



Data Transformation III

Data Transformation III Info



- Finish Reading Chapter 3 and Practice the Code in R4DS
- Covers
 - The Pipe
 - Statistical Summaries
 - Grouped Summaries
 - Helpful Functions
- Builds Off Last Tutorial

The Pipe



- Useful for Combining Multiple Steps of Operations
- Represented by `%>%`
- Reads as “Then”
- Works Like a Composite Function From Algebra

$$\begin{aligned}f(x) &= 3x + 4 \\g(x) &= 2x \\h &= 1\end{aligned}$$



$$\begin{aligned}\text{OUT} &= h \%>\% \\&\quad g() \%>\% \\&\quad \quad f()\end{aligned}$$

$$f(g(h)) = 3(2(1)) + 4 = 10$$

$$\text{OUT} = 10$$

The Pipe



- Chaining with the Pipe

```
library(tidyverse)

f.pipedream =
  # Acknowledge the Original Data
  flights %>%

  # Input Original Data and Perform Mutations
  mutate(dep_hr=dep_time%%100+(dep_time%%100)/60,
         sched_dep_hr=sched_dep_time%%100+(sched_dep_time%%100)/60,
         arr_hr=arr_time%%100+(arr_time%%100)/60,
         sched_arr_hr=sched_arr_time%%100+(sched_arr_time%%100)/60,
         dep_delay_hr=dep_hr-sched_dep_hr,
         arr_delay_hr=arr_hr-sched_arr_hr,
         gain_hr=arr_delay_hr-dep_delay_hr,
         percent_gain_hr=percent_rank(gain_hr)) %>%

  #Input Modified Data and Select the Variables of Interest
  select(carrier,origin:distance,dep_delay_hr:percent_gain_hr) %>%

  #Input Modified Data and Sort According to Empirical %-iles
  arrange(desc(percent_gain_hr))
```

carrier	origin	dest	air_time	distance	dep_delay_hr	arr_delay_hr	gain_hr	percent_gain_hr
B6	JFK	BQN	NA	1576	-23.90000	3.333333	27.23333	1.0000000
B6	JFK	PSE	NA	1617	-23.65000	3.550000	27.20000	0.9999970
B6	JFK	PSE	NA	1617	-23.80000	2.950000	26.75000	0.9999939
B6	JFK	SJU	NA	1598	-23.58333	3.116667	26.70000	0.9999909
B6	JFK	PSE	NA	1617	-23.76667	2.483333	26.25000	0.9999878



HTML Table: [knitr and kableExtra](#)

The Pipe



- Chaining with the Pipe

```
```{r}
f.pipedream2 =
 # Acknowledge the Original Data
 flights %>%

 # Input Original Data and Perform Mutations
 mutate(dep_hr=dep_time%%100+(dep_time%%100)/60,
 sched_dep_hr=sched_dep_time%%100+(sched_dep_time%%100)/60,
 arr_hr=arr_time%%100+(arr_time%%100)/60,
 sched_arr_hr=sched_arr_time%%100+(sched_arr_time%%100)/60,
 dep_delay_hr=dep_hr-sched_dep_hr,
 arr_delay_hr=arr_hr-sched_arr_hr,
 gain_hr=arr_delay_hr-dep_delay_hr,
 percent_gain_hr=percent_rank(gain_hr)) %>%

 #Input Modified Data and select the Variables of Interest
 select(carrier,origin:distance,dep_delay_hr:percent_gain_hr) %>%

 #Input Modified Data and Sort According to Empirical %-iles
 arrange(desc(percent_gain_hr)) %>%

