Week-7: Code-Along (Challenge 7)

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2023-10-02

```
# load packages
# install.packages("palmerpenguins")
library(tidyverse)
```

```
## Warning: package 'tidyverse' was built under R version 4.2.2
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.2 --
## v ggplot2 3.4.0     v purrr   1.0.1
## v tibble  3.1.8     v dplyr   1.1.0
## v tidyr   1.2.1     v stringr 1.5.0
## v readr   2.1.3     v forcats 0.5.2
```

```
## Warning: package 'ggplot2' was built under R version 4.2.2
```

```
## Warning: package 'tibble' was built under R version 4.2.1
```

```
## Warning: package 'tidyr' was built under R version 4.2.1
```

```
## Warning: package 'readr' was built under R version 4.2.2
```

```
## Warning: package 'purrr' was built under R version 4.2.2
```

```
## Warning: package 'dplyr' was built under R version 4.2.2
```

```
## Warning: package 'stringr' was built under R version 4.2.2
```

```
## Warning: package 'forcats' was built under R version 4.2.2
```

```
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```
library(palmerpenguins)
```

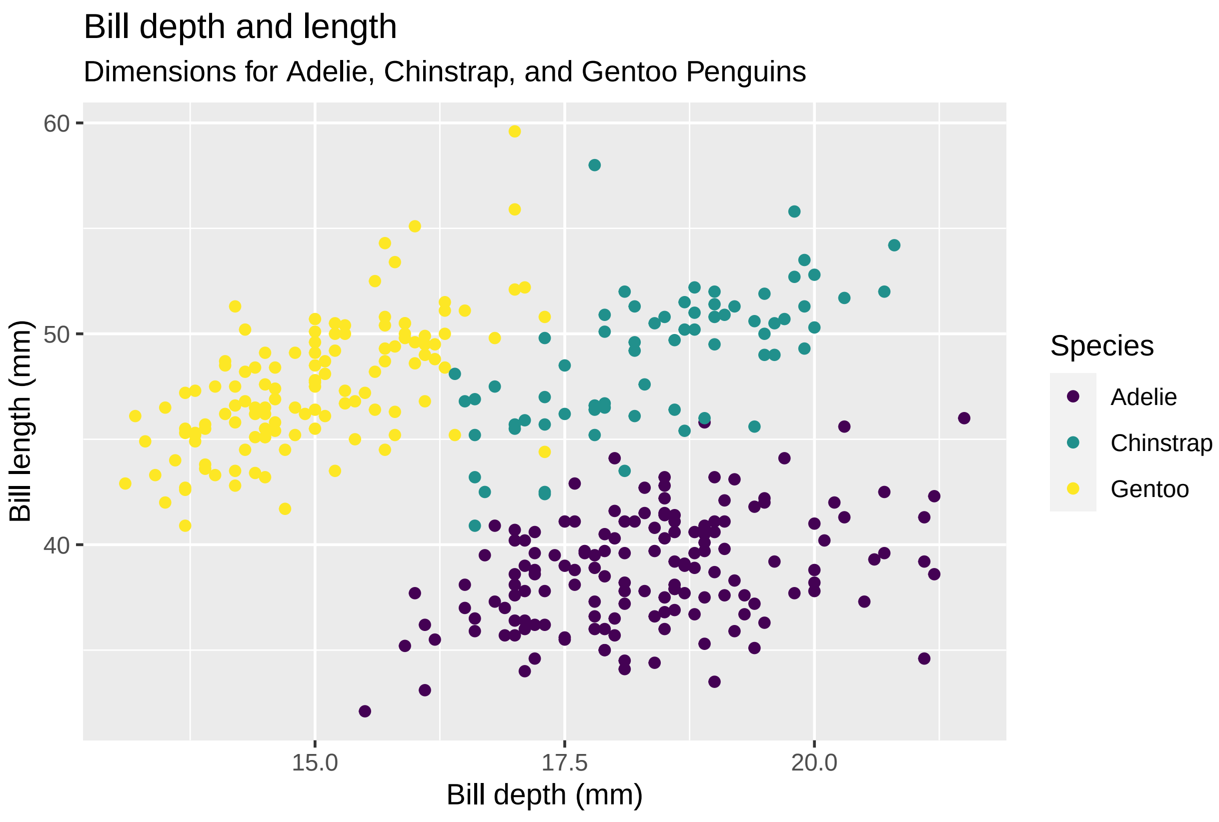
```
## Warning: package 'palmerpenguins' was built under R version 4.2.3
```

```
glimpse(penguins)
```

```
## Rows: 344
## Columns: 8
## $ species           <fct> Adelie, Adelie, Adelie, Adelie, Adelie, Adelie, Adel~
## $ island            <fct> Torgersen, Torgersen, Torgersen, Torgersen, Torgerse~
## $ bill_length_mm    <dbl> 39.1, 39.5, 40.3, NA, 36.7, 39.3, 38.9, 39.2, 34.1, ~
## $ bill_depth_mm     <dbl> 18.7, 17.4, 18.0, NA, 19.3, 20.6, 17.8, 19.6, 18.1, ~
## $ flipper_length_mm <int> 181, 186, 195, NA, 193, 190, 181, 195, 193, 190, 186~
## $ body_mass_g       <int> 3750, 3800, 3250, NA, 3450, 3650, 3625, 4675, 3475, ~
## $ sex               <fct> male, female, female, NA, female, male, female, male~
## $ year              <int> 2007, 2007, 2007, 2007, 2007, 2007, 2007, 2007, 2007~
```

```
# recreate penguin plot
ggplot(data = penguins,
 mapping = aes(x = bill_depth_mm,
 y = bill_length_mm,
 colour = species)) +
 geom_point() +
 labs(title = "Bill depth and length",
 subtitle = "Dimensions for Adelie, Chinstrap, and Gentoo Penguins",
 x = "Bill depth (mm)", y = "Bill length (mm)",
 colour = "Species",
 caption = "Source: Palmer Station LTER / palmerpenguins package") +
 scale_colour_viridis_d()
```

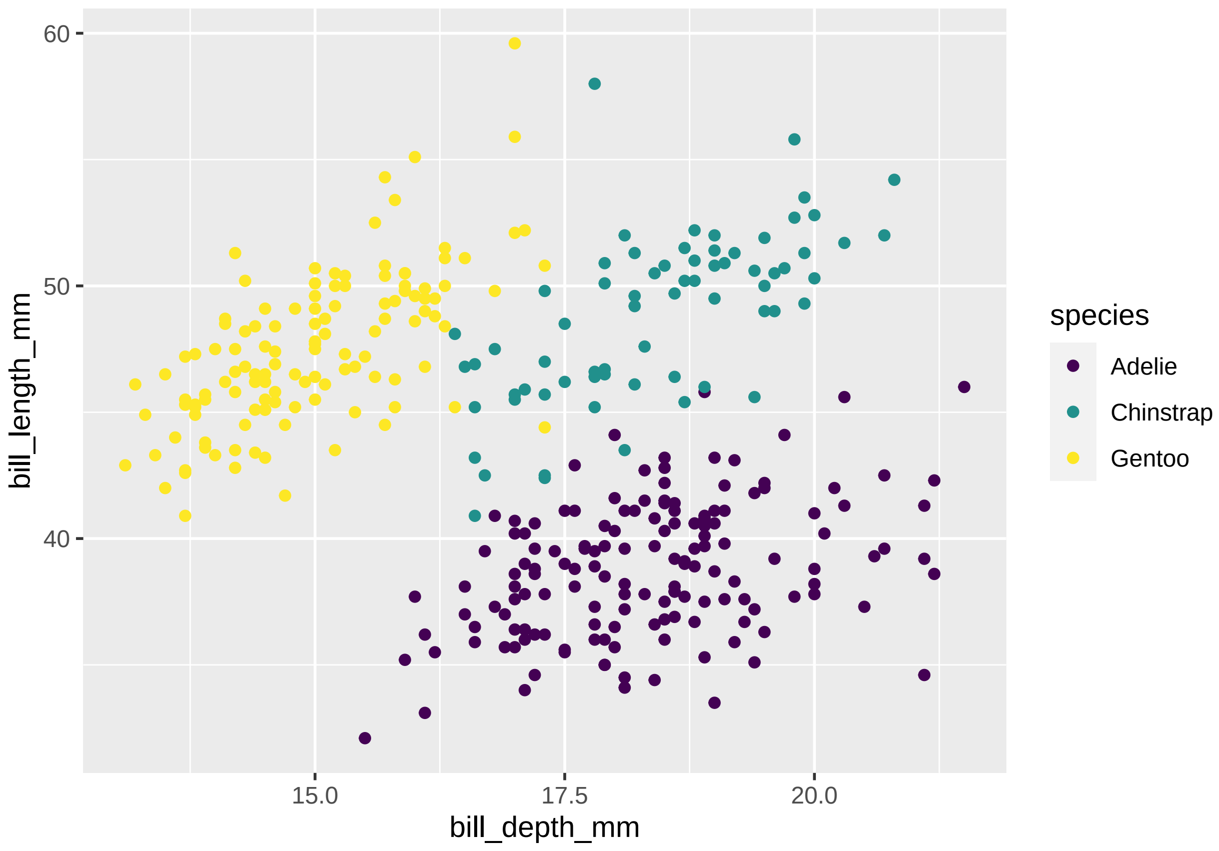
```
## Warning: Removed 2 rows containing missing values (‘geom_point()‘).
```



Source: Palmer Station LTER / palmerpenguins package

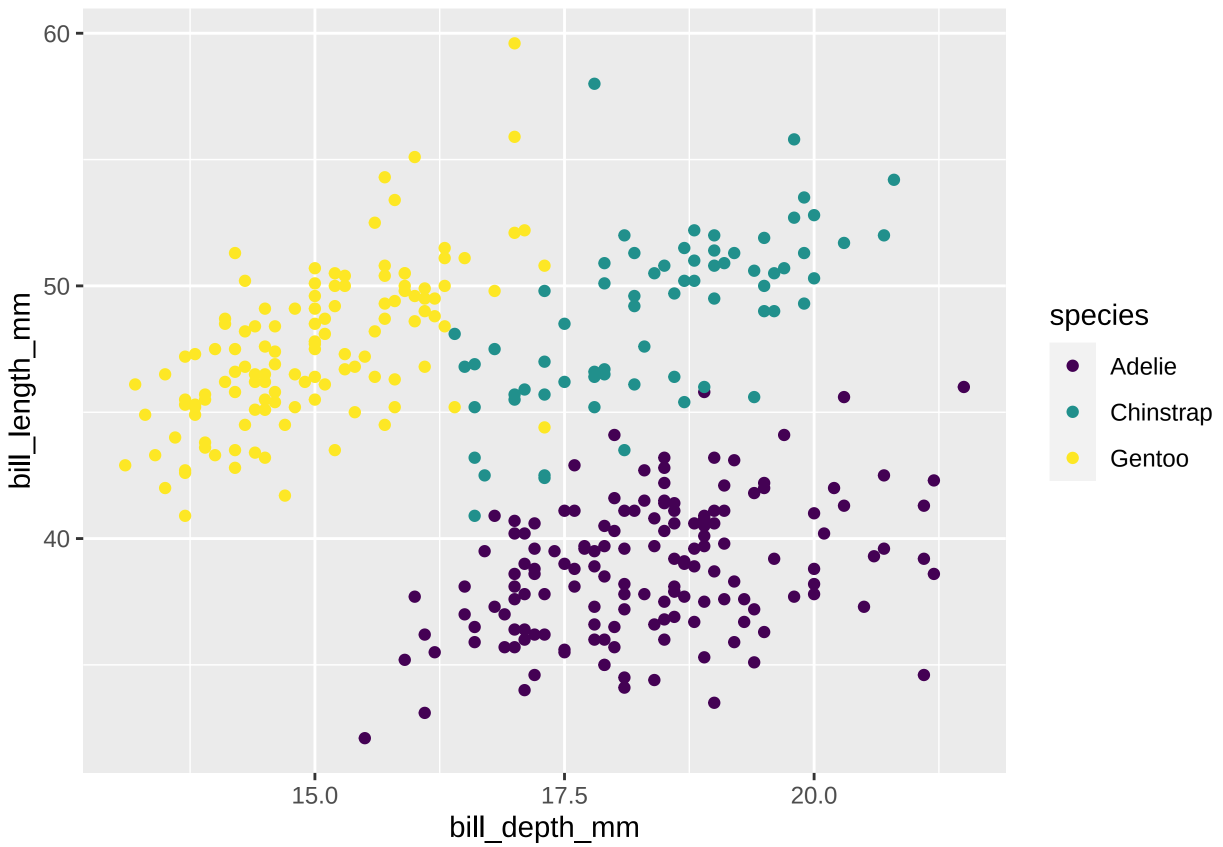
```
# omit data and mapping argument names
ggplot(penguins,
 aes(x = bill_depth_mm,
 y = bill_length_mm,
 colour = species)) +
 geom_point() +
 scale_colour_viridis_d()
```

```
## Warning: Removed 2 rows containing missing values (‘geom_point()‘).
```



