tidying

Saneesh

1/24/2022

packages

```
# install.packages ('gapminder')
library(gapminder)
library(tidyverse)
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.2 --
## v ggplot2 3.3.6      v purrr   0.3.4
## v tibble  3.1.8      v dplyr   1.0.10
## v tidyr   1.2.1      v stringr 1.4.1
## v readr   2.1.2      v forcats 0.5.2
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

shortcuts

alt+- will add <-
shift+ctrl+c to add # infront of a line
'—-' for a header, so it is easy to navigate through the script
command +shift + m
ctrl+alt+i for new code chunk # syntax Plain text
end a line with two spaces to start a new paragraph.
italics and *italics*
bold and **bold**
superscript^2
~~strikethrough~~
link to rstudio

logical operations

1==1 # equality
1!=3 #unequal
13<14 #13 smaller than 14
14>13 #14 bigger than 13
12>=0 #12 greater or equal to zero
12<=3 #12 smaller or equal to zero

creating data.frame

family

```
name <- c('saneesh', 'sanusha', 'appu', 'kishan')
weight <- c(63,48, 20, NA)
height <- c(164, 150, NA, 75)
family <- data.frame(name, weight, height)
family %>% as_tibble()
```

```
## # A tibble: 4 x 3
##   name    weight height
##   <chr>    <dbl>  <dbl>
## 1 saneesh     63    164
## 2 sanusha     48    150
## 3 appu        20     NA
## 4 kishan      NA     75
```

```
library(tidyverse)
data <- data.frame(sex=c(rep('female', 10), rep('male', 8)),
                   score=c(rnorm(n= 10, mean = 7.56, sd = 1.978), rnorm(n= 8, mean=7.75, sd= 1.631)))

data
```

data frame with unequal values 10 and 8

```
##       sex     score
## 1  female  5.086595
## 2  female  5.616088
## 3  female  7.624725
## 4  female 10.488919
## 5  female 11.073935
## 6  female  7.456617
## 7  female  7.546695
## 8  female  5.953369
## 9  female 10.515885
## 10 female  4.730557
## 11   male  5.073760
## 12   male  4.710225
## 13   male  7.141875
## 14   male  4.988168
## 15   male  7.117418
## 16   male  5.630331
## 17   male  5.269851
## 18   male  9.503780
```

```
data %>% group_by(sex) %>%
  summarise(score= n()) %>%
  mutate(freq=score/sum(score)*100)
```

```
## # A tibble: 2 x 3
##   sex    score  freq
##   <chr>  <int> <dbl>
## 1 female    10  55.6
## 2 male       8  44.4
```

tibble

```
library(tidyverse)
years <- tribble(
  ~Location, ~Year, ~Month, ~Day,
  "Sydney", 2000, 9, 15,
  "Athens", 2004, 8, 13,
  "Beijing", 2008, 8, 8,
  "London", 2012, 7, 27,
  "Rio de Janeiro", 2016, 8, 5
)
```

tabyl

tabyl

```
library(janitor)
```

```
##
## Attaching package: 'janitor'

## The following objects are masked from 'package:stats':
##
##     chisq.test, fisher.test
```

```
data <- data.frame(HairEyeColor)

data %>% tabyl(Hair, Eye) %>%
  adorn_percentages('row') %>%
  adorn_pct_formatting(digits = 2) %>%
  adorn_ns() %>%
  knitr::kable()
```

Hair	Brown	Blue	Hazel	Green
Black	25.00% (2)	25.00% (2)	25.00% (2)	25.00% (2)
Brown	25.00% (2)	25.00% (2)	25.00% (2)	25.00% (2)
Red	25.00% (2)	25.00% (2)	25.00% (2)	25.00% (2)
Blond	25.00% (2)	25.00% (2)	25.00% (2)	25.00% (2)

is.na

```
# identify location of NAs in vector
which(is.na(family))
```

```
## [1]  8 11
```

```
colSums(is.na(family))
```

```
##   name weight height
##      0      1      1
```

replace na

```
mat <- matrix(sample(c(NA, 1:5), 50, replace = TRUE), 5)
df <- as.data.frame(mat)
df %>% replace(is.na(.), 0)%>% view()
```

clean names

```
# install.packages('janitor')
library(janitor)

id <- (c(1,1,2,2,3,3))
Country <- c('Angola', 'Angola','Botswana', 'Botswana','Zimbabwe','Zimbabwe')
year <- c('2006', '2007', '2008', '2009', '2010', '2006')
bank.ratio <- c(24,25,38,34,42,49)
Reserve.ratio <- c(77,59,64,65,57,86)
broad.money <- c(163,188,317,361,150,288)


bank <- data.frame(id, Country, year, bank.ratio, Reserve.ratio,broad.money)

bank %>% view()
  as_tibble()
```

```
## Warning: The `x` argument of `as_tibble()` can't be missing as of tibble 3.0.0.
```

```
## # A tibble: 0 x 0
```

```
bank <- bank %>% clean_names() # replaced . with _

glimpse(bank)
```

```
## Rows: 6
## Columns: 6
## $ id            <dbl> 1, 1, 2, 2, 3, 3
## $ country       <chr> "Angola", "Angola", "Botswana", "Botswana", "Zimbabwe", ~
## $ year          <chr> "2006", "2007", "2008", "2009", "2010", "2006"
## $ bank_ratio    <dbl> 24, 25, 38, 34, 42, 49
## $ reserve_ratio <dbl> 77, 59, 64, 65, 57, 86
## $ broad_money   <dbl> 163, 188, 317, 361, 150, 288
```

```
bank <- bank %>% clean_names() # replaced . with _
```

filter bank data frame below such that it retains a country if a given id is satisfied e.g. filtering a data frame that has countries with id 1 and 2 only

```
bank %>%
  filter(id%in% c(1,2)) %>%
  as_tibble()
```

```
## # A tibble: 4 x 6
##      id country  year  bank_ratio reserve_ratio broad_money
##   <dbl> <chr>    <chr>      <dbl>         <dbl>       <dbl>
## 1     1 Angola   2006          24            77         163
## 2     1 Angola   2007          25            59         188
## 3     2 Botswana 2008          38            64         317
## 4     2 Botswana 2009          34            65         361
```

summarise fund available with each countries

```
bank %>%
  group_by(country) %>%
  summarise(fund=sum(broad_money)) %>%
  as_tibble()
```

```
## # A tibble: 3 x 2
##   country   fund
##   <chr>    <dbl>
## 1 Angola     351
## 2 Botswana   678
## 3 Zimbabwe   438
```

count/ frequency

```
mtcars %>%
  count(am) %>%
  as_tibble()
```

```
## # A tibble: 2 x 2
##      am     n
##   <dbl> <int>
## 1     0    19
## 2     1    13
```

```
mtcars %>%
  count(gear)
```

```
##   gear  n
## 1    3 15
## 2    4 12
## 3    5  5
```

rename column

column: new name= old name

```
iris %>%
  rename(S.len=Sepal.Length,
         Sp.= Species) %>% head(3)
```

```
##   S.len Sepal.Width Petal.Length Petal.Width    Sp.
## 1   5.1         3.5          1.4         0.2 setosa
## 2   4.9         3.0          1.4         0.2 setosa
## 3   4.7         3.2          1.3         0.2 setosa
```

rename to lower

```
iris %>%
  rename_with(tolower) %>% head(3)
```

```
##   sepal.length sepal.width petal.length petal.width species
## 1          5.1         3.5          1.4         0.2  setosa
## 2          4.9         3.0          1.4         0.2  setosa
## 3          4.7         3.2          1.3         0.2  setosa
```

rename to lower specific columns

```
iris %>% select_at(vars(Species, Petal.Length), tolower) %>% head(3)
```

```
##   species petal.length
## 1  setosa          1.4
## 2  setosa          1.4
## 3  setosa          1.3
```

add column

```
library(tibble)
iris %>% add_column(ob_no=1:150)
```

```
##     Sepal.Length Sepal.Width Petal.Length Petal.Width    Species ob_no
## 1            5.1         3.5          1.4         0.2     setosa     1
## 2            4.9         3.0          1.4         0.2     setosa     2
## 3            4.7         3.2          1.3         0.2     setosa     3
## 4            4.6         3.1          1.5         0.2     setosa     4
## 5            5.0         3.6          1.4         0.2     setosa     5
## 6            5.4         3.9          1.7         0.4     setosa     6
## 7            4.6         3.4          1.4         0.3     setosa     7
## 8            5.0         3.4          1.5         0.2     setosa     8
## 9            4.4         2.9          1.4         0.2     setosa     9
## 10           4.9         3.1          1.5         0.1     setosa    10
## 11           5.4         3.7          1.5         0.2     setosa    11
## 12           4.8         3.4          1.6         0.2     setosa    12
## 13           4.8         3.0          1.4         0.1     setosa    13
## 14           4.3         3.0          1.1         0.1     setosa    14
## 15           5.8         4.0          1.2         0.2     setosa    15
## 16           5.7         4.4          1.5         0.4     setosa    16
## 17           5.4         3.9          1.3         0.4     setosa    17
## 18           5.1         3.5          1.4         0.3     setosa    18
## 19           5.7         3.8          1.7         0.3     setosa    19
## 20           5.1         3.8          1.5         0.3     setosa    20
## 21           5.4         3.4          1.7         0.2     setosa    21
## 22           5.1         3.7          1.5         0.4     setosa    22
## 23           4.6         3.6          1.0         0.2     setosa    23
## 24           5.1         3.3          1.7         0.5     setosa    24
## 25           4.8         3.4          1.9         0.2     setosa    25
## 26           5.0         3.0          1.6         0.2     setosa    26
## 27           5.0         3.4          1.6         0.4     setosa    27
## 28           5.2         3.5          1.5         0.2     setosa    28
## 29           5.2         3.4          1.4         0.2     setosa    29
## 30           4.7         3.2          1.6         0.2     setosa    30
## 31           4.8         3.1          1.6         0.2     setosa    31
## 32           5.4         3.4          1.5         0.4     setosa    32
## 33           5.2         4.1          1.5         0.1     setosa    33
## 34           5.5         4.2          1.4         0.2     setosa    34
## 35           4.9         3.1          1.5         0.2     setosa    35
## 36           5.0         3.2          1.2         0.2     setosa    36
## 37           5.5         3.5          1.3         0.2     setosa    37
## 38           4.9         3.6          1.4         0.1     setosa    38
## 39           4.4         3.0          1.3         0.2     setosa    39
## 40           5.1         3.4          1.5         0.2     setosa    40
## 41           5.0         3.5          1.3         0.3     setosa    41
## 42           4.5         2.3          1.3         0.3     setosa    42
## 43           4.4         3.2          1.3         0.2     setosa    43
## 44           5.0         3.5          1.6         0.6     setosa    44
## 45           5.1         3.8          1.9         0.4     setosa    45
## 46           4.8         3.0          1.4         0.3     setosa    46
## 47           5.1         3.8          1.6         0.2     setosa    47
## 48           4.6         3.2          1.4         0.2     setosa    48
## 49           5.3         3.7          1.5         0.2     setosa    49
```

```
## 50          5.0         3.3          1.4         0.2     setosa    50
## 51          7.0         3.2          4.7         1.4 versicolor    51
## 52          6.4         3.2          4.5         1.5 versicolor    52
## 53          6.9         3.1          4.9         1.5 versicolor    53
## 54          5.5         2.3          4.0         1.3 versicolor    54
## 55          6.5         2.8          4.6         1.5 versicolor    55
## 56          5.7         2.8          4.5         1.3 versicolor    56
## 57          6.3         3.3          4.7         1.6 versicolor    57
## 58          4.9         2.4          3.3         1.0 versicolor    58
## 59          6.6         2.9          4.6         1.3 versicolor    59
## 60          5.2         2.7          3.9         1.4 versicolor    60
## 61          5.0         2.0          3.5         1.0 versicolor    61
## 62          5.9         3.0          4.2         1.5 versicolor    62
## 63          6.0         2.2          4.0         1.0 versicolor    63
## 64          6.1         2.9          4.7         1.4 versicolor    64
## 65          5.6         2.9          3.6         1.3 versicolor    65
## 66          6.7         3.1          4.4         1.4 versicolor    66
## 67          5.6         3.0          4.5         1.5 versicolor    67
## 68          5.8         2.7          4.1         1.0 versicolor    68
## 69          6.2         2.2          4.5         1.5 versicolor    69
## 70          5.6         2.5          3.9         1.1 versicolor    70
## 71          5.9         3.2          4.8         1.8 versicolor    71
## 72          6.1         2.8          4.0         1.3 versicolor    72
## 73          6.3         2.5          4.9         1.5 versicolor    73
## 74          6.1         2.8          4.7         1.2 versicolor    74
## 75          6.4         2.9          4.3         1.3 versicolor    75
## 76          6.6         3.0          4.4         1.4 versicolor    76
## 77          6.8         2.8          4.8         1.4 versicolor    77
## 78          6.7         3.0          5.0         1.7 versicolor    78
## 79          6.0         2.9          4.5         1.5 versicolor    79
## 80          5.7         2.6          3.5         1.0 versicolor    80
## 81          5.5         2.4          3.8         1.1 versicolor    81
## 82          5.5         2.4          3.7         1.0 versicolor    82
## 83          5.8         2.7          3.9         1.2 versicolor    83
## 84          6.0         2.7          5.1         1.6 versicolor    84
## 85          5.4         3.0          4.5         1.5 versicolor    85
## 86          6.0         3.4          4.5         1.6 versicolor    86
## 87          6.7         3.1          4.7         1.5 versicolor    87
## 88          6.3         2.3          4.4         1.3 versicolor    88
## 89          5.6         3.0          4.1         1.3 versicolor    89
## 90          5.5         2.5          4.0         1.3 versicolor    90
## 91          5.5         2.6          4.4         1.2 versicolor    91
## 92          6.1         3.0          4.6         1.4 versicolor    92
## 93          5.8         2.6          4.0         1.2 versicolor    93
## 94          5.0         2.3          3.3         1.0 versicolor    94
## 95          5.6         2.7          4.2         1.3 versicolor    95
## 96          5.7         3.0          4.2         1.2 versicolor    96
## 97          5.7         2.9          4.2         1.3 versicolor    97
## 98          6.2         2.9          4.3         1.3 versicolor    98
## 99          5.1         2.5          3.0         1.1 versicolor    99
## 100         5.7         2.8          4.1         1.3 versicolor   100
## 101         6.3         3.3          6.0         2.5  virginica   101
## 102         5.8         2.7          5.1         1.9  virginica   102
## 103         7.1         3.0          5.9         2.1  virginica   103
```

```
## 104          6.3         2.9          5.6         1.8  virginica   104
## 105          6.5         3.0          5.8         2.2  virginica   105
## 106          7.6         3.0          6.6         2.1  virginica   106
## 107          4.9         2.5          4.5         1.7  virginica   107
## 108          7.3         2.9          6.3         1.8  virginica   108
## 109          6.7         2.5          5.8         1.8  virginica   109
## 110          7.2         3.6          6.1         2.5  virginica   110
## 111          6.5         3.2          5.1         2.0  virginica   111
## 112          6.4         2.7          5.3         1.9  virginica   112
## 113          6.8         3.0          5.5         2.1  virginica   113
## 114          5.7         2.5          5.0         2.0  virginica   114
## 115          5.8         2.8          5.1         2.4  virginica   115
## 116          6.4         3.2          5.3         2.3  virginica   116
## 117          6.5         3.0          5.5         1.8  virginica   117
## 118          7.7         3.8          6.7         2.2  virginica   118
## 119          7.7         2.6          6.9         2.3  virginica   119
## 120          6.0         2.2          5.0         1.5  virginica   120
## 121          6.9         3.2          5.7         2.3  virginica   121
## 122          5.6         2.8          4.9         2.0  virginica   122
## 123          7.7         2.8          6.7         2.0  virginica   123
## 124          6.3         2.7          4.9         1.8  virginica   124
## 125          6.7         3.3          5.7         2.1  virginica   125
## 126          7.2         3.2          6.0         1.8  virginica   126
## 127          6.2         2.8          4.8         1.8  virginica   127
## 128          6.1         3.0          4.9         1.8  virginica   128
## 129          6.4         2.8          5.6         2.1  virginica   129
## 130          7.2         3.0          5.8         1.6  virginica   130
## 131          7.4         2.8          6.1         1.9  virginica   131
## 132          7.9         3.8          6.4         2.0  virginica   132
## 133          6.4         2.8          5.6         2.2  virginica   133
## 134          6.3         2.8          5.1         1.5  virginica   134
## 135          6.1         2.6          5.6         1.4  virginica   135
## 136          7.7         3.0          6.1         2.3  virginica   136
## 137          6.3         3.4          5.6         2.4  virginica   137
## 138          6.4         3.1          5.5         1.8  virginica   138
## 139          6.0         3.0          4.8         1.8  virginica   139
## 140          6.9         3.1          5.4         2.1  virginica   140
## 141          6.7         3.1          5.6         2.4  virginica   141
## 142          6.9         3.1          5.1         2.3  virginica   142
## 143          5.8         2.7          5.1         1.9  virginica   143
## 144          6.8         3.2          5.9         2.3  virginica   144
## 145          6.7         3.3          5.7         2.5  virginica   145
## 146          6.7         3.0          5.2         2.3  virginica   146
## 147          6.3         2.5          5.0         1.9  virginica   147
## 148          6.5         3.0          5.2         2.0  virginica   148
## 149          6.2         3.4          5.4         2.3  virginica   149
## 150          5.9         3.0          5.1         1.8  virginica   150
```

gapminder

```
iris %>% as_tibble()
```

```
## # A tibble: 150 x 5
##    Sepal.Length Sepal.Width Petal.Length Petal.Width Species
##           <dbl>       <dbl>        <dbl>       <dbl> <fct>
##  1          5.1         3.5          1.4         0.2 setosa
##  2          4.9         3            1.4         0.2 setosa
##  3          4.7         3.2          1.3         0.2 setosa
##  4          4.6         3.1          1.5         0.2 setosa
##  5          5           3.6          1.4         0.2 setosa
##  6          5.4         3.9          1.7         0.4 setosa
##  7          4.6         3.4          1.4         0.3 setosa
##  8          5           3.4          1.5         0.2 setosa
##  9          4.4         2.9          1.4         0.2 setosa
## 10          4.9         3.1          1.5         0.1 setosa
## # ... with 140 more rows
```