 #Input Modified Data and Remove Flights Missing Air Time
 filter(!is.na(air_time))
```
```

| carrier | origin | dest | air_time | distance | dep_delay_hr | arr_delay_hr | gain_hr | percent_gain_hr |
|---------|--------|------|----------|----------|--------------|--------------|----------|-----------------|
| B6 | JFK | PSE | 214 | 1617 | -23.66667 | 1.133333 | 24.80000 | 0.9999848 |
| B6 | JFK | PSE | 214 | 1617 | -23.26667 | 1.500000 | 24.76667 | 0.9999817 |
| B6 | JFK | BQN | 199 | 1576 | -21.66667 | 3.050000 | 24.71667 | 0.9999787 |
| B6 | JFK | LAX | 317 | 2475 | -22.63333 | 2.050000 | 24.68333 | 0.9999726 |
| B6 | JFK | PSE | 200 | 1617 | -23.61667 | 1.066667 | 24.68333 | 0.9999726 |

The Pipe



- Chaining with the Pipe



```
```{r}
f.pipedream3 =

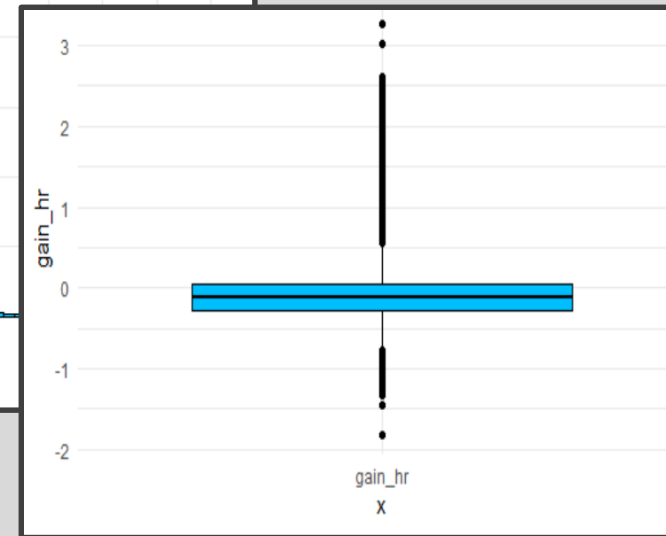
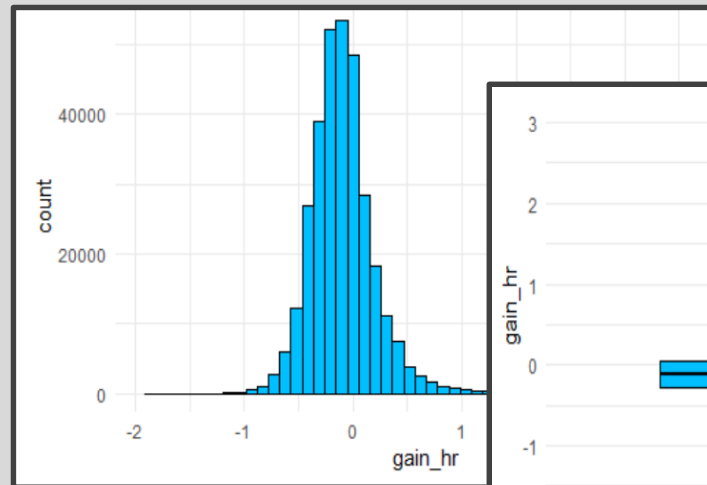
 # Acknowledge the Modified Data
 f.pipedream2 %>%

 # Filter Based on Gain Variable
 filter(abs(gain_hr)<10)
```
```

`summarize()`



- Summarizing All Data
- Using Graphics



Both the histogram and the boxplot are made from summary statistics.