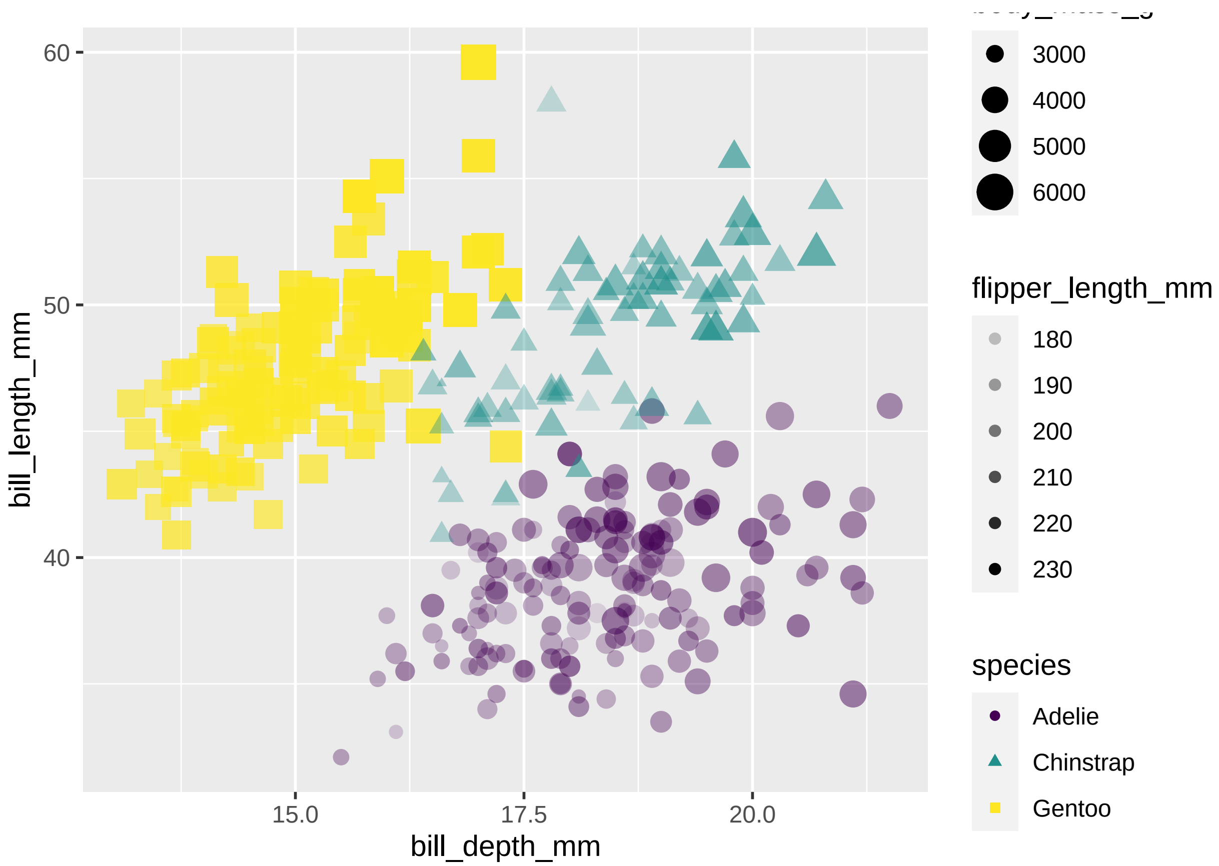
```r
# alternative formatting
ggplot(penguins) + # Data layer
 aes(x = bill_depth_mm,
 y = bill_length_mm,
 colour = species) + # Aesthetics layer
 geom_point() + # Geometric layer
 scale_colour_viridis_d()
```

```
## Warning: Removed 2 rows containing missing values (‘geom_point()‘).
```



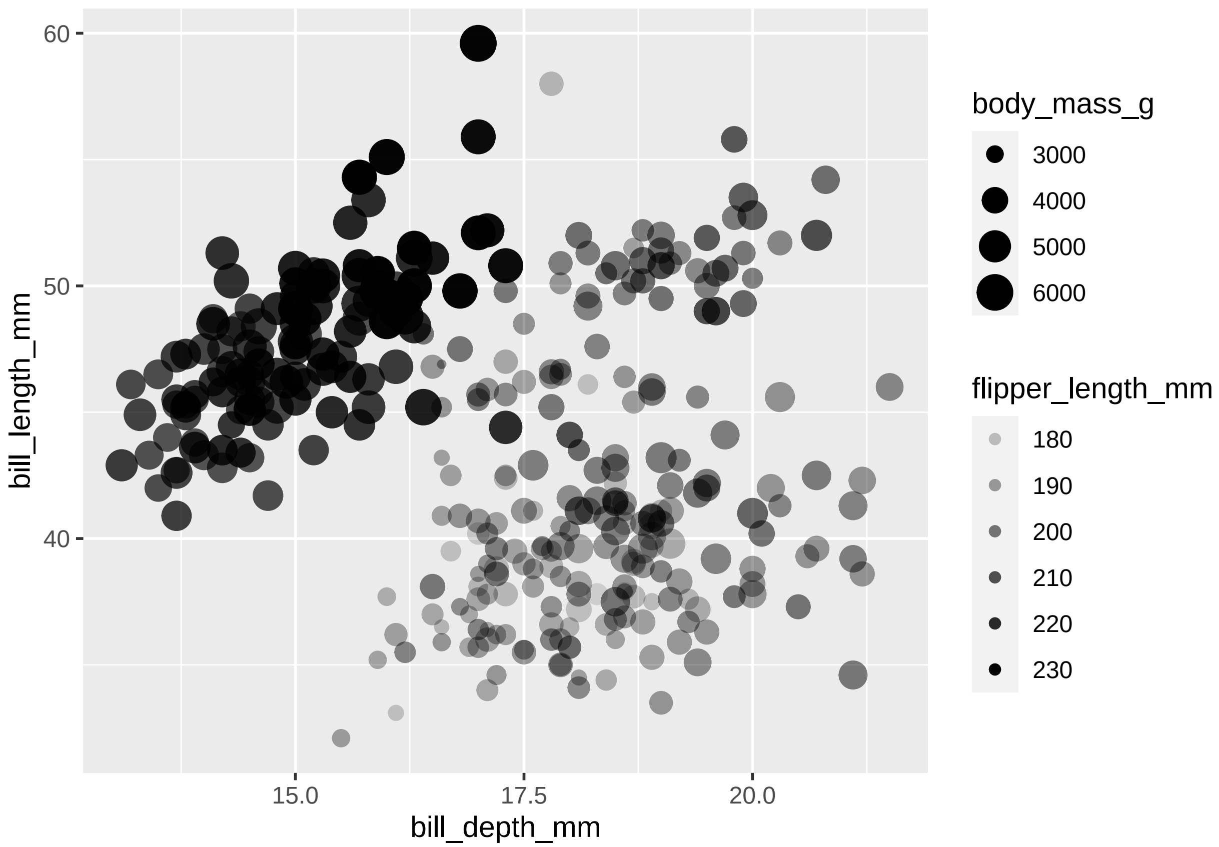
```
# mapping colour, shape, size and alpha to different variables
ggplot(penguins, aes(x = bill_depth_mm, y = bill_length_mm, colour = species,
 shape = species, size = body_mass_g, alpha = flipper_length_mm)) +
 geom_point() + scale_colour_viridis_d()
```

```
## Warning: Removed 2 rows containing missing values ('geom_point()').
```



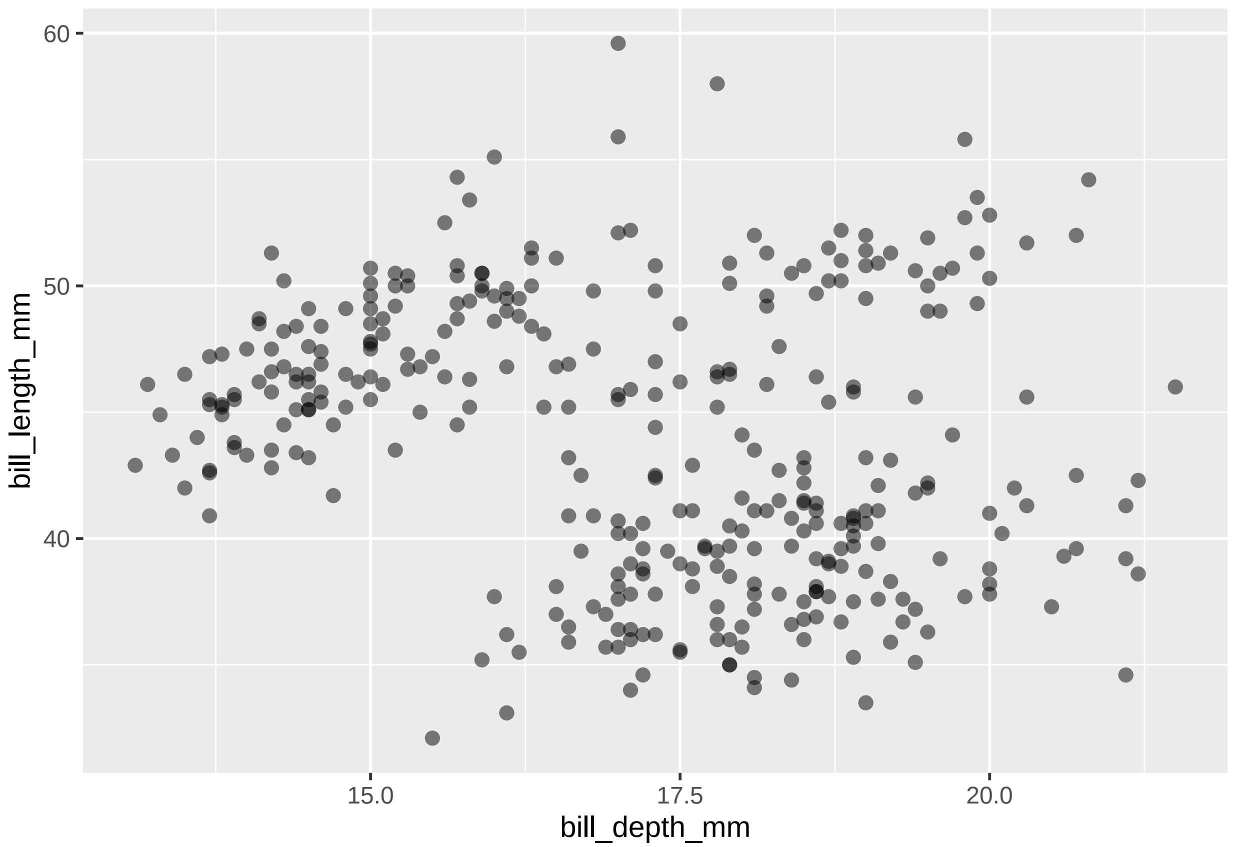
```
# mapping vs setting
# mapping
ggplot(penguins) +
 aes(x = bill_depth_mm,
 y = bill_length_mm,
 size = body_mass_g,
 alpha = flipper_length_mm) +
 geom_point()
```

```
## Warning: Removed 2 rows containing missing values (`geom_point()`).
```



