R

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Contents

ggp	${ m plot}2$
1.1	
1.2	ggplot2
1.3	ggplot2
1.4	
1.5	facet
1.6	ggsave
1.7	(windows)
1.8	theme
1.9	
mag	grritr
2.1	tidyverse magrittr
2.2	v
2.3	
2.4	%T>%
2.5	%\$%

1 ggplot2

1.1 R

- \bullet base(graphics)
- lattice
- \bullet grid
- ggplot2

1.2 ggplot2

ggplot2 tidy data

1.3 ggplot2

1 plot facet

magrittr %\$% %T%

```
ggplot2
```

ggpubr

1.4 ggplot2

iris vegan dave tidy data aesthetics $geom_point()\ geom_bar()\ aes()\ colour\ group\ size$

1.5 facet

for subset dplyr::filter

- 1.6 ggsave
- 1.7 (windows)
- 1.8 theme
- 1.9
 - ggplot2
 - ggplot2
 - unwin GDA

•

2 magrritr

tidyverse R

2.1 tidyverse magrittr

R

tidyverse

library(tidyverse)

-- Attaching packages ------ tidyverse 1.3.1 -
v ggplot2 3.3.6 v purrr 0.3.4

tidyverse 1

```
## v ggplot2 3.3.6
                      v purrr
                                0.3.4
## v tibble 3.1.8
                               1.0.10
                      v dplyr
## v tidyr
           1.2.1
                      v stringr 1.4.1
## v readr
            2.1.2
                      v forcats 0.5.1
## -- Conflicts ------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()
                   masks stats::lag()
      (forcats tibble stringr dplyr tidyr purrr) %>%( ) %>% tidyverse
                                                                       %>%
                                                                              magrittr
  tidyverse
                                                                      R
                 %>%
tidyverse
                        1
                                  tibble
```

2.2 %>%

%>%

- %<>%
- %T>%
- %\$%

```
tidyverse
                      magrittr
library(magrittr)
##
## Attaching package: 'magrittr'
## The following object is masked from 'package:purrr':
##
##
       set_names
## The following object is masked from 'package:tidyr':
##
##
       extract
2.3 %<>%
2.3.1
%<>%
mpg #
## # A tibble: 234 x 11
##
      manufacturer model
                               displ year
                                              cyl trans drv
                                                                       hwy fl
                                                                                  class
                                                                 cty
##
      <chr>
                   <chr>
                               <dbl> <int> <int> <chr> <int> <int> <chr>
                                                                                  <chr>
##
    1 audi
                   a4
                                 1.8
                                      1999
                                                4 auto~ f
                                                                        29 p
                                                                  18
                                                                                  comp~
                                                                        29 p
##
    2 audi
                                 1.8
                                      1999
                                                4 manu~ f
                                                                  21
                   a4
                                                                                  comp~
##
   3 audi
                                 2
                                      2008
                                                4 manu~ f
                                                                  20
                                                                        31 p
                   a4
                                                                                  comp~
                                                                                  comp~
##
  4 audi
                                 2
                                      2008
                                                4 auto~ f
                   a4
                                                                  21
                                                                        30 p
## 5 audi
                   a4
                                 2.8 1999
                                                6 auto~ f
                                                                  16
                                                                        26 p
                                                                                  comp~
##
    6 audi
                   a4
                                 2.8
                                      1999
                                                6 manu~ f
                                                                  18
                                                                        26 p
                                                                                  comp~
##
                                      2008
  7 audi
                                 3.1
                                                6 auto~ f
                                                                  18
                                                                        27 p
                    a4
                                                                                  comp~
                                                                                  comp~
   8 audi
                                                                        26 p
##
                    a4 quattro
                                 1.8
                                      1999
                                                4 manu~ 4
                                                                  18
## 9 audi
                                 1.8
                                      1999
                                                                  16
                    a4 quattro
                                                4 auto~ 4
                                                                        25 p
                                                                                  comp~
                                      2008
                                                                        28 p
## 10 audi
                    a4 quattro
                                 2
                                                4 manu~ 4
                                                                  20
                                                                                  comp~
## # ... with 224 more rows
tmp <- mpg
tmp <-
 tmp %>%
  dplyr::filter(year==1999) %>%
  tidyr::separate(trans, into=c("trans1", "trans2", NA)) %>%
 print()
## # A tibble: 117 x 12
      manufac~1 model displ year
                                      cyl trans1 trans2 drv
                                                                 cty
                                                                       hwy fl
                                                                                  class
##
      <chr>
                <chr> <dbl> <int> <int> <chr>
                                                <chr>
                                                                                  <chr>
                                                        <chr> <int> <int> <chr>
                                                                        29 p
##
   1 audi
                a4
                         1.8 1999
                                        4 auto
                                                 15
                                                        f
                                                                  18
                                                                                  comp~
    2 audi
                         1.8 1999
                                        4 manual m5
##
                a4
                                                        f
                                                                  21
                                                                        29 p
                                                                                  comp~
                                                                        26 p
##
    3 audi
                a4
                         2.8 1999
                                        6 auto
                                                 15
                                                        f
                                                                  16
                                                                                  comp~
##
   4 audi
                a4
                         2.8 1999
                                        6 manual m5
                                                        f
                                                                  18
                                                                        26 p
                                                                                  comp~
                         1.8 1999
##
  5 audi
                                        4 manual m5
                                                        4
                                                                  18
                                                                        26 p
                a4 q~
                                                                                  comp~
##
    6 audi
                a4 q~
                         1.8
                              1999
                                        4 auto
                                                 15
                                                        4
                                                                  16
                                                                        25 p
                                                                                  comp~
##
  7 audi
                         2.8 1999
                                        6 auto
                                                 15
                                                        4
                                                                  15
                                                                        25 p
                a4 q~
                                                                                  comp~
                                                                        25 p
##
    8 audi
                a4 q~
                         2.8 1999
                                        6 manual m5
                                                        4
                                                                  17
                                                                                  comp~
```