```
summary(gapminder)
```

```
##         country        continent        year         lifeExp
##  Afghanistan:  12   Africa  :624   Min.   :1952   Min.   :23.60
##  Albania    :  12   Americas:300   1st Qu.:1966   1st Qu.:48.20
##  Algeria    :  12   Asia    :396   Median :1980   Median :60.71
##  Angola     :  12   Europe  :360   Mean   :1980   Mean   :59.47
##  Argentina  :  12   Oceania : 24   3rd Qu.:1993   3rd Qu.:70.85
##  Australia  :  12                  Max.   :2007   Max.   :82.60
##  (Other)    :1632
##       pop              gdpPercap
##  Min.   :6.001e+04   Min.   :   241.2
##  1st Qu.:2.794e+06   1st Qu.:  1202.1
##  Median :7.024e+06   Median :  3531.8
##  Mean   :2.960e+07   Mean   :  7215.3
##  3rd Qu.:1.959e+07   3rd Qu.:  9325.5
##  Max.   :1.319e+09   Max.   :113523.1
##
```

```
str(gapminder)
```

```
## tibble [1,704 x 6] (S3: tbl_df/tbl/data.frame)
##  $ country  : Factor w/ 142 levels "Afghanistan",..: 1 1 1 1 1 1 1 1 1 1 ...
##  $ continent: Factor w/ 5 levels "Africa","Americas",..: 3 3 3 3 3 3 3 3 3 3 ...
##  $ year     : int [1:1704] 1952 1957 1962 1967 1972 1977 1982 1987 1992 1997 ...
##  $ lifeExp  : num [1:1704] 28.8 30.3 32 34 36.1 ...
##  $ pop      : int [1:1704] 8425333 9240934 10267083 11537966 13079460 14880372 12881816 13867957 163
##  $ gdpPercap: num [1:1704] 779 821 853 836 740 ...
```

recode observation

change name of observation— mutate (variable=recode (variable, 'old name'='new name')))

```
gapminder %>%
 mutate(country=recode(country, 'India'='IND' )) %>%
  filter(country=='IND')
```

```
## # A tibble: 12 x 6
##    country continent  year lifeExp        pop gdpPercap
##    <fct>   <fct>     <int>   <dbl>      <int>     <dbl>
##  1 IND     Asia       1952    37.4  372000000      547.
##  2 IND     Asia       1957    40.2  409000000      590.
##  3 IND     Asia       1962    43.6  454000000      658.
##  4 IND     Asia       1967    47.2  506000000      701.
##  5 IND     Asia       1972    50.7  567000000      724.
##  6 IND     Asia       1977    54.2  634000000      813.
##  7 IND     Asia       1982    56.6  708000000      856.
##  8 IND     Asia       1987    58.6  788000000      977.
##  9 IND     Asia       1992    60.2  872000000     1164.
## 10 IND     Asia       1997    61.8  959000000     1459.
## 11 IND     Asia       2002    62.9 1034172547     1747.
## 12 IND     Asia       2007    64.7 1110396331     2452.
```

select

```
gapminder %>%
  select(year, country, gdpPercap)
```

```
## # A tibble: 1,704 x 3
##     year country     gdpPercap
##    <int> <fct>           <dbl>
##  1  1952 Afghanistan      779.
##  2  1957 Afghanistan      821.
##  3  1962 Afghanistan      853.
##  4  1967 Afghanistan      836.
##  5  1972 Afghanistan      740.
##  6  1977 Afghanistan      786.
##  7  1982 Afghanistan      978.
##  8  1987 Afghanistan      852.
##  9  1992 Afghanistan      649.
## 10  1997 Afghanistan      635.
## # ... with 1,694 more rows
```

```
msleep %>% select(starts_with("sleep"))
```

```
## # A tibble: 83 x 3
##    sleep_total sleep_rem sleep_cycle
##          <dbl>     <dbl>       <dbl>
##  1        12.1      NA         NA
##  2        17         1.8       NA
##  3        14.4       2.4       NA
##  4        14.9       2.3        0.133
##  5         4         0.7        0.667
##  6        14.4       2.2        0.767
##  7         8.7       1.4        0.383
##  8         7        NA         NA
##  9        10.1       2.9        0.333
```

```
## 10          3         NA         NA
## # ... with 73 more rows
```

do not select

```
iris %>% select(-Sepal.Length, -Species) %>% head(3)
```

```
##   Sepal.Width Petal.Length Petal.Width
## 1         3.5          1.4         0.2
## 2         3.0          1.4         0.2
## 3         3.2          1.3         0.2
```

or

```
iris %>% select(-c(Sepal.Length)) %>% head(3)
```

```
##   Sepal.Width Petal.Length Petal.Width Species
## 1         3.5          1.4         0.2  setosa
## 2         3.0          1.4         0.2  setosa
## 3         3.2          1.3         0.2  setosa
```

```
iris %>% select(!Sepal.Length) %>% head(3)
```

```
##   Sepal.Width Petal.Length Petal.Width Species
## 1         3.5          1.4         0.2  setosa
## 2         3.0          1.4         0.2  setosa
## 3         3.2          1.3         0.2  setosa
```

ends_with

```
iris %>% select(ends_with('length')) %>% head(3)
```

```
##   Sepal.Length Petal.Length
## 1          5.1          1.4
## 2          4.9          1.4
## 3          4.7          1.3
```

starts_with

```
iris %>% select(starts_with('Sepal')) %>% head(3)
```

```
##   Sepal.Length Sepal.Width
## 1          5.1         3.5
## 2          4.9         3.0
## 3          4.7         3.2
```

filter

```
gapminder %>%
  select(year, country, lifeExp) %>%
  filter(country=="Eritrea", year>1950)
```

```
## # A tibble: 12 x 3
##     year country lifeExp
##    <int> <fct>     <dbl>
##  1  1952 Eritrea    35.9
##  2  1957 Eritrea    38.0
##  3  1962 Eritrea    40.2
##  4  1967 Eritrea    42.2
##  5  1972 Eritrea    44.1
##  6  1977 Eritrea    44.5
##  7  1982 Eritrea    43.9
##  8  1987 Eritrea    46.5
##  9  1992 Eritrea    50.0
## 10  1997 Eritrea    53.4
## 11  2002 Eritrea    55.2
## 12  2007 Eritrea    58.0
```

```
gapminder %>% filter(country=="Canada") %>% head(3) # from gapminder data filter country Canada and sho
```

```
## # A tibble: 3 x 6
##   country continent  year lifeExp      pop gdpPercap
##   <fct>   <fct>     <int>   <dbl>    <int>     <dbl>
## 1 Canada  Americas   1952    68.8 14785584    11367.
## 2 Canada  Americas   1957    70.0 17010154    12490.
## 3 Canada  Americas   1962    71.3 18985849    13462.
```

except

```
gapminder %>% filter(country!="Oman") %>% head(3) # from gapminder data filter all the other countries
```

```
## # A tibble: 3 x 6
##   country     continent  year lifeExp      pop gdpPercap
##   <fct>       <fct>     <int>   <dbl>    <int>     <dbl>
## 1 Afghanistan Asia       1952    28.8  8425333      779.
## 2 Afghanistan Asia       1957    30.3  9240934      821.
## 3 Afghanistan Asia       1962    32.0 10267083      853.
```

omit

```
iris %>% filter(Species!='setosa') %>% glimpse()
```

```
## Rows: 100
## Columns: 5
## $ Sepal.Length <dbl> 7.0, 6.4, 6.9, 5.5, 6.5, 5.7, 6.3, 4.9, 6.6, 5.2, 5.0, 5.~
## $ Sepal.Width  <dbl> 3.2, 3.2, 3.1, 2.3, 2.8, 2.8, 3.3, 2.4, 2.9, 2.7, 2.0, 3.~
## $ Petal.Length <dbl> 4.7, 4.5, 4.9, 4.0, 4.6, 4.5, 4.7, 3.3, 4.6, 3.9, 3.5, 4.~
## $ Petal.Width  <dbl> 1.4, 1.5, 1.5, 1.3, 1.5, 1.3, 1.6, 1.0, 1.3, 1.4, 1.0, 1.~
## $ Species      <fct> versicolor, versicolor, versicolor, versicolor, versicolo~
```

omit multiple

```
iris %>% filter(!Species %in% c('setosa', 'versicolor')) %>% glimpse()
```

```
## Rows: 50
## Columns: 5
## $ Sepal.Length <dbl> 6.3, 5.8, 7.1, 6.3, 6.5, 7.6, 4.9, 7.3, 6.7, 7.2, 6.5, 6.~
## $ Sepal.Width  <dbl> 3.3, 2.7, 3.0, 2.9, 3.0, 3.0, 2.5, 2.9, 2.5, 3.6, 3.2, 2.~
## $ Petal.Length <dbl> 6.0, 5.1, 5.9, 5.6, 5.8, 6.6, 4.5, 6.3, 5.8, 6.1, 5.1, 5.~
## $ Petal.Width  <dbl> 2.5, 1.9, 2.1, 1.8, 2.2, 2.1, 1.7, 1.8, 1.8, 2.5, 2.0, 1.~
## $ Species      <fct> virginica, virginica, virginica, virginica, virginica, vi~
```

filter between

```
iris %>% filter(Petal.Width >=2 & Petal.Width <= 5) %>% glimpse()
```

```
## Rows: 29
## Columns: 5
## $ Sepal.Length <dbl> 6.3, 7.1, 6.5, 7.6, 7.2, 6.5, 6.8, 5.7, 5.8, 6.4, 7.7, 7.~
## $ Sepal.Width  <dbl> 3.3, 3.0, 3.0, 3.0, 3.6, 3.2, 3.0, 2.5, 2.8, 3.2, 3.8, 2.~
## $ Petal.Length <dbl> 6.0, 5.9, 5.8, 6.6, 6.1, 5.1, 5.5, 5.0, 5.1, 5.3, 6.7, 6.~
## $ Petal.Width  <dbl> 2.5, 2.1, 2.2, 2.1, 2.5, 2.0, 2.1, 2.0, 2.4, 2.3, 2.2, 2.~
## $ Species      <fct> virginica, virginica, virginica, virginica, virginica, vi~
```

pull

```
iris %>% pull(Species) # returns vector values
```

```
##   [1] setosa     setosa     setosa     setosa     setosa     setosa
##   [7] setosa     setosa     setosa     setosa     setosa     setosa
##  [13] setosa     setosa     setosa     setosa     setosa     setosa
##  [19] setosa     setosa     setosa     setosa     setosa     setosa
##  [25] setosa     setosa     setosa     setosa     setosa     setosa
##  [31] setosa     setosa     setosa     setosa     setosa     setosa
##  [37] setosa     setosa     setosa     setosa     setosa     setosa
##  [43] setosa     setosa     setosa     setosa     setosa     setosa
##  [49] setosa     setosa     versicolor versicolor versicolor versicolor
##  [55] versicolor versicolor versicolor versicolor versicolor versicolor
```

```
##  [61] versicolor versicolor versicolor versicolor versicolor versicolor
##  [67] versicolor versicolor versicolor versicolor versicolor versicolor
##  [73] versicolor versicolor versicolor versicolor versicolor versicolor
##  [79] versicolor versicolor versicolor versicolor versicolor versicolor
##  [85] versicolor versicolor versicolor versicolor versicolor versicolor
##  [91] versicolor versicolor versicolor versicolor versicolor versicolor
##  [97] versicolor versicolor versicolor versicolor virginica  virginica
## [103] virginica  virginica  virginica  virginica  virginica  virginica
## [109] virginica  virginica  virginica  virginica  virginica  virginica
## [115] virginica  virginica  virginica  virginica  virginica  virginica
## [121] virginica  virginica  virginica  virginica  virginica  virginica
## [127] virginica  virginica  virginica  virginica  virginica  virginica
## [133] virginica  virginica  virginica  virginica  virginica  virginica
## [139] virginica  virginica  virginica  virginica  virginica  virginica
## [145] virginica  virginica  virginica  virginica  virginica  virginica
## Levels: setosa versicolor virginica
```

```
iris %>% select(Species) # returns a table with one column
```

```
##        Species
## 1       setosa
## 2       setosa
## 3       setosa
## 4       setosa
## 5       setosa
## 6       setosa
## 7       setosa
## 8       setosa
## 9       setosa
## 10      setosa
## 11      setosa
## 12      setosa
## 13      setosa
## 14      setosa
## 15      setosa
## 16      setosa
## 17      setosa
## 18      setosa
## 19      setosa
## 20      setosa
## 21      setosa
## 22      setosa
## 23      setosa
## 24      setosa
## 25      setosa
## 26      setosa
## 27      setosa
## 28      setosa
## 29      setosa
## 30      setosa
## 31      setosa
## 32      setosa
## 33      setosa
## 34      setosa
```

```
## 35      setosa
## 36      setosa
## 37      setosa
## 38      setosa
## 39      setosa
## 40      setosa
## 41      setosa
## 42      setosa
## 43      setosa
## 44      setosa
## 45      setosa
## 46      setosa
## 47      setosa
## 48      setosa
## 49      setosa
## 50      setosa
## 51  versicolor
## 52  versicolor
## 53  versicolor
## 54  versicolor
## 55  versicolor
## 56  versicolor
## 57  versicolor
## 58  versicolor
## 59  versicolor
## 60  versicolor
## 61  versicolor
## 62  versicolor
## 63  versicolor
## 64  versicolor
## 65  versicolor
## 66  versicolor
## 67  versicolor
## 68  versicolor
## 69  versicolor
## 70  versicolor
## 71  versicolor
## 72  versicolor
## 73  versicolor
## 74  versicolor
## 75  versicolor
## 76  versicolor
## 77  versicolor
## 78  versicolor
## 79  versicolor
## 80  versicolor
## 81  versicolor
## 82  versicolor
## 83  versicolor
## 84  versicolor
## 85  versicolor
## 86  versicolor
## 87  versicolor
## 88  versicolor
```

```
## 89  versicolor
## 90  versicolor
## 91  versicolor
## 92  versicolor
## 93  versicolor
## 94  versicolor
## 95  versicolor
## 96  versicolor
## 97  versicolor
## 98  versicolor
## 99  versicolor
## 100 versicolor
## 101  virginica
## 102  virginica
## 103  virginica
## 104  virginica
## 105  virginica
## 106  virginica
## 107  virginica
## 108  virginica
## 109  virginica
## 110  virginica
## 111  virginica
## 112  virginica
## 113  virginica
## 114  virginica
## 115  virginica
## 116  virginica
## 117  virginica
## 118  virginica
## 119  virginica
## 120  virginica
## 121  virginica
## 122  virginica
## 123  virginica
## 124  virginica
## 125  virginica
## 126  virginica
## 127  virginica
## 128  virginica
## 129  virginica
## 130  virginica
## 131  virginica
## 132  virginica
## 133  virginica
## 134  virginica
## 135  virginica
## 136  virginica
## 137  virginica
## 138  virginica
## 139  virginica
## 140  virginica
## 141  virginica
## 142  virginica
```

```
## 143  virginica
## 144  virginica
## 145  virginica
## 146  virginica
## 147  virginica
## 148  virginica
## 149  virginica
## 150  virginica
```

```
iris %>% select(everything()) %>% head(3)
```

```
##   Sepal.Length Sepal.Width Petal.Length Petal.Width Species
## 1          5.1         3.5          1.4         0.2  setosa
## 2          4.9         3.0          1.4         0.2  setosa
## 3          4.7         3.2          1.3         0.2  setosa
```

multiple conditions

```
gapminder %>%
  filter(country=="Oman" &
           year>1980 &
           year<=2000) %>% head(4)
```

```
## # A tibble: 4 x 6
##   country continent  year lifeExp     pop gdpPercap
##   <fct>   <fct>     <int>   <dbl>   <int>     <dbl>
## 1 Oman    Asia       1982    62.7 1301048    12955.
## 2 Oman    Asia       1987    67.7 1593882    18115.
## 3 Oman    Asia       1992    71.2 1915208    18617.
## 4 Oman    Asia       1997    72.5 2283635    19702.
```

```
gapminder %>%
  select(country, year) %>%
  filter(year>=1980, country=="India"|
           country=="Oman"|
           country=="Canada")
```

```
## # A tibble: 18 x 2
##    country  year
##    <fct>   <int>
##  1 Canada   1982
##  2 Canada   1987
##  3 Canada   1992
##  4 Canada   1997
##  5 Canada   2002
##  6 Canada   2007
##  7 India    1982
##  8 India    1987
##  9 India    1992
## 10 India    1997
```

```
## 11 India    2002
## 12 India    2007
## 13 Oman     1982
## 14 Oman     1987
## 15 Oman     1992
## 16 Oman     1997
## 17 Oman     2002
## 18 Oman     2007
```

```
gapminder %>% filter(country!="Oman") %>% head(3) # from gapminder data filter all the other countires
```

```
## # A tibble: 3 x 6
##   country     continent  year lifeExp      pop gdpPercap
##   <fct>       <fct>     <int>   <dbl>    <int>     <dbl>
## 1 Afghanistan Asia       1952    28.8  8425333      779.
## 2 Afghanistan Asia       1957    30.3  9240934      821.
## 3 Afghanistan Asia       1962    32.0 10267083      853.
```

filter multipe using %in%

```
gapminder %>% filter(country %in% c('Hungary','Iceland', 'Mongolia')) %>% head(3)
```

```
## # A tibble: 3 x 6
##   country continent  year lifeExp      pop gdpPercap
##   <fct>   <fct>     <int>   <dbl>    <int>     <dbl>
## 1 Hungary Europe     1952    64.0  9504000     5264.
## 2 Hungary Europe     1957    66.4  9839000     6040.
## 3 Hungary Europe     1962    68.0 10063000     7550.
```

```
target <- c('Hungary','Iceland', 'Mongolia')
gapminder %>% filter(country %in% target) %>% head (3)
```

```
## # A tibble: 3 x 6
##   country continent  year lifeExp      pop gdpPercap
##   <fct>   <fct>     <int>   <dbl>    <int>     <dbl>
## 1 Hungary Europe     1952    64.0  9504000     5264.
## 2 Hungary Europe     1957    66.4  9839000     6040.
## 3 Hungary Europe     1962    68.0 10063000     7550.
```

