Tidying

Saneesh

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 for pipe `%>%` ctrl+alt+i for new code chunk

syntax

Plain text
end a line with two spaces to start a new paragraph.
italics and *italics* * text * or _ text _ (without gap `*text*`) **bold** and **bold** ** text ** or ___ text ___ (without gap `**text**`) superscript^2 superscript`^2^` ~~strikethrough~~

link to rstudio (`[text]` and without gap `(paste link withhttp://)`)

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 %>%
    head(5)
```

data frame with unequal values 10 and 8

```
##      sex    score
## 1 female 8.998824
## 2 female 9.348690
## 3 female 7.506639
## 4 female 6.881178
## 5 female 9.659900
```

```
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, ~Lenght, "Sydney", 2000, 9, 15,
    12.1213, "Athens", 2004, 8, 13, 12.1212, "Beijing", 2008, 8, 8, 13.212, "London",
    2012, 7, 27, 13.1212, "Rio de Janeiro", 2016, 8, 5, 65)
```

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

tabyl

tabyl

mutate round

```
# run previous code chunk
library(gt)
years %>%
    gt()
```

Location	Year	Month	Day	Lenght
Sydney	2000	9	15	12.1213
Athens	2004	8	13	12.1212
Beijing	2008	8	8	13.2120
London	2012	7	27	13.1212
Rio de Janeiro	2016	8	5	65.0000

```
years %>%
    mutate(Lenght = round(Lenght, 2)) %>%
    gt() %>%
    tab_options(column_labels.font.size = 11, column_labels.font.weight = "bold",
        table.font.size = 10, ) %>%
    opt_table_outline(style = "solid", width = px(2))
```

Location	Year	Month	Day	Lenght
Sydney	2000	9	15	12.12
Athens	2004	8	13	12.12
Beijing	2008	8	8	13.21
London	2012	7	27	13.12
Rio de Janeiro	2016	8	5	65.00

```
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()
```

drop na

see spread & gather

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.
## This warning is displayed once every 8 hours.
## Call 'lifecycle::last_lifecycle_warnings()' to see where this warning was
## generated.
```

```
## # 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
```

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 name to a nameless column

```
library(tidyverse)
mtcars <- mtcars %>%
    as_tibble(rownames = "cars")
```

add column

```
library(tibble)
iris %>%
    add_column(ob_no = 1:150) %>%
    head(5)
```

```
##   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
```

```
iris %>%
    as_tibble() %>%
    head(3)
```

```
## # A tibble: 3 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
```

```
library(gapminder)
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") %>%
    head(3)
```

```
## # A tibble: 3 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.
```

convert numeric values to a binary (Yes/No)

To convert all non-zero numeric values to "Yes" to convert zero values to "No"

```
df <- data.frame(name = c("saneesh", "sanusha", "appu", "jaru"), sex = c(2, 0, 5,
    8))
df
```

```
##      name sex
```

```
## 1 saneesh   2
## 2 sanusha   0
## 3    appu   5
## 4    jaru   8
```

```
# convert numeric values to 'Yes'
df %>%
    mutate(sex1 = ifelse(sex != 0, "Yes", "No"))
```

```
##      name sex sex1
## 1 saneesh   2  Yes
## 2 sanusha   0   No
## 3    appu   5  Yes
## 4    jaru   8  Yes
```

```
df %>%
    mutate(sex1 = ifelse(sex != 0, "Male", "Female"))
```

```
##      name sex   sex1
## 1 saneesh   2   Male
## 2 sanusha   0 Female
## 3    appu   5   Male
## 4    jaru   8   Male
```

The `ifelse()` function is used to check whether each value in the "sex" column is non-zero. If it is, the value is replaced with "Yes". If not, the value is replaced with "No".

select

```
gapminder %>%
    select(year, country, gdpPercap) %>%
    head(3)
```

```
## # A tibble: 3 x 3
##    year country     gdpPercap
##   <int> <fct>           <dbl>
## 1  1952 Afghanistan      779.
## 2  1957 Afghanistan      821.
## 3  1962 Afghanistan      853.
```

```
msleep %>%
    select(starts_with("sleep")) %>%
    head(3)
```

```
## # A tibble: 3 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
```

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) %>%
    head(3)
```

```
## # A tibble: 3 x 3
##    year country lifeExp
##   <int> <fct>     <dbl>
## 1  1952 Eritrea    35.9
## 2  1957 Eritrea    38.0
## 3  1962 Eritrea    40.2
```

```
gapminder %>%
    filter(country == "Canada") %>%
    head(3)  # from gapminder data filter country Canada and show only 2 observations
```

```
## # 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 except Oman
```

```
## # 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~
```

filter multiple

```
iris %>%
    select(Species) %>%
    distinct(Species) %>%
    filter(Species %in% c("setosa", "versicolor")) %>%
    head(3)
```

```
##      Species
## 1     setosa
## 2 versicolor
```

filter multipe

using a vector, save the names as a vector and give it to `%in%`

```
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.  Column
# 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
```

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~
```

filter matching

```
library(tidyverse)
mtcars <- mtcars %>%
    rownames_to_column
mtcars %>%
    filter(str_detect(rowname, "Merc")) %>%
    head(3)  # filter only 'Merc'
```

```
## # A tibble: 0 x 13
## # i 13 variables: rowname <chr>, cars <chr>, mpg <dbl>, cyl <dbl>, disp <dbl>,
## #   hp <dbl>, drat <dbl>, wt <dbl>, qsec <dbl>, vs <dbl>, am <dbl>, gear <dbl>,
## #   carb <dbl>
```

```
mtcars %>%
    filter(!str_detect(rowname, "Merc")) %>%
    head(3)  # filter everything except 'Merc'
```

```
## # A tibble: 3 x 13
##   rowname cars         mpg   cyl  disp    hp  drat    wt  qsec    vs    am  gear
##   <chr>   <chr>      <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>
## 1 1       Mazda RX4   21       6   160   110  3.9   2.62  16.5     0     1     4
## 2 2       Mazda RX4~  21       6   160   110  3.9   2.88  17.0     0     1     4
## 3 3       Datsun 710  22.8     4   108    93  3.85  2.32  18.6     1     1     4
## # i 1 more variable: carb <dbl>
```

filter distinct

To remove or exclude all entries in the “name” column of your data frame that have 1 in the “pref” column, you can use the `filter()` and `distinct()` functions from the dplyr

```
df <- data.frame(name = c("a", "a", "b", "c", "d", "a", "d"), pref = c(1, 2, 2, 1,
    3, 4, 1))

df
```

```
##   name pref
## 1    a    1
## 2    a    2
## 3    b    2
## 4    c    1
## 5    d    3
## 6    a    4
## 7    d    1
```

```
df %>%
    group_by(name) %>%
    filter(!any(pref == 1)) %>%
    ungroup()
```

```
## # A tibble: 1 x 2
##   name   pref
##   <chr> <dbl>
## 1 b         2
```

or, if you have multiple rows with the same name but different values in the "pref" column, the code above will remove all rows with that name if any of them have 1 in the "pref" column. If you want to remove only the rows with 1 in the "pref" column, but keep the other rows with the same name, you can modify the code as follows:

```
df %>%
    group_by(name) %>%
    filter(!any(pref == 1)) %>%
    ungroup()
```

```
## # A tibble: 1 x 2
##   name   pref
##   <chr> <dbl>
## 1 b         2
```

pull

```
iris %>%
    pull(Species) %>%
    head(3)  # returns vector values
```

```
## [1] setosa setosa setosa
## Levels: setosa versicolor virginica
```

```
iris %>%
    select(Species) %>%
    head(3)  # returns a table with one column
```

```
##   Species
## 1  setosa
## 2  setosa
## 3  setosa
```

```
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") %>%
    head(4)
```

```
## # A tibble: 4 x 2
##   country  year
##   <fct>   <int>
## 1 Canada   1982
## 2 Canada   1987
## 3 Canada   1992
## 4 Canada   1997
```

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

```
## # 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.
```

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) %>%
    head(3)
```

```
## # A tibble: 3 x 2
##   country    meanLE
##   <fct>       <dbl>
## 1 Swaziland    39.6
## 2 Mozambique   42.1
## 3 Zambia       42.4
```

```
gapminder %>%
    group_by(country) %>%
    summarise(minLE = min(lifeExp)) %>%
    arrange(minLE, decreasing = FALSE) %>%
    head(3)
```

```
## # A tibble: 3 x 2
##   country     minLE
##   <fct>       <dbl>
## 1 Rwanda       23.6
## 2 Afghanistan  28.8
## 3 Gambia       30
```

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
```

```
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
```

grouping with conditions

If we want make a 'new column' with values from 'number' only if 'sp.name' 'a' or any other values has the following responses 'young' and 'adult', if not enter 0 in the 'new column'.

You need to have groups with any of stage == "young" & "adult" (group level conditions) and stage == "adult" (row-level condition):

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))
```

```
## Warning: Returning more (or less) than 1 row per `summarise()` group was deprecated in
## dplyr 1.1.0.
## i Please use `reframe()` instead.
## i When switching from `summarise()` to `reframe()`, remember that `reframe()`
##   always returns an ungrouped data frame and adjust accordingly.
## Call `lifecycle::last_lifecycle_warnings()` to see where this warning was
## generated.
```

```
## # 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.
```

remove duplicates from a column and summarise

```
df <- data.frame(name = c("a", "a", "b", "c"), seedling = c(1, 0, 1, 0), adult = c(0,
    5, 0, 1))

df_new <- df %>%
    group_by(name) %>%
    summarise(seedling = max(seedling, 0), adult = max(adult, 0)) %>%
    ungroup()
```

count/summarize

count name column

```
iris %>%
    count(Species, name = "how many")
```

```
##      Species how many
## 1     setosa       50
## 2 versicolor       50
## 3  virginica       50
```

```
mtcars %>%
    count(am, name = "number") %>%
    as_tibble()
```

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

```
mtcars %>%
    count(gear, name = "no. gear")
```

```
## # A tibble: 3 x 2
##    gear `no. gear`
##   <dbl>      <int>
## 1     3         15
## 2     4         12
## 3     5          5
```

```
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, name = "#sites")
```

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

count within years

```
year <-  c(rep(2000, 4),
           rep(2001, 4),
           rep(2002, 4)
           )
site <- c(rep('a', 3),
          rep('b', 3),
          rep('c', 3),
          rep('d', 3)
          )

fire <- c('yes', 'no', 'yes',
          'yes', 'no', 'no',
          'yes', 'yes', 'yes',
          'yes', 'yes', 'yes')

df <- data.frame(year, site, fire)

df %>%
  group_by(site) %>%
  summarize(
    Burnt_once = sum(fire == "yes" &
                       year %in% c(2000, 2001, 2002)) == 1, # in these years look for 1 'yes'
    Burnt_twice = sum(fire == "yes" &
                        year %in% c(2000, 2001, 2002)) == 2, # in these years look for 2 'yes'
    Burnt_thrice = sum(fire == "yes" &
                         year %in% c(2000, 2001, 2002)) == 3 # in these years look for 3 'yes'
  ) %>% # returns a logical vector
```

```
  mutate(
    Burnt_once = ifelse(Burnt_once, 1, 0),
    Burnt_twice = ifelse(Burnt_twice, 1, 0),
    Burnt_thrice = ifelse(Burnt_thrice, 1, 0)
  ) %>% # convert logical response to numeric
  summarise( # summarise data
    across( # specifycolumns
      where(is.numeric), # select columns with numeric ones
      ~ sum( # selected column using the ~ formula notation
        .x, # for each selected columns
        na.rm = TRUE))) # remove any missing values before calculating the sum
```

```
## # A tibble: 1 x 3
##   Burnt_once Burnt_twice Burnt_thrice
##        <dbl>       <dbl>        <dbl>
## 1          1           1            2
```

case when new column

```
library(dplyr)
library(stringr)
feedback <- c("good_book", "good_read", "for knowledge", "adventure")
book <- c("Ramayana", "Bible", "Encyclopedia", "Mbharatha")

df <- data.frame(book, feedback)

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 <NA>
## 4 Mbharatha    <NA>
```

separate

text to columns

```
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
```

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

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

unite

```
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

```
df1 <- data.frame(id = c(1:4), films = c("Spider_man", "James_bond", "Iron_man",
    "Bat_man"))

df2 <- data.frame(id = c(1:4), country = rep("us", 4))
df3 <- left_join(df1, df2, by = "id")
```

spread & gather

We are making a wide format from long format in the first example. The second example is to make a long format from wide.

```
# the following is already in long format
classdata <- data.frame(
  studentname = c('captian', 'ant', 'james', 'spider', 'tony', 'bat', 'wonder'),
  sibject = c('math', 'his', 'math', 'geo', 'his', 'geo', 'math'),
  grade = c('A+', 'B', 'B', 'A+', 'C', 'B+', 'C')
)

classdata %>% head()
```

```
##   studentname sibject grade
## 1     captian    math    A+
## 2         ant     his     B
## 3       james    math     B
## 4      spider     geo    A+
## 5        tony     his     C
## 6         bat     geo    B+
```

```
wide.class <- spread(classdata, # name of the data frame
                     sibject, # new columns to be made
                     grade) # values to go into new columns

head(wide.class)
```

```
##   studentname  geo  his math
## 1         ant <NA>    B <NA>
## 2         bat   B+ <NA> <NA>
## 3     captian <NA> <NA>   A+
## 4       james <NA> <NA>    B
## 5      spider   A+ <NA> <NA>
## 6        tony <NA>    C <NA>
```

```
gather(wide.class, # name of the data frame
       subject, # name of the column to put data into
       grade, # name of the column to put value into
       geo, his, math) %>% # from where values has to be gathered
  drop_na()
```

```
##   studentname subject grade
## 1         bat     geo    B+
## 2      spider     geo    A+
## 3         ant     his     B
## 4        tony     his     C
## 5     captian    math    A+
## 6       james    math     B
## 7      wonder    math     C
```

join rows

bind rows

```
df1 <- data.frame(id = c(1:4), films = c("Spider_man", "James_bond", "Iron_man",
    "Bat_man"))
df2 <- data.frame(id = c(5:8), films = c("King Cong", "Silence of the lambs", "Intersteller",
    "Gravity"))
dplyr::bind_rows(df1, df2)
```

```
##   id               films
## 1  1          Spider_man
## 2  2          James_bond
## 3  3            Iron_man
```

```
## 4  4              Bat_man
## 5  5            King Cong
## 6  6 Silence of the lambs
## 7  7         Intersteller
## 8  8              Gravity
```

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 or every other columns.

```
library(gapminder)
gapminder %>%
    select(pop, everything()) %>%
    head(3)
```

```
## # A tibble: 3 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.
```

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 = "weight")
```

Pivot wider

```
library(tidyverse)

df <- data.frame(name = c("saneesh", "sanusha", "appu", "jaru"), fav.no = c(11, 7,
    20, 21), animal = c("human", "human", "human", "dog"))

df %>%
    pivot_wider(names_from = "animal", values_from = "fav.no")
```

```
## # A tibble: 4 x 3
##   name    human   dog
##   <chr>   <dbl> <dbl>
## 1 saneesh    11    NA
## 2 sanusha     7    NA
## 3 appu       20    NA
## 4 jaru       NA    21
```

```
# but when we have similar names in the grouping column
df1 <- data.frame(name = c("saneesh", "sanusha", "appu", "jaru", "saneesh"), fav.no = c(11,
    7, 20, 21, 12), animal = c("human", "human", "human", "dog", "human"))

df1 %>%
    pivot_wider(names_from = "animal", values_from = "fav.no")
```

```
## Warning: Values from `fav.no` are not uniquely identified; output will contain
## list-cols.
## * Use `values_fn = list` to suppress this warning.
## * Use `values_fn = {summary_fun}` to summarise duplicates.
## * Use the following dplyr code to identify duplicates.
##   {data} %>%
##   dplyr::group_by(name, animal) %>%
##   dplyr::summarise(n = dplyr::n(), .groups = "drop") %>%
##   dplyr::filter(n > 1L)
```

```
## # A tibble: 4 x 3
##   name    human     dog
##   <chr>   <list>    <list>
## 1 saneesh <dbl [2]> <NULL>
## 2 sanusha <dbl [1]> <NULL>
## 3 appu    <dbl [1]> <NULL>
## 4 jaru    <NULL>    <dbl [1]>
```

```
# because saneesh is repeated twice but with two fav.nos the solution is to add
# a row id, make pivot wide and get rid of the row id
df1 %>%
    mutate(id = row_number()) %>%
    group_by(name) %>%
    pivot_wider(names_from = "animal", values_from = "fav.no", values_fill = 0) %>%
    select(-id)
```

```
## # A tibble: 5 x 3
## # Groups:   name [4]
##   name    human   dog
##   <chr>   <dbl> <dbl>
## 1 saneesh    11     0
## 2 sanusha     7     0
## 3 appu       20     0
## 4 jaru        0    21
## 5 saneesh    12     0
```

Scoring numbers to likert

```
library(tidyverse)
numbers <- data.frame(test = seq(1:10))