(Statistical Transformations in Ch. 3)

summarize()



- Summarizing All Data
- Using Tables

```
```{r}
gain_hr.summary1 = summarize(f.pipedream3,
 n=n(),
 mean=mean(gain_hr, na.rm=T),
 var=var(gain_hr, na.rm=T),
 sd=sd(gain_hr, na.rm=T))

gain_hr.summary2 =
 f.pipedream3 %>%
 summarize(n=n(),
 min=min(gain_hr),
 Q1=quantile(gain_hr,0.25),
 Q2=quantile(gain_hr,0.5),
 Q3=quantile(gain_hr,0.75),
 max=max(gain_hr),
 IQR=Q3-Q1)
```
```

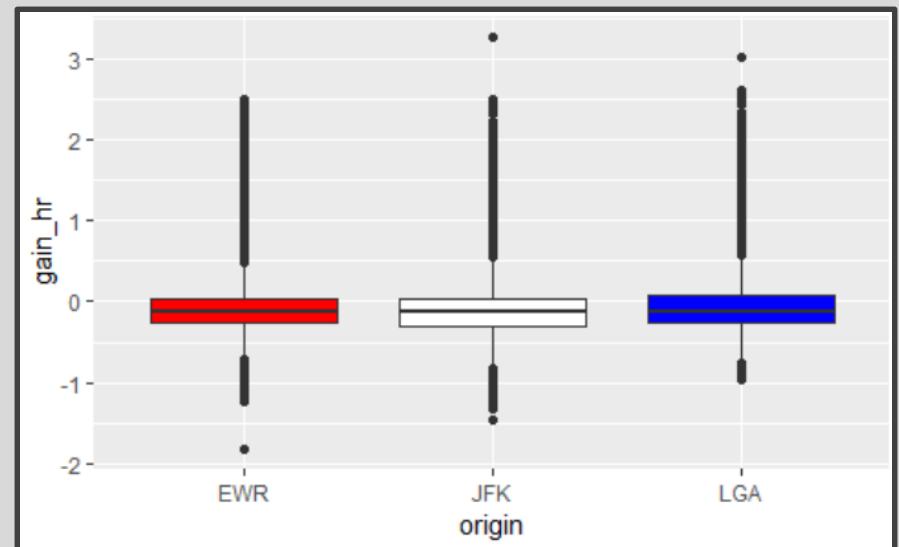
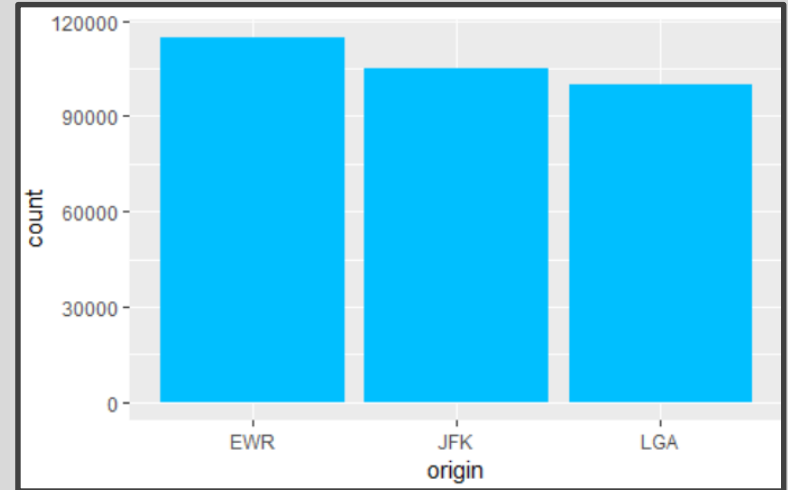
| n | mean | var | sd |
|--------|------------|-----------|-----------|
| 319966 | -0.0964329 | 0.0879657 | 0.2965902 |

| n | min | Q1 | Q2 | Q3 | max | IQR |
|--------|-----------|------------|------------|------|----------|-----------|
| 319966 | -1.816667 | -0.2833333 | -0.1166667 | 0.05 | 3.266667 | 0.3333333 |


```
summarize()  
  with  
  group_by()
```



- Summarizing Data by Groups
- Using Graphics



summarize()
with
group_by()