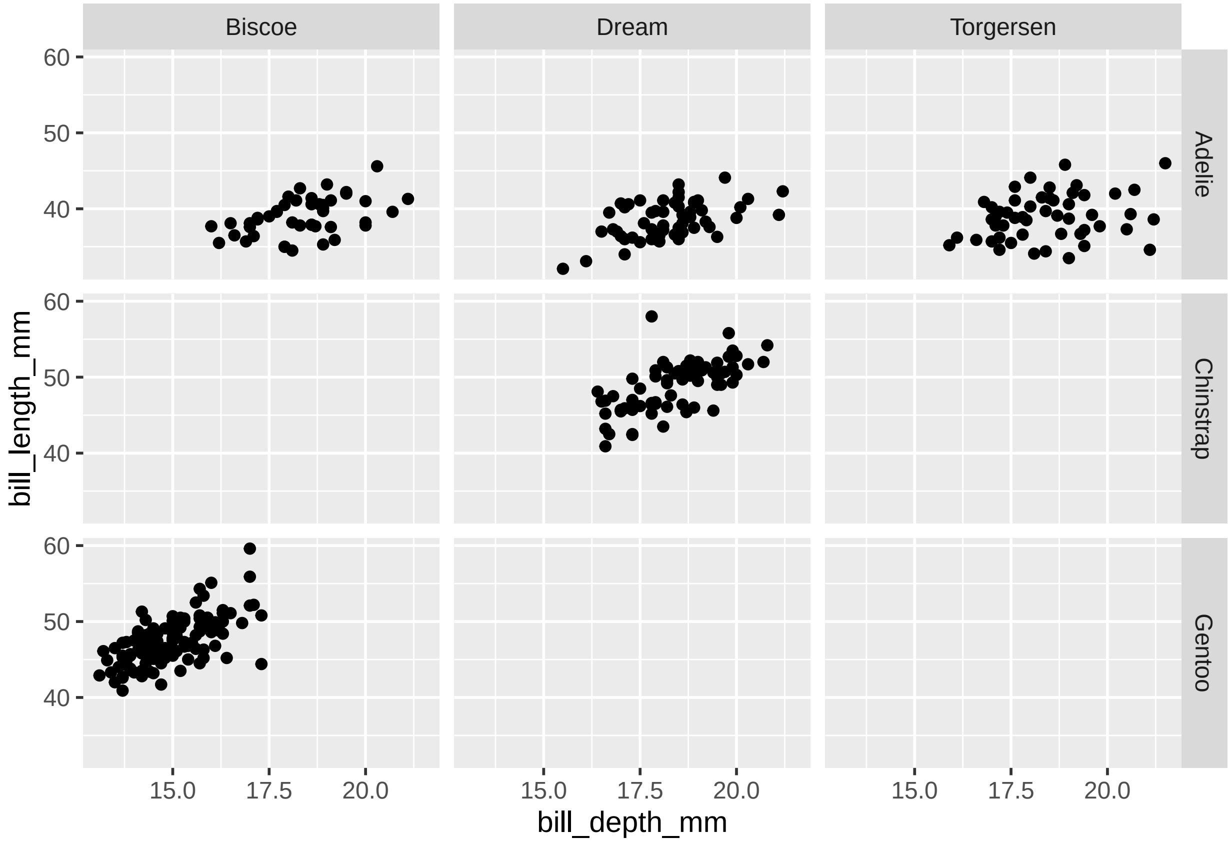
```
# setting
ggplot(penguins) +
 aes(x = bill_depth_mm,
 y = bill_length_mm) +
 geom_point(size = 2, alpha = 0.5)
```

```
## Warning: Removed 2 rows containing missing values (‘geom_point()‘).
```



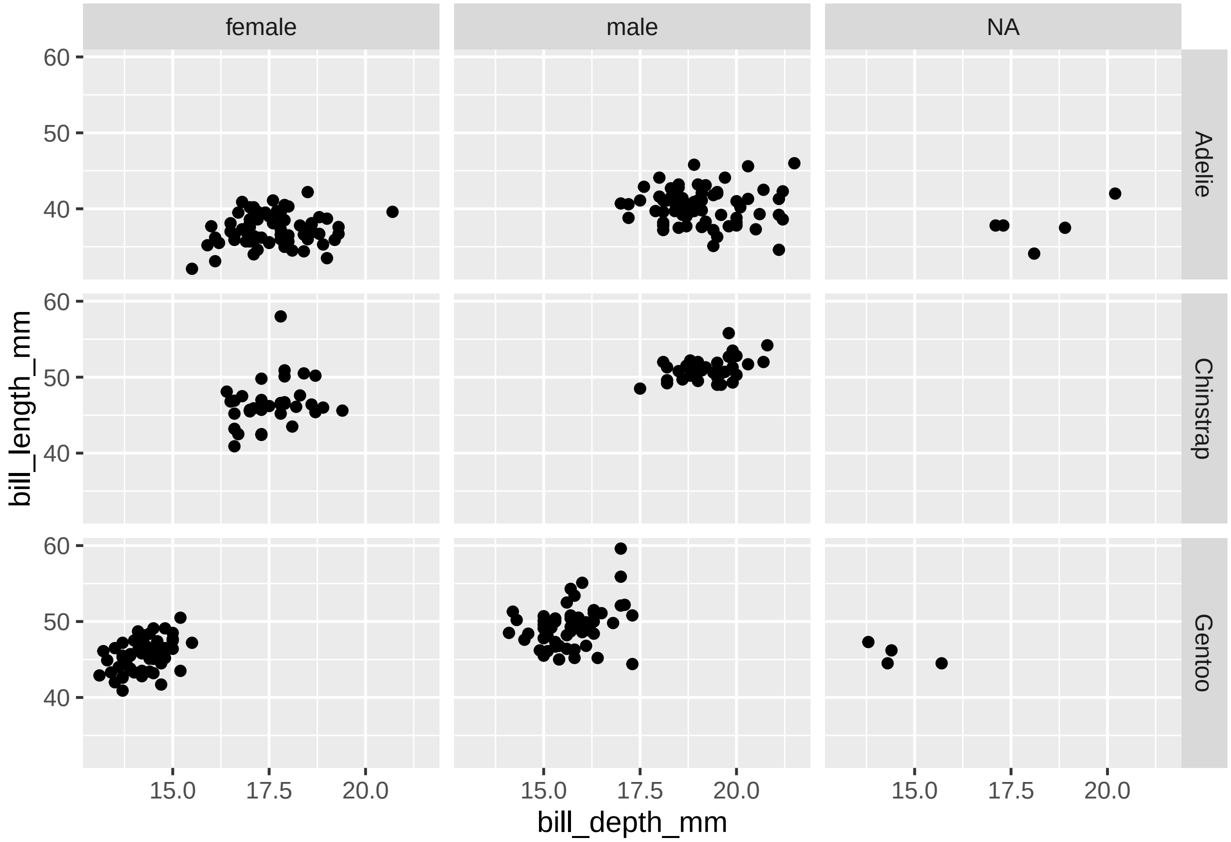
```
# faceting

#species against island
ggplot(penguins) +
 aes(x = bill_depth_mm,
 y = bill_length_mm) +
 geom_point() +
 facet_grid(species ~ island)
```

```
## Warning: Removed 2 rows containing missing values (‘geom_point()‘).
```



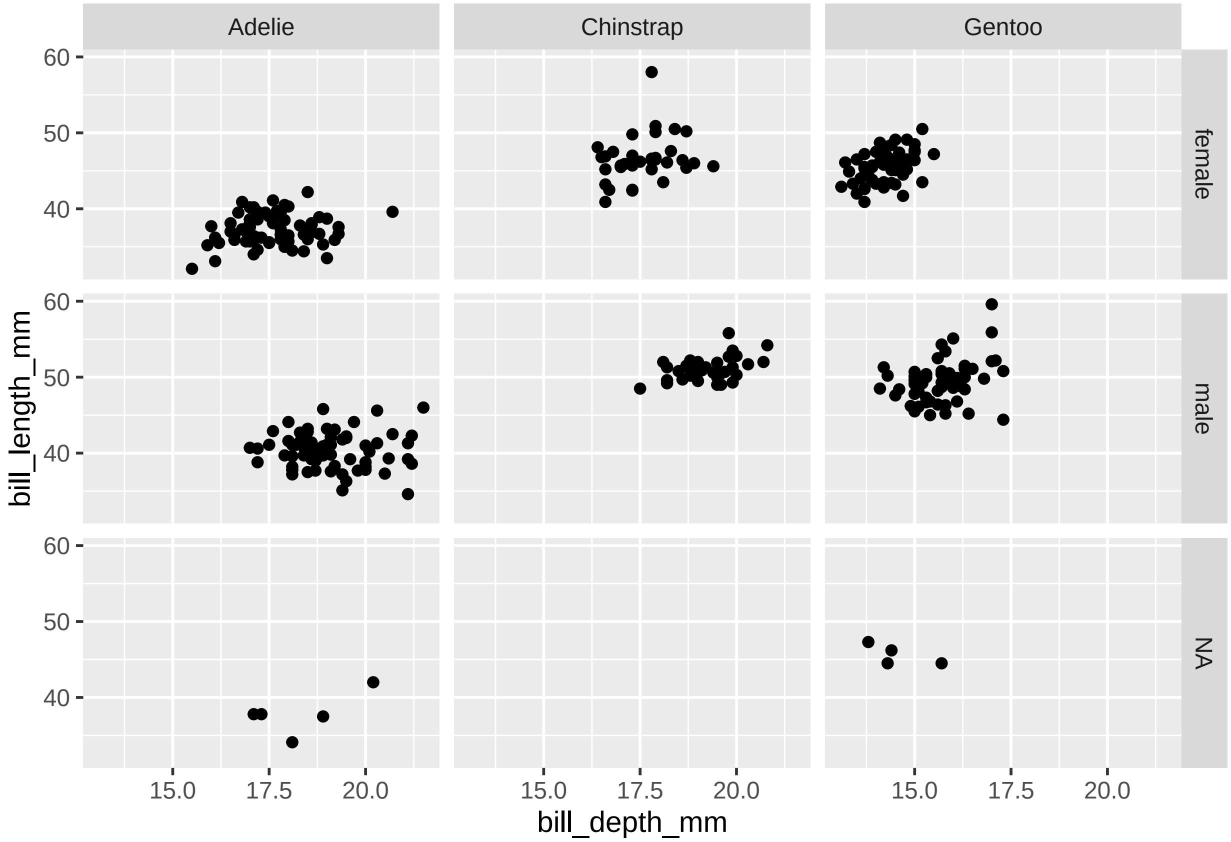
```
#species against sex
ggplot(penguins, aes(x = bill_depth_mm, y = bill_length_mm)) + geom_point() +
 facet_grid(species ~ sex)
```

```
## Warning: Removed 2 rows containing missing values (`geom_point()`).
```