```
friends <- data.frame(Names=c('Saneesh', 'Appu', 'Shruti', 'Aradhana', 'Arathi', 'James Bond'),
                      age=c(40,9, 25, 25, 25, 50))
# data frame is friends
# columns in friends are Names, Age, Height, etc.
# Colum Name have 'Saneesh', 'Appu', 'Shruti', 'Aradhana', 'Arathi', 'James Bond'
# We want to filter information related to Sanees and James Bond only, so we created a vector with
# these names in it.

target <- c('Appu', 'James Bond') #and then

friends %>% filter(Names %in% target)
```

```
##        Names age
## 1       Appu   9
## 2 James Bond  50
```

```
# or
friends %>% filter(Names== 'Appu'| Names== 'James Bond')
```

```
##        Names age
## 1       Appu   9
## 2 James Bond  50
```

```
# or
friends %>% filter(Names %in% c('Appu', 'James Bond'))
```

```
##        Names age
## 1       Appu   9
## 2 James Bond  50
```

drop

```
gapminder %>%
  select(-year,-pop) %>%
  head(5)
```

```
## # A tibble: 5 x 4
##   country     continent lifeExp gdpPercap
##   <fct>       <fct>       <dbl>     <dbl>
## 1 Afghanistan Asia         28.8      779.
## 2 Afghanistan Asia         30.3      821.
## 3 Afghanistan Asia         32.0      853.
## 4 Afghanistan Asia         34.0      836.
## 5 Afghanistan Asia         36.1      740.
```

group by & summarise

```
gapminder %>%
  filter(year==2007) %>%
  group_by(country) %>%
  summarise(meanLE=mean(lifeExp)) %>%
  arrange(meanLE,decreasing = TRUE)
```

```
## # A tibble: 142 x 2
##    country                  meanLE
##    <fct>                     <dbl>
##  1 Swaziland                  39.6
##  2 Mozambique                 42.1
```

```
##  3 Zambia                     42.4
##  4 Sierra Leone               42.6
##  5 Lesotho                    42.6
##  6 Angola                     42.7
##  7 Zimbabwe                   43.5
##  8 Afghanistan                43.8
##  9 Central African Republic   44.7
## 10 Liberia                    45.7
## # ... with 132 more rows
```

```
gapminder %>%
  group_by(country) %>%
  summarise(minLE=min(lifeExp)) %>%
  arrange(minLE,decreasing=FALSE)
```

```
## # A tibble: 142 x 2
##    country       minLE
##    <fct>         <dbl>
##  1 Rwanda         23.6
##  2 Afghanistan    28.8
##  3 Gambia         30
##  4 Angola         30.0
##  5 Sierra Leone   30.3
##  6 Cambodia       31.2
##  7 Mozambique     31.3
##  8 Burkina Faso   32.0
##  9 Guinea-Bissau  32.5
## 10 Yemen, Rep.    32.5
## # ... with 132 more rows
```

grouped by continent, then summarise two things, first n=n() number of rows in which each continent are or the size of each group, then the mean of the mean of the lifeExp variable.

```
gapminder %>%
  group_by(continent) %>%
  summarise(n=n(),
            meanLife=mean(lifeExp))
```

```
## # A tibble: 5 x 3
##   continent     n meanLife
##   <fct>     <int>    <dbl>
## 1 Africa      624     48.9
## 2 Americas    300     64.7
## 3 Asia        396     60.1
## 4 Europe      360     71.9
## 5 Oceania      24     74.3
```

```
gapminder %>%
  group_by(continent) %>%
  summarise(PopConti=sum(pop))
```

```
## # A tibble: 5 x 2
```

```
##   continent    PopConti
##   <fct>           <dbl>
## 1 Africa     6187585961
## 2 Americas   7351438499
## 3 Asia      30507333901
## 4 Europe     6181115304
## 5 Oceania     212992136
```

```
pets <- data.frame(names=c(rep('saneesh', 3), rep('appu', 2), 'sanusha'),
                   pet=c(rep('dog', 3), rep('cat', 2), 'tiger'), number=c(2,2,5,7,8,1),
                   size=c(rep('medium', 2), rep('small', 3), 'big'))

pets
```

```
##     names   pet number   size
## 1 saneesh   dog      2 medium
## 2 saneesh   dog      2 medium
## 3 saneesh   dog      5  small
## 4    appu   cat      7  small
## 5    appu   cat      8  small
## 6 sanusha tiger      1    big
```

```
library(tidyverse)

pets %>% group_by(pet, size) %>%
  summarise(totalpet= sum(number))
```

```
## `summarise()` has grouped output by 'pet'. You can override using the `.groups`
## argument.
```

```
## # A tibble: 4 x 3
## # Groups:   pet [3]
##   pet   size   totalpet
##   <chr> <chr>     <dbl>
## 1 cat   small        15
## 2 dog   medium        4
## 3 dog   small         5
## 4 tiger big           1
```

summarise

```
library(tidyverse)
plot <- c(rep(1,2), rep(2,4), rep(3,3))
bird <- c('a','b', 'a','b', 'c', 'd', 'a', 'b', 'c')
area <- c(rep(10,2), rep(5,4), rep(15,3))

birdlist <- data.frame(plot,bird,area)
birdlist
```

```
##   plot bird area
## 1    1    a   10
## 2    1    b   10
## 3    2    a    5
## 4    2    b    5
## 5    2    c    5
## 6    2    d    5
## 7    3    a   15
## 8    3    b   15
## 9    3    c   15
```

```
# summarize the following data frame to a summary table.
# option 1
birdlist %>%
  group_by(plot) %>%
  summarise(bird = n(), area = unique(area))
```

```
## # A tibble: 3 x 3
##    plot  bird  area
##   <dbl> <int> <dbl>
## 1     1     2    10
## 2     2     4     5
## 3     3     3    15
```

```
# option 2
birdlist %>%
  count(plot, area, name = "bird")
```

```
##   plot area bird
## 1    1   10    2
## 2    2    5    4
## 3    3   15    3
```

```
gapminder %>%
  summarise(mean(lifeExp))
```

```
## # A tibble: 1 x 1
##   `mean(lifeExp)`
##             <dbl>
## 1            59.5
```

```
gapminder %>%
  summarise(range(lifeExp))
```

```
## # A tibble: 2 x 1
##   `range(lifeExp)`
##              <dbl>
## 1             23.6
## 2             82.6
```

```
gapminder %>%
  filter(country=="India") %>%
  group_by(country) %>%
  summarise(GDPmax=max(gdpPercap),
            GDPmin=min(gdpPercap),
            GDPmean=mean(gdpPercap))
```

```
## # A tibble: 1 x 4
##   country GDPmax GDPmin GDPmean
##   <fct>    <dbl>  <dbl>   <dbl>
## 1 India    2452.   547.   1057.
```

count/summarize

```
library(tidyverse)
plot <- c(rep(1,2), rep(2,4), rep(3,3))
bird <- as.factor(c('a','b', 'a','b', 'c', 'd', 'a', 'b', 'c'))
area <- c(rep(10,2), rep(5,4), rep(15,3))

birdlist <- data.frame(plot,bird,area)
birdlist
```

```
##   plot bird area
## 1    1    a   10
## 2    1    b   10
## 3    2    a    5
## 4    2    b    5
## 5    2    c    5
## 6    2    d    5
## 7    3    a   15
## 8    3    b   15
## 9    3    c   15
```

```
#birdlist %>%    group_by(plot, area) %>%    mutate(count(bird))


birdlist %>%
  group_by(plot, area) %>%
  dplyr::summarize(bird = n(), # when summarize doesn't work directly use it (dplyr::)like this
            .groups = "drop") # to summarize of a column with reference to two other variables.
```

```
## # A tibble: 3 x 3
##    plot  area  bird
##   <dbl> <dbl> <int>
## 1     1    10     2
## 2     2     5     4
## 3     3    15     3
```

count sites

```
treatment <- c(rep('ab',2), rep('bgrnf', 8), rep('bgpnf', 4))
site <- c('ab1', 'ab2',
          rep('bgrnf1', 3),
          rep('bgrnf2', 2),
          'bgrnf3',
          'bgrnf4',
          'bgrnf5',
          rep('bgpnf1', 2),
          rep('bgpnf2', 2))
data <- data.frame(treatment, site)
library(tidyverse)
# to find the site per each treatment
data %>% group_by(treatment) %>% count(treatment)
```

```
## # A tibble: 3 x 2
## # Groups:   treatment [3]
##   treatment     n
##   <chr>     <int>
## 1 ab            2
## 2 bgpnf         4
## 3 bgrnf         8
```

case when new column

```
library(dplyr)
library(stringr)
feedback <- c('good_book', 'good_read', 'good_story', 'good for knowledge')
book <- c('ramayana', 'bible', 'encyclopedia', 'Mbharatha')

df <- data.frame(feedback, book)

df %>%
  mutate(response = case_when(str_starts(feedback, 'good') ~ 'good')) %>%
  select(book, response) %>% as_tibble()
```

```
## # A tibble: 4 x 2
##   book         response
##   <chr>        <chr>
## 1 ramayana     good
## 2 bible        good
## 3 encyclopedia good
## 4 Mbharatha    good
```

separate

text to columns

```r
df <- data.frame(films = c("Spider_man", "James_bond", "Iron_man", "Bat_man"))
df
```

```
##        films
## 1 Spider_man
## 2 James_bond
## 3   Iron_man
## 4    Bat_man
```

```r
df1 <- df %>%
  separate(films, c("a", "b"), sep='([_])')
df1
```

```
##        a    b
## 1 Spider  man
## 2  James bond
## 3   Iron  man
## 4    Bat  man
```

unite

```r
df1 %>% unite("names", a:b, remove=FALSE)
```

```
##        names      a    b
## 1 Spider_man Spider  man
## 2 James_bond  James bond
## 3   Iron_man   Iron  man
## 4    Bat_man    Bat  man
```

join

```r
df2 <- data.frame(id=c(1:4) ,films = c("Spider_man", "James_bond", "Iron_man", "Bat_man"))
df3 <- data.frame(id=c(1:4) ,country= rep("us", 4))

df4 <- left_join(df2, df3, by="id")
df4
```

```
##   id      films country
## 1  1 Spider_man      us
## 2  2 James_bond      us
## 3  3   Iron_man      us
## 4  4    Bat_man      us
```

across

for multiple variables

```
library(tidyverse)
srno <- c(1:2)
film <- c("arabica", "robust")
rate <- c("good", "better")
lang_Eng <- c("yes", "yes")

films <- data.frame(srno, film, rate, lang_Eng)

str(films)
```

```
## 'data.frame':    2 obs. of  4 variables:
##  $ srno    : int  1 2
##  $ film    : chr  "arabica" "robust"
##  $ rate    : chr  "good" "better"
##  $ lang_Eng: chr  "yes" "yes"
```

```
films <- films %>%
  mutate(across(c(rate, lang_Eng), as.factor))

str(films)
```

```
## 'data.frame':    2 obs. of  4 variables:
##  $ srno    : int  1 2
##  $ film    : chr  "arabica" "robust"
##  $ rate    : Factor w/ 2 levels "better","good": 2 1
##  $ lang_Eng: Factor w/ 1 level "yes": 1 1
```

everthing

select a key variable and everything

```
library(gapminder)
gapminder %>% select(pop, everything())
```

```
## # A tibble: 1,704 x 6
##         pop country     continent  year lifeExp gdpPercap
##       <int> <fct>       <fct>     <int>   <dbl>     <dbl>
##  1  8425333 Afghanistan Asia       1952    28.8      779.
##  2  9240934 Afghanistan Asia       1957    30.3      821.
##  3 10267083 Afghanistan Asia       1962    32.0      853.
##  4 11537966 Afghanistan Asia       1967    34.0      836.
##  5 13079460 Afghanistan Asia       1972    36.1      740.
##  6 14880372 Afghanistan Asia       1977    38.4      786.
##  7 12881816 Afghanistan Asia       1982    39.9      978.
##  8 13867957 Afghanistan Asia       1987    40.8      852.
##  9 16317921 Afghanistan Asia       1992    41.7      649.
## 10 22227415 Afghanistan Asia       1997    41.8      635.
## # ... with 1,694 more rows
```

toupper

tolower

```
library(stringr)

data <- data.frame(Dose.Cm=c("d1", "D2", "D3"),
                Len.km=c("High", 'low', 'Low'))
glimpse(data)
```

```
## Rows: 3
## Columns: 2
## $ Dose.Cm <chr> "d1", "D2", "D3"
## $ Len.km  <chr> "High", "low", "Low"
```

```
data %>% mutate(Dose.Cm= tolower(Dose.Cm), Len.km=toupper(Len.km))
```

```
##   Dose.Cm Len.km
## 1      d1   HIGH
## 2      d2    LOW
## 3      d3    LOW
```

factor

```
data <- data.frame(Dose.Cm=c("d1", "D2", "D3"),
                Len.km=c("high", 'low', 'medium'))
data <- data %>% mutate(len= as.factor(Len.km))

glimpse(data)
```

```
## Rows: 3
## Columns: 3
## $ Dose.Cm <chr> "d1", "D2", "D3"
## $ Len.km  <chr> "high", "low", "medium"
## $ len     <fct> high, low, medium
```

change order of factor

```
data %>% mutate(len= fct_relevel(len, c('low', 'medium', 'high')))
```

```
##   Dose.Cm Len.km    len
## 1      d1   high   high
## 2      D2    low    low
## 3      D3 medium medium
```

parse_number

This drops any non-numeric characters before or after the first number. The grouping mark specified by the locale is ignored inside the number.

```
library(tidyverse)
class <- c('8th', '9th', '10th')
students <- c('25-30', '35-41', '21-28')
school <- data.frame(class, students)
school
```

```
##   class students
## 1   8th    25-30
## 2   9th    35-41
## 3  10th    21-28
```

```
glimpse(school) # notice students is a binned variable it is a not a numeric.
```

```
## Rows: 3
## Columns: 2
## $ class    <chr> "8th", "9th", "10th"
## $ students <chr> "25-30", "35-41", "21-28"
```

```
school %>% mutate(students= parse_number(students)) %>% glimpse()
```

```
## Rows: 3
## Columns: 2
## $ class    <chr> "8th", "9th", "10th"
## $ students <dbl> 25, 35, 21
```

```
school %>% mutate(students= parse_number(students))
```

```
##   class students
## 1   8th       25
## 2   9th       35
## 3  10th       21
```

```
# now students because number with first value of the column
```

pivot longer

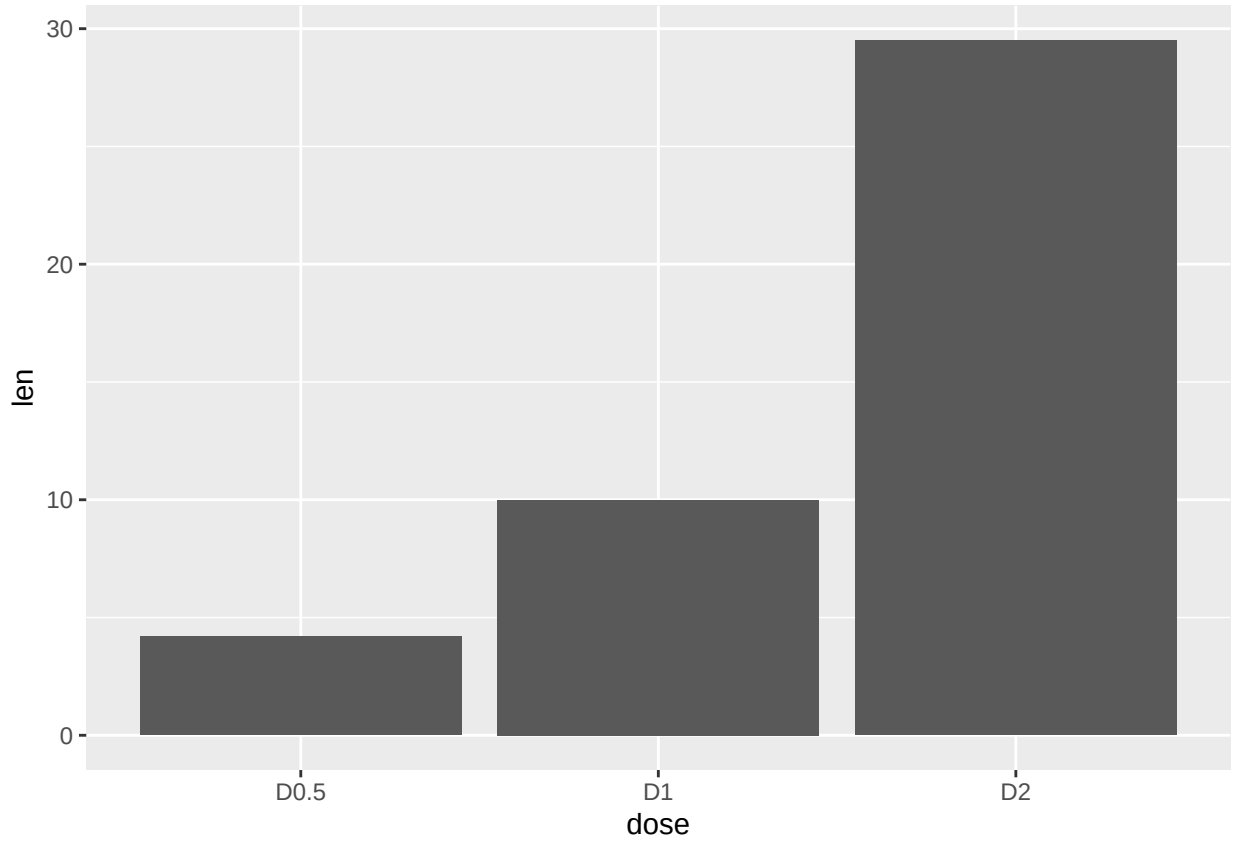
```
library(tidyverse)

rawdata <- data.frame(species_1=rnorm(n = 40, mean = 300, sd = 18.5), species_2=rnorm(40, 305, 16.7))


data <- pivot_longer(data = rawdata, cols = species_1:species_2, names_to = 'species', values_to = 'wei
```

ggplot