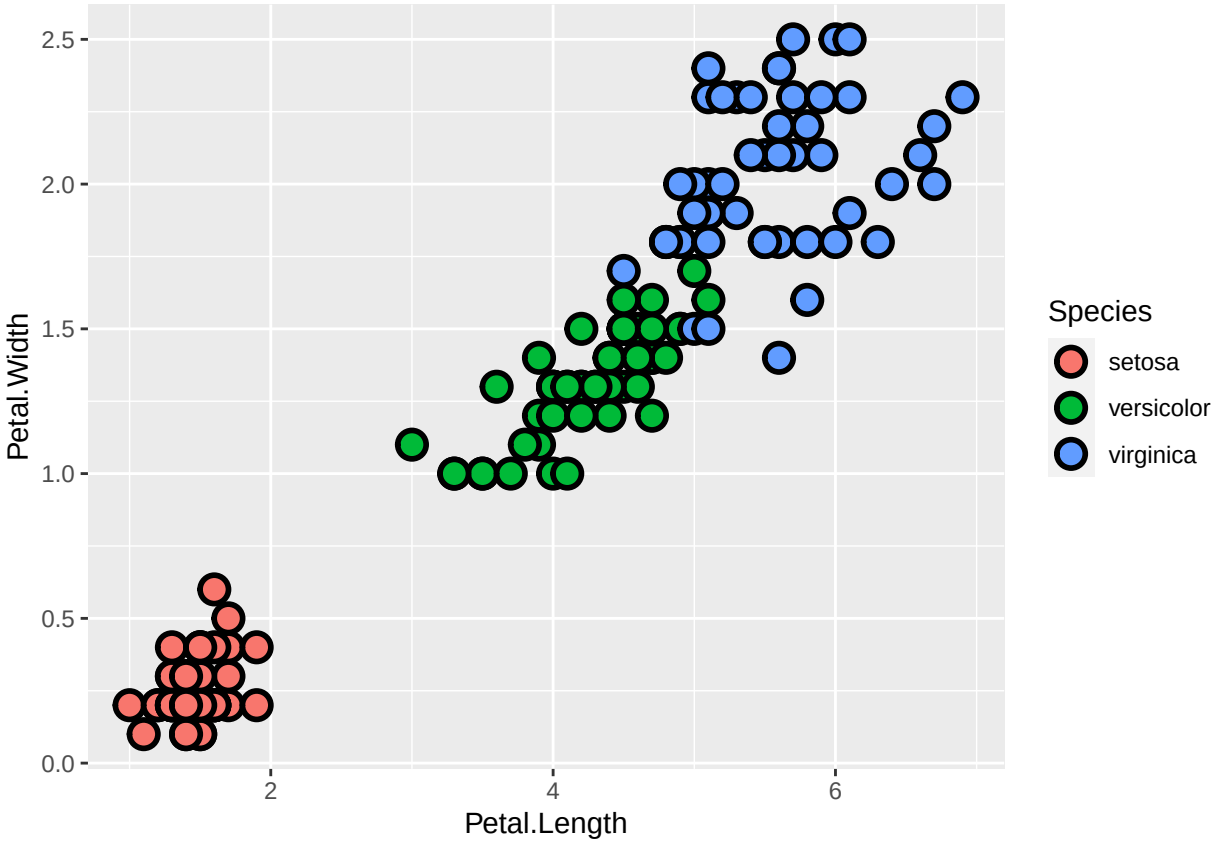
numbers <- numbers %>%
    mutate(test1 = as.numeric(cut_number(test, 3)))
numbers <- numbers %>%
    mutate(test1 = as.factor(test1)) %>%
    mutate(test2 = recode(test1, `1` = "low", `2` = "medium", `3` = "high"))
```

ggplot

sthda

add border to points

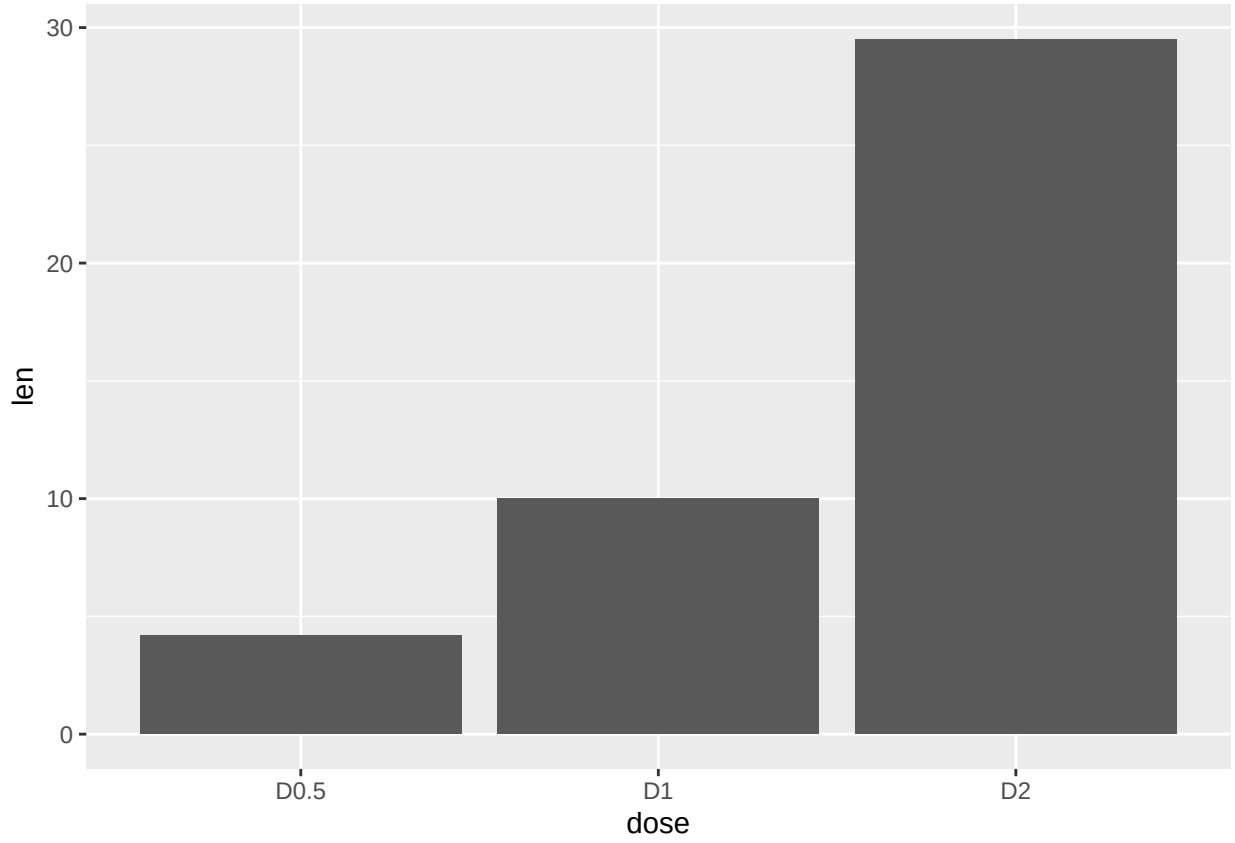
```
library(ggplot2)
ggplot(iris, aes(x = Petal.Length, y = Petal.Width, fill = Species), alpha = 0.07) +
    geom_point(size = 4, shape = 21, color = "black", stroke = 1.5)
```




```
df <- data.frame(dose = c("D0.5", "D1", "D2"), len = c(4.2, 10, 29.5))
```

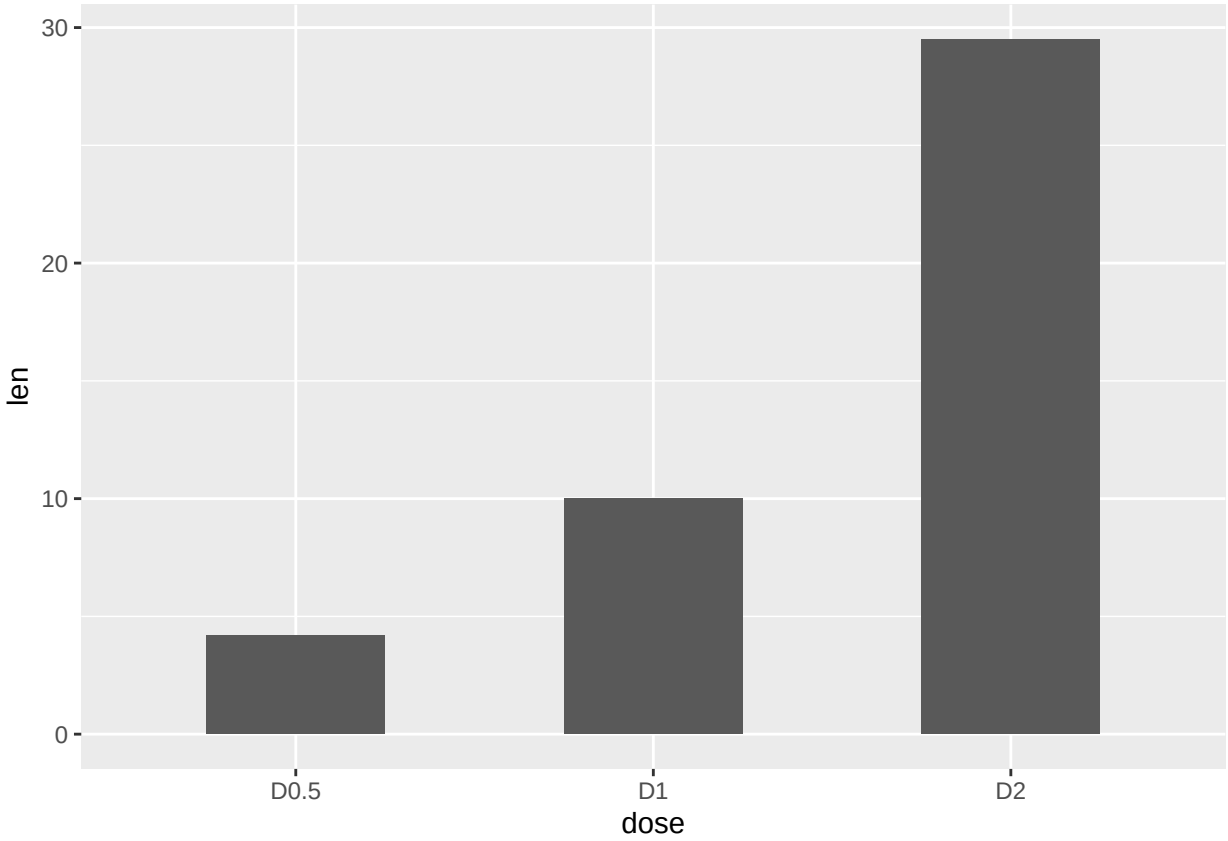
bar plot

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

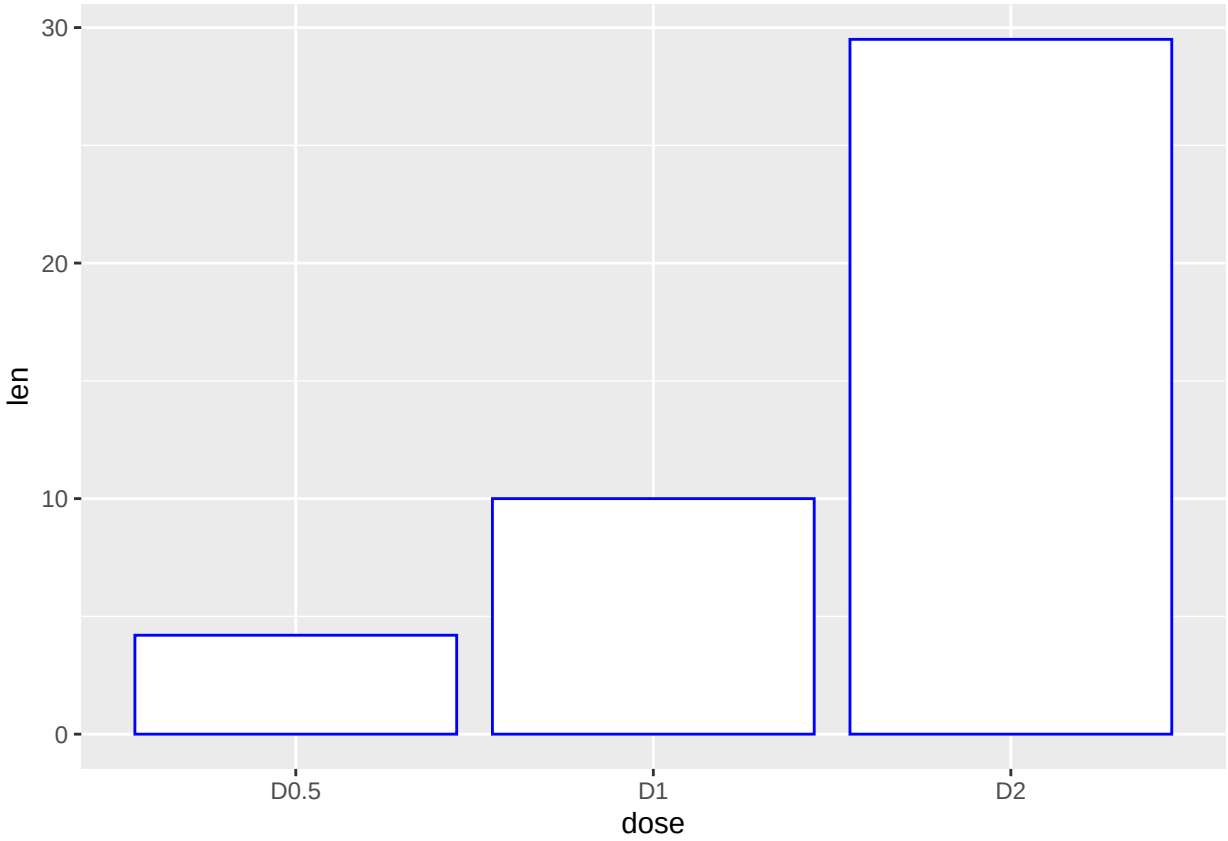



```
# Horizontal bar plot p + coord_flip()
```

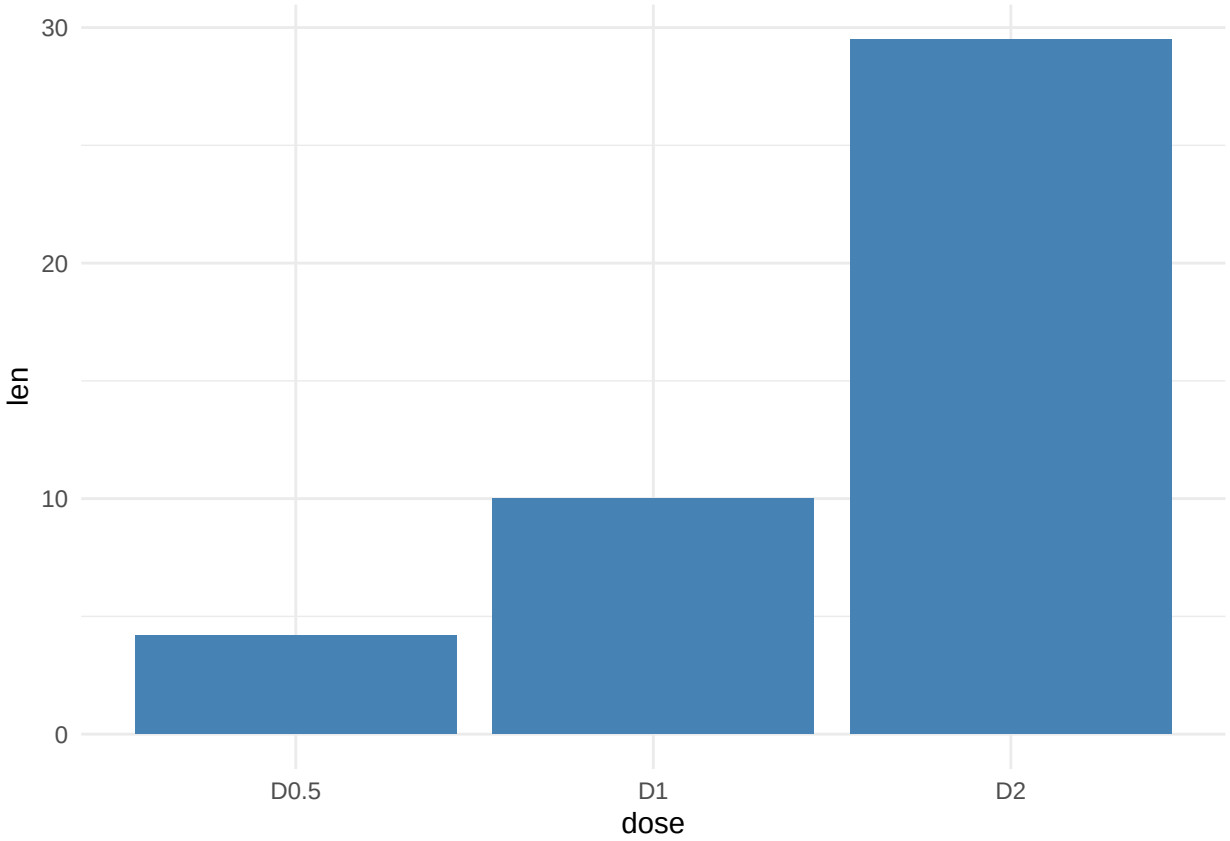
```
# Change the width of bars
ggplot(data = df, aes(x = dose, y = len)) + geom_bar(stat = "identity", width = 0.5)
```




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

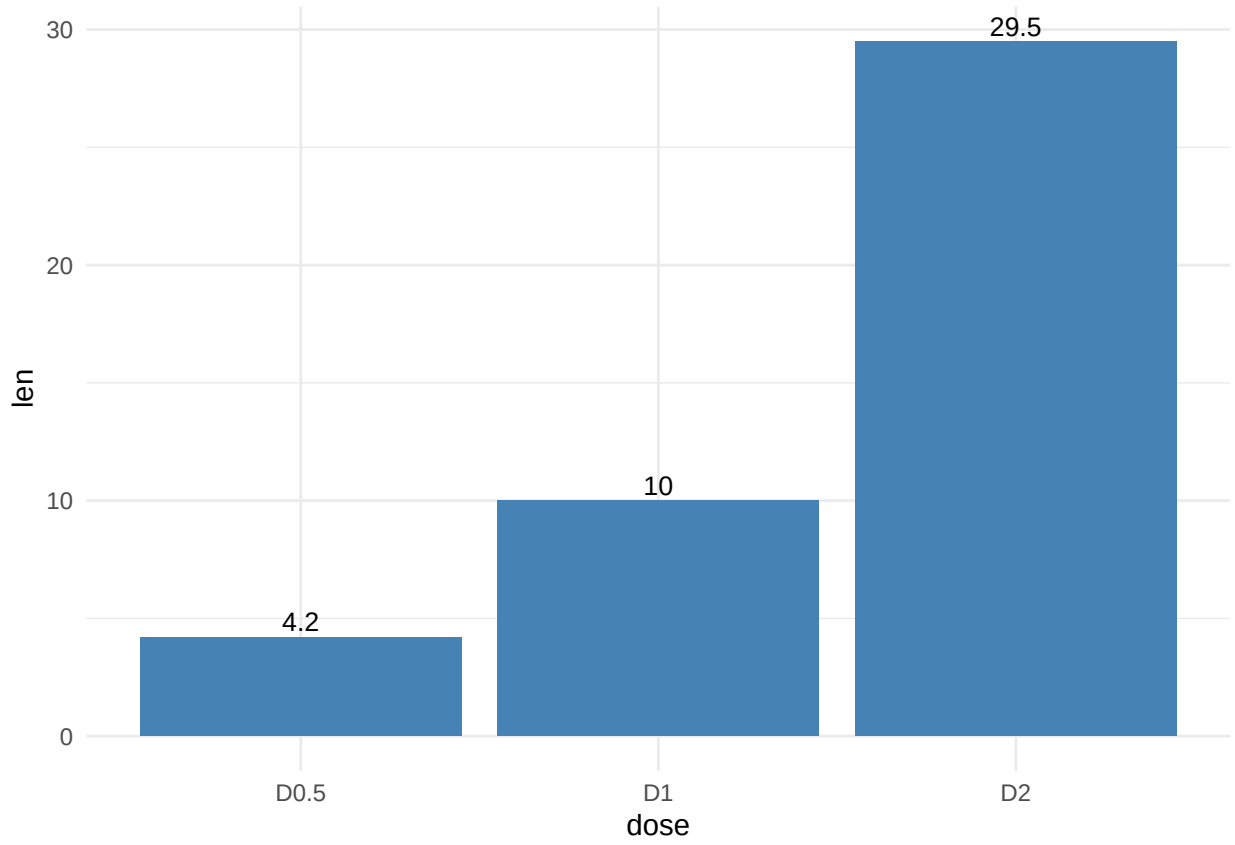