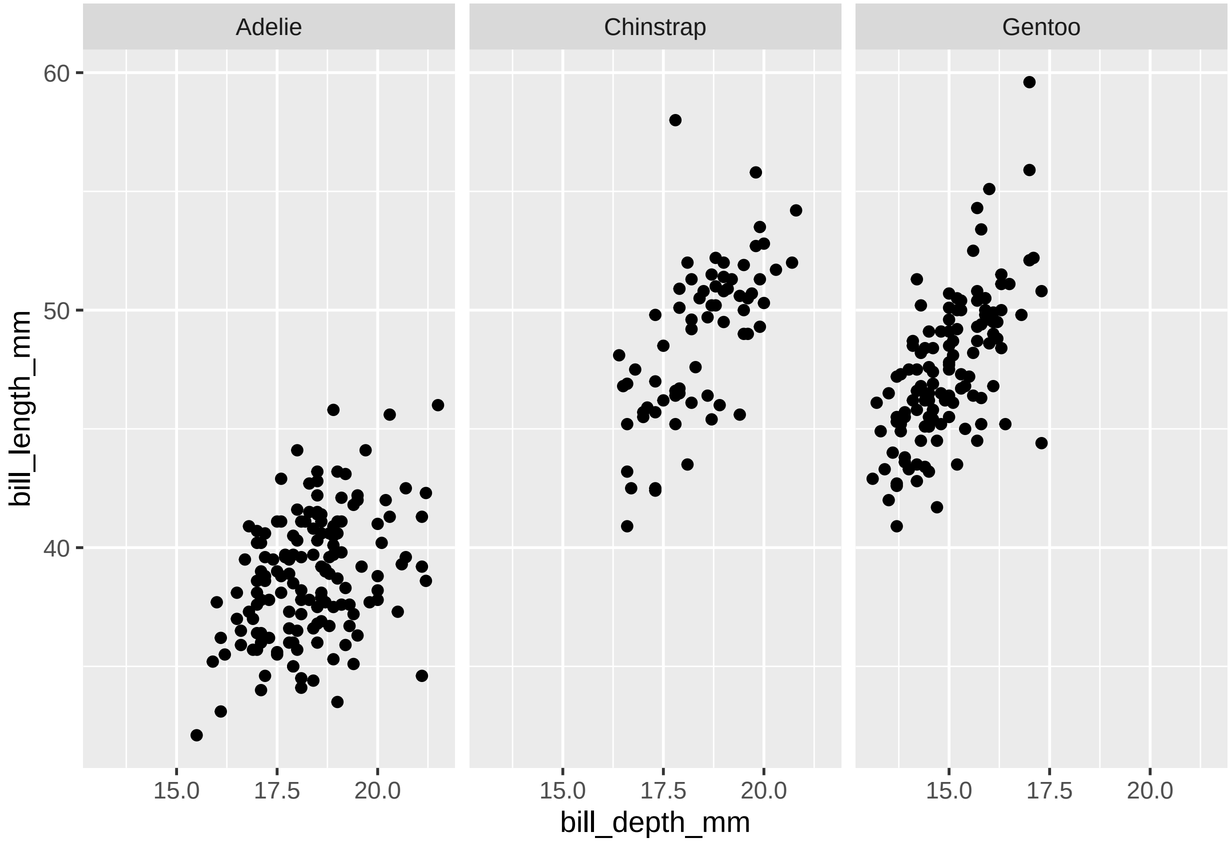
```r
# sex against species
ggplot(penguins, aes(x = bill_depth_mm, y = bill_length_mm)) + geom_point() +
 facet_grid(sex ~ species)
```

```
## Warning: Removed 2 rows containing missing values (`geom_point()`).
```



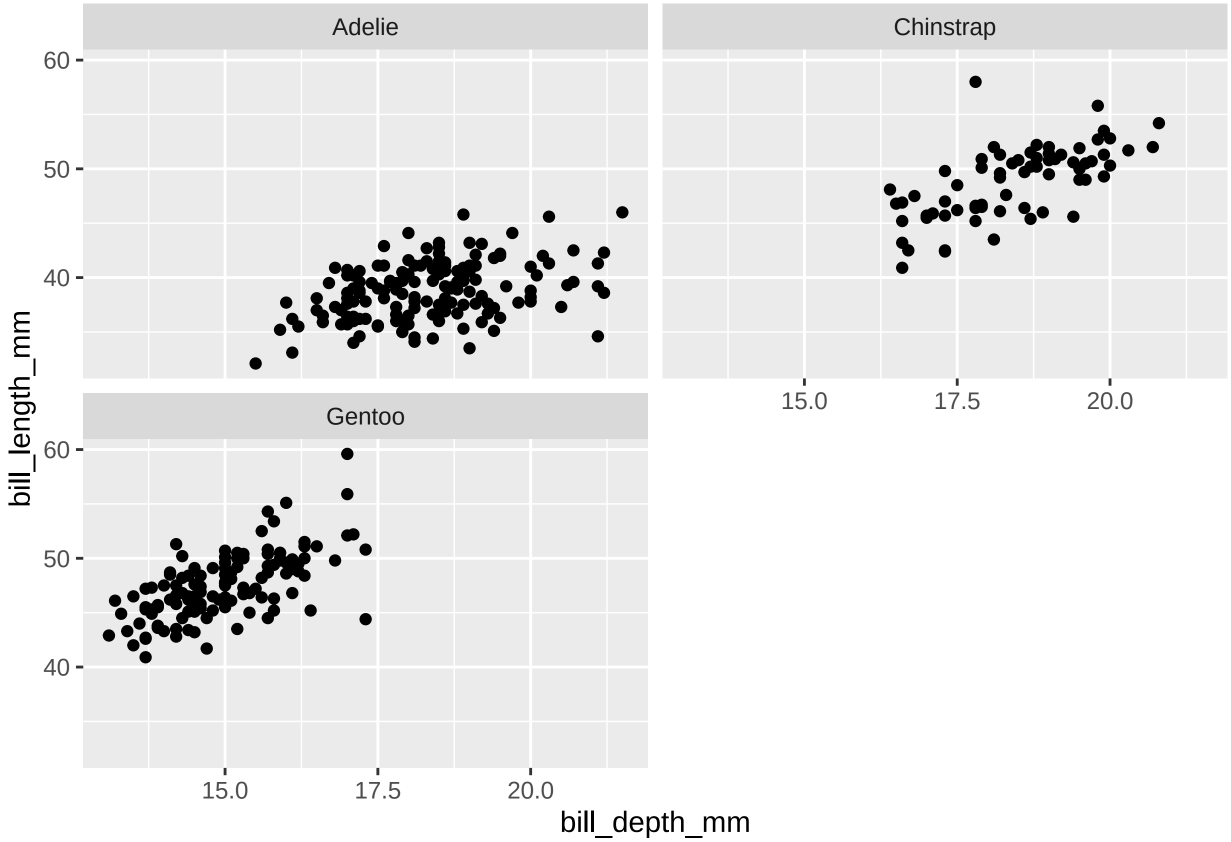
```
# species only
ggplot(penguins, aes(x = bill_depth_mm, y = bill_length_mm)) + geom_point() +
 facet_wrap(~ species)
```

```
## Warning: Removed 2 rows containing missing values (`geom_point()`).
```



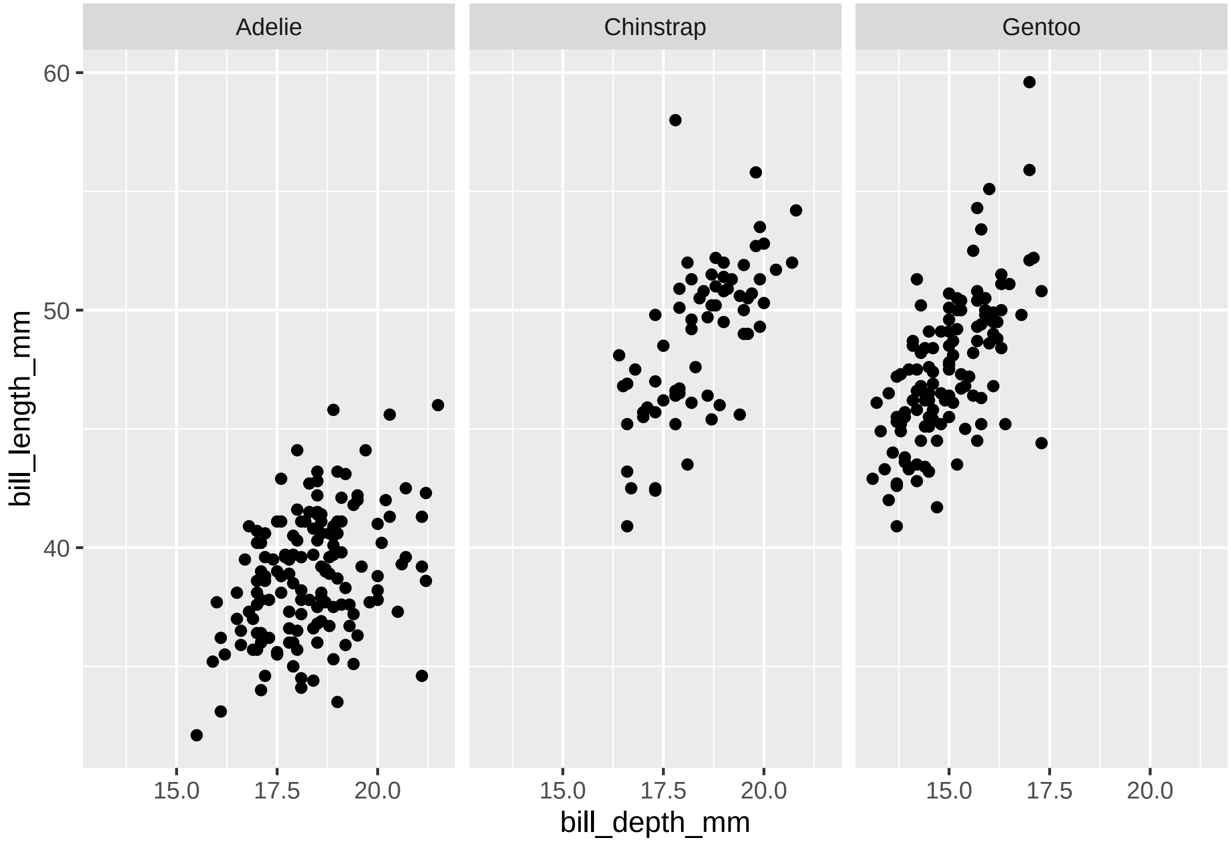
```
# species only, two columns
ggplot(penguins, aes(x = bill_depth_mm, y = bill_length_mm)) + geom_point() +
 facet_wrap(~ species, ncol = 2)
```

```
## Warning: Removed 2 rows containing missing values (‘geom_point()‘).
```