```
#sthda.com/english/wiki/ggplot2-barplots-quick-start-guide-r-software-and-data-visualization
df <- data.frame(dose=c("D0.5", "D1", "D2"),
                 len=c(4.2, 10, 29.5))
```

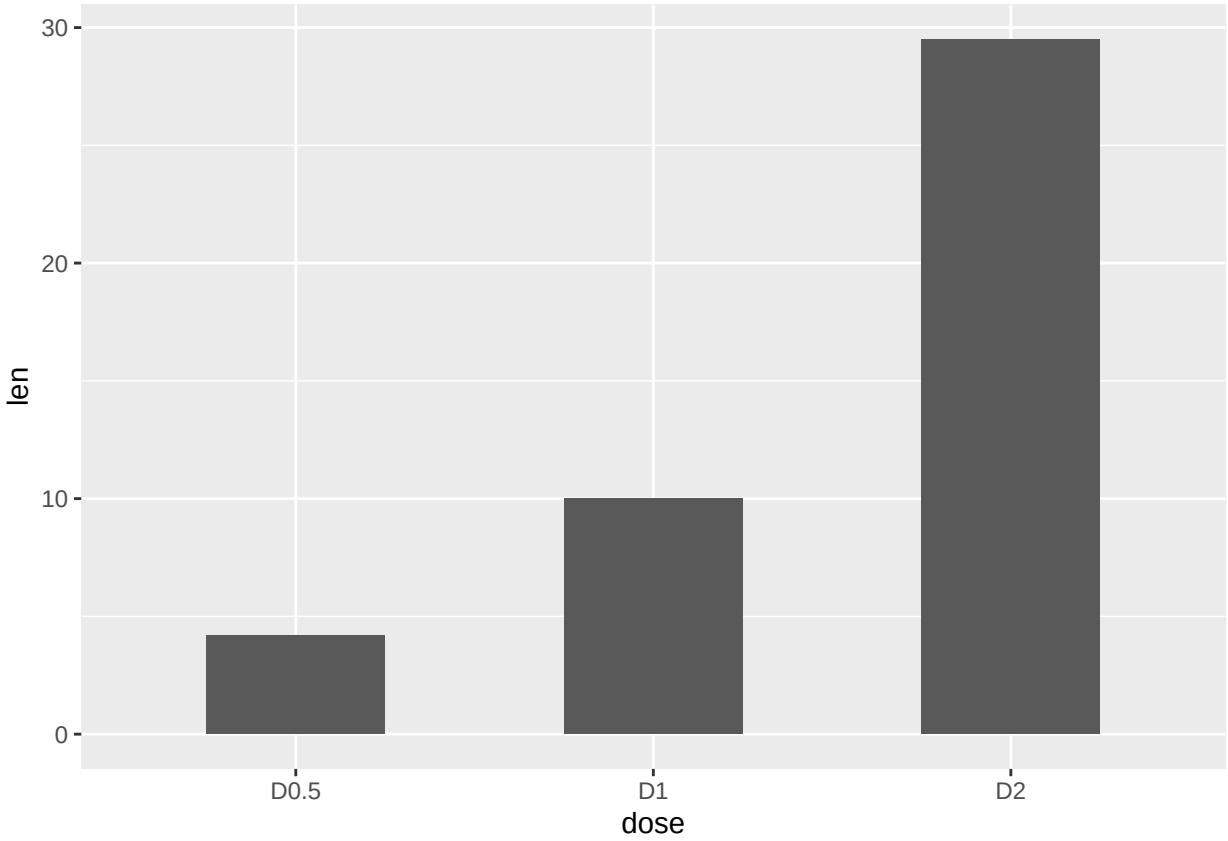
bar plot

```
library(ggplot2)
# Basic barplot
p<-ggplot(data=df, aes(x=dose, y=len)) +
  geom_bar(stat="identity")
p
```

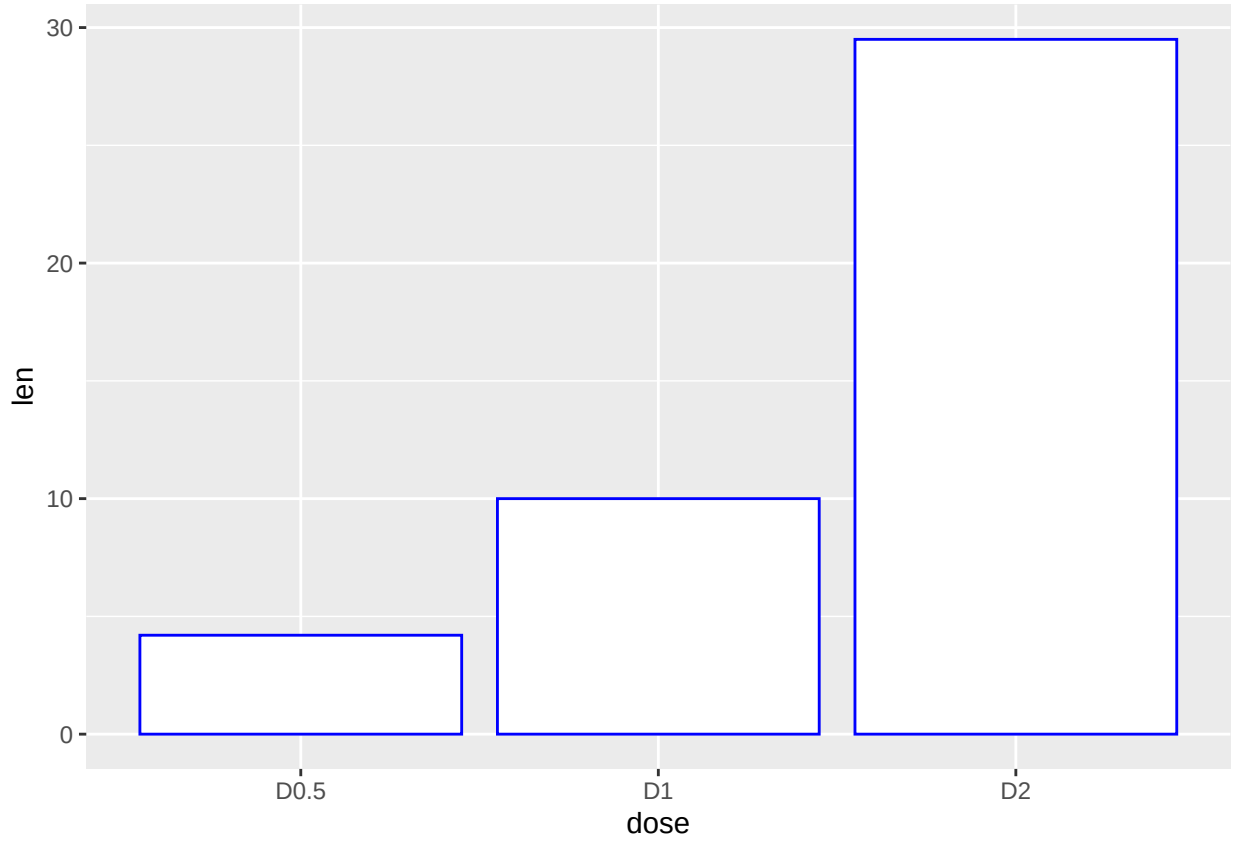



```
# Horizontal bar plot
# p + coord_flip()
```

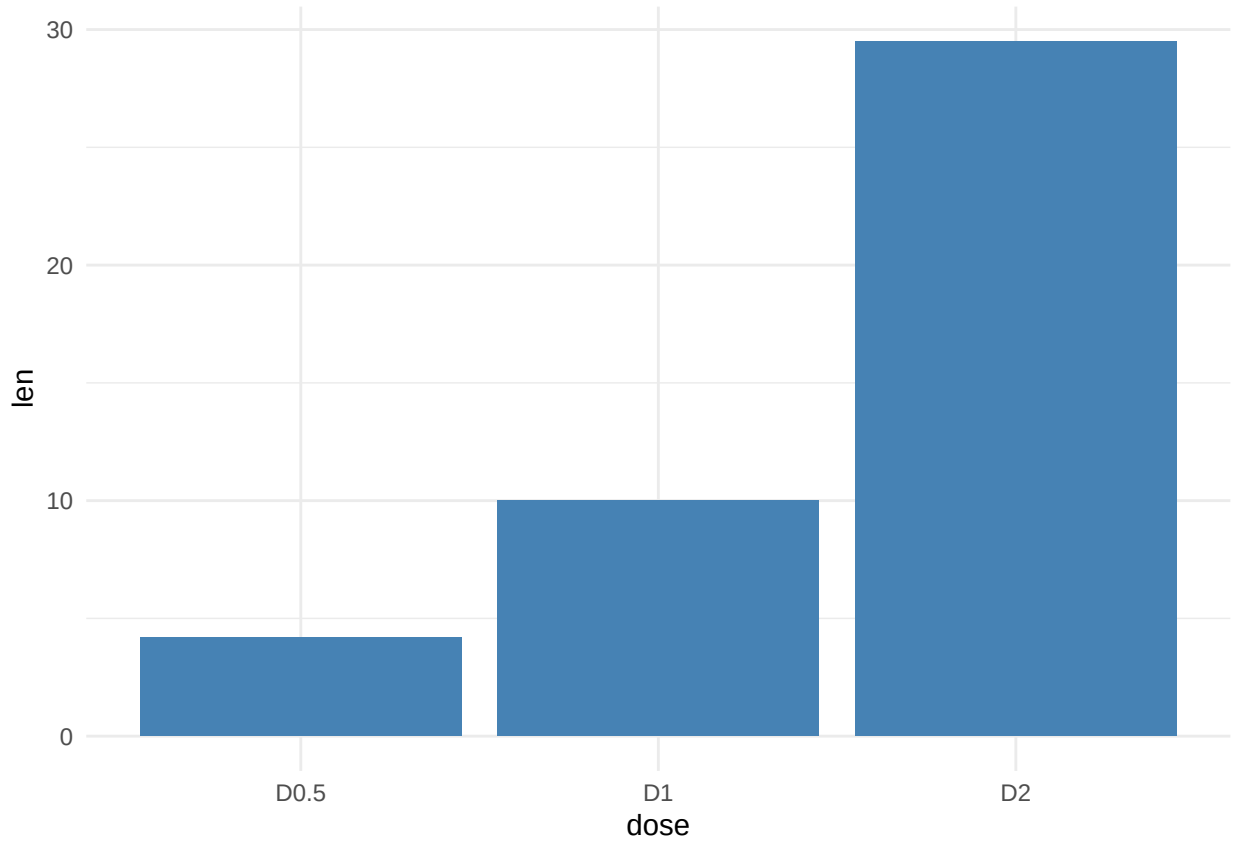
```
# Change the width of bars
ggplot(data=df, aes(x=dose, y=len)) +
  geom_bar(stat="identity", width=0.5)
```




```
# Change colors
ggplot(data=df, aes(x=dose, y=len)) +
  geom_bar(stat="identity", color="blue", fill="white")
```

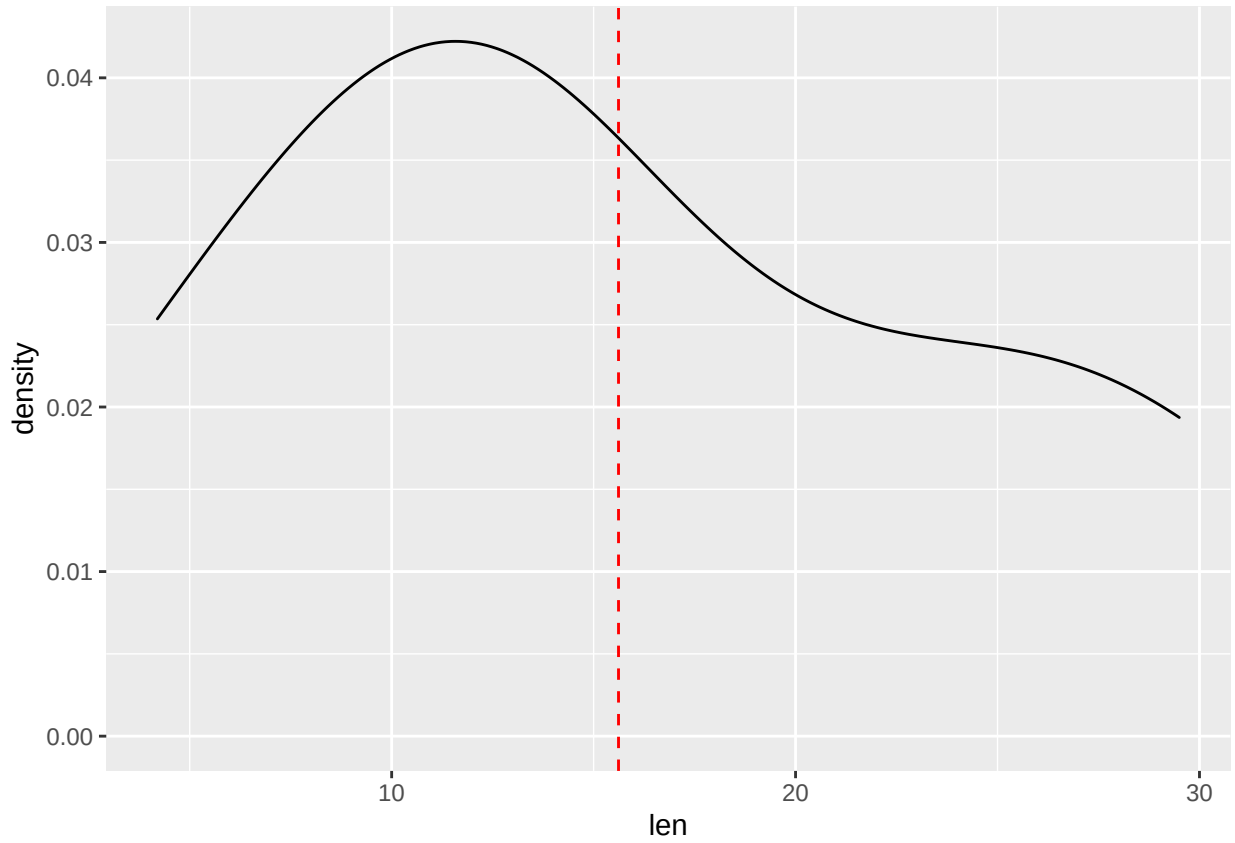



```
# Minimal theme + blue fill color
p<-ggplot(data=df, aes(x=dose, y=len)) +
  geom_bar(stat="identity", fill="steelblue")+
  theme_minimal()
p
```



geom_vline

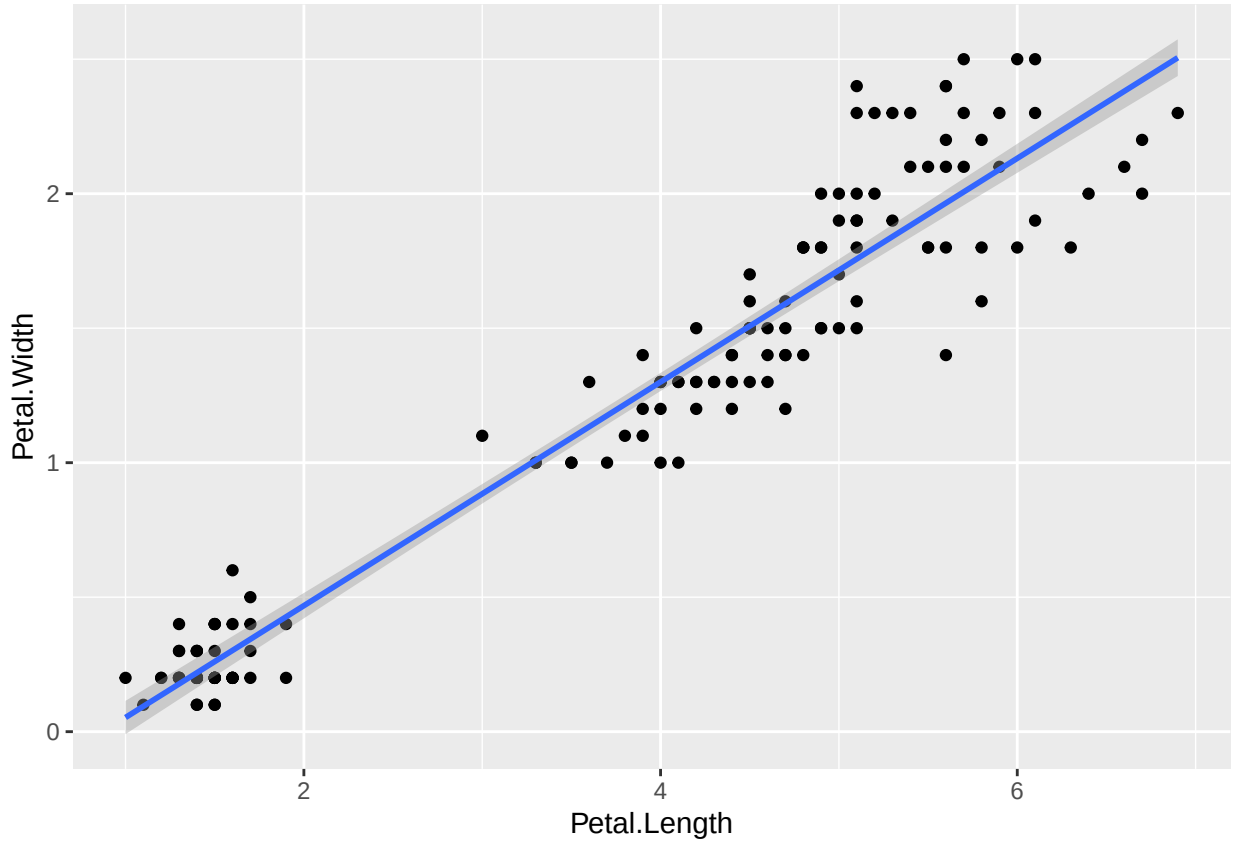
```
df <- data.frame(dose=c("D0.5", "D1", "D2", 'pp', 'kk', 'rr'),
                 len=c(4.2, 10, 29.5, 12, 15, 23))
library(ggplot2)

ggplot(df, aes(len))+
  geom_density()+
  geom_vline(aes(xintercept = mean(len)), col='red', linetype= 'dashed')
```



scatter plot with lm

