 0.00
##  2      : 360   2:1160    15     : 300   1st Qu.:1.0   buttery:696   1st Qu.: 0.00
##  3      : 360   3:1160    16     : 300   Median :1.5   grassy :696   Median : 1.50
##  4      : 360             19     : 300   Mean   :1.5   rancid :696   Mean   : 3.16
##  5      : 360             51     : 300   3rd Qu.:2.0   painty :696   3rd Qu.: 5.50
##  6      : 360             52     : 300   Max.   :2.0                 Max.   :14.90
##  (Other):1320             (Other):1680                               NA's   :9
```

Your Turn

- Explore inter-replicate consistency
- Pattern of missingness?

Casting

```
cast(molten, rows ~ columns, aggregate)
```



Casting

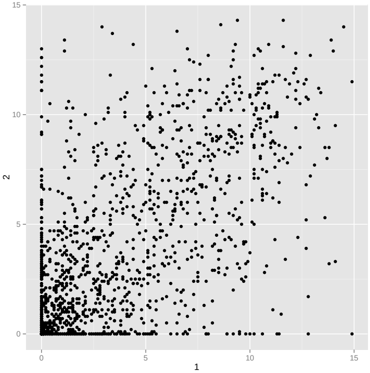
- Just like pivot tables and facetting plots
- Row variables, column variables, and a summary function (sum, mean, max...)

```
cast(molten, row~col, summary)
cast(molten, row1 + row2~col, summary)
cast(molten, row~., summary)
cast(molten, .~col, summary)
```

Inter-rep consistency

```
reps <- dcast(ffm, time+subject+
        treatment+variable~rep)
head(reps)
##   time subject treatment variable    1    2
## 1    1       3         1   potato  2.9 14.0
## 2    1       3         1  buttery  0.0  0.0
## 3    1       3         1   grassy  0.0  0.0
## 4    1       3         1   rancid  0.0  1.1
## 5    1       3         1   painty  5.5  0.0
## 6    1       3         2   potato 13.9 13.4
```

```
qplot(`1`, `2`, data=reps)
```



Your Turn

- How do average ratings by scale (potato-y, buttery, ...) vary over time?

  Hint: Start with a cast by scale, then include averages by scale, then include time...

- Challenge: find the correlation between replicate 1 and replicate 2 over time.