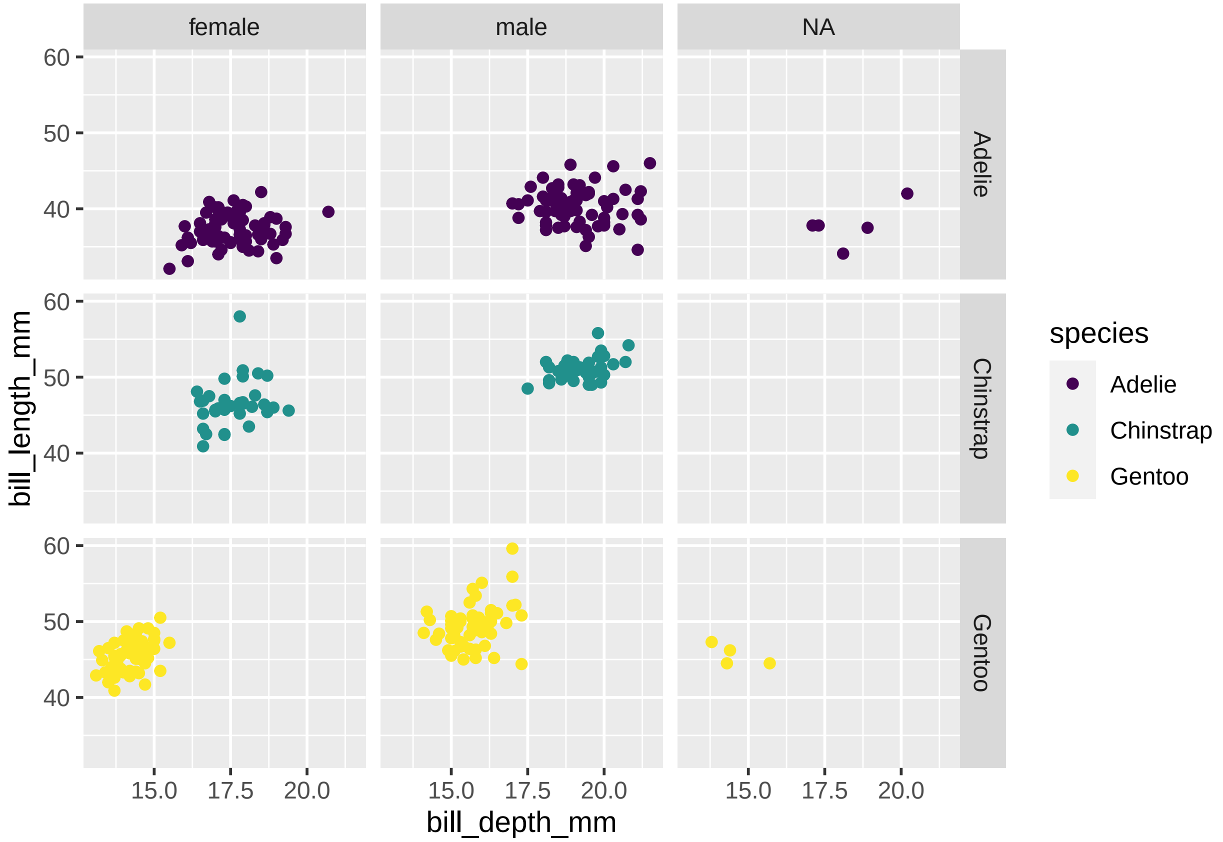
```
# species only using facet_grid
ggplot(penguins, aes(x = bill_depth_mm, y = bill_length_mm)) + geom_point() +
 facet_grid(. ~ species)
```

```
## Warning: Removed 2 rows containing missing values (`geom_point()`).
```



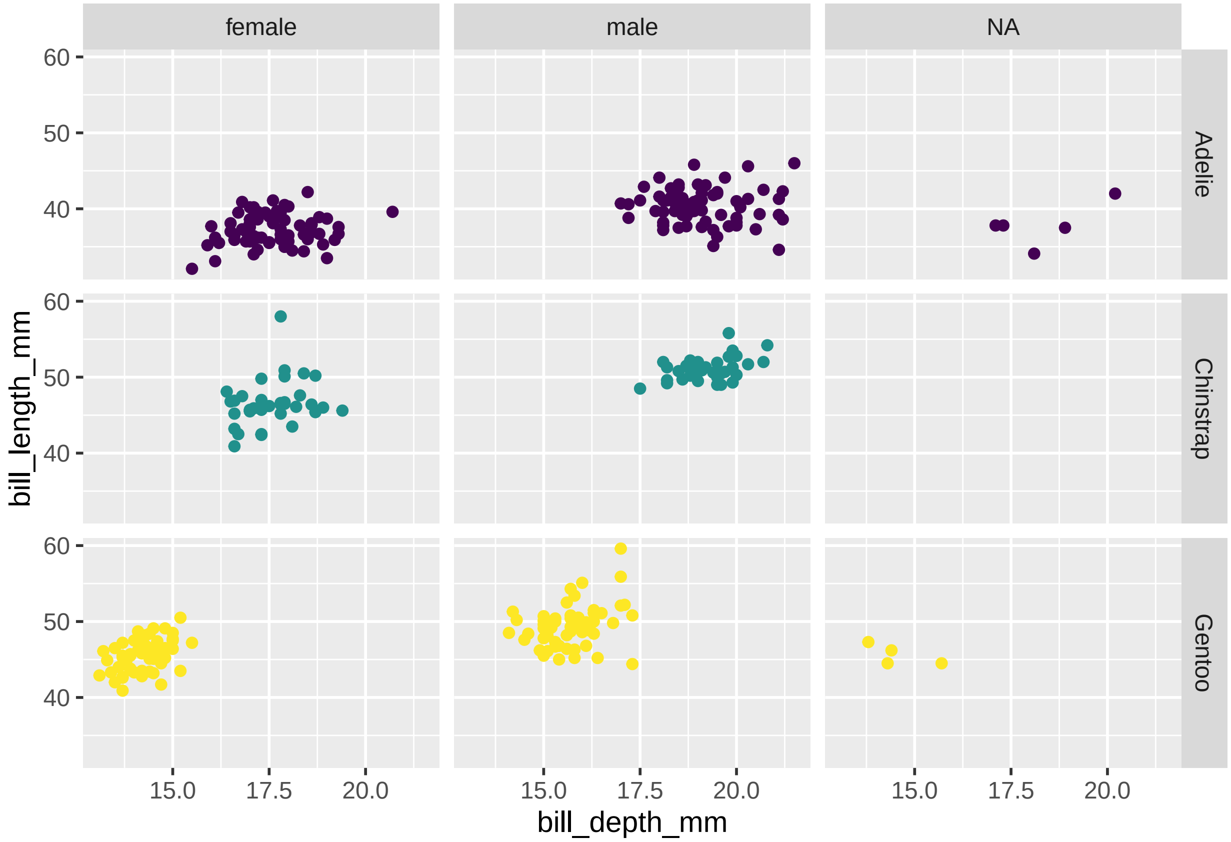
```
# facet and colour
ggplot(penguins, aes(x = bill_depth_mm, y = bill_length_mm, color = species)) +
 geom_point() + facet_grid(species ~ sex) + scale_color_viridis_d()
```

```
## Warning: Removed 2 rows containing missing values (‘geom_point()‘).
```



```
# facet and colour sans legend
ggplot(penguins, aes(x = bill_depth_mm, y = bill_length_mm, color = species)) +
 geom_point() + facet_grid(species ~ sex) + scale_color_viridis_d() +
 guides(color = "none")
```

```
## Warning: Removed 2 rows containing missing values (‘geom_point()‘).
```



```
# load packages
# install.packages("openintro")
library(openintro)
```

```
## Warning: package 'openintro' was built under R version 4.2.3

## Loading required package: airports

## Warning: package 'airports' was built under R version 4.2.3

## Loading required package: cherryblossom

## Warning: package 'cherryblossom' was built under R version 4.2.3

## Loading required package: usdata

## Warning: package 'usdata' was built under R version 4.2.3
```

```
glimpse(loans_full_schema)
```