```
# Minimal theme + blue fill color
p <- ggplot(data = df, aes(x = dose, y = len)) + geom_bar(stat = "identity", fill = "steelblue") +
    theme_minimal()
p
```

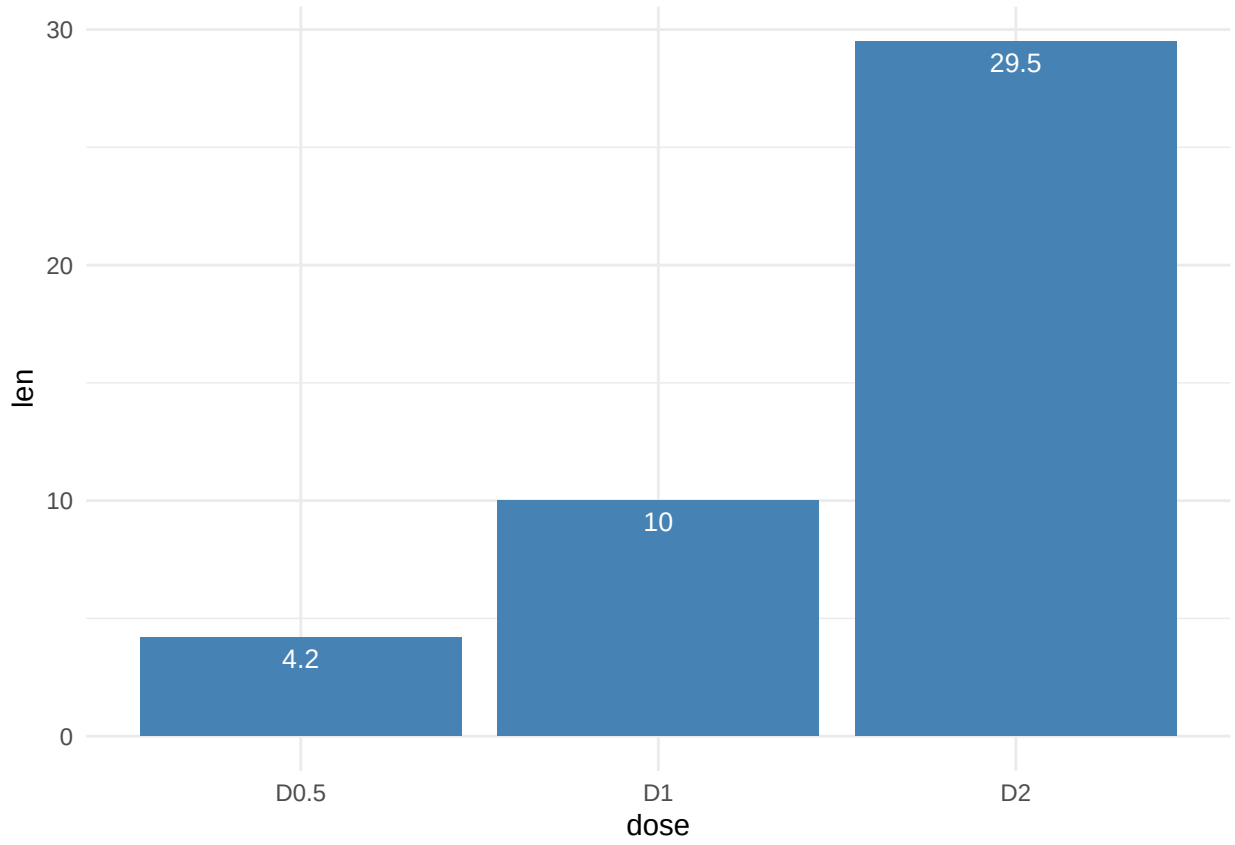


labels

```
# out side the bars
p + geom_text(aes(label = len), vjust = -0.3, size = 3.5) + theme_minimal()
```



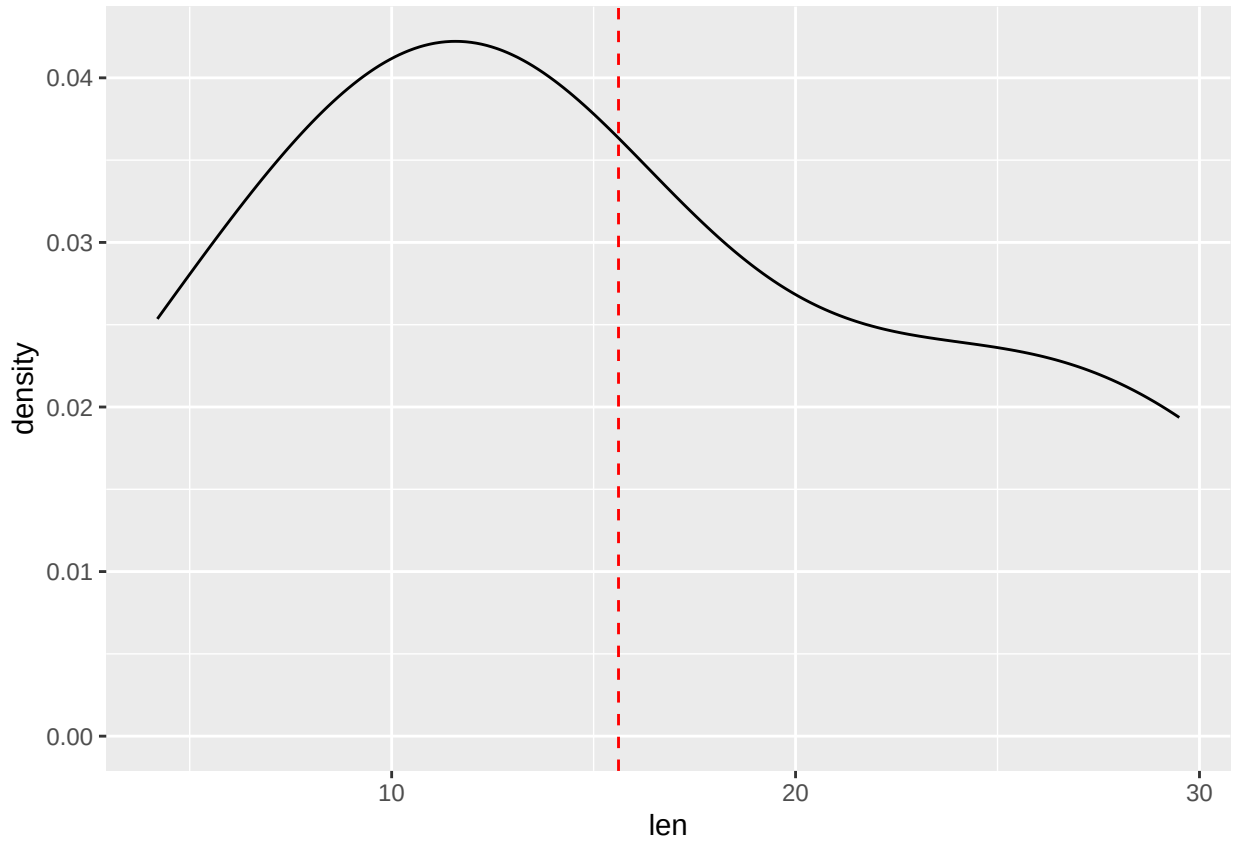

```
p + geom_text(aes(label = len), vjust = 1.6, color = "white", size = 3.5) + theme_minimal()
```



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")
```

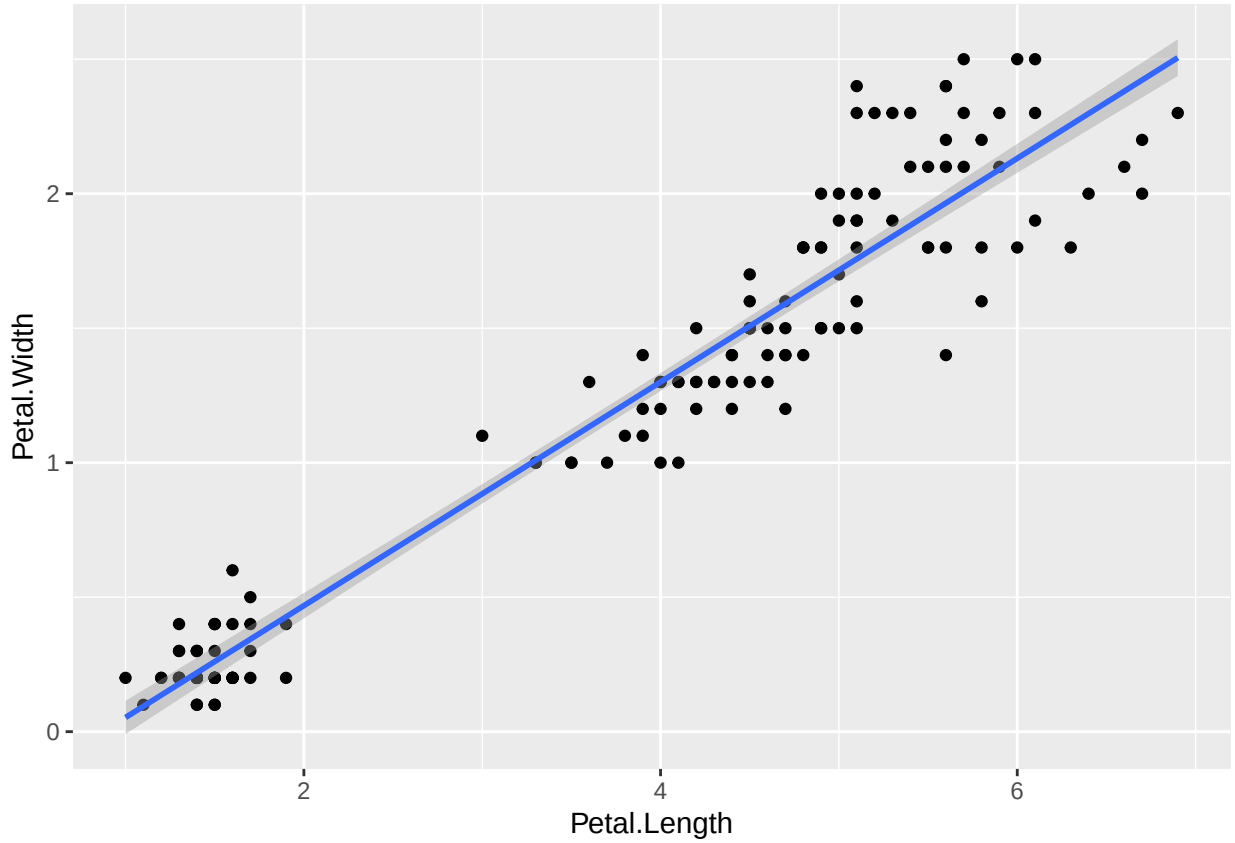


scatter plot with lm

```
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: 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'

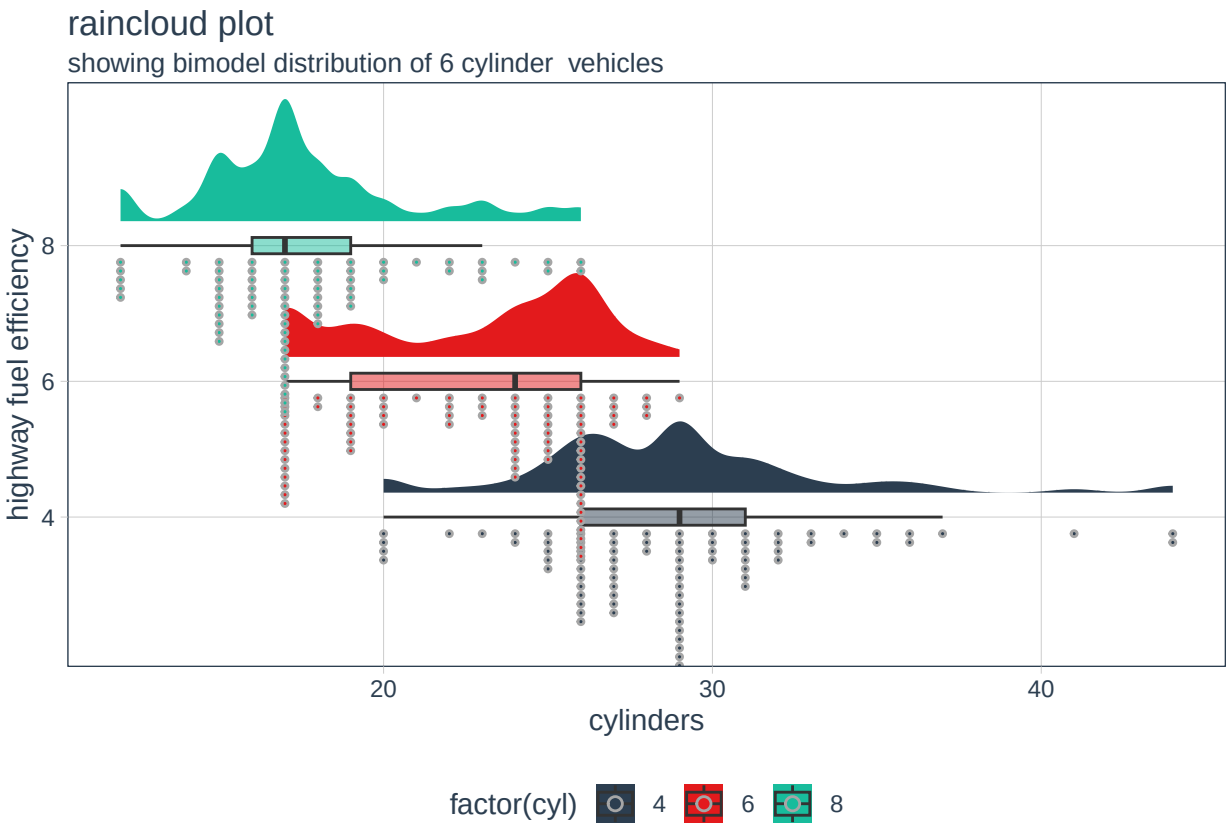
## The following object is masked from 'package:graphics':
##
##     legend

## 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()
```



hex plot

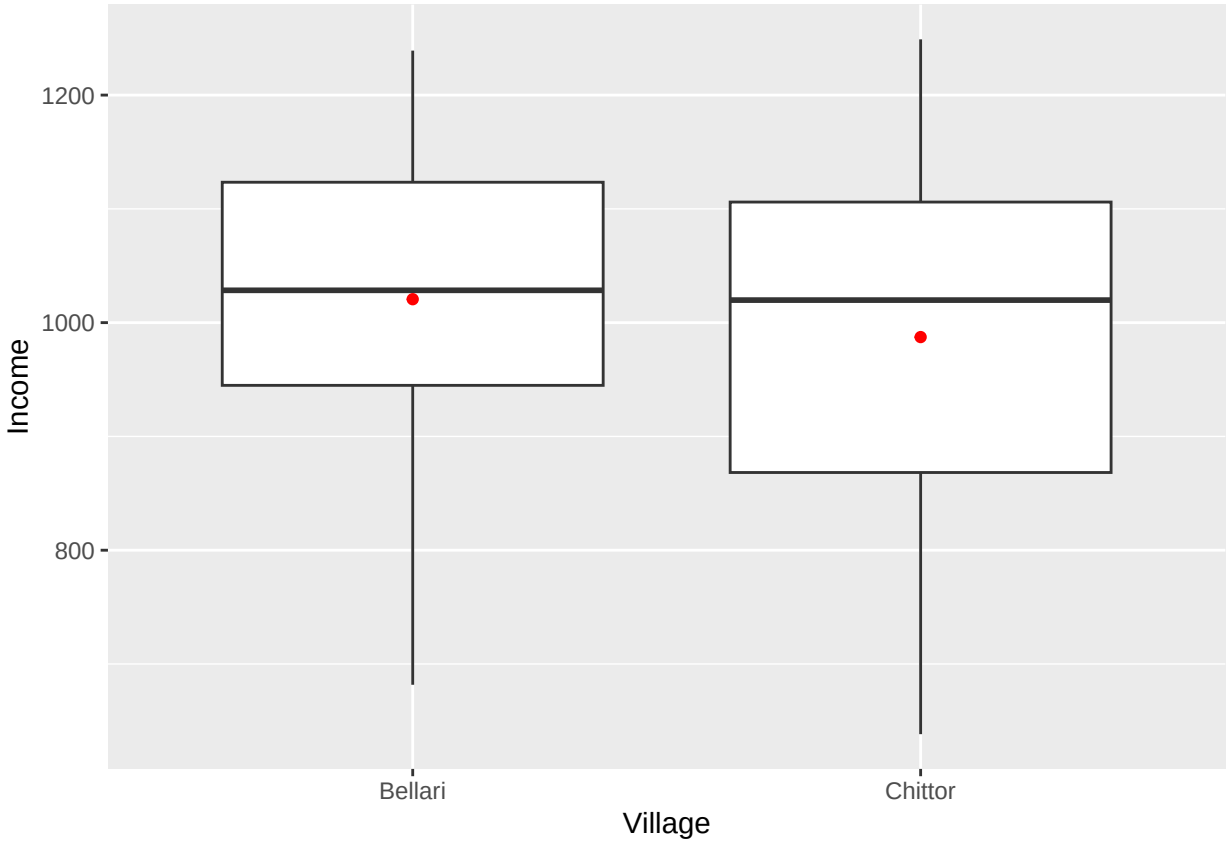
```
library(tidyverse)
# install.packages('hexbin')
class <- c(rep("10th", 8))
students <- c("10 to 15", "15-20", "17 to 24", "20  to 25", "25 to 30", "30 to 40",
    "45 to 47", "50 to 55")
latitude <- c(11.50897246, 11.48323136, 11.48719031, 11.46366611, 11.41097322, 11.52111154,
    11.44491386, 11.46569568)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