- Summarizing Data by Groups
- Using Tables

```
```{r}
group.summary1 = f.pipedream3 %>%
 group_by(origin) %>%
 summarize(count=n())

group.summary2 =
 f.pipedream3 %>%
 group_by(origin) %>%
 summarize(
 n=n(),
 min=min(gain_hr),
 Q1=quantile(gain_hr,0.25),
 Q2=quantile(gain_hr,0.5),
 Q3=quantile(gain_hr,0.75),
 max=max(gain_hr),
 IQR=Q3-Q1,
 nLow=sum(gain_hr<Q1-1.5*IQR),
 propHigh=mean(gain_hr>Q3+1.5*IQR)
) %>%
 select(-IQR)
```
```

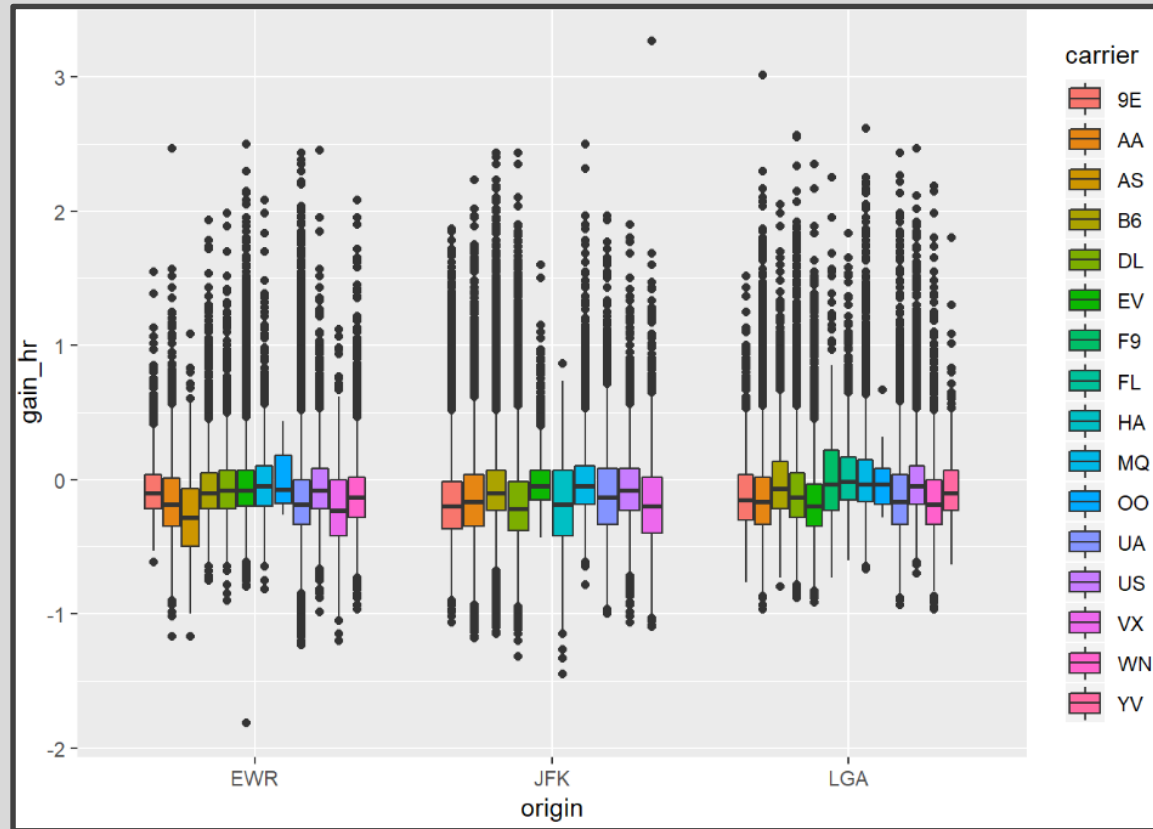
| origin | count |
|--------|--------|
| EWR | 114682 |
| JFK | 105243 |
| LGA | 100041 |