15

14

4

r

15

13

24 p

17 r

mids~

suv

6 auto

8 auto

2.8 1999

5.7 1999

a6 q~

##

9 audi

10 chevrolet c150~

```
## # ... with 107 more rows, and abbreviated variable name 1: manufacturer
tmp <- mpg
tmp %<>%
  dplyr::filter(year==1999) %>%
  tidyr::separate(trans, into=c("trans1", "trans2", NA)) %>%
 print()
## # A tibble: 117 x 12
      manufac~1 model displ year
                                     cyl trans1 trans2 drv
                                                                      hwy fl
                                                                cty
                                                                                 class
      <chr>
                <chr> <dbl> <int> <int> <chr>
                                                <chr>
                                                        <chr> <int> <int> <chr> <chr>
   1 audi
                         1.8 1999
                                       4 auto
##
                a4
                                                 15
                                                        f
                                                                 18
                                                                       29 p
                                                                                 comp~
                                                                       29 p
##
    2 audi
                a4
                         1.8 1999
                                       4 manual m5
                                                        f
                                                                 21
                                                                                 comp~
##
    3 audi
                a4
                        2.8 1999
                                       6 auto
                                                 15
                                                        f
                                                                 16
                                                                       26 p
                                                                                 comp~
##
   4 audi
                a4
                        2.8 1999
                                       6 manual m5
                                                        f
                                                                 18
                                                                       26 p
                                                                                 comp~
                a4 q~
##
    5 audi
                        1.8
                             1999
                                       4 manual m5
                                                        4
                                                                 18
                                                                       26 p
                                                                                 comp~
                                                                       25 p
##
  6 audi
                        1.8 1999
                                       4 auto
                                                15
                                                        4
                                                                 16
                a4 q~
                                                                                 comp~
                a4 q~
                                                                       25 p
##
  7 audi
                        2.8 1999
                                       6 auto
                                                 15
                                                        4
                                                                 15
                                                                                 comp~
                        2.8 1999
## 8 audi
                a4 q~
                                       6 manual m5
                                                        4
                                                                 17
                                                                       25 p
                                                                                 comp~
##
   9 audi
                a6 q~
                        2.8 1999
                                       6 auto
                                                15
                                                        4
                                                                 15
                                                                       24 p
                                                                                 mids~
## 10 chevrolet c150~
                        5.7 1999
                                       8 auto
                                                14
                                                                 13
                                                                       17 r
                                                                                 suv
                                                        r
## # ... with 107 more rows, and abbreviated variable name 1: manufacturer
```

2.3.2

2.4 %T>%

2.4.1

```
mpg #
```

```
## # A tibble: 234 x 11
##
      manufacturer model
                                displ year
                                               cyl trans drv
                                                                  cty
                                                                         hwy fl
                                                                                   class
##
      <chr>
                    <chr>
                                <dbl> <int> <int> <chr> <int> <int> <chr> <int> <int> <chr>
##
    1 audi
                    a4
                                  1.8 1999
                                                 4 auto~ f
                                                                          29 p
                                                                                   comp~
                                                                   18
                                                                          29 p
##
    2 audi
                    a4
                                  1.8
                                      1999
                                                 4 manu~ f
                                                                   21
                                                                                   comp~
##
    3 audi
                                  2
                                       2008
                                                 4 manu~ f
                                                                   20
                    a4
                                                                          31 p
                                                                                   comp~
##
    4 audi
                    a4
                                  2
                                       2008
                                                 4 auto~ f
                                                                   21
                                                                          30 p
                                                                                   comp~
##
    5 audi
                    a4
                                  2.8 1999
                                                 6 auto~ f
                                                                   16
                                                                          26 p
                                                                                   comp~
    6 audi
                                  2.8
                                      1999
                                                                          26 p
                    a4
                                                 6 manu~ f
                                                                   18
                                                                                   comp~
                                       2008
                                                                          27 p
##
    7 audi
                                  3.1
                                                 6 auto~ f
                                                                   18
                    a4
                                                                                   comp~
                                                                          26 p
##
    8 audi
                                  1.8
                                       1999
                                                                   18
                    a4 quattro
                                                 4 manu~ 4
                                                                                   comp~
## 9 audi
                                  1.8 1999
                                                 4 auto~ 4
                                                                   16
                                                                          25 p
                    a4 quattro
                                                                                   comp~
## 10 audi
                                       2008
                                                                                   comp~
                    a4 quattro
                                  2
                                                 4 manu~ 4
                                                                   20
                                                                          28 p
## # ... with 224 more rows
```

2.4.2

<- <<-

- 2.5 %\$%
- 2.5.1
- 2.5.2