```
## Warning: Computation failed in `stat_summary_hex()`
## Caused by error in `compute_group()`:
## ! The package "hexbin" is required for `stat_summary_hex()`
```

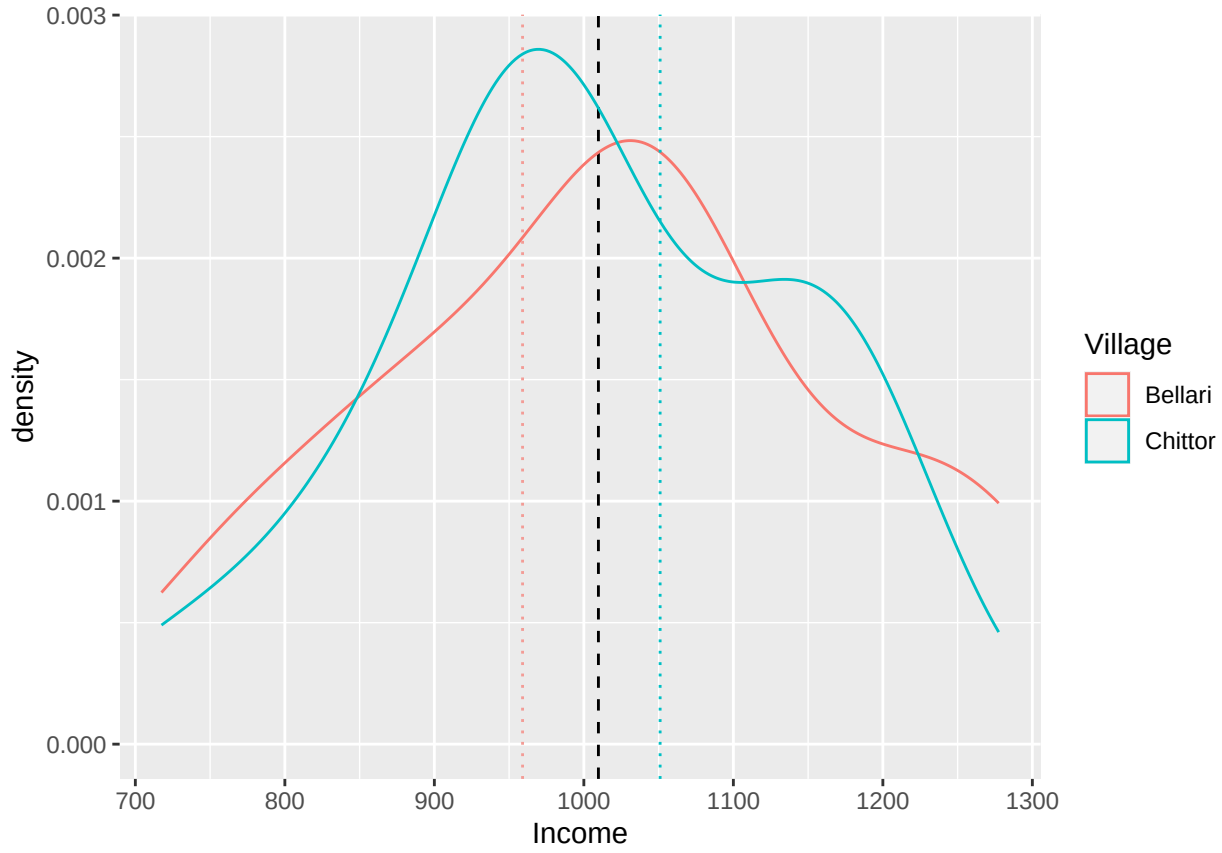
stat summary

```
income.data <- data.frame(Village = c(rep("Chittor", 20), rep("Bellari", 20)), Income = c(rnorm(n = 20,
    mean = 1000, sd = 150), rnorm(n = 20, mean = 1000, sd = 150)))
library(ggplot2)
ggplot(income.data, aes(Village, Income)) + geom_boxplot() + stat_summary(geom = "point",
    fun = mean, col = "red")
```



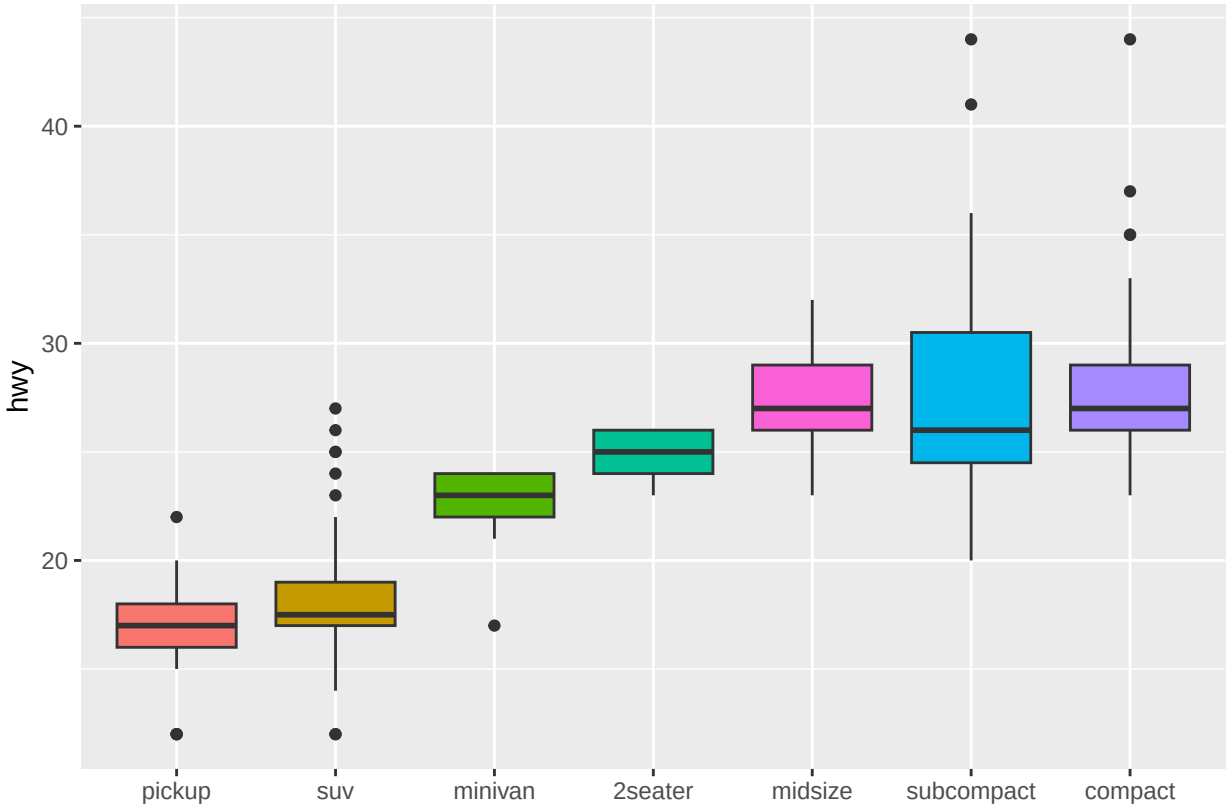
geom_density

```
income.data <- data.frame(Village = c(rep("Chittor", 20), rep("Bellari", 20)), Income = c(rnorm(n = 20,
    mean = 1000, sd = 150), rnorm(n = 20, mean = 1000, sd = 150)))
library(ggplot2)
ggplot(income.data) + geom_vline(aes(xintercept = mean(Income)), linetype = "dashed") +
    geom_density(aes(x = Income, color = Village)) + geom_vline(xintercept = 959,
    linetype = "dotted", col = "#f39c96") + geom_vline(xintercept = 1051, linetype = "dotted",
    col = "#00bfc4")
```



reorder axis

```
library(tidyverse)
# Using median
mpg %>%
    mutate(class = fct_reorder(class, hwy, .fun = "median")) %>%
    ggplot(aes(x = reorder(class, hwy), y = hwy, fill = class)) + geom_boxplot() +
    xlab("class") + theme(legend.position = "none") + xlab("")
```



pie chart

```
library(plotly)
```

```
##
## Attaching package: 'plotly'

## The following object is masked from 'package:ggplot2':
##
##     last_plot

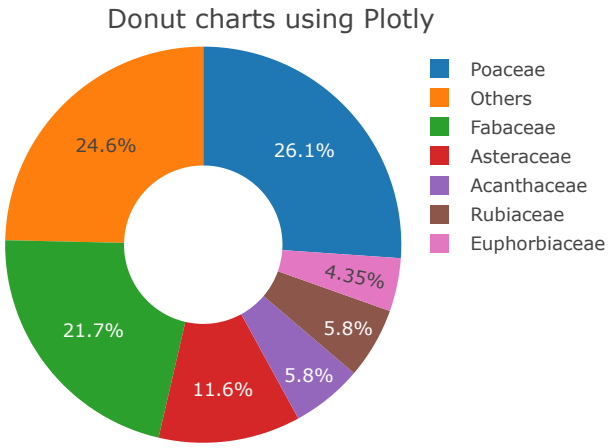
## The following object is masked from 'package:stats':
##
##     filter

## The following object is masked from 'package:graphics':
##
##     layout
```

```
data <- data.frame(category = c("Poaceae", "Fabaceae", "Asteraceae", "Acanthaceae",
    "Rubiaceae", "Euphorbiaceae", "Others"), count = c(18, 15, 8, 4, 4, 3, 17))
```

```
fig <- data %>%
    plot_ly(labels = ~category, values = ~count)
fig <- fig %>%
    add_pie(hole = 0.4) %>%
    layout(title = "Donut charts using Plotly", showlegend = T)

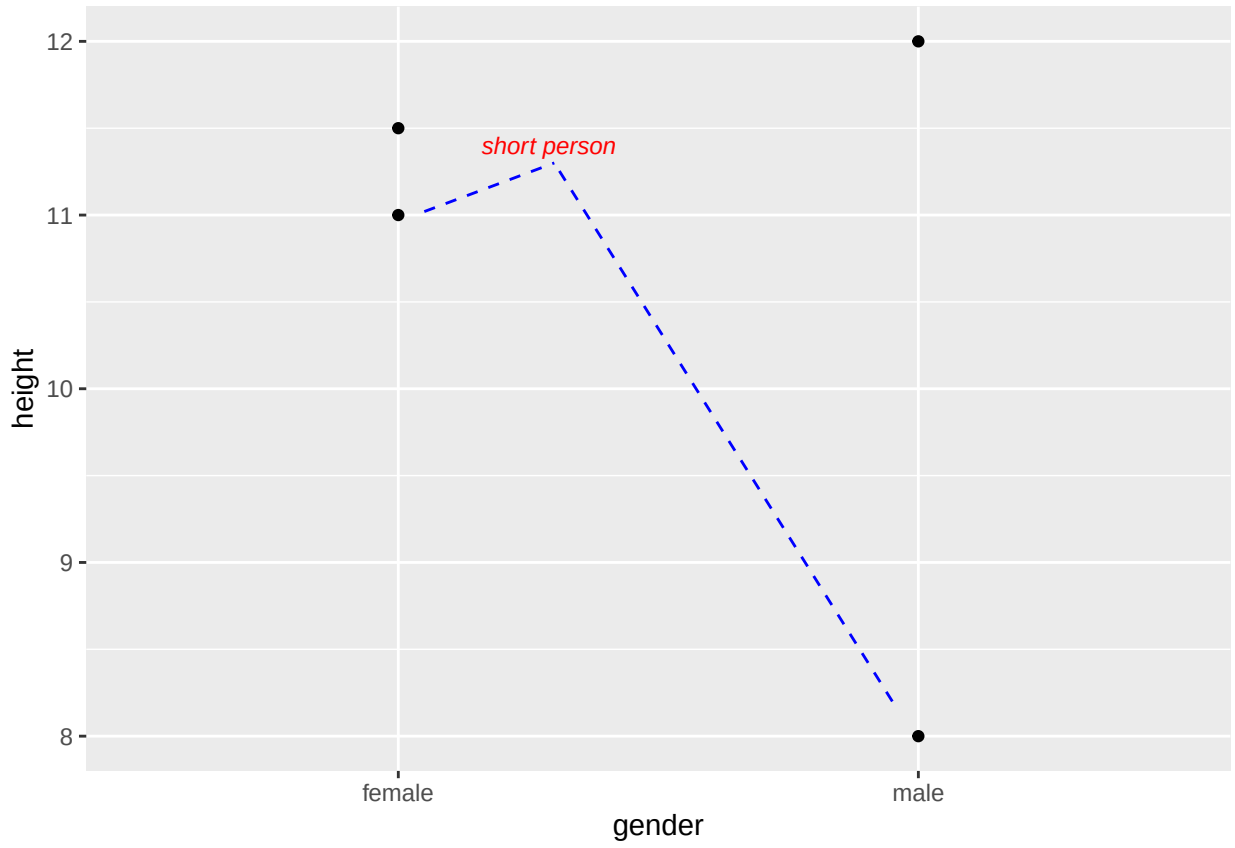
fig
```


Donut charts using Plotly
Poaceae
Others
Fabaceae
Asteraceae
Acanthaceae
Rubiaceae
Euphorbiaceae
26.1%
24.6%
21.7%
11.6%
5.8%
5.8%
4.35%

annotate

```
library(tidyverse)
df <- tribble(~ gender,
              ~ height,
              'male',
              12,
              'male',
              8,
              'female',
              11.5,
              'female',
              11)

ggplot(df, aes(gender, height)) +
  geom_point() +
  annotate(
    geom = 'text',
    x = 1.29,
    y = 11.4,
    label = 'short person',
    color = 'red',
    size = 3,
    fontface = 'italic'
  ) +
  annotate(
    geom = 'segment',
    x = 1.05,
    # starting point on x, this decides length
    xend = 1.3,
    # end point on x, this decides length
    y = 11.02,
    # starting point on y
    yend = 11.3,
    # ending point on y
    color = 'blue',
    linetype = 'dashed'
  ) +
  annotate(
    geom = 'segment',
    x = 1.95,
    # starting point on x, this decides length
    xend = 1.3,
    # end point on x, this decides length
    y = 8.2,
    # starting point on y
    yend = 11.3,
    # ending point on y
    color = 'blue',
    linetype = 'dashed'
  )
```



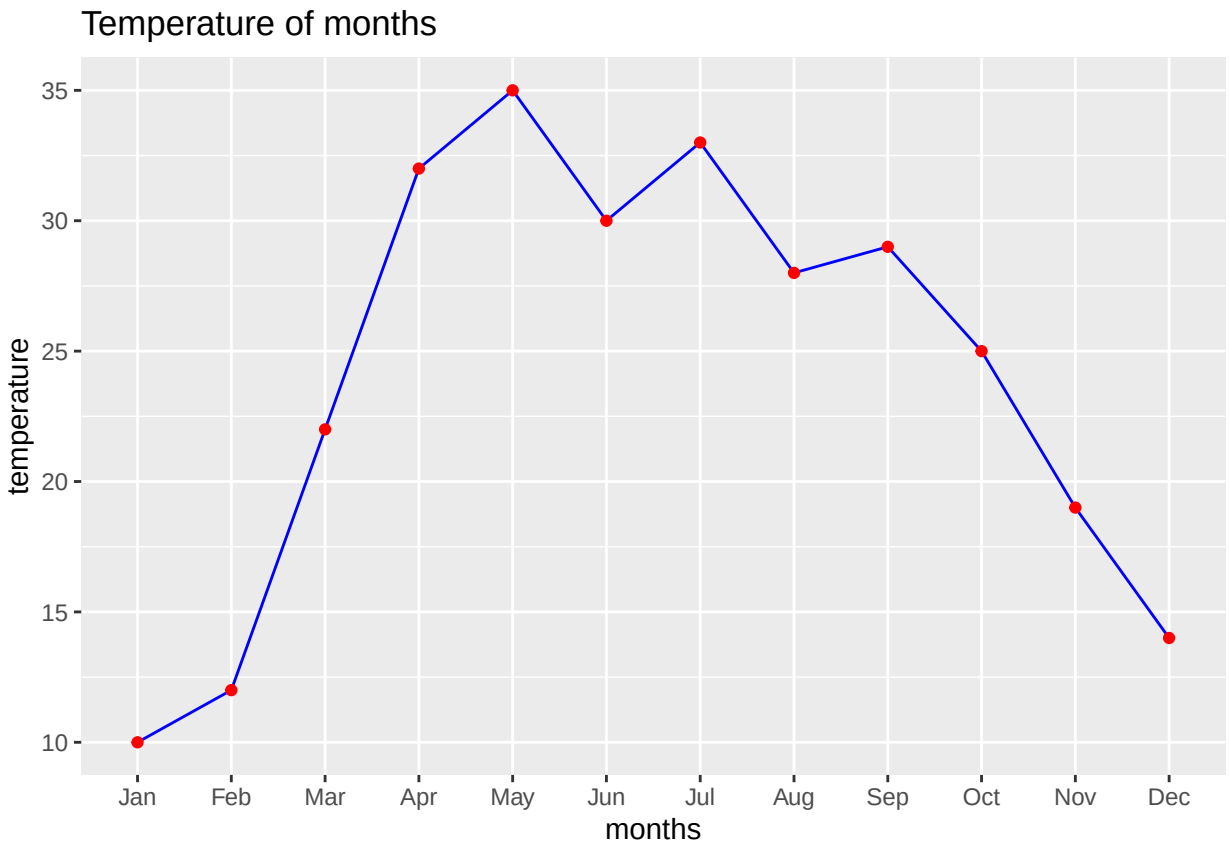
months

