

# Load the dplyr package

This step is important!

```
library(dplyr)
```

```
##
```

```
## Attaching package: 'dplyr'
```

```
##
```

```
## The following object is masked from 'package:stats':
```

```
##
```

```
##      filter
```

```
##
```

```
## The following objects are masked from 'package:base':
```

```
##
```

```
##      intersect, setdiff, setequal, union
```

# select

```
chicago <- readRDS("chicago.rds")  
dim(chicago)
```

```
## [1] 6940      8
```

```
head(select(chicago, 1:5))
```

```
##   city tmpd   dptp      date pm25tmean2  
## 1 chic 31.5 31.500 1987-01-01          NA  
## 2 chic 33.0 29.875 1987-01-02          NA  
## 3 chic 33.0 27.375 1987-01-03          NA  
## 4 chic 29.0 28.625 1987-01-04          NA  
## 5 chic 32.0 28.875 1987-01-05          NA  
## 6 chic 40.0 35.125 1987-01-06          NA
```

# select

```
names(chicago)[1:3]
```

```
## [1] "city" "tmpd" "dptp"
```

```
head(select(chicago, city:dptp))
```

```
##      city tmpd   dptp
## 1 chic 31.5 31.500
## 2 chic 33.0 29.875
## 3 chic 33.0 27.375
## 4 chic 29.0 28.625
## 5 chic 32.0 28.875
## 6 chic 40.0 35.125
```

# select

In dplyr you can do

```
head(select(chicago, -(city:dptp)))
```

Equivalent base R

```
i <- match("city", names(chicago))  
j <- match("dptp", names(chicago))  
head(chicago[, -(i:j)])
```

# filter

```
chic.f <- filter(chicago, pm25tmean2 > 30)
head(select(chic.f, 1:3, pm25tmean2), 10)
```

##	city	tmpd	dptp	pm25tmean2
## 1	chic	23	21.9	38.10
## 2	chic	28	25.8	33.95
## 3	chic	55	51.3	39.40
## 4	chic	59	53.7	35.40
## 5	chic	57	52.0	33.30
## 6	chic	57	56.0	32.10
## 7	chic	75	65.8	56.50
## 8	chic	61	59.0	33.80
## 9	chic	73	60.3	30.30
## 10	chic	78	67.1	41.40

# filter

```
chic.f <- filter(chicago, pm25tmean2 > 30 & tmpd > 80)  
head(select(chic.f, 1:3, pm25tmean2, tmpd), 10)
```

##	city	tmpd	dptp	pm25tmean2
## 1	chic	81	71.2	39.6000
## 2	chic	81	70.4	31.5000
## 3	chic	82	72.2	32.3000
## 4	chic	84	72.9	43.7000
## 5	chic	85	72.6	38.8375
## 6	chic	84	72.6	38.2000
## 7	chic	82	67.4	33.0000
## 8	chic	82	63.5	42.5000
## 9	chic	81	70.4	33.1000
## 10	chic	82	66.2	38.8500

## arrange

Reordering rows of a data frame (while preserving corresponding order of other columns) is normally a pain to do in R.

```
chicago <- arrange(chicago, date)
head(select(chicago, date, pm25tmean2), 3)
```

```
##           date pm25tmean2
## 1 1987-01-01      NA
## 2 1987-01-02      NA
## 3 1987-01-03      NA
```

```
tail(select(chicago, date, pm25tmean2), 3)
```

```
##           date pm25tmean2
## 6938 2005-12-29    7.45000
## 6939 2005-12-30   15.05714
## 6940 2005-12-31   15.00000
```

## arrange

Columns can be arranged in descending order too.

```
chicago <- arrange(chicago, desc(date))  
head(select(chicago, date, pm25tmean2), 3)
```

```
##           date pm25tmean2  
## 1 2005-12-31    15.00000  
## 2 2005-12-30    15.05714  
## 3 2005-12-29     7.45000
```

```
tail(select(chicago, date, pm25tmean2), 3)
```

```
##           date pm25tmean2  
## 6938 1987-01-03         NA  
## 6939 1987-01-02         NA  
## 6940 1987-01-01         NA
```