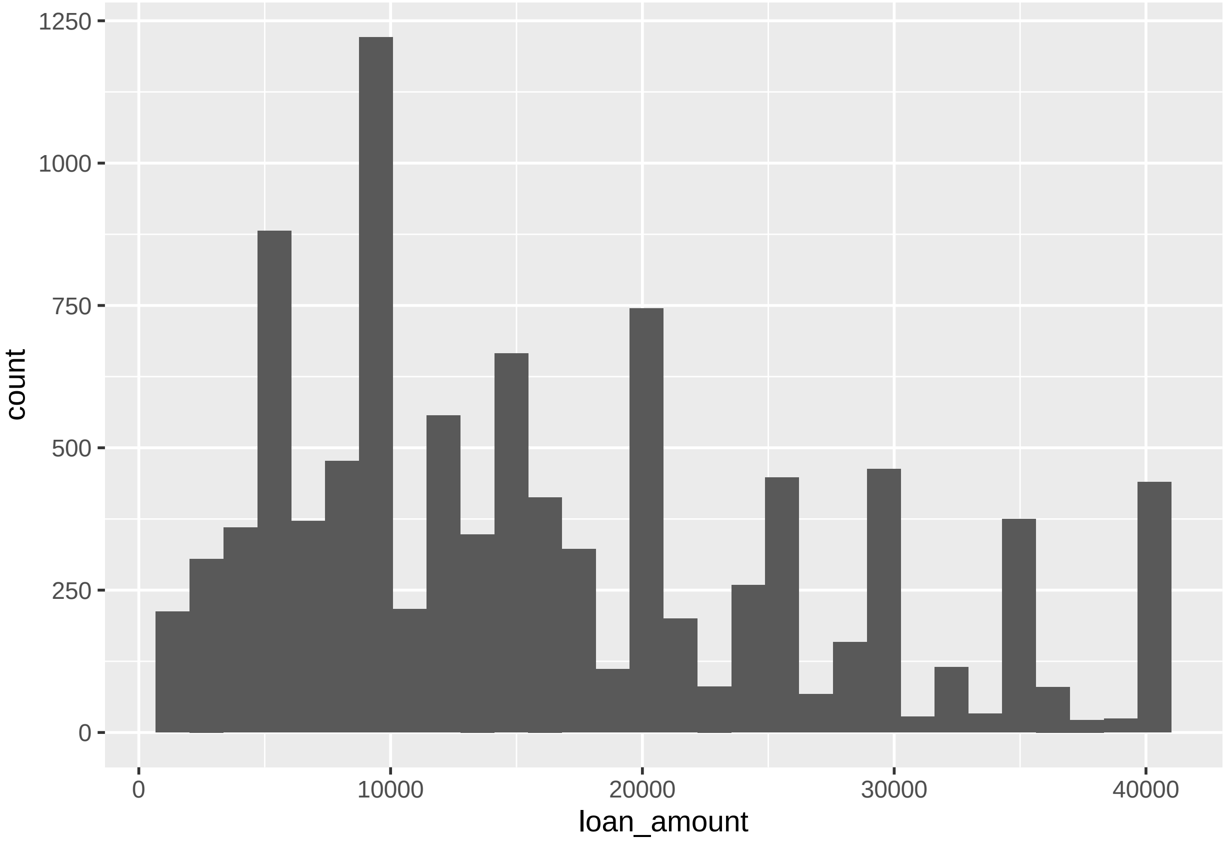
```
## Rows: 10,000
## Columns: 55
## $ emp_title                        <chr> "global config engineer ", "warehouse~
## $ emp_length                       <dbl> 3, 10, 3, 1, 10, NA, 10, 10, 10, 3, 1~
## $ state                            <fct> NJ, HI, WI, PA, CA, KY, MI, AZ, NV, I~
## $ homeownership                    <fct> MORTGAGE, RENT, RENT, RENT, RENT, OWN~
## $ annual_income                    <dbl> 90000, 40000, 40000, 30000, 35000, 34~
## $ verified_income                  <fct> Verified, Not Verified, Source Verifi~
## $ debt_to_income                   <dbl> 18.01, 5.04, 21.15, 10.16, 57.96, 6.4~
## $ annual_income_joint              <dbl> NA, NA, NA, NA, 57000, NA, 155000, NA~
## $ verification_income_joint        <fct> , , , , Verified, , Not Verified, , ,~
## $ debt_to_income_joint             <dbl> NA, NA, NA, NA, 37.66, NA, 13.12, NA,~
## $ delinq_2y                        <int> 0, 0, 0, 0, 0, 1, 0, 1, 1, 0, 0, 0, 0~
## $ months_since_last_delinq         <int> 38, NA, 28, NA, NA, 3, NA, 19, 18, NA~
## $ earliest_credit_line             <dbl> 2001, 1996, 2006, 2007, 2008, 1990, 2~
## $ inquiries_last_12m               <int> 6, 1, 4, 0, 7, 6, 1, 1, 3, 0, 4, 4, 8~
## $ total_credit_lines               <int> 28, 30, 31, 4, 22, 32, 12, 30, 35, 9,~
## $ open_credit_lines                <int> 10, 14, 10, 4, 16, 12, 10, 15, 21, 6,~
## $ total_credit_limit               <int> 70795, 28800, 24193, 25400, 69839, 42~
## $ total_credit_utilized            <int> 38767, 4321, 16000, 4997, 52722, 3898~
## $ num_collections_last_12m         <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0~
## $ num_historical_failed_to_pay     <int> 0, 1, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0~
## $ months_since_90d_late            <int> 38, NA, 28, NA, NA, 60, NA, 71, 18, N~
## $ current_accounts_delinq          <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0~
## $ total_collection_amount_ever     <int> 1250, 0, 432, 0, 0, 0, 0, 0, 0, 0, 0,~
## $ current_installment_accounts     <int> 2, 0, 1, 1, 1, 0, 2, 2, 6, 1, 2, 1, 2~
## $ accounts_opened_24m              <int> 5, 11, 13, 1, 6, 2, 1, 4, 10, 5, 6, 7~
## $ months_since_last_credit_inquiry <int> 5, 8, 7, 15, 4, 5, 9, 7, 4, 17, 3, 4,~
## $ num_satisfactory_accounts        <int> 10, 14, 10, 4, 16, 12, 10, 15, 21, 6,~
## $ num_accounts_120d_past_due       <int> 0, 0, 0, 0, 0, 0, 0, NA, 0, 0, 0, 0, ~
## $ num_accounts_30d_past_due        <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0~
## $ num_active_debit_accounts        <int> 2, 3, 3, 2, 10, 1, 3, 5, 11, 3, 2, 2,~
## $ total_debit_limit                <int> 11100, 16500, 4300, 19400, 32700, 272~
## $ num_total_cc_accounts            <int> 14, 24, 14, 3, 20, 27, 8, 16, 19, 7, ~
## $ num_open_cc_accounts             <int> 8, 14, 8, 3, 15, 12, 7, 12, 14, 5, 8,~
## $ num_cc_carrying_balance          <int> 6, 4, 6, 2, 13, 5, 6, 10, 14, 3, 5, 3~
## $ num_mort_accounts                <int> 1, 0, 0, 0, 0, 3, 2, 7, 2, 0, 2, 3, 3~
## $ account_never_delinq_percent     <dbl> 92.9, 100.0, 93.5, 100.0, 100.0, 78.1~
## $ tax_liens                        <int> 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0~
## $ public_record_bankrupt           <int> 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0~
## $ loan_purpose                     <fct> moving, debt_consolidation, other, de~
## $ application_type                 <fct> individual, individual, individual, i~
## $ loan_amount                      <int> 28000, 5000, 2000, 21600, 23000, 5000~
## $ term                             <dbl> 60, 36, 36, 36, 36, 36, 60, 60, 36, 3~
## $ interest_rate                    <dbl> 14.07, 12.61, 17.09, 6.72, 14.07, 6.7~
## $ installment                      <dbl> 652.53, 167.54, 71.40, 664.19, 786.87~
## $ grade                            <fct> C, C, D, A, C, A, C, B, C, A, C, B, C~
## $ sub_grade                        <fct> C3, C1, D1, A3, C3, A3, C2, B5, C2, A~
## $ issue_month                      <fct> Mar-2018, Feb-2018, Feb-2018, Jan-201~
## $ loan_status                      <fct> Current, Current, Current, Current, C~
## $ initial_listing_status           <fct> whole, whole, fractional, whole, whol~
## $ disbursement_method              <fct> Cash, Cash, Cash, Cash, Cash, Cash, C~
## $ balance                          <dbl> 27015.86, 4651.37, 1824.63, 18853.26,~
## $ paid_total                       <dbl> 1999.330, 499.120, 281.800, 3312.890,~
## $ paid_principal                   <dbl> 984.14, 348.63, 175.37, 2746.74, 1569~
## $ paid_interest                    <dbl> 1015.19, 150.49, 106.43, 566.15, 754.~
## $ paid_late_fees                   <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0~
```

```r
# select variables
loans <- loans_full_schema %>%
 select(loan_amount, interest_rate, term, grade,
 state, annual_income, homeownership, debt_to_income)
glimpse(loans)
```

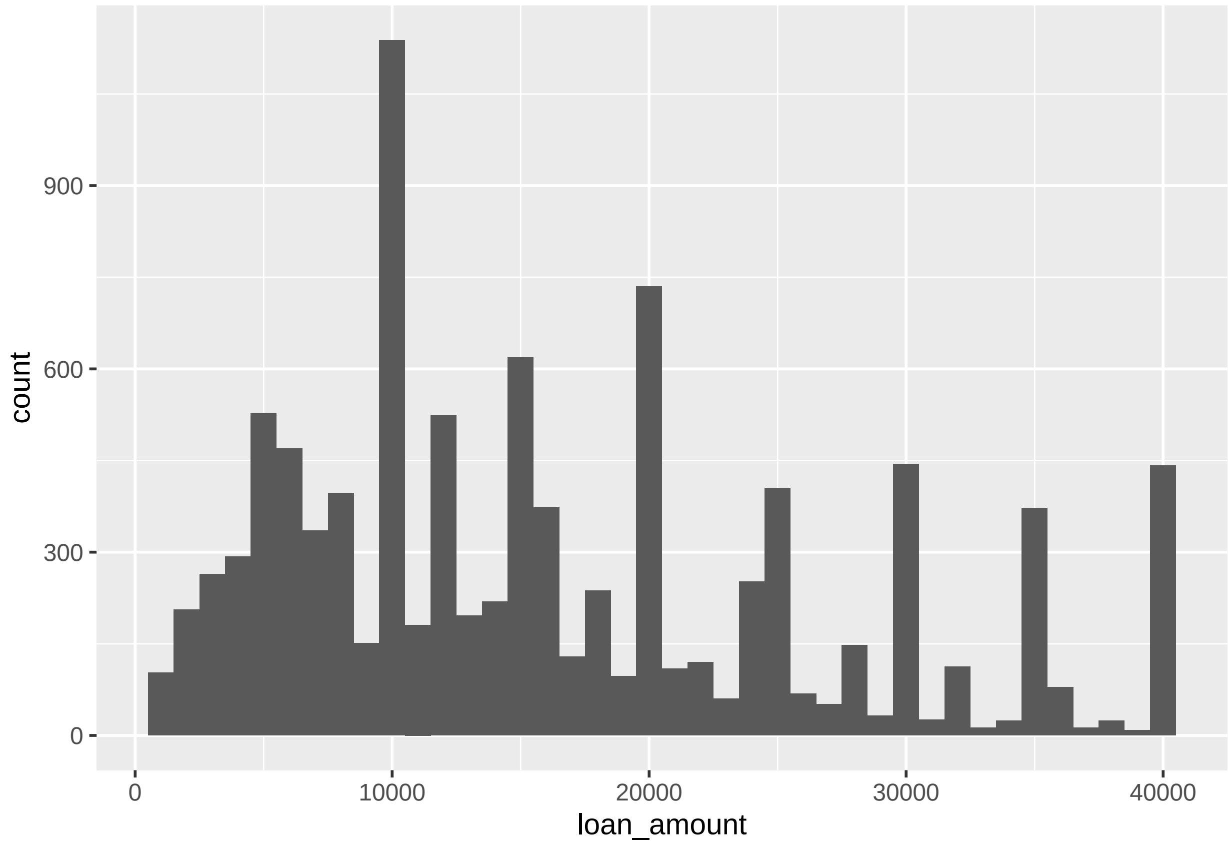
```
## Rows: 10,000
## Columns: 8
## $ loan_amount    <int> 28000, 5000, 2000, 21600, 23000, 5000, 24000, 20000, 20~
## $ interest_rate  <dbl> 14.07, 12.61, 17.09, 6.72, 14.07, 6.72, 13.59, 11.99, 1~
## $ term           <dbl> 60, 36, 36, 36, 36, 36, 60, 60, 36, 36, 60, 60, 36, 60,~
## $ grade          <fct> C, C, D, A, C, A, C, B, C, A, C, B, C, B, D, D, D, F, E~
## $ state          <fct> NJ, HI, WI, PA, CA, KY, MI, AZ, NV, IL, IL, FL, SC, CO,~
## $ annual_income  <dbl> 90000, 40000, 40000, 30000, 35000, 34000, 35000, 110000~
## $ homeownership  <fct> MORTGAGE, RENT, RENT, RENT, RENT, OWN, MORTGAGE, MORTGA~
## $ debt_to_income <dbl> 18.01, 5.04, 21.15, 10.16, 57.96, 6.46, 23.66, 16.19, 3~
```

```r
# histogram
ggplot(loans) + aes(x = loan_amount) +
 geom_histogram()
```

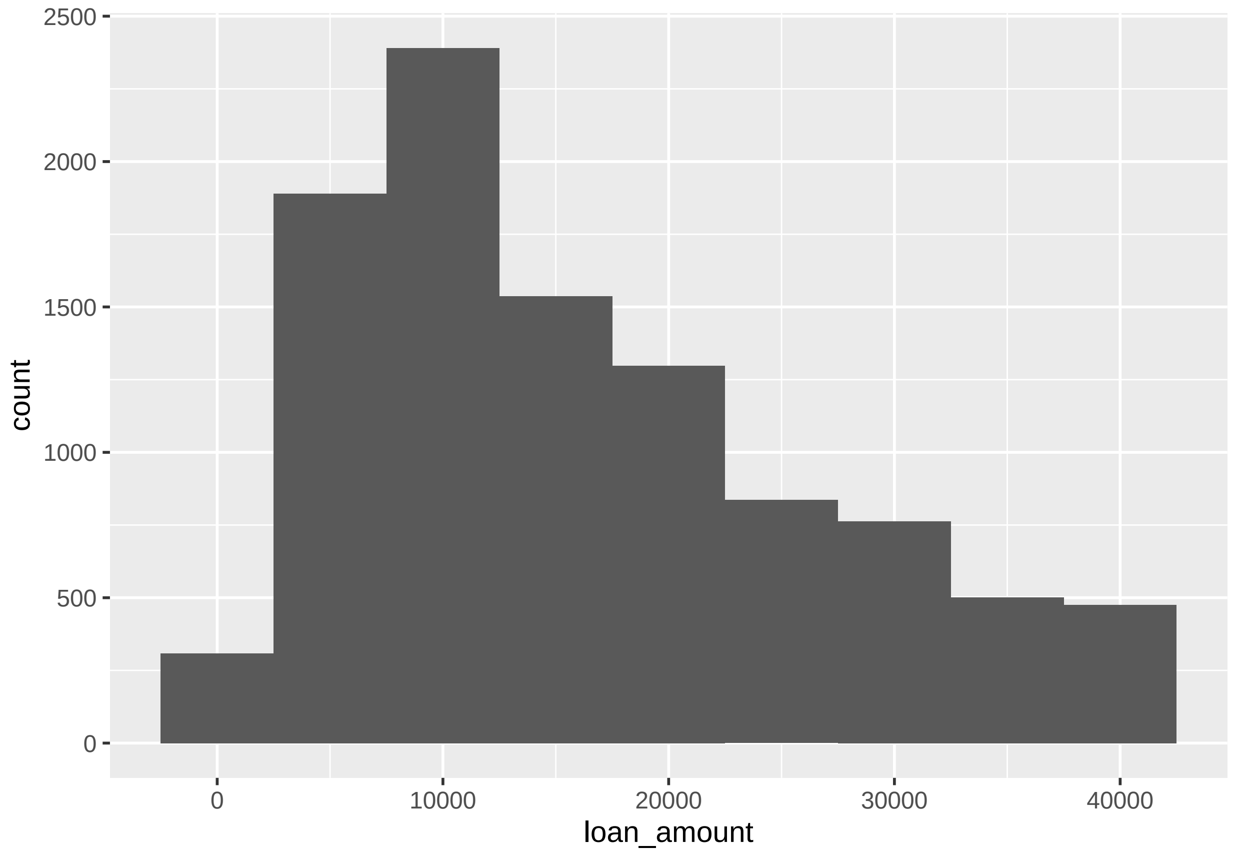
```
## ‘stat_bin()‘ using ‘bins = 30‘. Pick better value with ‘binwidth‘.
```