```
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)
```



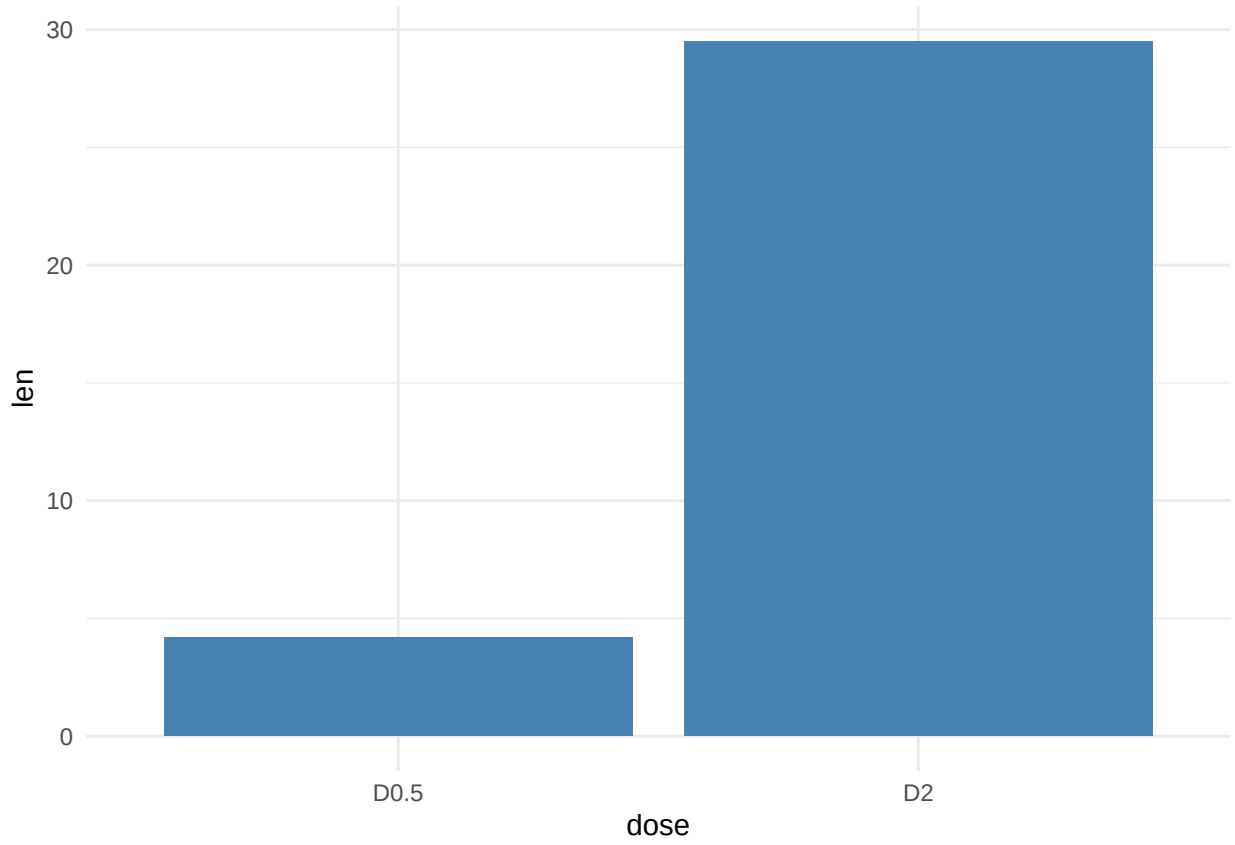

```
# create and view data frame
df <- data.frame(date = c("05/30/2021", "08/18/2021", "09/13/2021", "02/19/2021"),
    sales = c(3, 15, 14, 9))

df <- df %>%
    mutate(date = as.Date(date, format = "%m/%d/%Y")) %>%
    arrange(date)
df
```

```
##         date sales
## 1 2021-02-19     9
## 2 2021-05-30     3
## 3 2021-08-18    15
## 4 2021-09-13    14
```

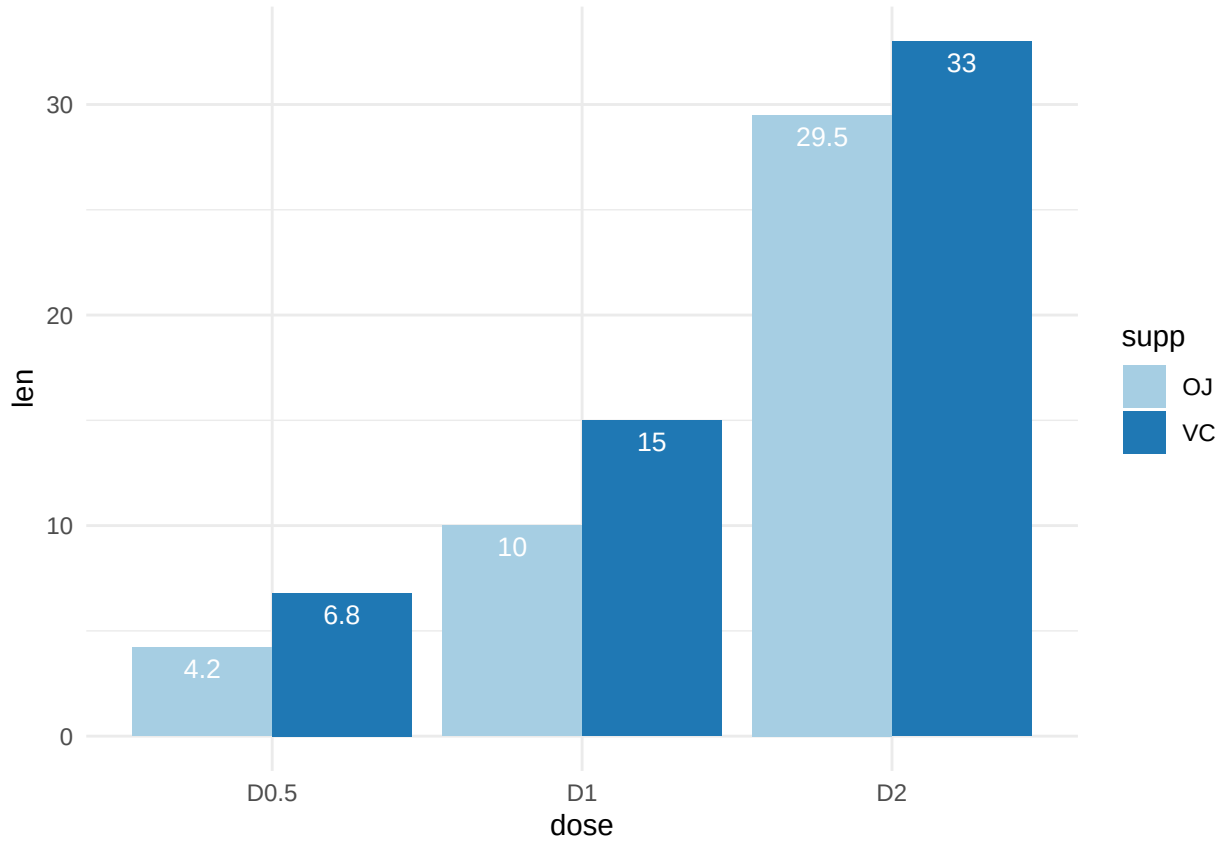
```
p + scale_x_discrete(limits = c("D0.5", "D2"))
```

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

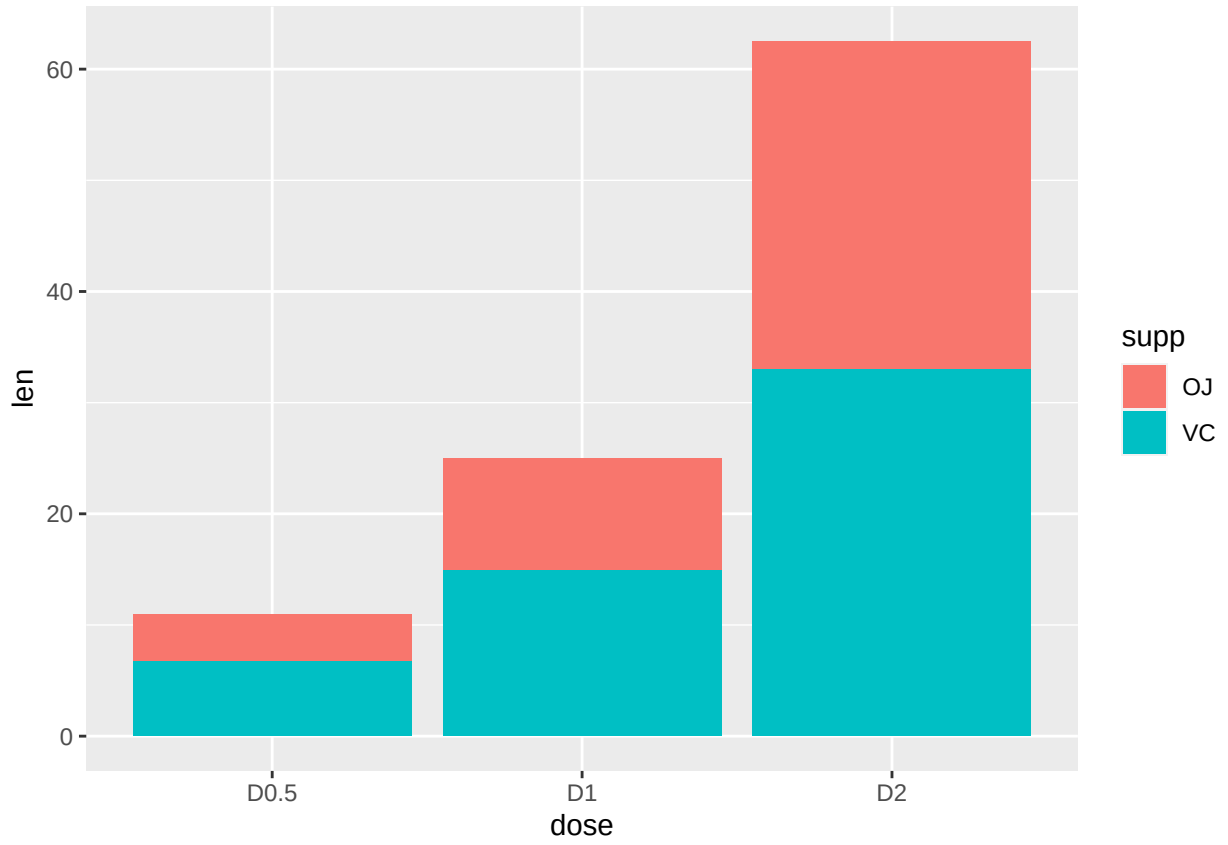



```
df2 <- data.frame(supp = rep(c("VC", "OJ"), each = 3), dose = rep(c("D0.5", "D1",
    "D2"), 2), len = c(6.8, 15, 33, 4.2, 10, 29.5))
```

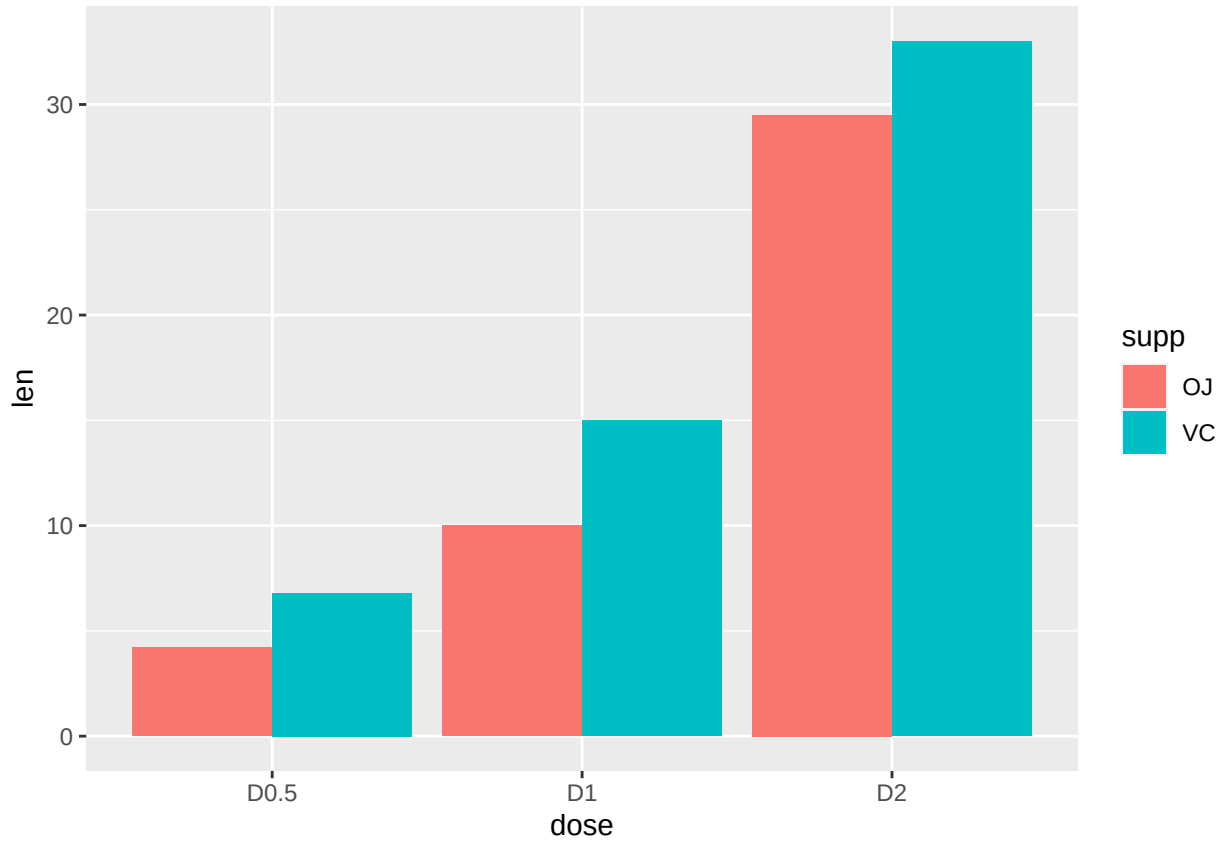
```
ggplot(data = df2, aes(x = dose, y = len, fill = supp)) + geom_bar(stat = "identity",
    position = position_dodge()) + geom_text(aes(label = len), vjust = 1.6, color = "white",
    position = position_dodge(0.9), size = 3.5) + scale_fill_brewer(palette = "Paired") +
    theme_minimal()
```



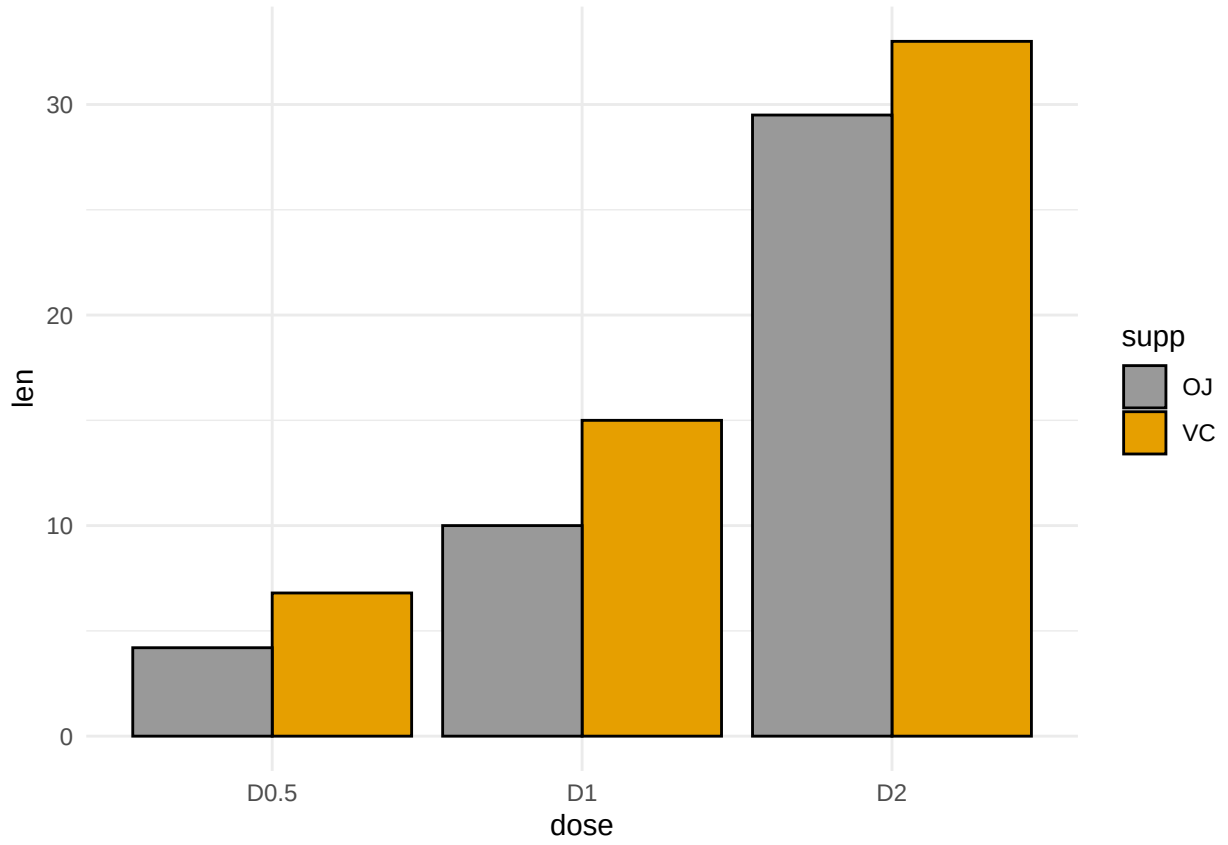