```
library(ggplot2)

ggplot(iris, aes(Petal.Length, Petal.Width))+
  geom_point()+
  geom_smooth(method = 'lm')
```

```
## `geom_smooth()` using formula 'y ~ x'
```



raincloud plot

```
library(ggdist)
library(tidyverse)
library(tidyquant)
```

```
## Loading required package: lubridate
```

```
##
## Attaching package: 'lubridate'
```

```
## The following objects are masked from 'package:base':
##
##     date, intersect, setdiff, union
```

```
## Loading required package: PerformanceAnalytics
```

```
## Loading required package: xts
```

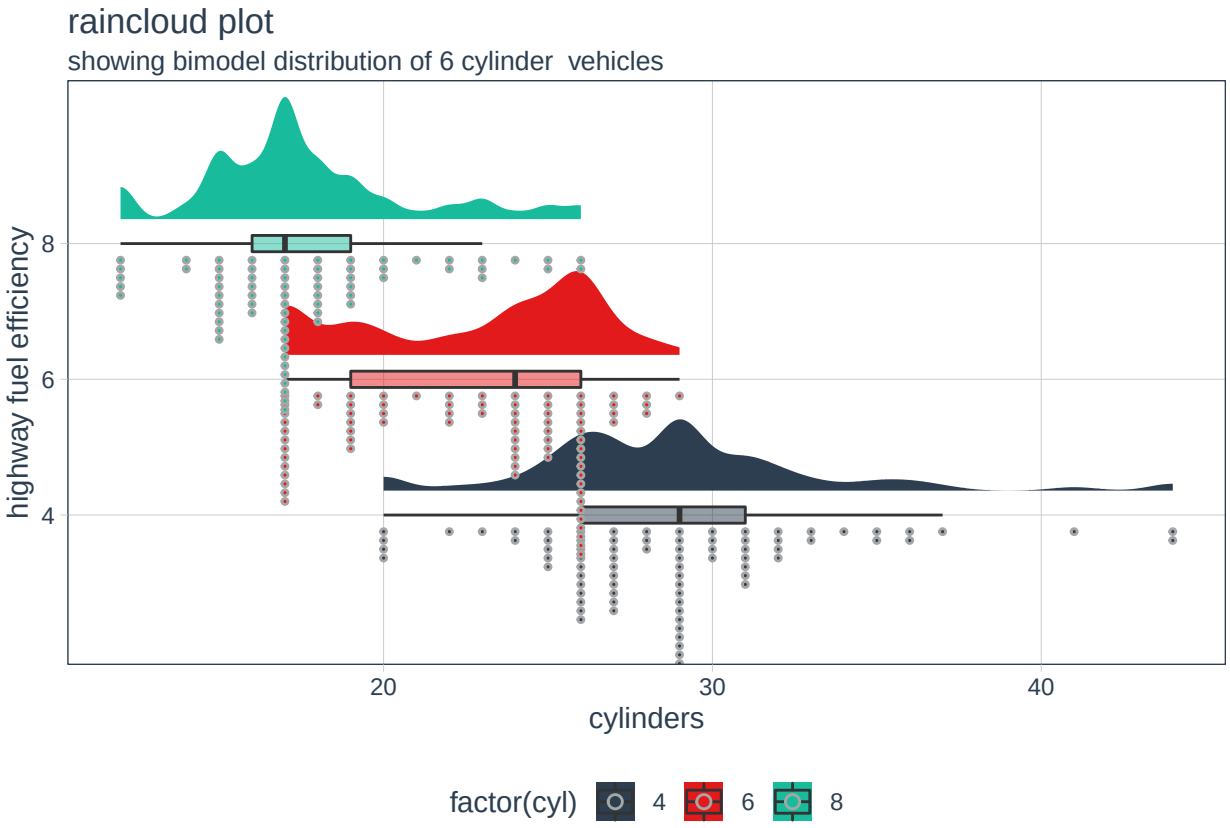
```
## Loading required package: zoo
```

```
##
## Attaching package: 'zoo'
```

```
## The following objects are masked from 'package:base':
##
##     as.Date, as.Date.numeric

##
## Attaching package: 'xts'

## The following objects are masked from 'package:dplyr':
##
##     first, last

##
## Attaching package: 'PerformanceAnalytics'

## The following object is masked from 'package:graphics':
##
##     legend

## Loading required package: quantmod

## Loading required package: TTR

## Registered S3 method overwritten by 'quantmod':
##   method            from
##   as.zoo.data.frame zoo
```

```
mpg %>% filter(cyl %in% c(4,6,8)) %>%
  ggplot(aes( x= factor(cyl), y= hwy, fill=factor(cyl)))+
# add half violin from `ggdist` package
ggdist::stat_halfeye(
  # custom bandwidth
  adjust = 0.5,
  # move geom to right
  justification= -0.2,
  # remove slab interval
  .width = 0,
  point_color= NA
)+
  # add boxplot
  geom_boxplot(
    width= 0.12,
    # remove outliers
    outlier.colour = NA,
    alpha= 0.5
  )+
  # add dot plots from `ggdist` package
  ggdist::stat_dots(
    #orientation of the plot
    side= 'left',
    # move geom to the left
    justification= 1.1,
    # adjust grouping of observation
```

```
  binwidth=0.25
)+
# adjust theme
scale_fill_tq()+
theme_tq()+
labs(
  title= 'raincloud plot',
  subtitle= 'showing bimodel distribution of 6 cylinder  vehicles',
  x= 'highway fuel efficiency',
  y= 'cylinders'
)+
coord_flip()
```

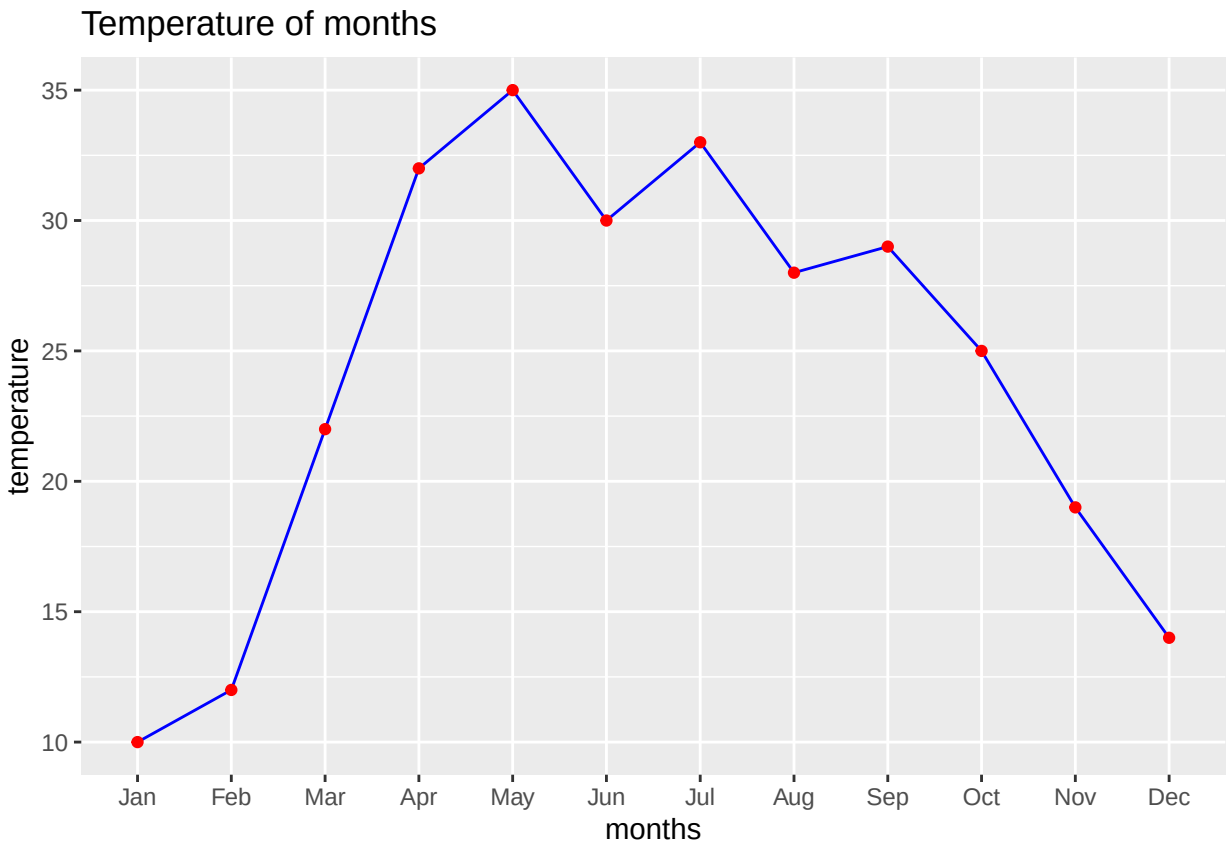


months

```
library(lubridate)
months <- seq(month(1:12)) # make moths
months <- month.abb[months] # make abbriviations
temperature <- c(10,12,22,32,35,30,33,28,29,25,19,14)
myframe <- data.frame(months,temperature) # creating a new data frame

library(tidyverse)
glimpse(myframe)
```

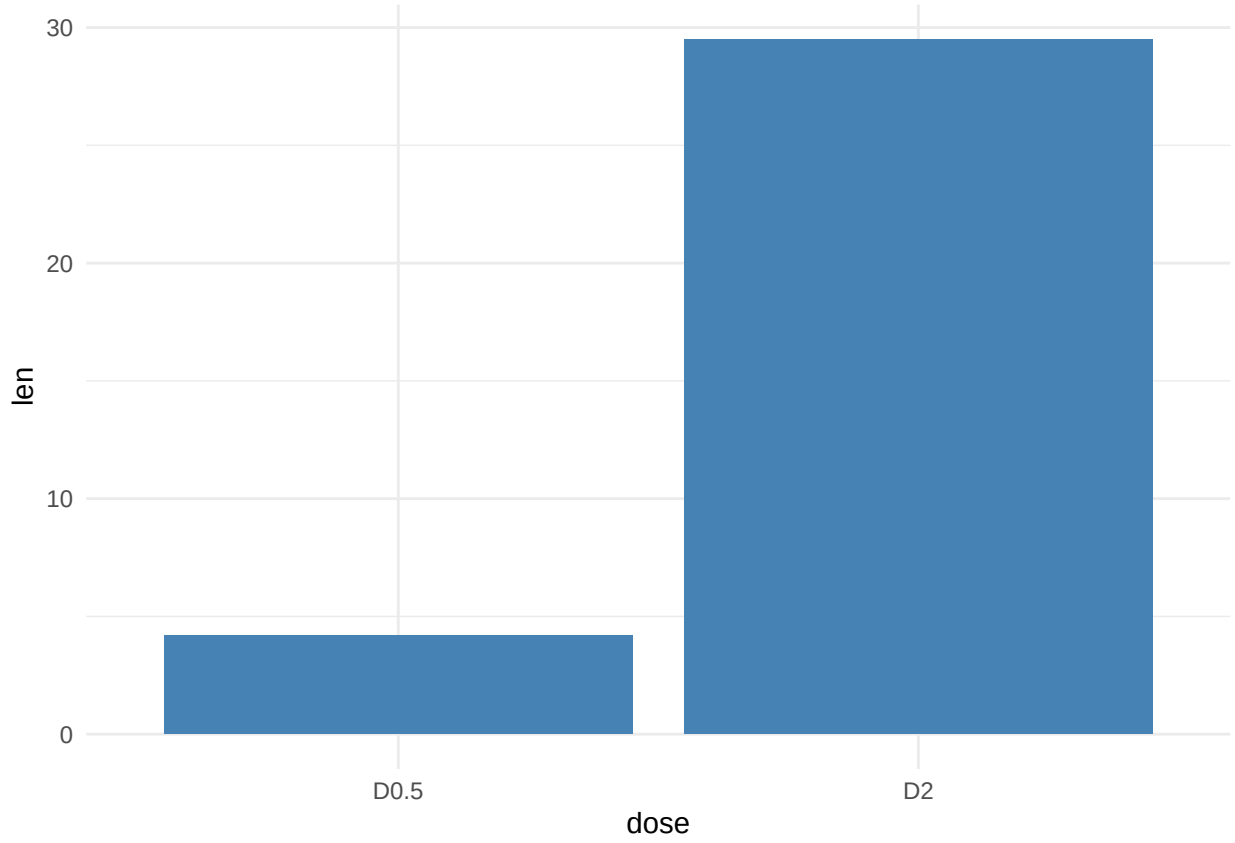
```
## Rows: 12
## Columns: 2
## $ months      <chr> "Jan", "Feb", "Mar", "Apr", "May", "Jun", "Jul", "Aug", "S~
## $ temperature <dbl> 10, 12, 22, 32, 35, 30, 33, 28, 29, 25, 19, 14
```

```
library(ggplot2)
ggplot(myframe, aes(x=months, y=temperature, group=1))+
  geom_line(col='blue')+
  geom_point(col='red')+
  ggtitle('Temperature of months')+
  scale_x_discrete(limits = month.abb) # this will order months on the x axis
```

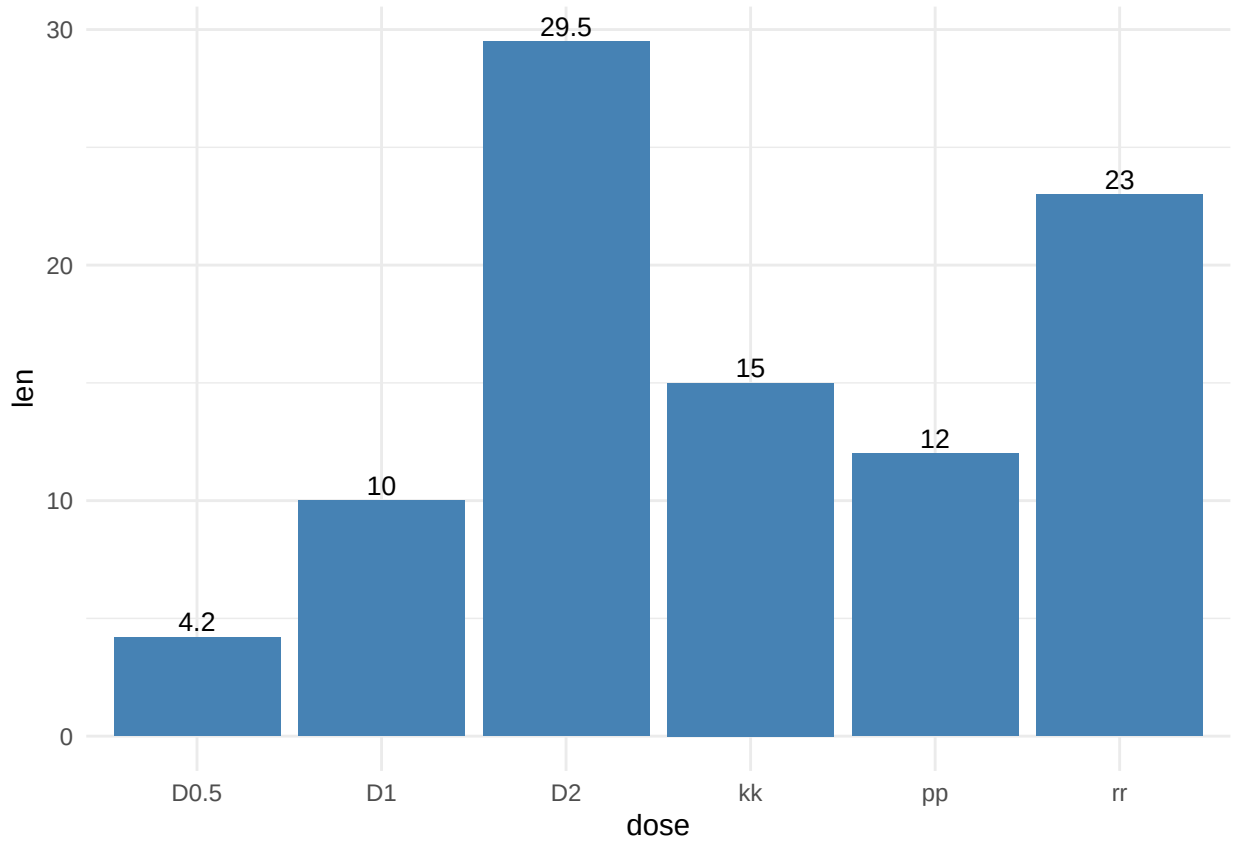



```
p + scale_x_discrete(limits=c("D0.5", "D2"))
```

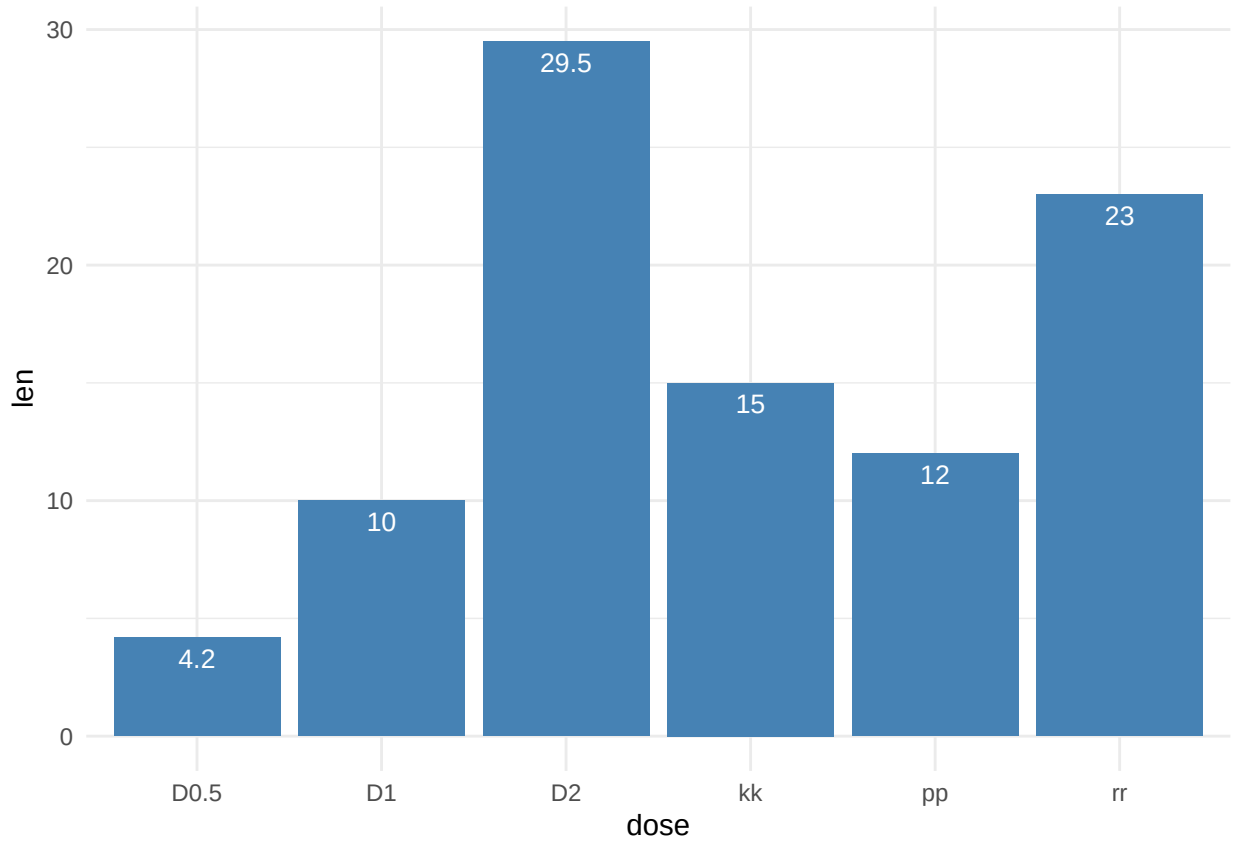
```
## Warning: Removed 1 rows containing missing values (position_stack).
```