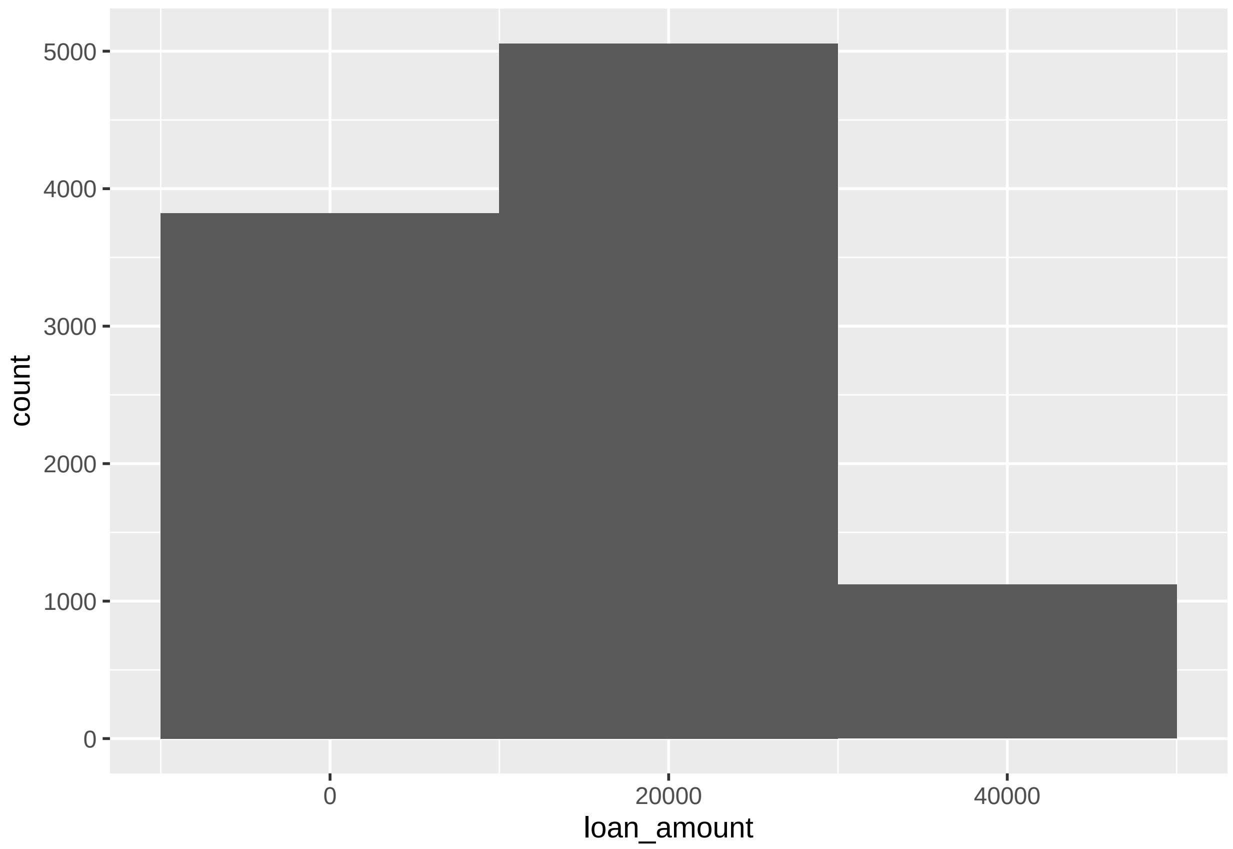
```r
# binwidth = 1000
ggplot(loans, aes(x = loan_amount)) +
 geom_histogram(binwidth = 1000)
```



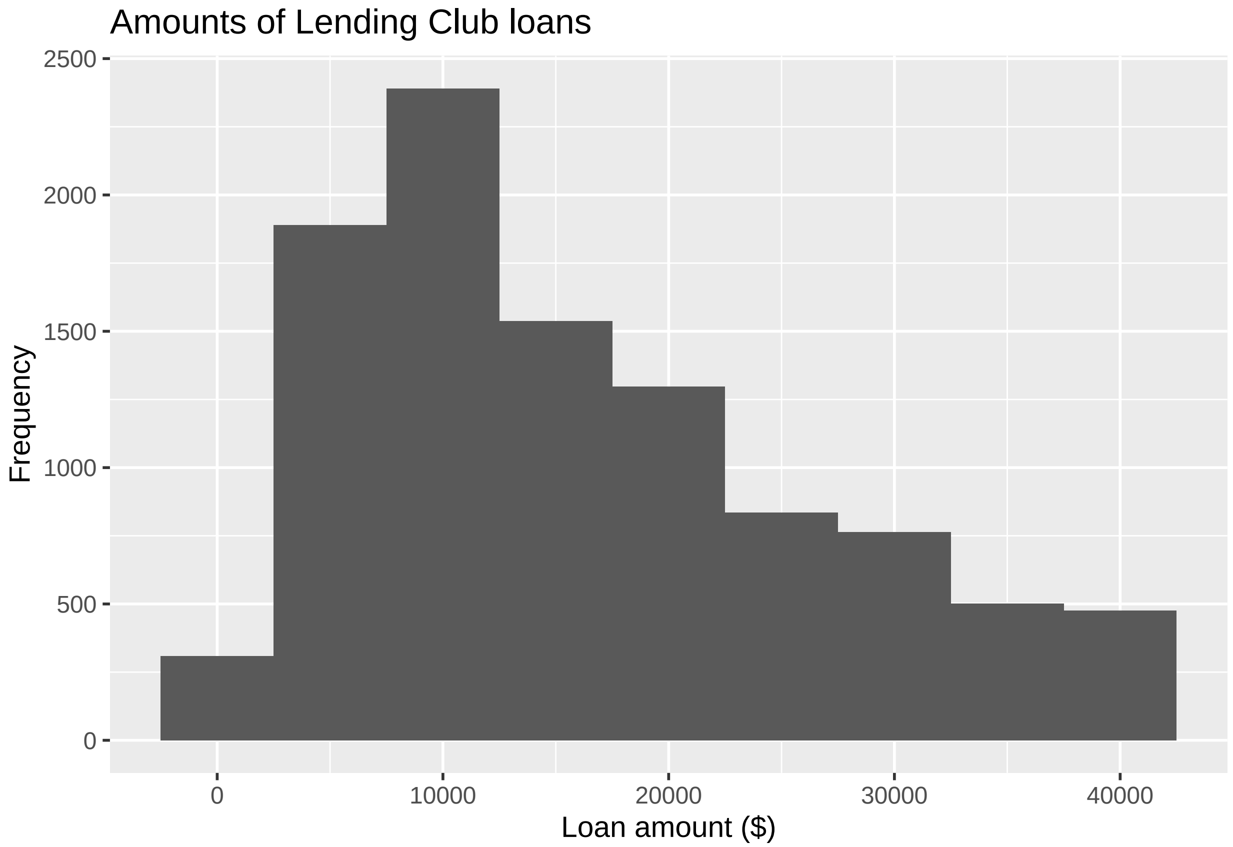
```r
# binwidth = 5000
ggplot(loans, aes(x = loan_amount)) +
 geom_histogram(binwidth = 5000)
```



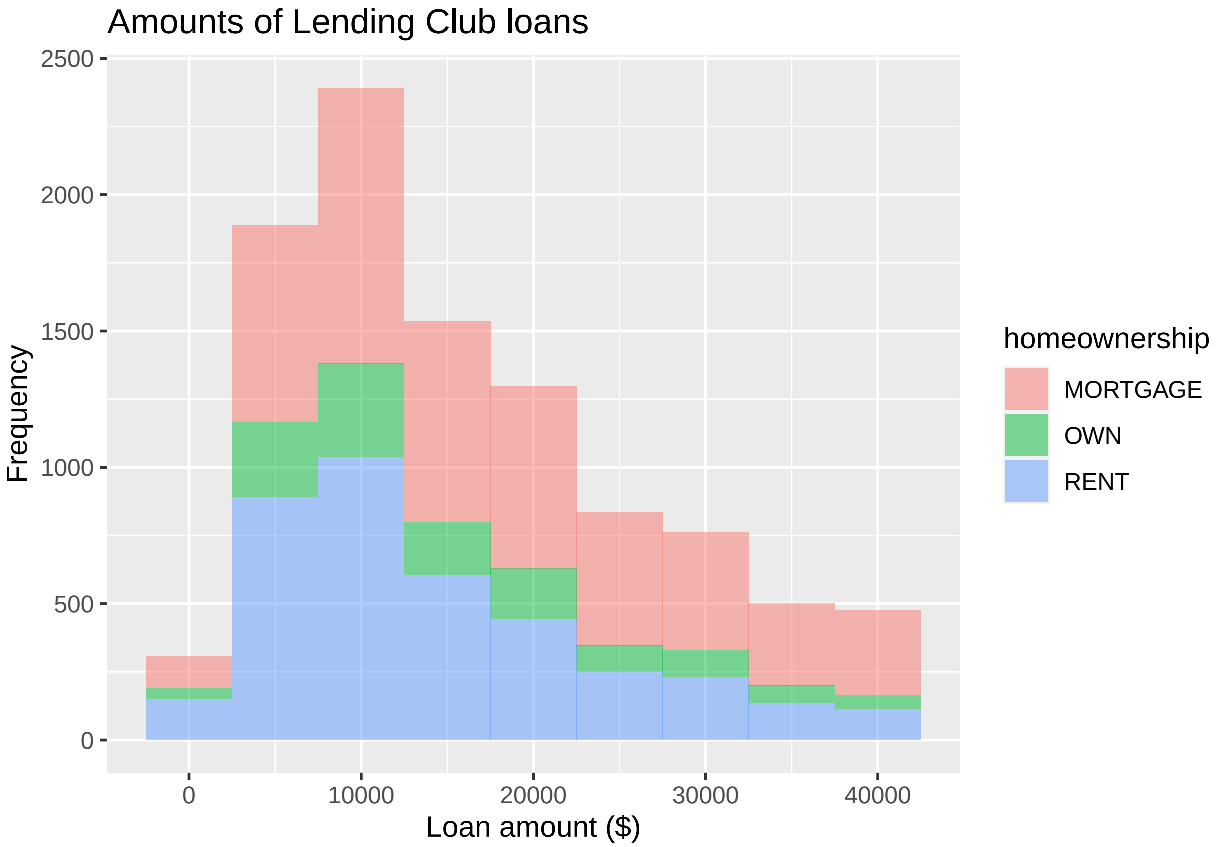
```
# binwidth = 20000
ggplot(loans, aes(x = loan_amount)) +
 geom_histogram(binwidth = 20000)
```