```
# Stacked barplot with multiple groups
ggplot(data = df2, aes(x = dose, y = len, fill = supp)) + geom_bar(stat = "identity")
```



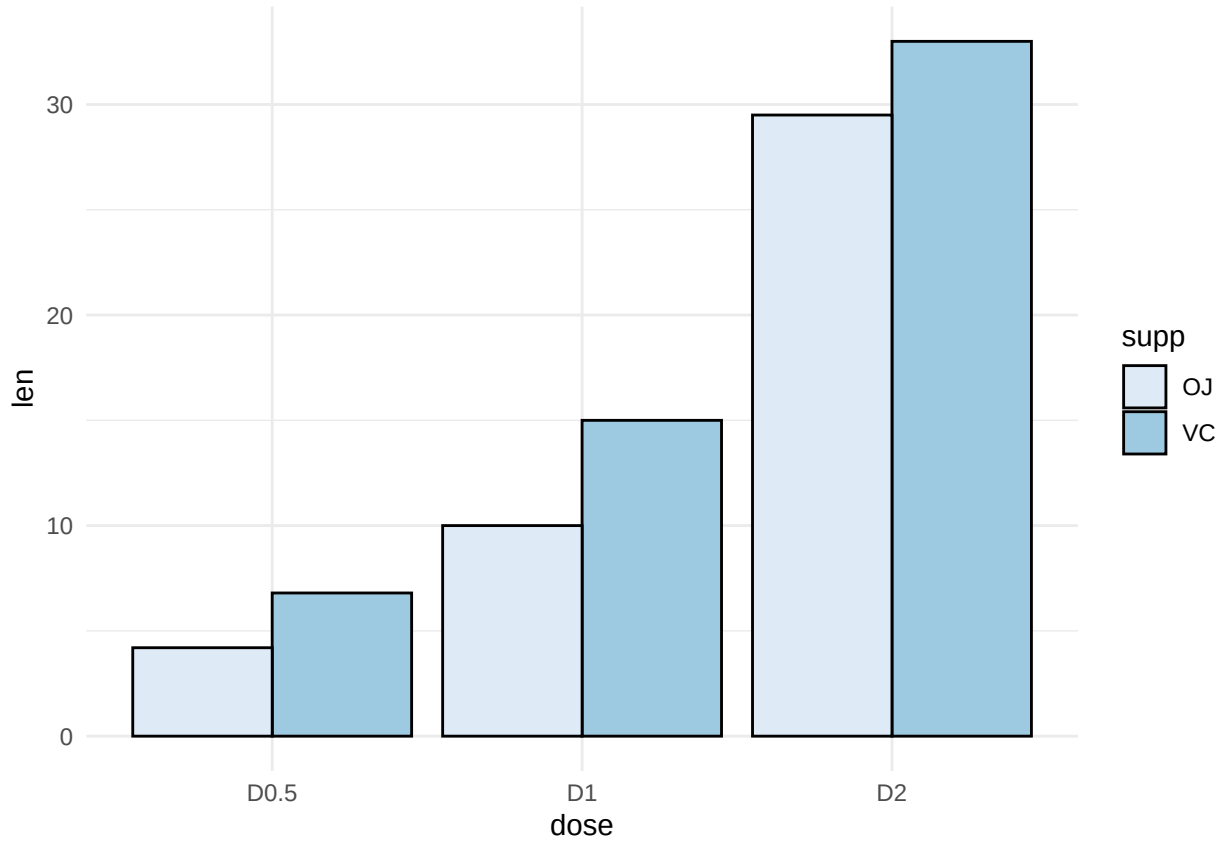

```
# Use position=position_dodge()
ggplot(data = df2, aes(x = dose, y = len, fill = supp)) + geom_bar(stat = "identity",
    position = position_dodge())
```




```
# 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")
```



Color Palettes

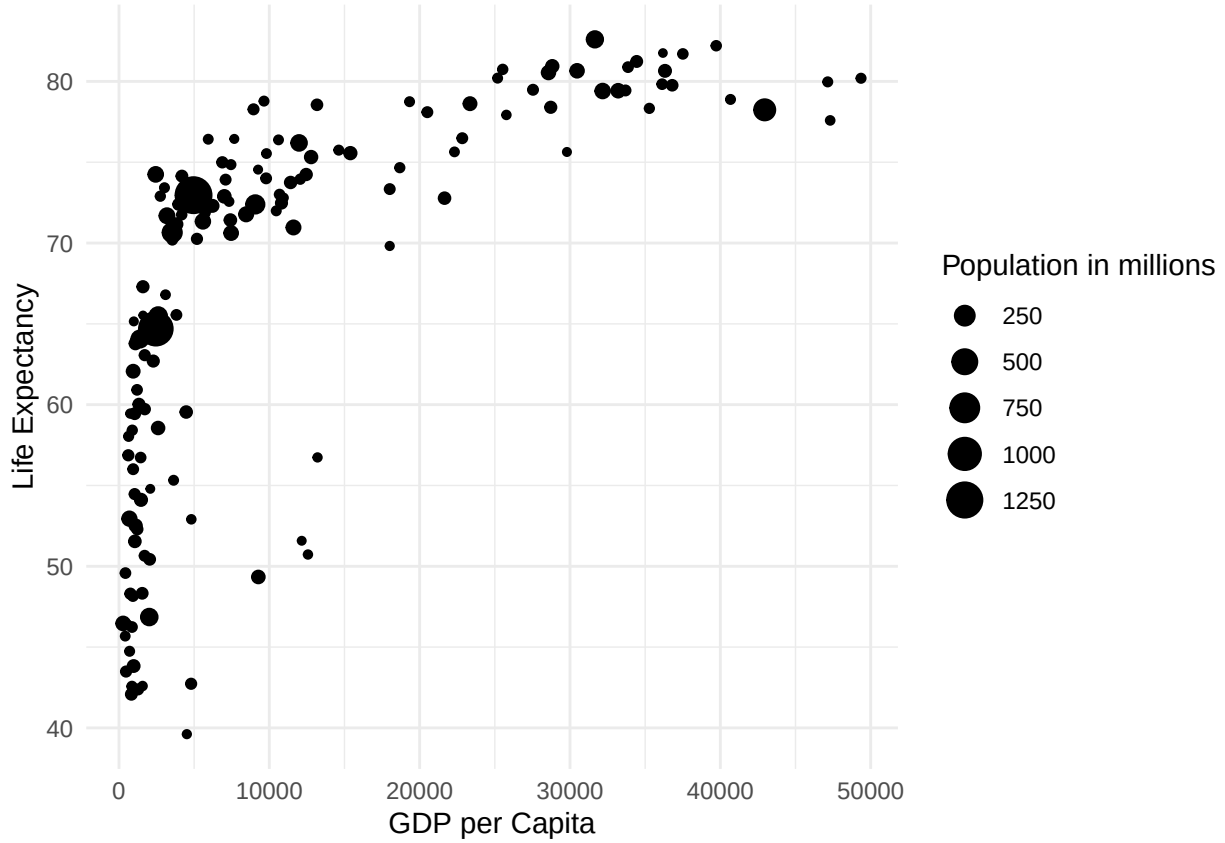
libraries

```
# 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.

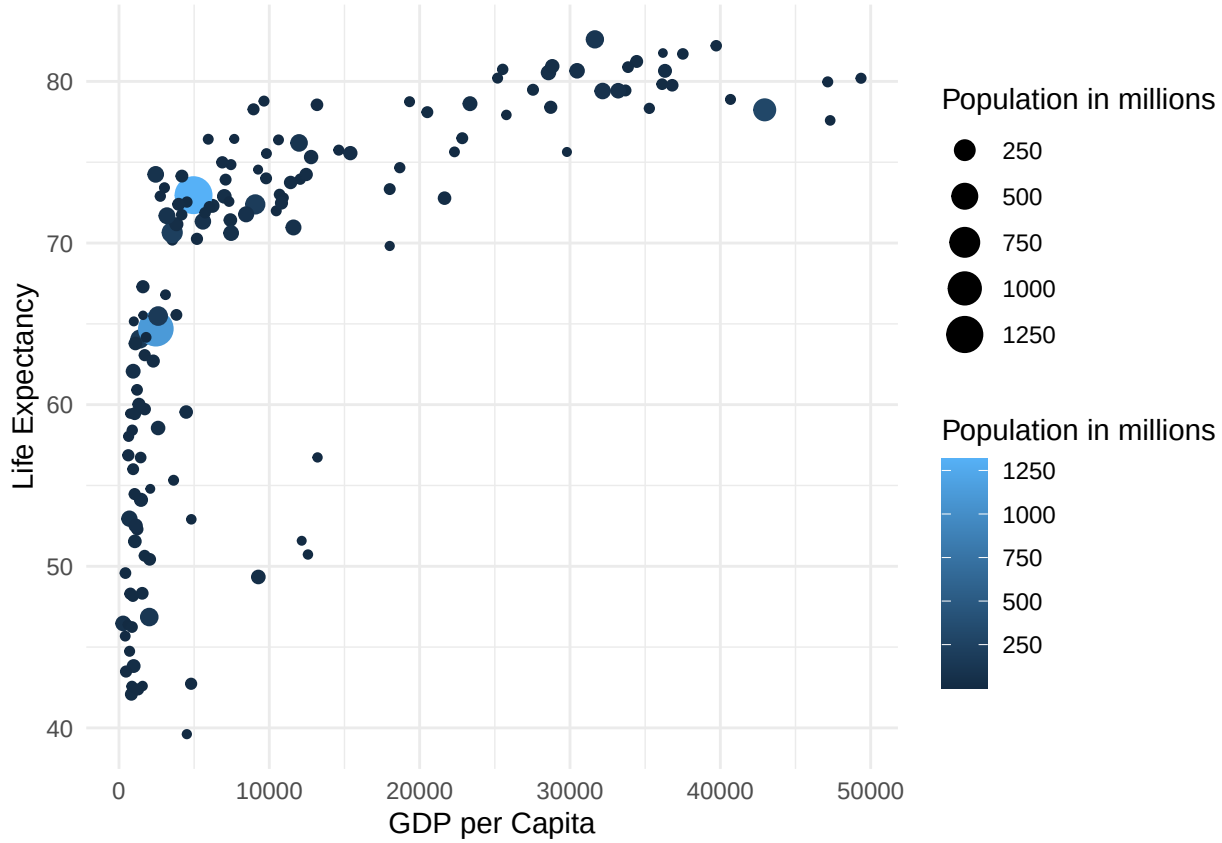
```
plot <- gapminder %>%
    filter(year == 2007) %>%
    ggplot() + labs(x = "GDP per Capita", y = "Life Expectancy", color = "Population in millions",
    size = "Population in millions") + theme_minimal()

plot + geom_point(aes(gdpPercap, lifeExp, size = pop/1e+06))
```



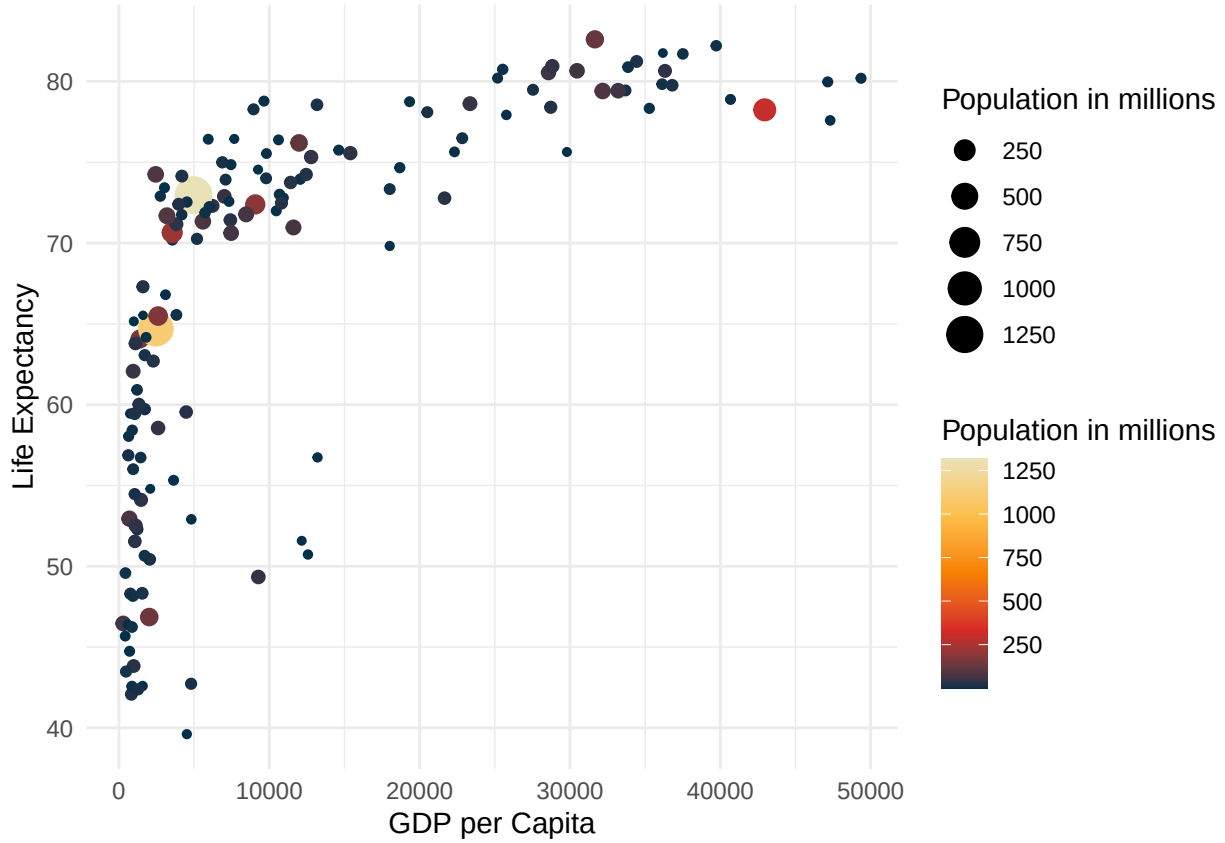
To use color in the plot, assign the Population variable to the color aesthetic. Since nothing is specied, ggplot2 chooses a color spectrum for this numerical variable (shades of blue).

```
plot + geom_point(aes(gdpPercap, lifeExp, size = pop/1e+06, color = pop/1e+06))
```



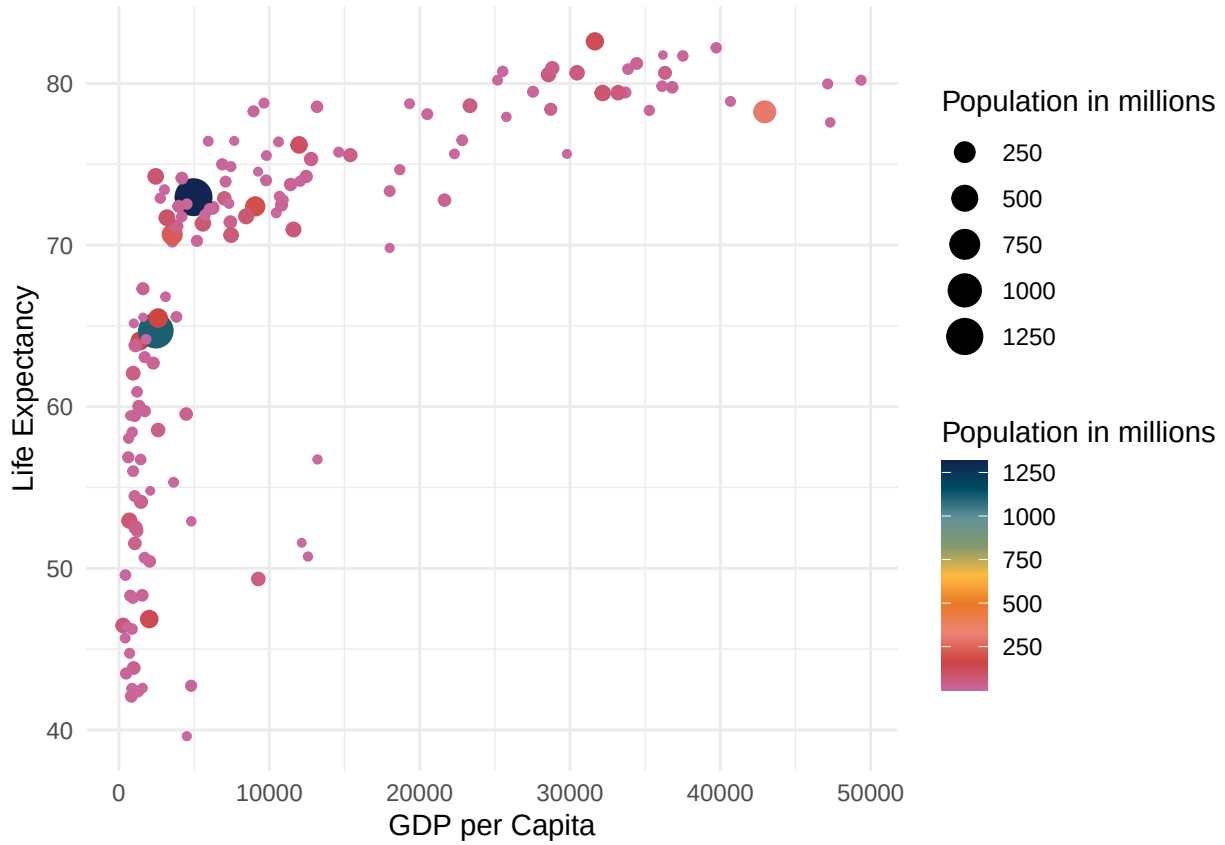
To control the color spectrum, we need to introduce a color scale. In the following plot, we have to provide a vector of hex color values. You would choose this if you got your colors from one of the mentioned above websites.

```
plot + geom_point(aes(gdpPercap, lifeExp, size = pop/1e+06, color = pop/1e+06)) +
    scale_color_gradientn(colors = c("#003049", "#D62828", "#F77F00", "#FCBF49",
        "#EAE2B7"))
```