## rename

Renaming a variable in a data frame in R is surprising hard to do!

```
head(chicago[, 1:5], 3)
```

```
##      city tmpd dptp      date pm25tmean2
## 1 chic     35 30.1 2005-12-31    15.00000
## 2 chic     36 31.0 2005-12-30    15.05714
## 3 chic     35 29.4 2005-12-29     7.45000
```

```
chicago <- rename(chicago, dewpoint = dptp,
                   pm25 = pm25tmean2)
```

```
head(chicago[, 1:5], 3)
```

```
##      city tmpd dewpoint      date      pm25
## 1 chic     35     30.1 2005-12-31 15.00000
## 2 chic     36     31.0 2005-12-30 15.05714
## 3 chic     35     29.4 2005-12-29  7.45000
```

## mutate

```
chicago <- mutate(chicago,  
                    pm25detrend=pm25-mean(pm25, na.rm=TRUE))  
head(select(chicago, pm25, pm25detrend))
```

```
##           pm25 pm25detrend  
## 1 15.00000    -1.230958  
## 2 15.05714    -1.173815  
## 3  7.45000   -8.780958  
## 4 17.75000     1.519042  
## 5 23.56000     7.329042  
## 6  8.40000   -7.830958
```

## group\_by

Generating summary statistics by stratum

```
chicago <- mutate(chicago,  
                    tempcat = factor(1 * (tmpd > 80),  
                                     labels = c("cold", "hot")  
                    )  
hotcold <- group_by(chicago, tempcat)  
summarize(hotcold, pm25 = mean(pm25, na.rm = TRUE),  
           o3 = max(o3tmean2),  
           no2 = median(no2tmean2))
```

```
## Source: local data frame [3 x 4]
```

```
##
```

```
##   tempcat      pm25      o3      no2  
## 1    cold 15.97807 66.587500 24.54924  
## 2    hot 26.48118 62.969656 24.93870  
## 3     NA 47.73750  9.416667 37.44444
```

## group\_by

Generating summary statistics by stratum

```
chicago <- mutate(chicago,  
                    year = as.POSIXlt(date)$year + 1900)  
years <- group_by(chicago, year)  
summarize(years, pm25 = mean(pm25, na.rm = TRUE),  
           o3 = max(o3tmean2, na.rm = TRUE),  
           no2 = median(no2tmean2, na.rm = TRUE))
```

```
## Source: local data frame [19 x 4]
```

```
##
```

##	year	pm25	o3	no2
## 1	1987	NaN	62.96966	23.49369
## 2	1988	NaN	61.67708	24.52296
## 3	1989	NaN	59.72727	26.14062
## 4	1990	NaN	52.22917	22.59583
## 5	1991	NaN	63.10417	21.38194
## 6	1992	NaN	50.82870	24.78921
## 7	1993	NaN	44.30093	25.76993

%>%

```
chicago %>% mutate(month = as.POSIXlt(date)$mon + 1)
           %>% group_by(month)
           %>% summarize(pm25 = mean(pm25, na.rm = TRUE),
                          o3 = max(o3tmean2, na.rm = TRUE),
                          no2 = median(no2tmean2, na.rm = TRUE))
```

```
## Source: local data frame [12 x 4]
```

```
##
```

##		month	pm25	o3	no2
##	1	1	17.76996	28.22222	25.35417
##	2	2	20.37513	37.37500	26.78034
##	3	3	17.40818	39.05000	26.76984
##	4	4	13.85879	47.94907	25.03125
##	5	5	14.07420	52.75000	24.22222
##	6	6	15.86461	66.58750	25.01140
##	7	7	16.57087	59.54167	22.38442
##	8	8	16.93380	53.96701	22.98333
##	9	9	15.91279	57.48864	24.47917

# dplyr

Once you learn the dplyr “grammar” there are a few additional benefits

- ▶ dplyr can work with other data frame “backends”
- ▶ `data.table` for large fast tables
- ▶ SQL interface for relational databases via the DBI package