```
# Outside bars
ggplot(data=df, aes(x=dose, y=len)) +
  geom_bar(stat="identity", fill="steelblue")+
  geom_text(aes(label=len), vjust=-0.3, size=3.5)+
  theme_minimal()
```

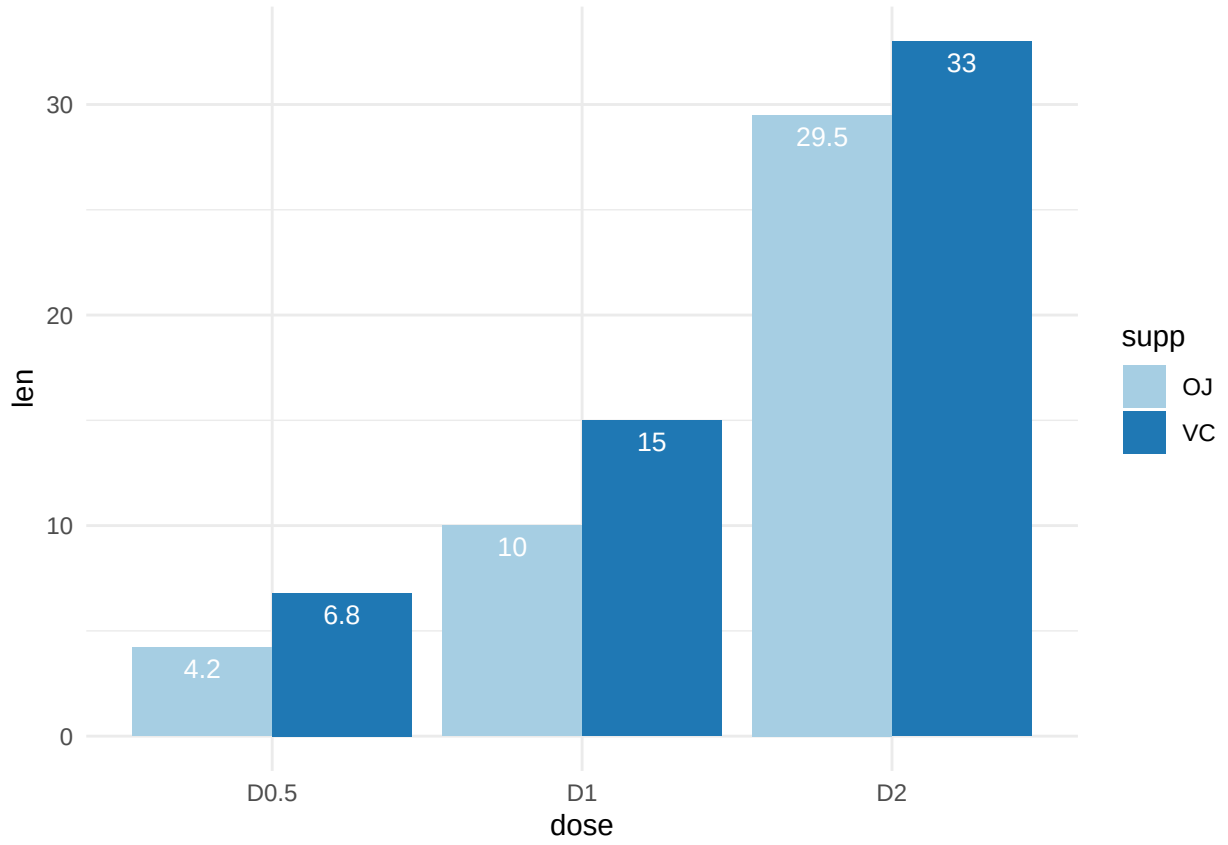



```
# Inside bars
ggplot(data=df, aes(x=dose, y=len)) +
  geom_bar(stat="identity", fill="steelblue")+
  geom_text(aes(label=len), vjust=1.6, color="white", size=3.5)+
  theme_minimal()
```

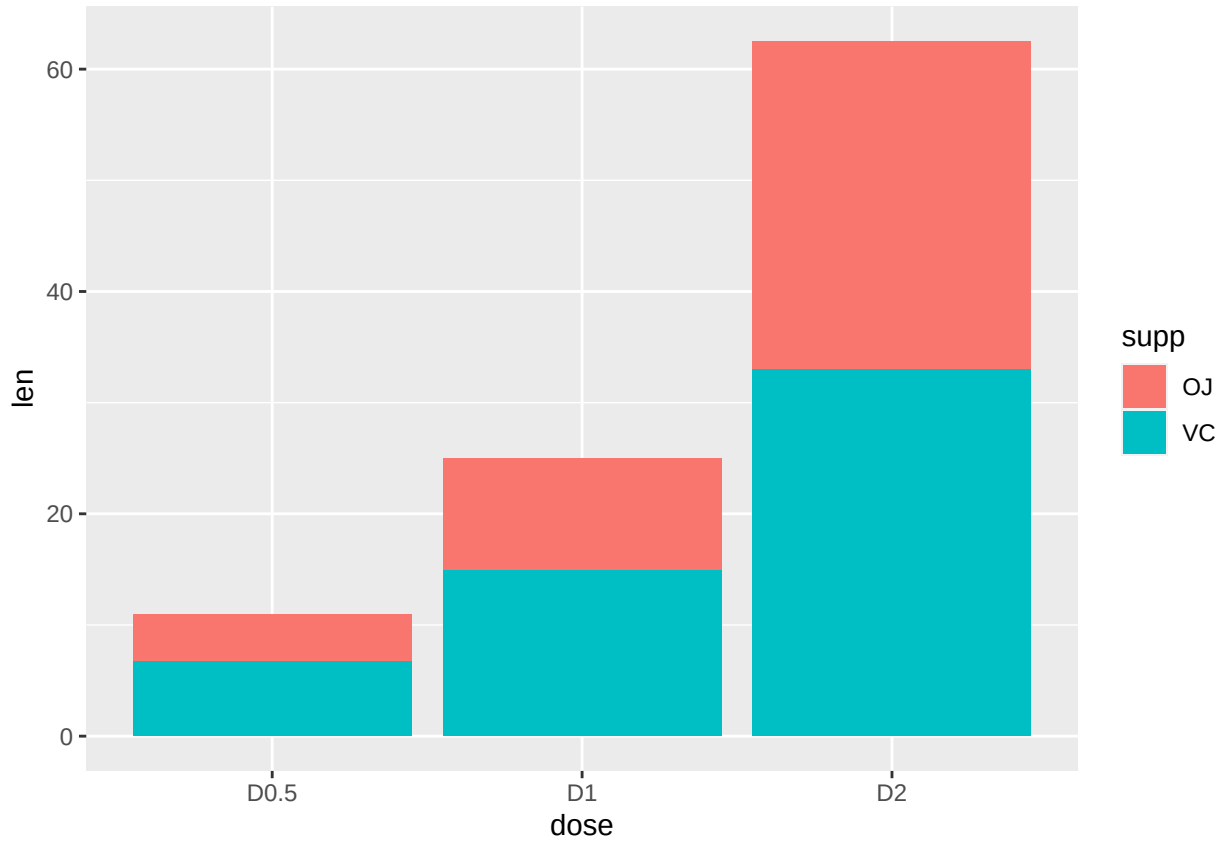



```
df2 <- data.frame(supp=rep(c("VC", "OJ"), each=3),
                  dose=rep(c("D0.5", "D1", "D2"),2),
                  len=c(6.8, 15, 33, 4.2, 10, 29.5))
```

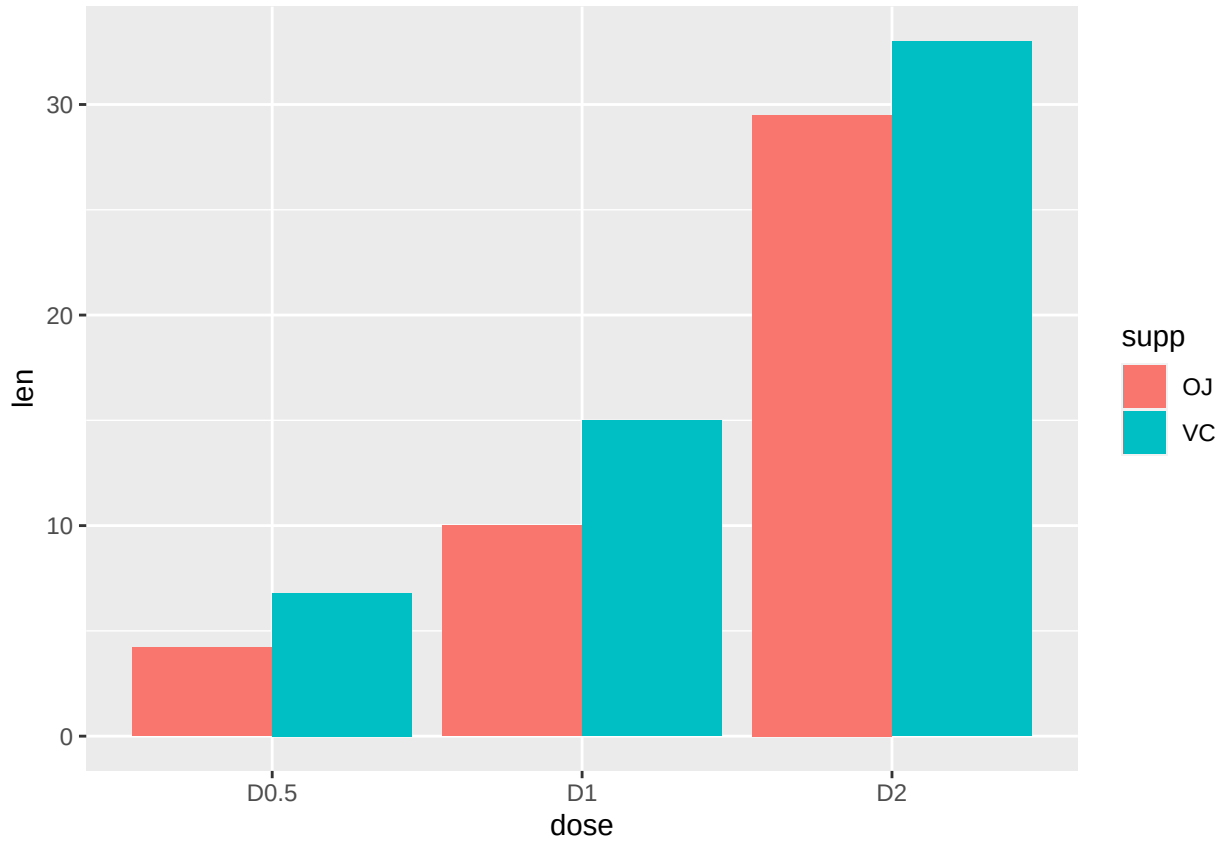
```
ggplot(data=df2, aes(x=dose, y=len, fill=supp)) +
  geom_bar(stat="identity", position=position_dodge())+
  geom_text(aes(label=len), vjust=1.6, color="white",
            position = position_dodge(0.9), size=3.5)+
  scale_fill_brewer(palette="Paired")+
  theme_minimal()
```



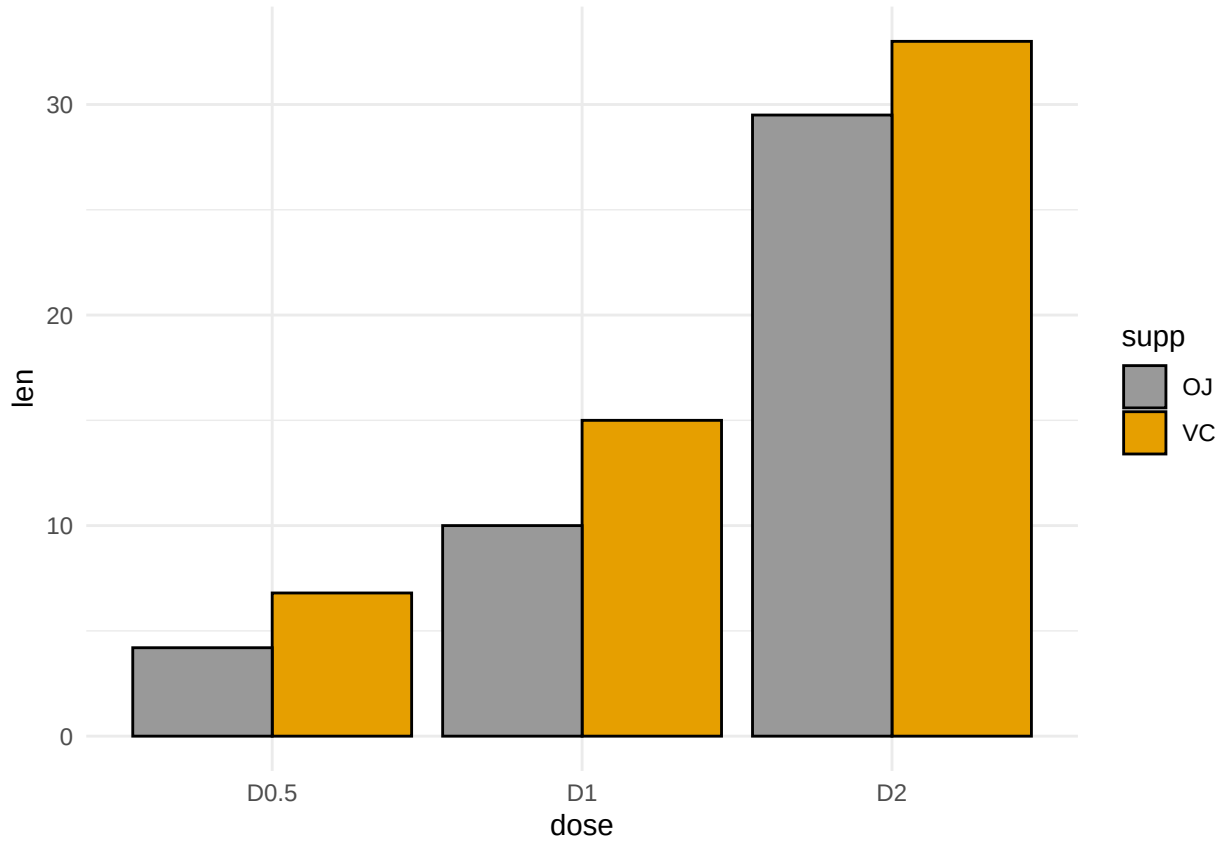

```
# Stacked barplot with multiple groups
ggplot(data=df2, aes(x=dose, y=len, fill=supp)) +
  geom_bar(stat="identity")
```



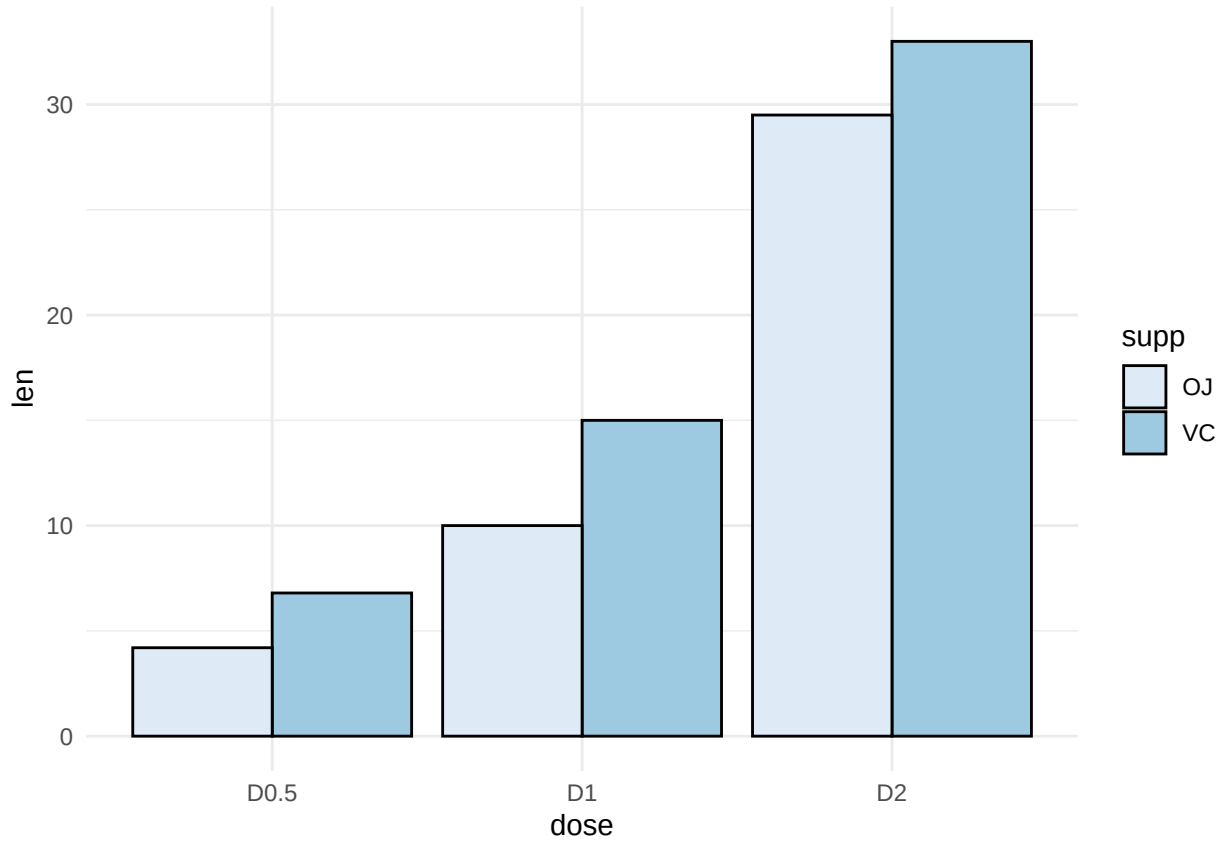