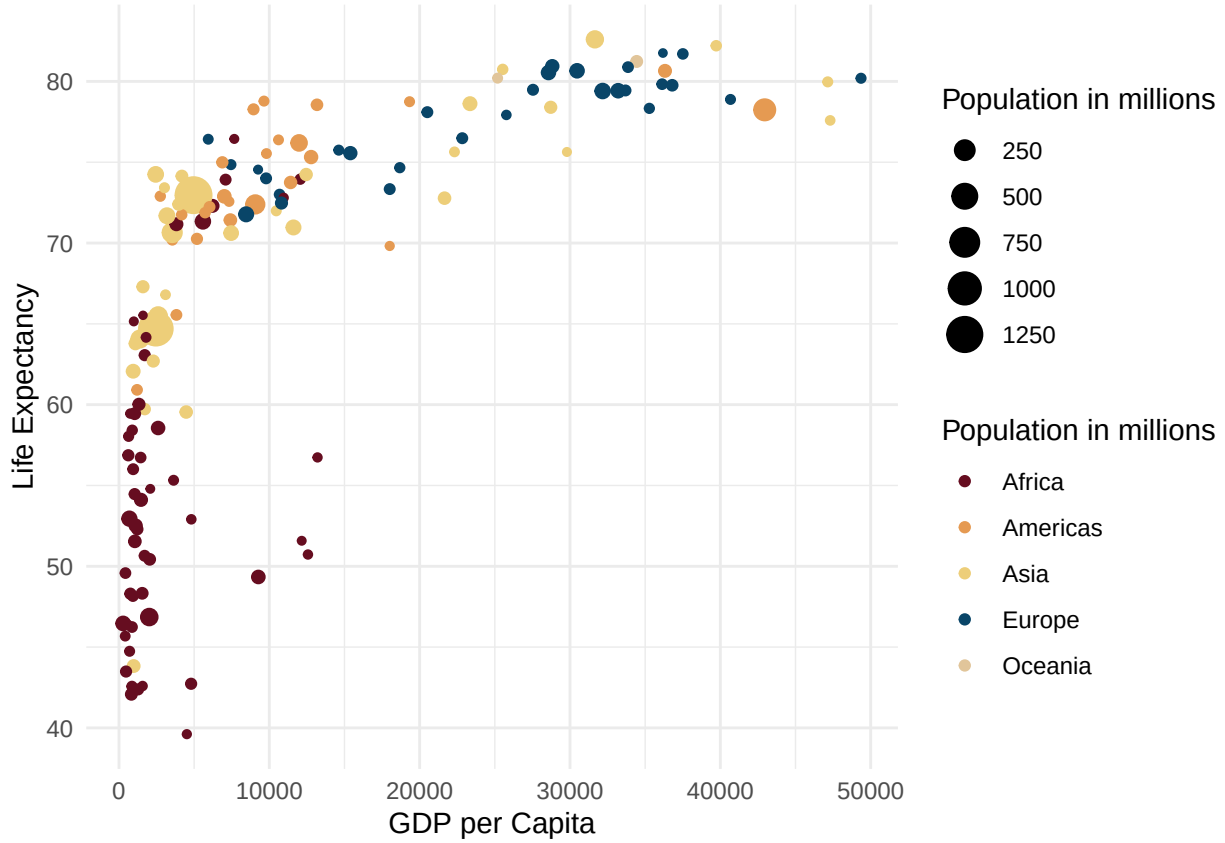
To apply one of the MetBrewer palettes, replace the hex-vector with a MetBrewer function. Within the function call, you provide the palette's name, then several colors, and tell it that we need a continuous palette since it is a numerical variable.

```
plot + geom_point(aes(gdpPercap, lifeExp, size = pop/1e+06, color = pop/1e+06)) +
    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.

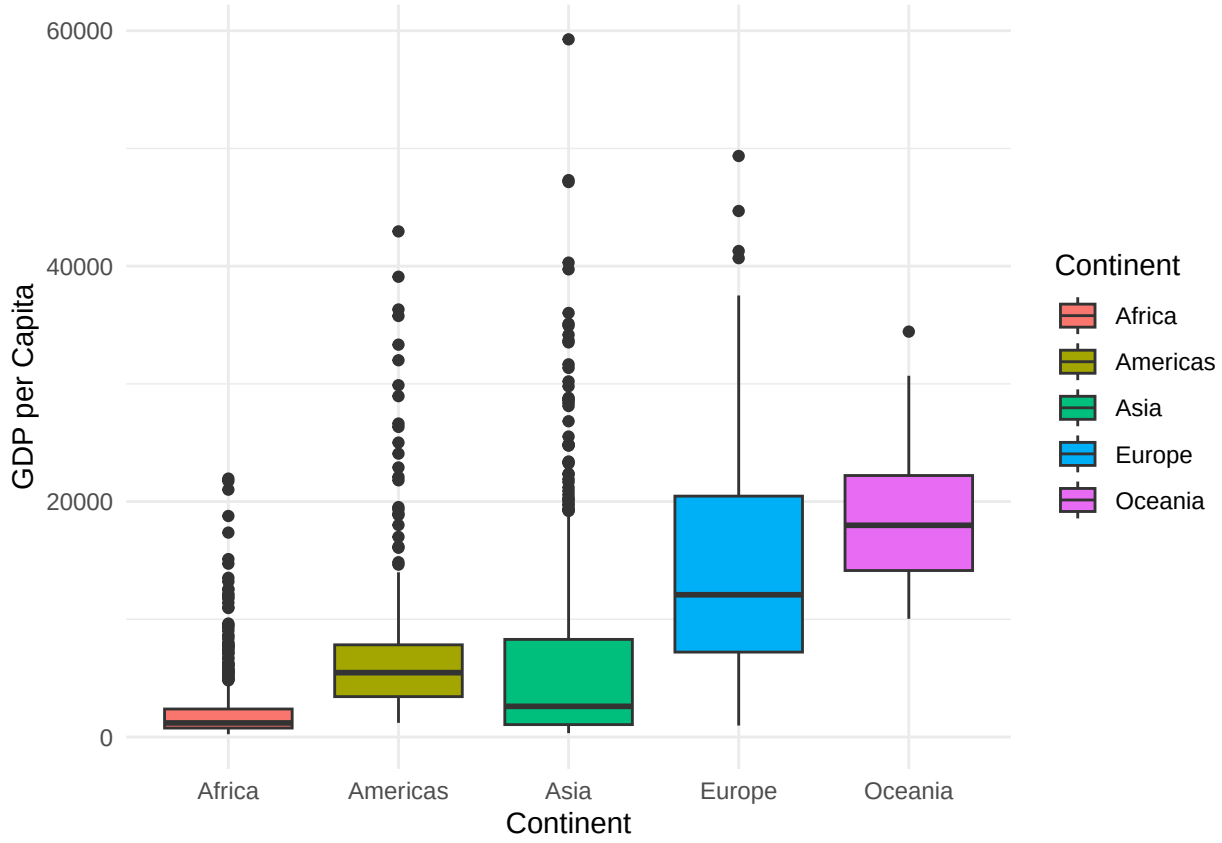
```
plot + geom_point(aes(gdpPercap, lifeExp, size = pop/1e+06, color = continent)) +
    scale_color_manual(values = met.brewer("Navajo", 5))
```



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.

```
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")
```

```
## Warning: The following aesthetics were dropped during statistical transformation: colour
## i This can happen when ggplot fails to infer the correct grouping structure in
##   the data.
## i Did you forget to specify a ‘group‘ aesthetic or to convert a numerical
##   variable into a factor?
```



scale fill manual

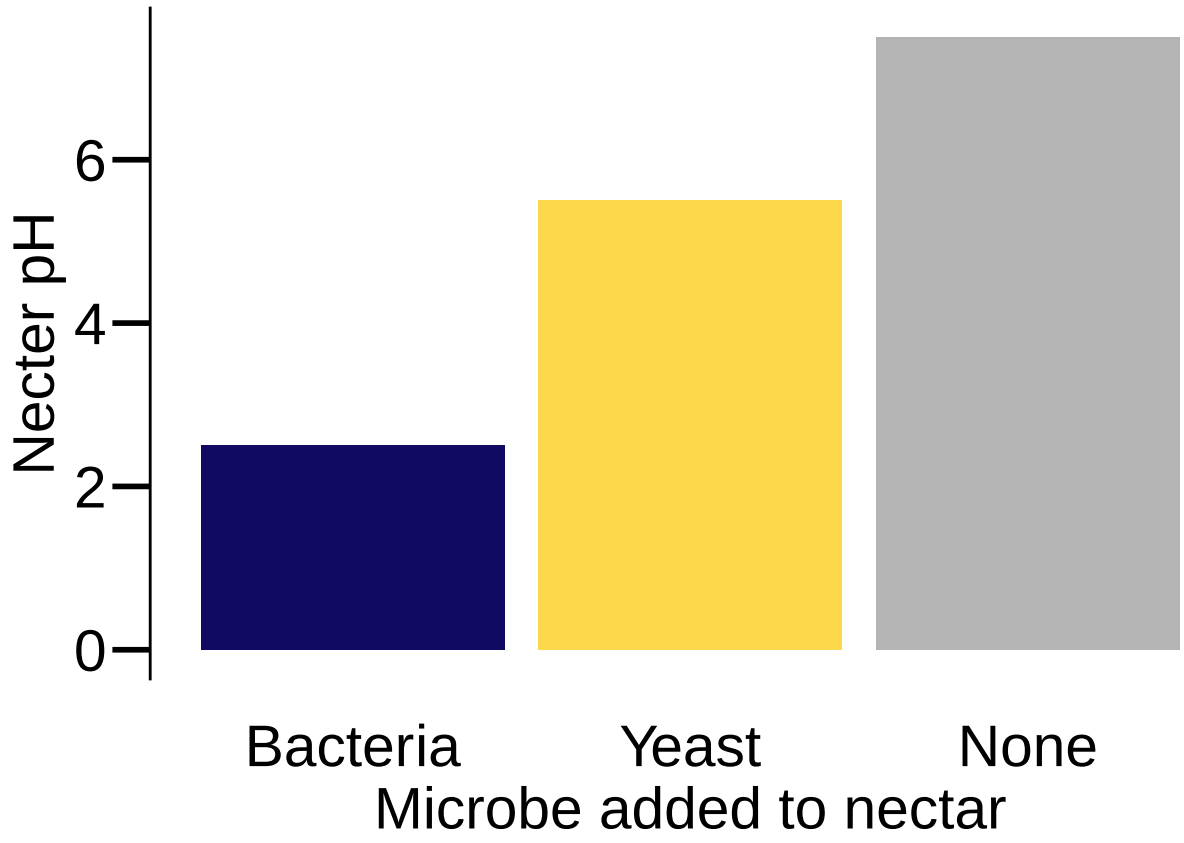
themes

```
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
    "#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(0.5,
        "cm")) + theme(text = element_text(size = 22))
```

```
## Warning: The ‘size‘ argument of ‘element_line()‘ is deprecated as of ggplot2 3.4.0.
## i Please use the ‘linewidth‘ argument instead.
## This warning is displayed once every 8 hours.
## Call ‘lifecycle::last_lifecycle_warnings()‘ to see where this warning was
## generated.
```



graphics

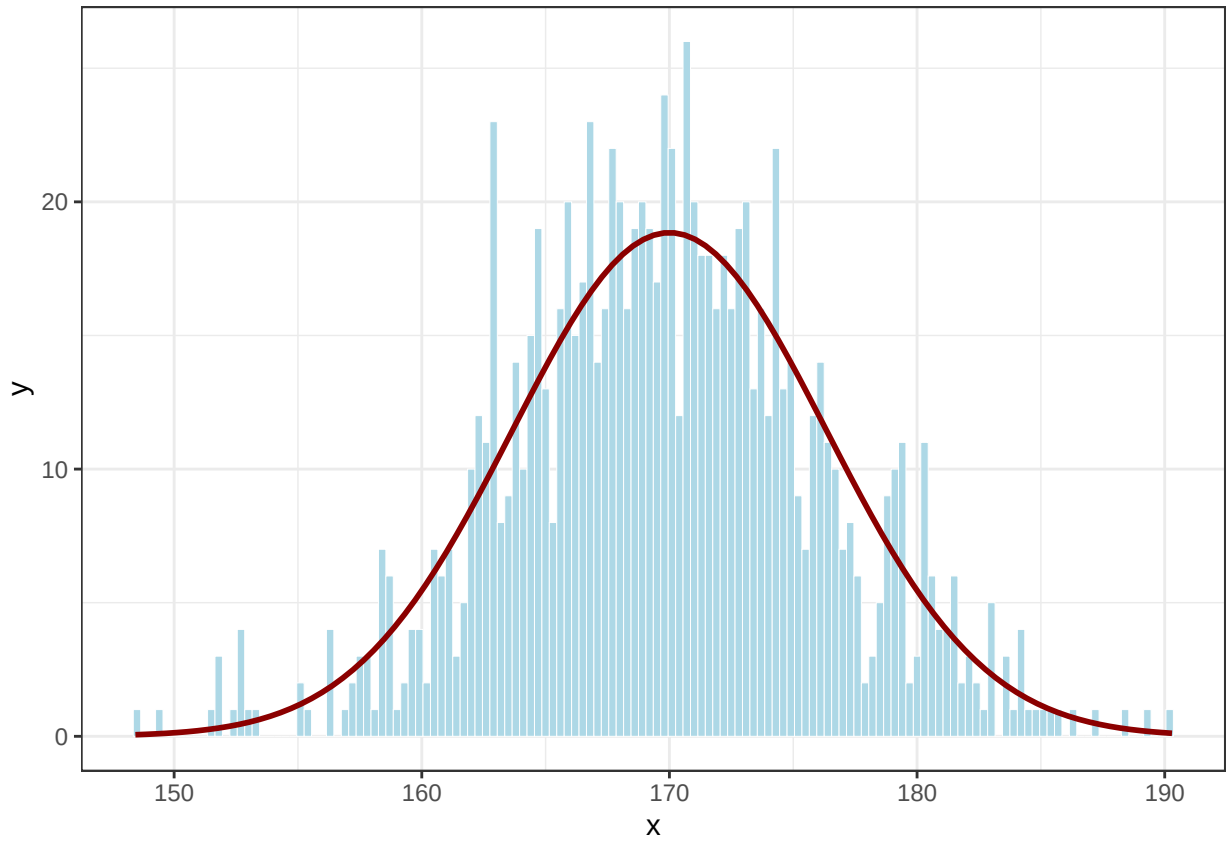
```
x11()  # opne a new window for graphics
graphics.off()  # close the new window
```

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.

```
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)
```

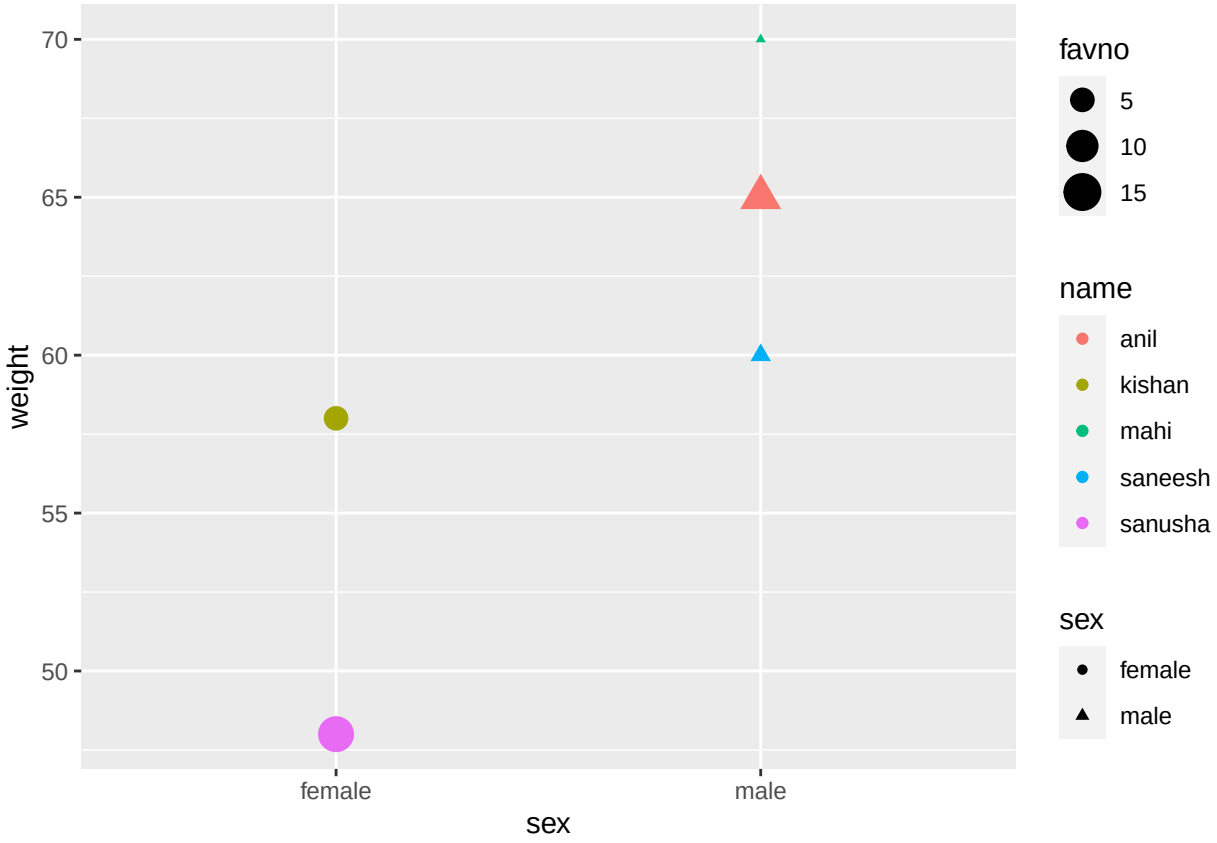
```
## Warning: Using ‘size‘ aesthetic for lines was deprecated in ggplot2 3.4.0.
## i Please use ‘linewidth‘ instead.
## This warning is displayed once every 8 hours.
## Call ‘lifecycle::last_lifecycle_warnings()‘ to see where this warning was
## generated.
```



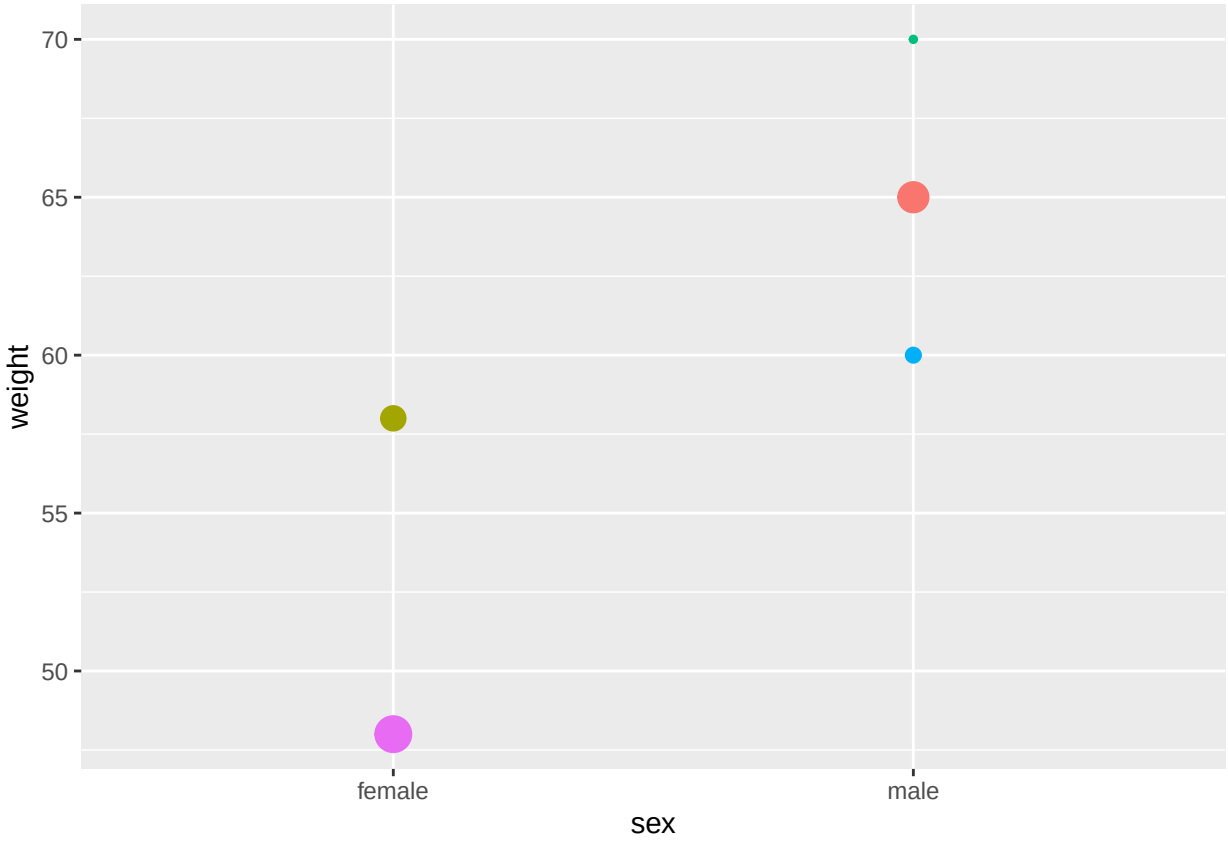
Legend