| origin | n | min | Q1 | Q2 | Q3 | max | nLow | propHigh |
|--------|--------|------------|------------|------------|------------|----------|------|-----------|
| EWR | 114682 | -1.8166667 | -0.2666667 | -0.1166667 | 0.03333333 | 2.500000 | 953 | 0.0294815 |
| JFK | 105243 | -1.4500000 | -0.3000000 | -0.1333333 | 0.03333333 | 3.266667 | 710 | 0.0314510 |
| LGA | 100041 | -0.9666667 | -0.2666667 | -0.1166667 | 0.0666667 | 3.016667 | 133 | 0.0277886 |

```
summarize()  
  with  
  group_by()
```



- Multiple Groups
 - Using Graphics



summarize()
with
group_by()



- Multiple Groups
- Using Tables

| origin | carrier | n | min | Q1 | Q2 | Q3 | max |
|--------|---------|-------|------------|------------|------------|------------|-----------|
| EWR | 9E | 1193 | -0.6166667 | -0.2166667 | -0.1000000 | 0.0333333 | 1.5500000 |
| EWR | AA | 3326 | -1.1666667 | -0.3500000 | -0.1833333 | 0.0125000 | 2.4666667 |
| EWR | AS | 704 | -1.1666667 | -0.5000000 | -0.2833333 | -0.0666667 | 1.0833333 |
| EWR | B6 | 6275 | -0.7500000 | -0.2166667 | -0.1000000 | 0.0500000 | 1.9333333 |
| EWR | DL | 4266 | -0.9000000 | -0.2166667 | -0.0833333 | 0.0666667 | 1.9833333 |
| EWR | EV | 40571 | -1.8166667 | -0.2000000 | -0.0833333 | 0.0666667 | 2.5000000 |
| EWR | MQ | 2086 | -0.8166667 | -0.2000000 | -0.0500000 | 0.1000000 | 2.0833333 |
| EWR | OO | 6 | -0.2666667 | -0.1791667 | -0.0750000 | 0.1791667 | 0.4333333 |
| EWR | UA | 44390 | -1.2333333 | -0.3333333 | -0.1833333 | 0.0000000 | 2.4333333 |
| EWR | US | 4322 | -0.9833333 | -0.2166667 | -0.0833333 | 0.0833333 | 2.4500000 |
| EWR | VX | 1521 | -1.2000000 | -0.4166667 | -0.2333333 | 0.0000000 | 1.1166667 |
| EWR | WN | 6022 | -0.9666667 | -0.2833333 | -0.1333333 | 0.0166667 | 2.0833333 |
| JFK | 9E | 13548 | -1.0666667 | -0.3666667 | -0.2000000 | -0.0166667 | 1.8666667 |
| JFK | AA | 13429 | -1.1833333 | -0.3500000 | -0.1666667 | 0.0333333 | 2.2333333 |
| JFK | B6 | 38920 | -1.1500000 | -0.2333333 | -0.1000000 | 0.0666667 | 2.4333333 |
| JFK | DL | 20136 | -1.3166667 | -0.3833333 | -0.2166667 | -0.0166667 | 2.4333333 |
| JFK | EV | 1317 | -0.4333333 | -0.1500000 | -0.0500000 | 0.0666667 | 1.6000000 |

Useful Summary Functions



- Measures of Center
 - `mean()`
 - `median()`
 - `mode()`
- Measures of Spread
 - `var()`
 - `sd()`
 - `IQR()`
 - `mad()`
- Measures of Rank
 - `min()`
 - `max()`
 - `quantile()`

Useful Summary Functions



- Measures of Position
 - Order Matters
 - `first() = x[1]`
 - `last() = x[length(x)]`
 - `nth(,k) = x[k]`
- Counts
 - `n()`
 - `n_distinct()`
- Counts/Proportions for Logical
 - `sum()`
 - `mean()`
 - Example
 - `sum(x>10)`
 - `mean(x>10)`

Closing



Disperse
and Make
Reasonable
Decisions