```
# Use position=position_dodge()
ggplot(data=df2, aes(x=dose, y=len, fill=supp)) +
geom_bar(stat="identity", position=position_dodge())
```




```
# Change the colors manually
p <- ggplot(data=df2, aes(x=dose, y=len, fill=supp)) +
geom_bar(stat="identity", color="black", position=position_dodge())+
  theme_minimal()
# Use custom colors
p + scale_fill_manual(values=c('#999999','#E69F00'))
```



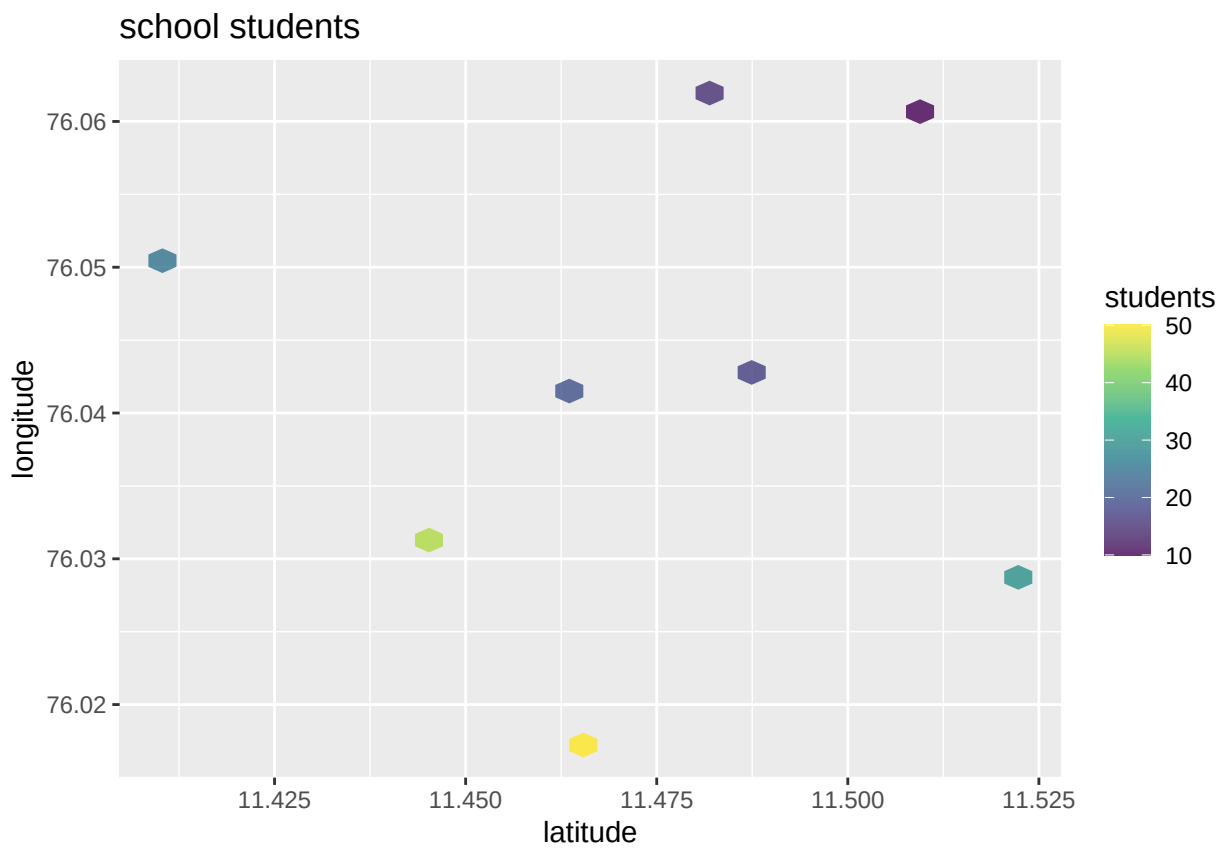

```
# Use brewer color palettes
p + scale_fill_brewer(palette="Blues")
```



hex plot

```
library(tidyverse)
# install.packages("hexbin")
class <- c(rep('10th', 8))
students <- c('10 to 15',
              "15-20",
              "17 to 24",
              "20  to 25",
              "25 to 30",
              "30 to 40",
              "45 to 47",
              '50 to 55')
latitude <- c(11.50897246,
              11.48323136,
              11.48719031,
              11.46366611,
              11.41097322,
              11.52111154,
              11.44491386,
              11.46569568)
longitude <- c(76.06032062,
               76.06192685,
```

```
                76.04266851,
                76.04156575,
                76.05075092,
                76.02846331,
                76.03084141,
                76.01766216)
school <- data.frame(class, students, latitude, longitude)

school %>% mutate(students= parse_number(students)) %>%
  ggplot(aes(latitude, longitude, z= students))+
  stat_summary_hex()+
  scale_fill_viridis_c(alpha= 0.8)+
  labs(fill='students', title = 'school students')
```



Color Palettes

Resources

- https://colorhunt.co/
- https://coolors.co/
- https://colorpalettes.net/
- https://www.canva.com/colors/color-palettes/
- https://color.adobe.com/de/create/color-wheel
- https://mycolor.space/

- http://colormind.io/

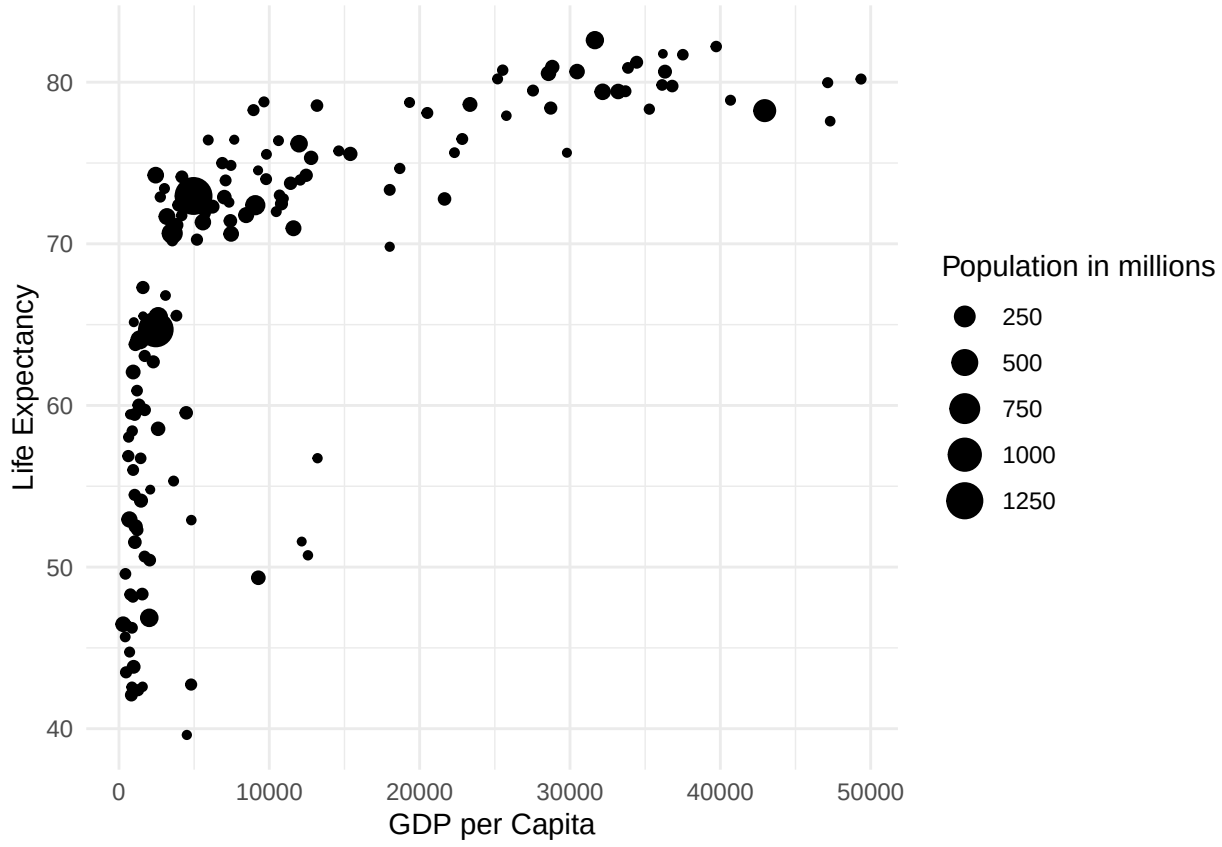
```
#install.packages(c("tidyverse", "gapminder", "MetBrewer"))
```

libraries

```
library(tidyverse)
library(gapminder)
# install.packages('MetBrewer')
library(MetBrewer)
```

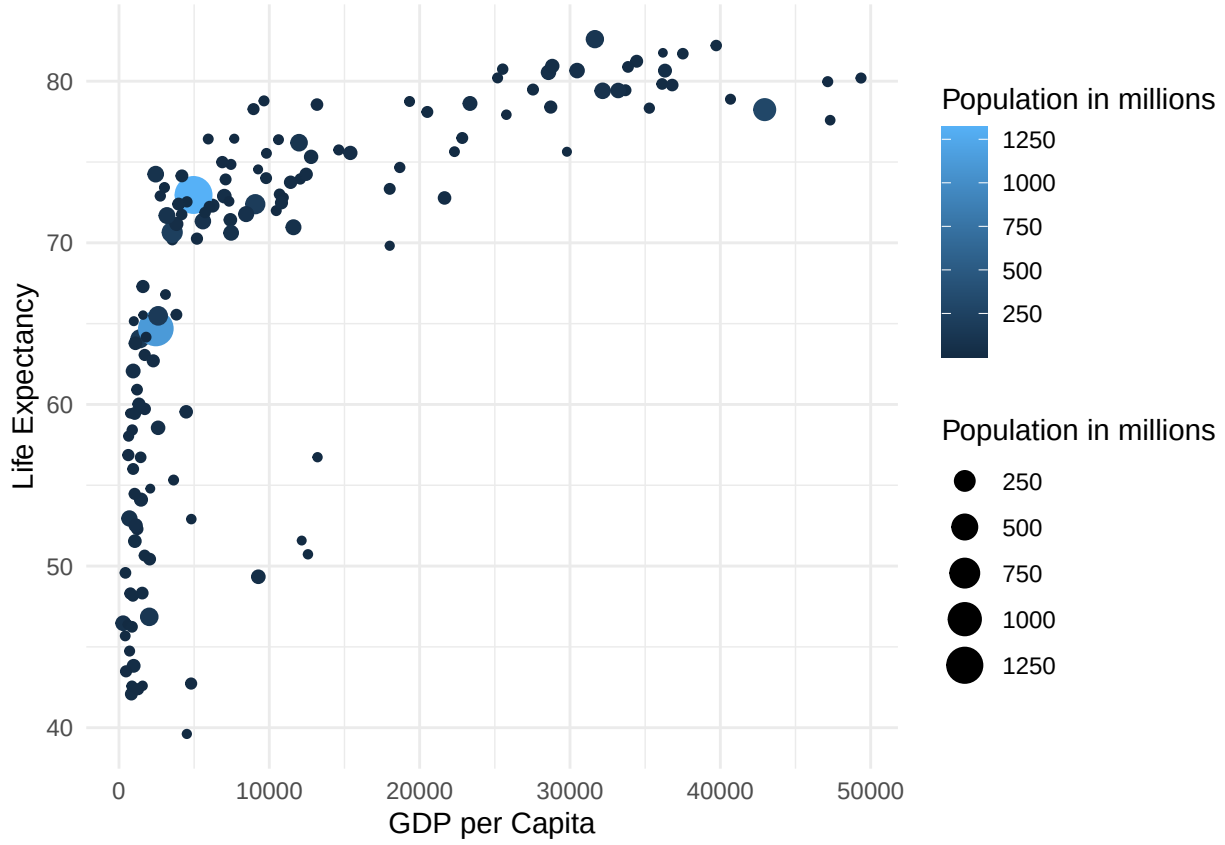
Plot the point plot using GDP per Capita as the x- axis and LE as the y axis. Numerical variable Population to control the size of each point.

```
plot <- gapminder %>%
  filter (year==2007) %>%
  ggplot()+
  labs(x= 'GDP per Capita',
              y= 'Life Expectancy',
       color= 'Population in millions',
       size='Population in millions')+
  theme_minimal()

plot+ geom_point(aes(gdpPercap, lifeExp, size= pop/1000000))
```



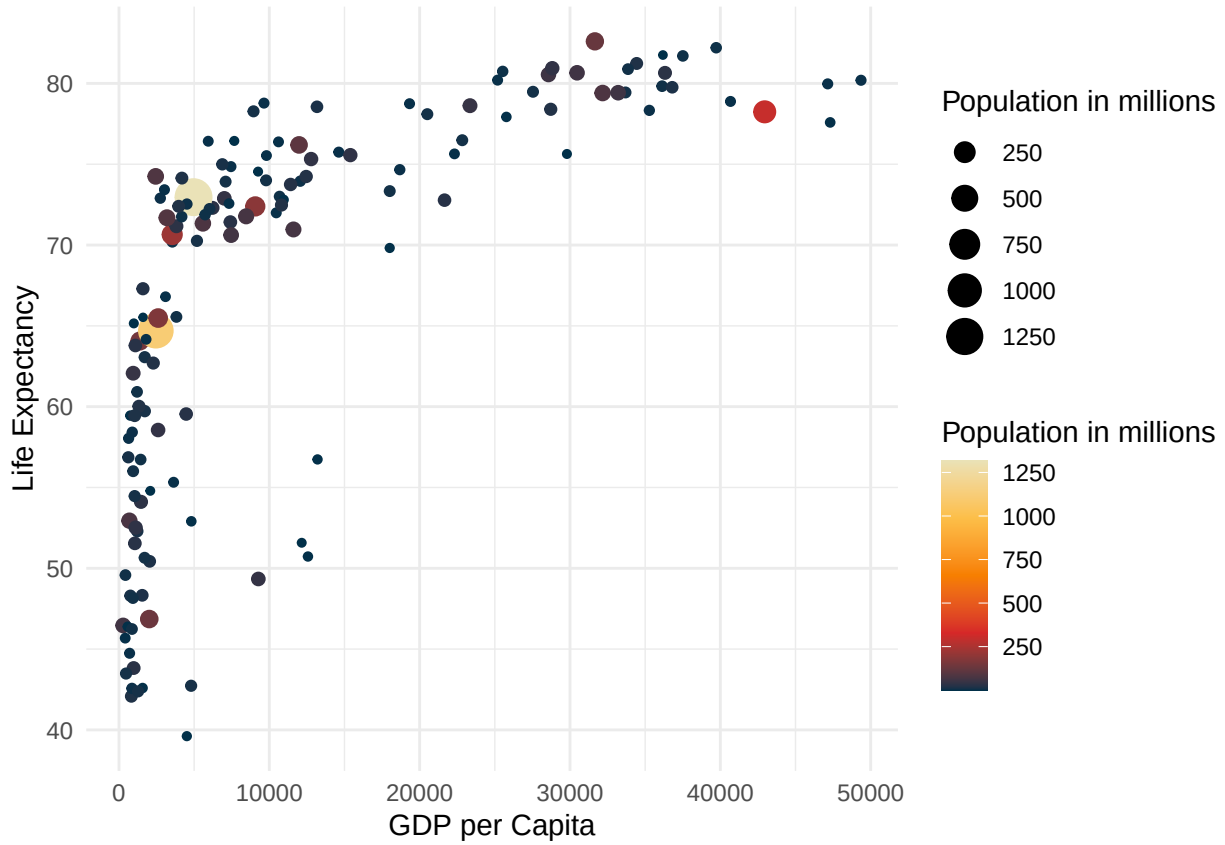
To use color in the plot, assign the Population variable to the color aesthetic. Since nothing is specied, ggplot2 chooses a color spectrum for this numerical variable (shades of blue).