```
df <- data.frame(name = c("saneesh", "kishan", "anil", "mahi", "sanusha"), sex = c("male",
    "female", "male", "male", "female"), weight = c(60, 58, 65, 70, 48), favno = c(2,
    6, 10, 1, 15))

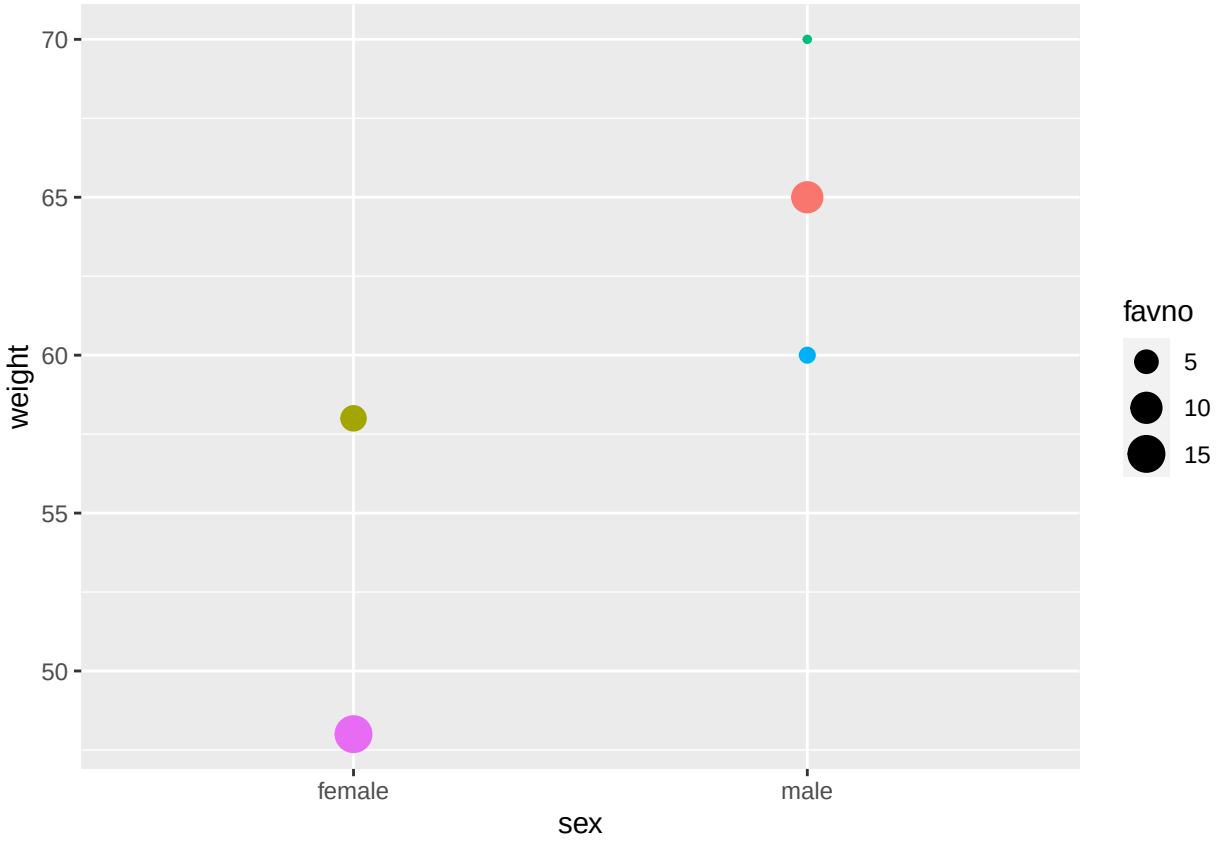
ggplot(df, aes(x = sex, y = weight, col = name, size = favno, shape = sex)) + geom_point()
```



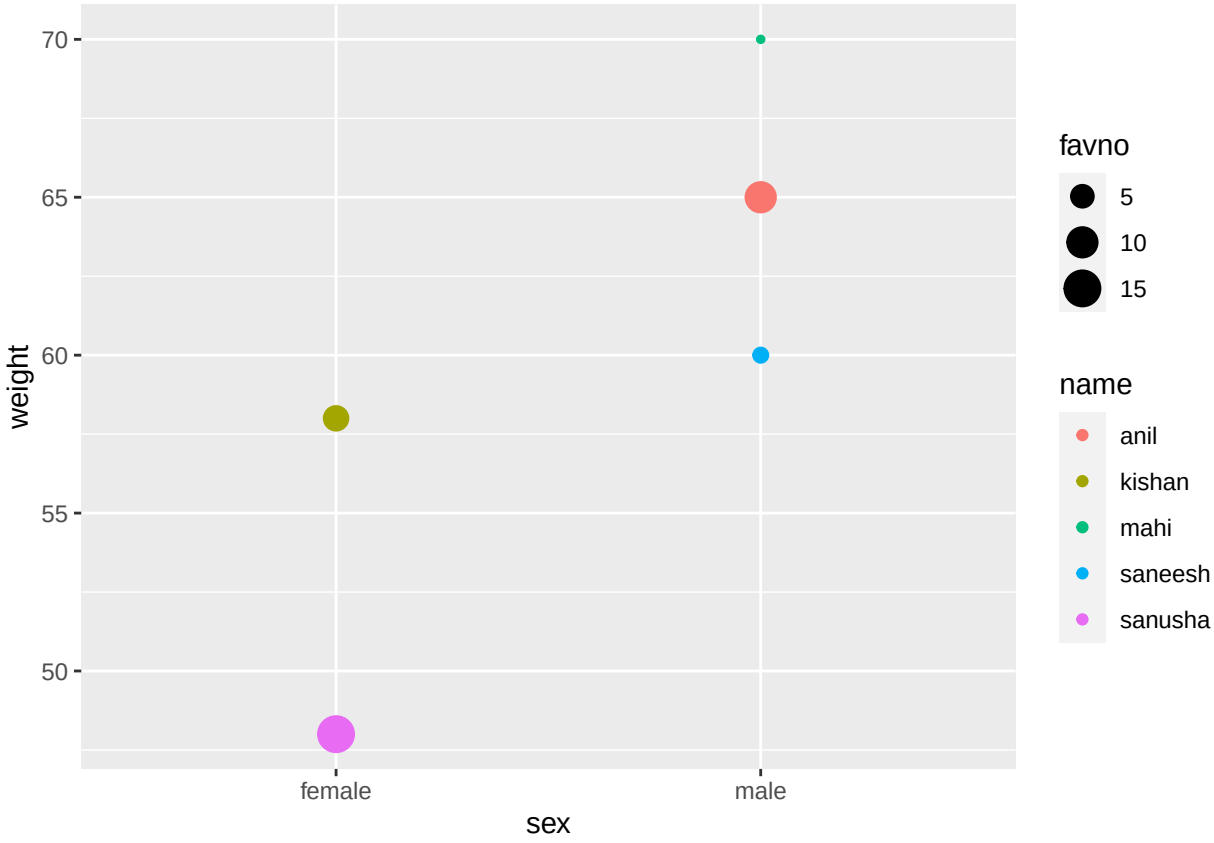

```
# remove all legends
ggplot(df, aes(x = sex, y = weight, col = name, size = favno)) + geom_point() + theme(legend.position =
```



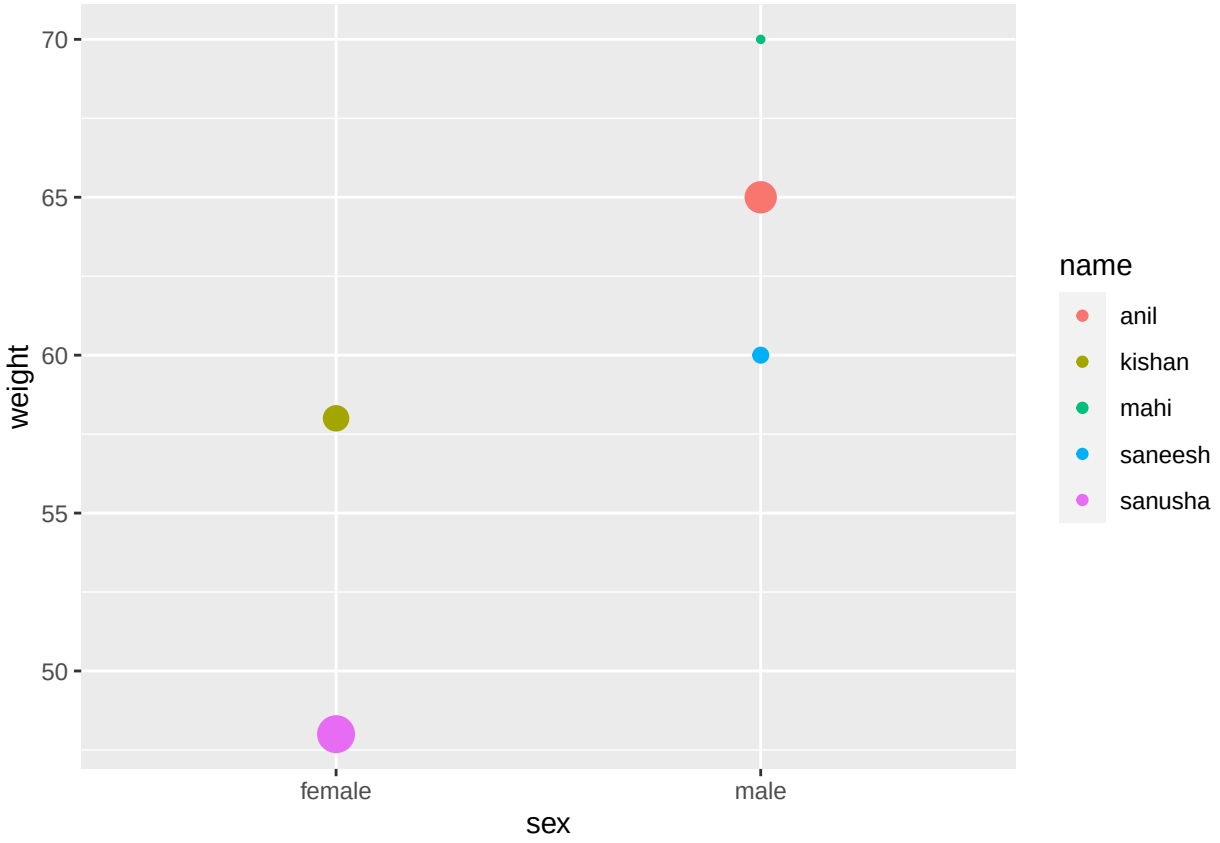

```
# remove legend created by color
ggplot(df, aes(x = sex, y = weight, col = name, size = favno)) + geom_point() + guides(color = "none")
```




```
# remove legend created by shape
ggplot(df, aes(x = sex, y = weight, col = name, size = favno)) + geom_point() + guides(shape = "none")
```




```
# remove legend created by size
ggplot(df, aes(x = sex, y = weight, col = name, size = favno)) + geom_point() + guides(size = "none")
```



Map

```
# packages----
library(sf)  #
```

```
## Linking to GEOS 3.9.3, GDAL 3.5.2, PROJ 8.2.1; sf_use_s2() is TRUE
```

```
library(tidyverse)  #

india.shape <- sf::st_read("C:/Users/ty00osat/OneDrive/R_projects/tidyandwork/india_shp_files/Admin2.sh
```

```
## Reading layer 'Admin2' from data source
##   'C:\Users\ty00osat\OneDrive\R_projects\tidyandwork\india_shp_files\Admin2.shp'
##   using driver 'ESRI Shapefile'
## Simple feature collection with 36 features and 1 field
## Geometry type: MULTIPOLYGON
## Dimension:     XY
## Bounding box:  xmin: 68.18625 ymin: 6.755953 xmax: 97.41529 ymax: 37.07827
## Geodetic CRS:  WGS 84
```

```
# plot(shp)
```

```
state_area <- read.csv("state_area.csv")
state_area <- state_area %>%
    rename(ST_NM = id)

shape.file <- fortify(india.shape, region = "ST_NM")

# names(shp) names(imr) names(shp.f)

merge.Indshp.area <- left_join(shape.file, state_area, by = "ST_NM")

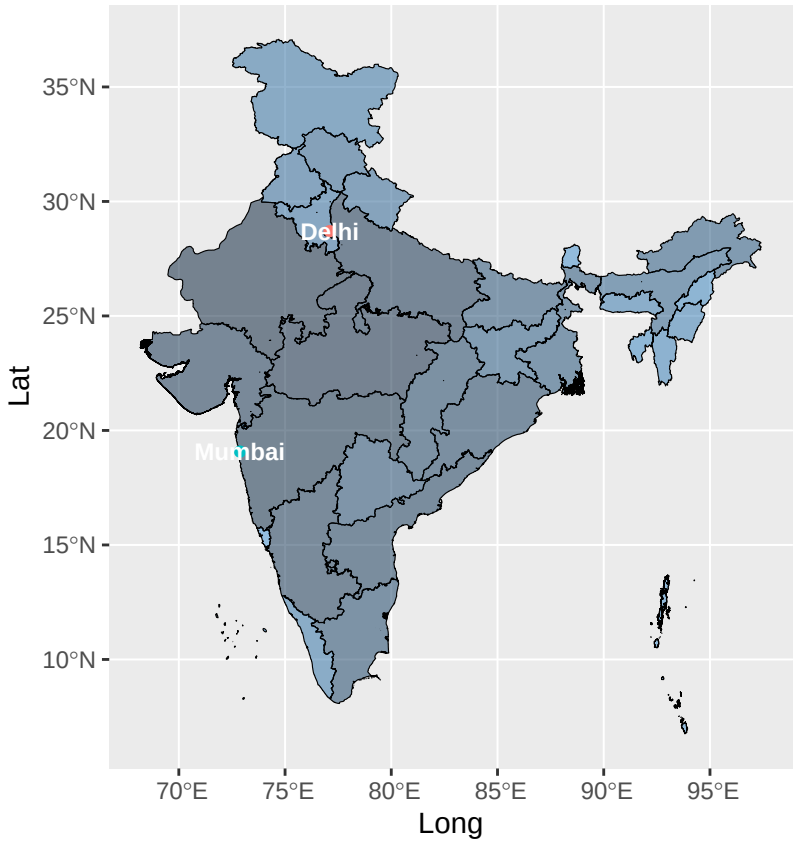
final.plot <- merge.Indshp.area %>%
    arrange(areaRank)

india <- ggplot() + geom_sf(data = final.plot, aes(fill = areaRank, alpha = 0.2),
    col = "black") + theme(legend.position = " ")

# add specific location to the map

places <- data.frame(name = c("Delhi", "Mumbai"), Lat = c(28.7041, 19.076), Long = c(77.1025,
    72.8777))


india + geom_point(data = places, (aes(x = Long, y = Lat, col = name))) + geom_text(data = places,
    aes(x = Long, y = Lat, label = name), size = 3, fontface = "bold", col = "white")
```



```
# ggsave('animalstudy.jpg',dpi = 300, width = 20, height = 20, units = 'cm')
```

Functions

dice

```
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
```

web scraping

```
library(rvest)
```

```
##
## Attaching package: 'rvest'
```

```
## The following object is masked from 'package:readr':
##
##     guess_encoding
```

```
page <- read_html("https://en.wikipedia.org/wiki/List_of_countries_and_dependencies_by_population")

tables <- html_table(page)
typeof(tables)
```

```
## [1] "list"
```

```
unlist(tables)
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```r
table2 <- as.data.frame(tables[[2]])
head(table2, 2)
```

```
##   Rank Country / Dependency    Population     Population       Date
## 1 Rank Country / Dependency       Numbers % of the world       Date
## 2    -                World 8,029,442,000           100% 9 May 2023
##   Source (official or from the United Nations) Notes
## 1 Source (official or from the United Nations) Notes
## 2                             UN projection[3]
```

Rmarkdown

knitr golbal options

to apply to every chunk in the file

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

```r
# 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
```

headings

1 # heading 1
2 ## heading 2 3 ### 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](https://rpruim.github.io/s341/S19/from-class/MathinRmd.html)
```

by `$by$`
μ `$\mu$`
$\sum$ `$\sum$`
$a \pm b$ `$a\pm b$`
$x = y$ `$x=y$`
$x > y$ `$x>y$`
x^2 `$x^2$`
$x \leq y$ `$x\le y$`
$\sum_{n=1}^{10} n^2$ `$\sum_{n=1}^{10} n^2$`
$LUI_i = \frac{1}{2}(gi/gm) + \frac{1}{2}(ti/tm)$ `$LUI_i=\frac12(gi/gm)+\frac12(ti/tm)$` $x_1 + x_2 + \cdots + x_n$ `$x_{1}+x_{2}+\cdots+x_{n}$`
$|A|$ `$|A|$`
$A \subset B$ `$A\subset B$`
$A \subseteq B$ `$A \subseteq B$`
$A \cup B$ `$A \cup B$`
$A \cap B$ `$A \cap B$`
$P(A|B)$ `$P(A|B)$`
α `$\alpha$`
β `$\beta$`
γ `$\gamma$`
θ `$\theta$`
H_2O `$H_2O$`

adding image and caption

Figure 1: write

Inside a chunk after three ... `r, echo=FALSE,out.width="70%",fig.align="center",fig.cap='write'` close the curly bracket, then write knitr::include_graphics("Idly.jpg") # keep the image in the project folder, then close the chunk. with ""'

write an exclamation mark `!`, then square brackets `[caption]` write caption in it, the normal brackets

Figure 2: Idly

`(Idly.jpg)` write the name of the file and it's extension i.e., `idly.jpg`

Resources

bbcplot
colorhunt
colors
colorpaletts
colorpaletts
coloradobe
colormind
datavizpyr
datatoviz
Cédric Scherer
ggplottheme
mycolor
viz-palette
Intro to r