```
plot + geom_point(aes(gdpPercap, lifeExp, size= pop/1000000, color= pop/1000000))
```



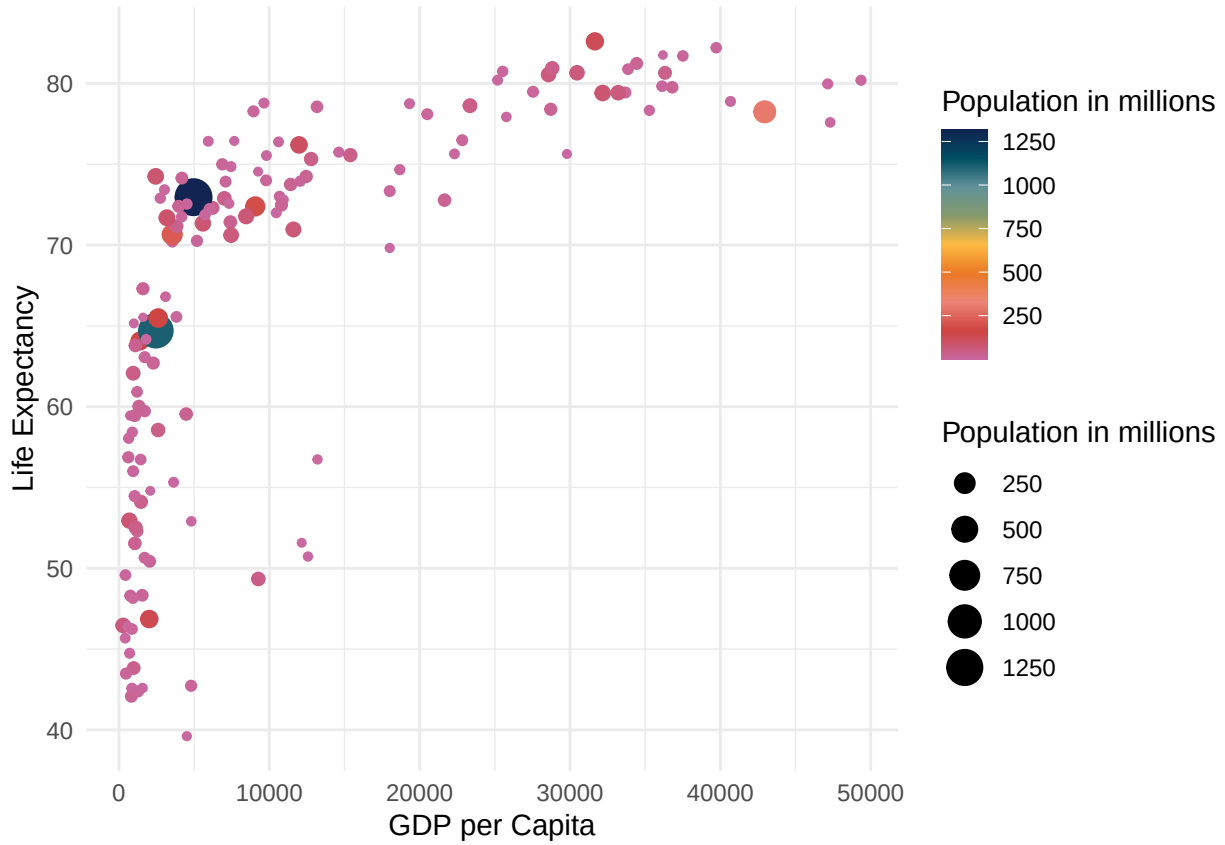
To control the color spectrum, we need to introduce a color scale. In the following plot, we have to provide a vector of hex color values. You would choose this if you got your colors from one of the mentioned above websites.

```
plot + geom_point(aes(gdpPercap, lifeExp, size= pop/1000000, color= pop/1000000))+
  scale_color_gradientn(colors = c("#003049", "#D62828", "#F77F00", "#FCBF49", "#EAE2B7"))
```



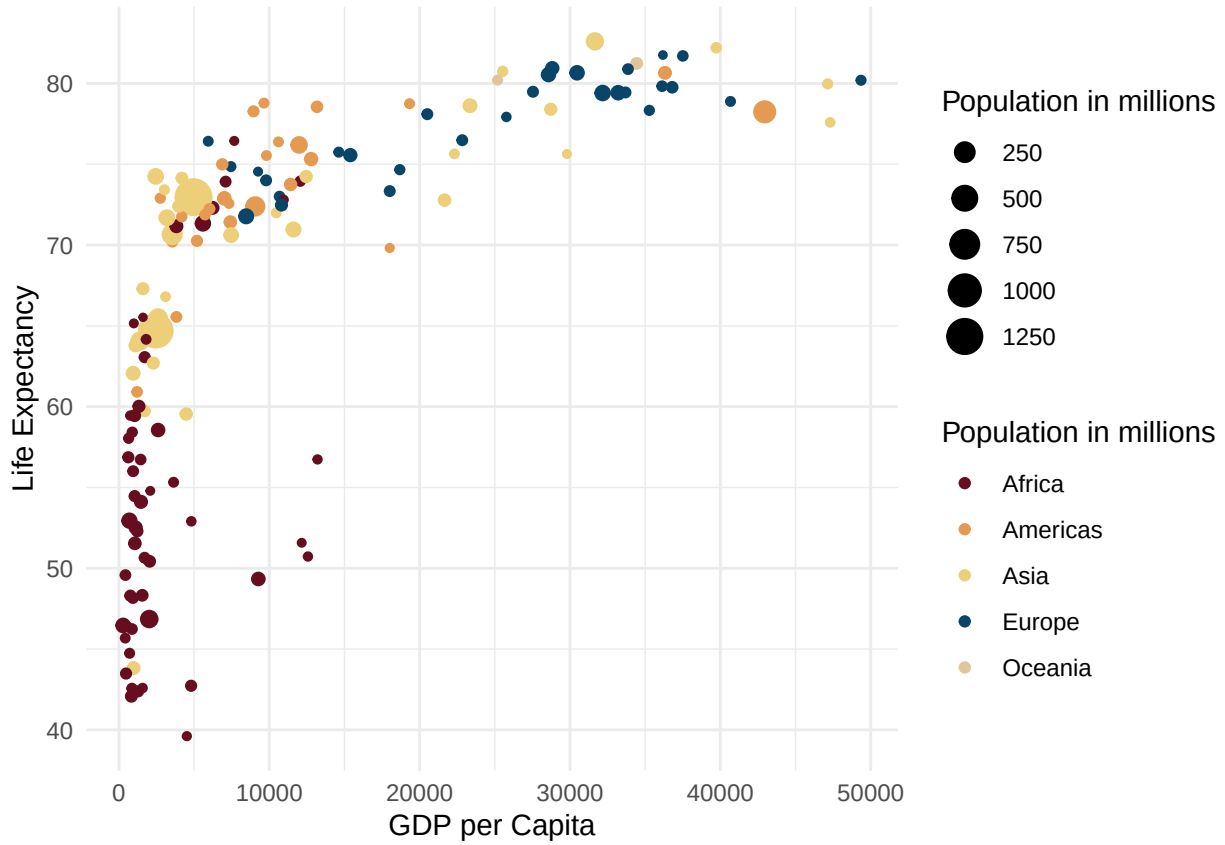
To apply one of the MetBrewer palettes, replace the hex-vector with a MetBrewer function. Within the function call, you provide the palette's name, then several colors, and tell it that we need a continuous palette since it is a numerical variable.

```
plot + geom_point(aes(gdpPercap, lifeExp, size= pop/1000000, color= pop/1000000))+
  scale_color_gradientn(colors = met.brewer('Cross', n=500, type = 'continuous'))
```



You might also want to use color palettes with non-numerical variables. Let us assume we want to apply color to the Continent variable. This implies using a manual color scale and providing a MetBrewer palette.

```
plot + geom_point(aes(gdpPercap, lifeExp, size= pop/1000000, color= continent))+
  scale_color_manual(values = met.brewer('Navajo', 5))
```



Please note if you want to apply color to the fill aesthetic rather than the color aesthetic, consider using the scale_fill_manuel function instead of the scale_color_manuel. This is useful for boxplots or bar charts.

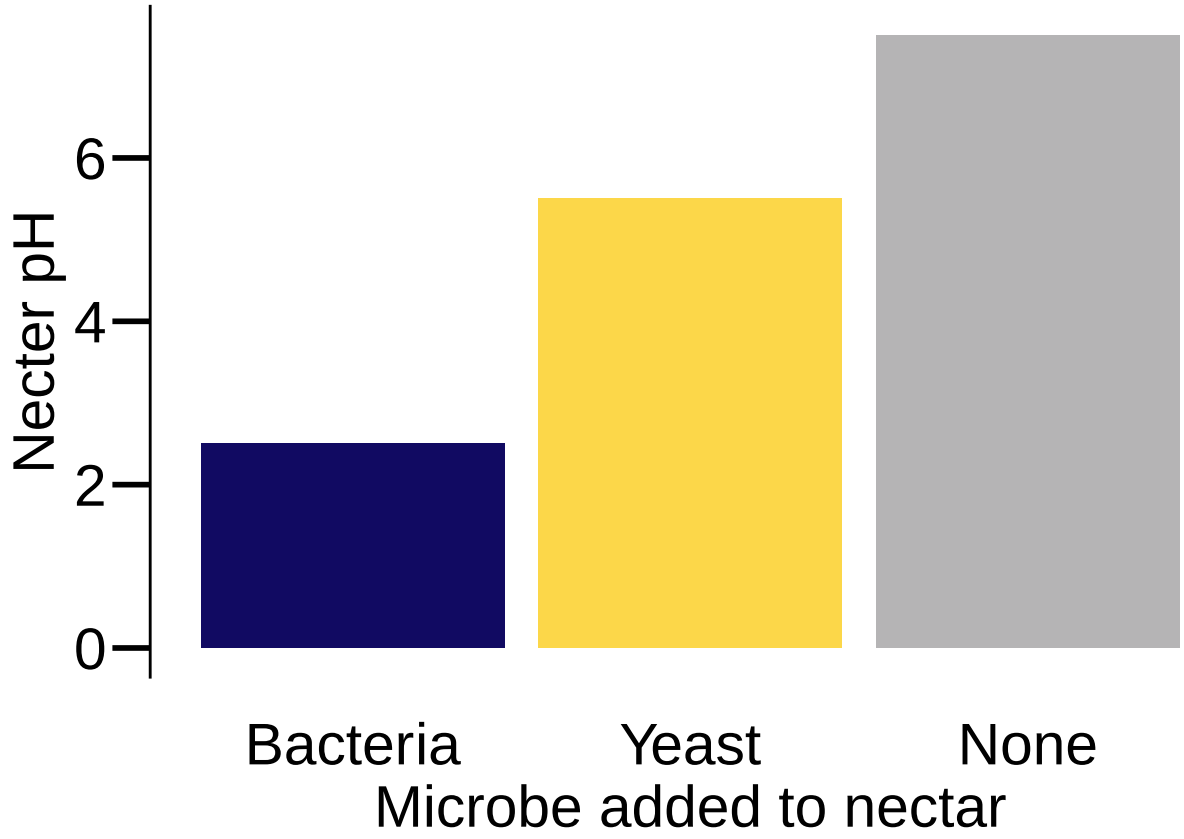
```
box <- gapminder %>%
  filter(gdpPercap< 60000) %>%
  ggplot(aes(continent, gdpPercap, color= year, fill= continent))+
           geom_boxplot()+
  theme_minimal()+ labs( x= 'Continent', y= 'GDP per Capita', fill= 'Continent')
```

scale fill manual

themes

```
df <- data.frame(
    Names=as.factor(c('Bacteria', 'Yeast', 'None')),
    Quantity=c(2.5, 5.5, 7.5))

library(ggplot2)
library(tidyverse)
df <- df %>% mutate(Names= fct_relevel(Names, c('Bacteria', 'Yeast', 'None')))

ggplot(df, aes(Names, Quantity, fill= Names))+
```

```
    geom_bar(stat = 'identity')+
    scale_fill_manual(values = c('#110a62', '#fcd749','#b5b4b5'))+
  labs(y='Necter pH', x= 'Microbe added to nectar')+
  theme_classic()+
    theme(legend.position = 'none', axis.ticks.x = element_blank())+
  theme(axis.text = element_text(size = 22, color= 'black'))+
theme(axis.line.x = element_blank())+
  theme(axis.ticks = element_line(size = 1, color="black"),
   axis.ticks.length = unit(.5, "cm"))+
  theme(text = element_text(size = 22))
```



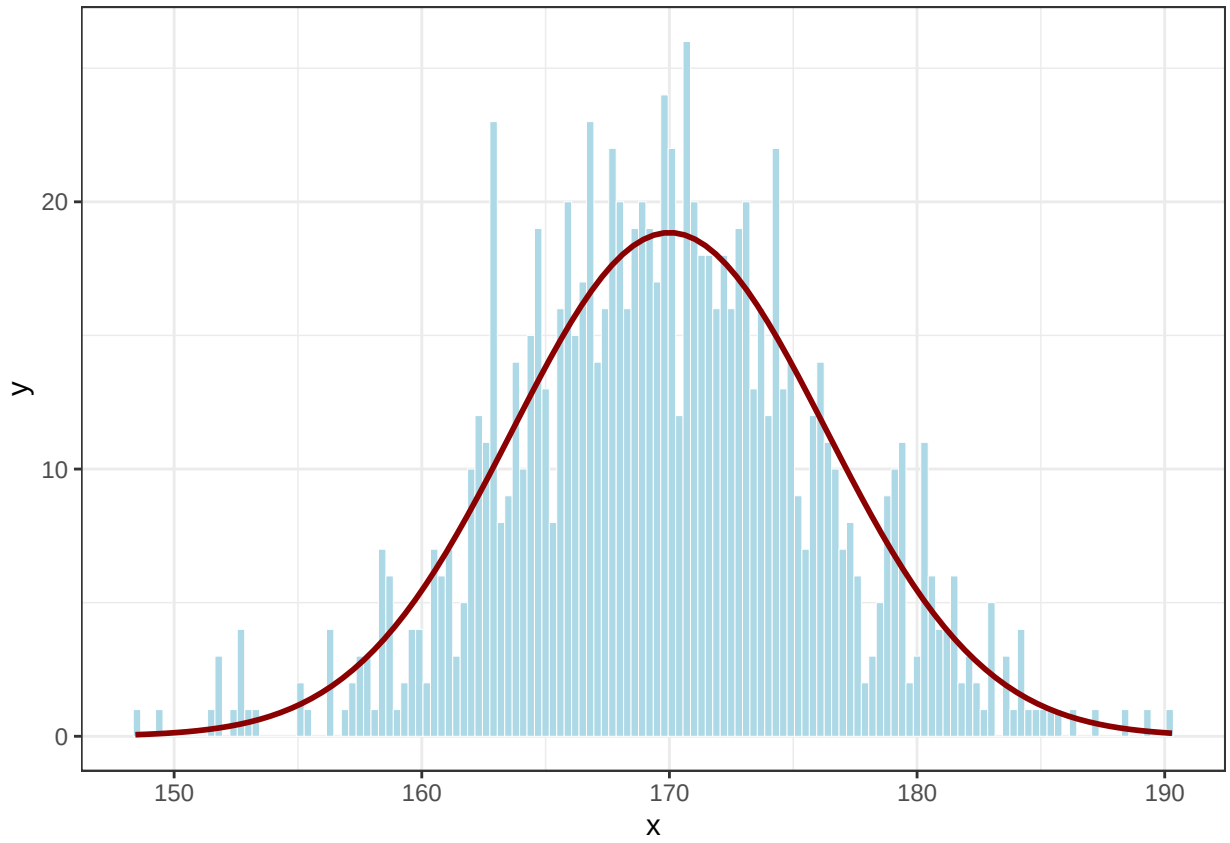
graphics

```
x11() # opne a new window for graphics
graphics.off() # close the new window
```

Normal distribution

Normal distribution, also known as the Gaussian distribution, is a probability distribution that is symmetric about the mean, showing that data near the mean are more frequent in occurrence than data far from the mean.

```r
library(tidyverse)
n = 1000
mean = 170 # cm
sd = 6.35 # cm
binwidth= 0.3
set.seed(1234)
df <- data.frame(x=rnorm(n, mean, sd))
ggplot(df, aes(x = x, mean = mean, sd = sd, binwidth = binwidth, n = n))+
    theme_bw()+
  geom_histogram(binwidth = binwidth,
        colour = "white", fill = "lightblue", size = 0.1)+
stat_function(fun = function(x) dnorm(x, mean = mean, sd = sd) * n * binwidth,
    color = "darkred", size = 1)
```



Functions

dice

```r
dice <- c(1:6)

myluck<- function(x){
  myluck <- sample(dice, size = 1, replace = T)
```

```
  return(myluck)
}

myluck()
```

```
## [1] 2
```

pick a name

```
names <- c('saneesh','appu','sanusha')
who <- function(x){
  who <- sample(names, 1, T)
  return(who)
}

who()
```

```
## [1] "saneesh"
```

function to split

```
df <- data.frame(name=as.factor(c('James Bond', 'Spider Man', 'Iron Man')))
# df <- df %>% separate(name, c('Genus', 'Species'), sep = '([ ])')

shorten <- function(df){
  name_split <- df %>% separate(name, c('Genus', 'Species'), sep = '([ ])')
  print(name_split)
}

shorten(df)
```

```
##    Genus Species
## 1  James    Bond
## 2 Spider     Man
## 3   Iron     Man
```

Rmarkdown

knitr golbal options

to apply to every chunk in the file

inside the `chunk` write `knitr::opts_chunk$set(include= ,echo = , message= , warning= )`

```
# knitr::opts_chunk$set(message = TRUE, echo = TRUE, warning = TRUE)
```

`include:` to show or hide code and results from appearing
`echo:` to show or hide code in the output but shows result
`message` to hide or show the messages generated by the code
`warning:` to show or hide warning generated by the code

these options can be written for individual chunks as well

```
## [1] 5
```

Heading 1

Heading 2

Heading 3

italics
italic

bold
bold

`plot()` to show r code/function
@Saneesh

blockquotes are writtedn after >

> this is a blockquote
> — Saneesh

plain code

```
hello
```

unordered items

- item 1
- item 2
  - sub item 1a
  - sub item 2b

ordered items

1. Item 1
2. Item 2
   - Item 2a # give two spaces before the +
   - Item 2b

writing mathematical functions

adding a link

mathematical notations

by
μ
$\sum$
$a \pm b$
$x = y$
$x > y$
x^2
$x \leq y$
$\sum_{n=1}^{10} n^2$
$x_1 + x_2 + \cdots + x_n$
$|A|$
$A \subset B$
$A \subseteq B$
$A \cup B$
$A \cap B$
$P(A|B)$
α
β
γ
θ
H_2O

table

using `knitr::kable()`

Sepal.Length	Sepal.Width	Petal.Length	Petal.Width	Species
6.3	3.3	6.0	2.5	virginica
6.3	2.9	5.6	1.8	virginica
6.3	2.7	4.9	1.8	virginica
6.3	2.8	5.1	1.5	virginica
6.3	3.4	5.6	2.4	virginica
6.3	2.5	5.0	1.9	virginica