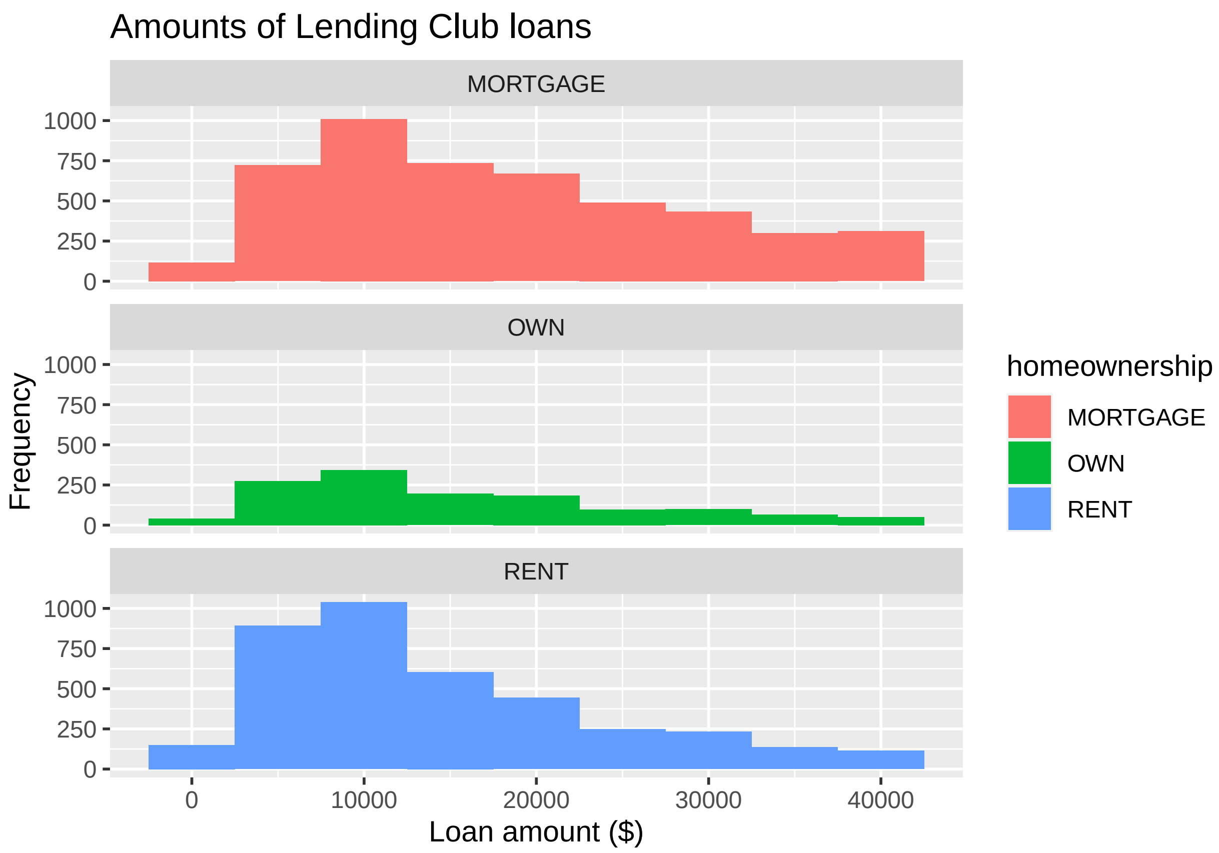
```r
# customizing histograms
ggplot(loans, aes(x = loan_amount)) + geom_histogram(binwidth = 5000) +
 labs(x = "Loan amount ($)", y = "Frequency", title = "Amounts of Lending Club loans" )
```



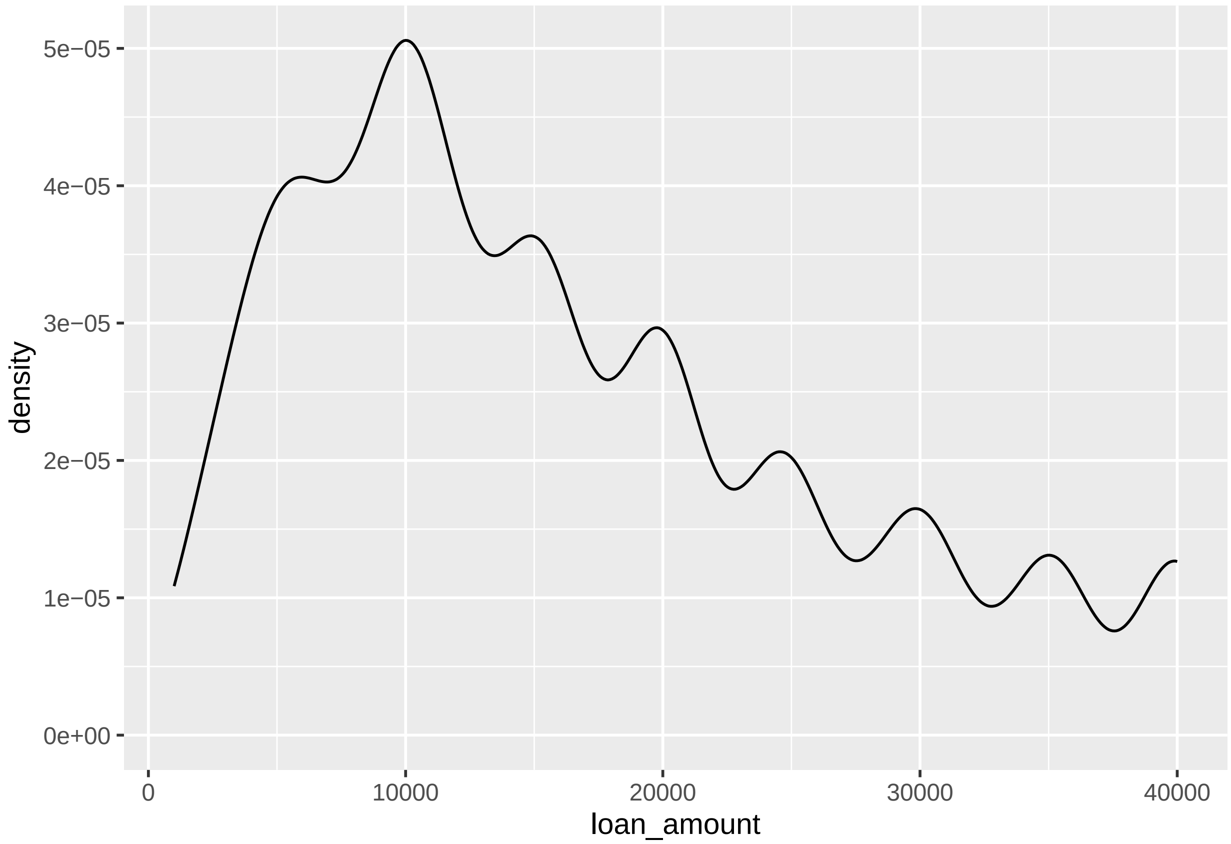
```
# fill with categorical variable
ggplot(loans, aes(x = loan_amount, fill = homeownership)) +
 geom_histogram(binwidth = 5000, alpha = 0.5) +
 labs(x = "Loan amount ($)",y = "Frequency",title = "Amounts of Lending Club loans")
```



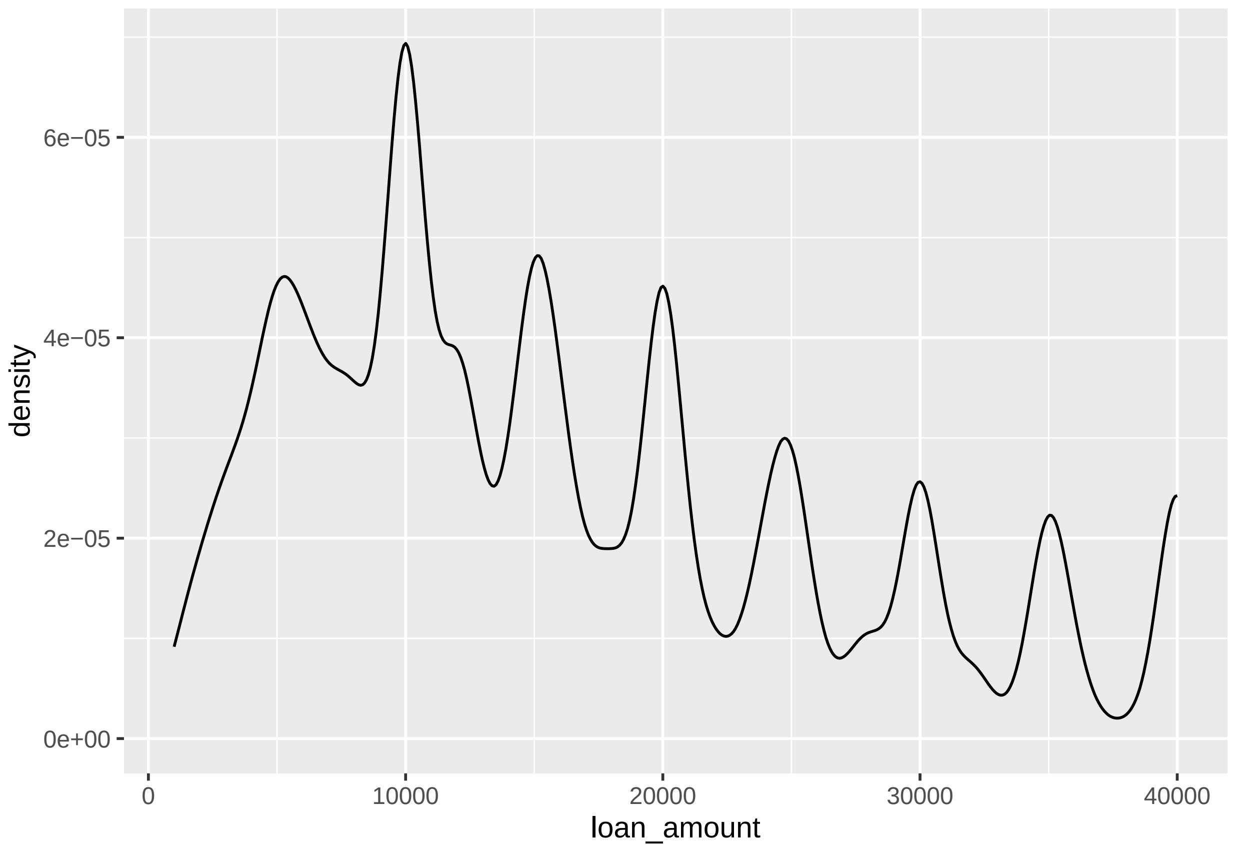
```
# facet with categorical variable
ggplot(loans, aes(x = loan_amount, fill = homeownership)) + geom_histogram(binwidth = 5000) +
 labs(x = "Loan amount ($)",y = "Frequency",title = "Amounts of Lending Club loans") +
 facet_wrap(~ homeownership, nrow = 3)
```



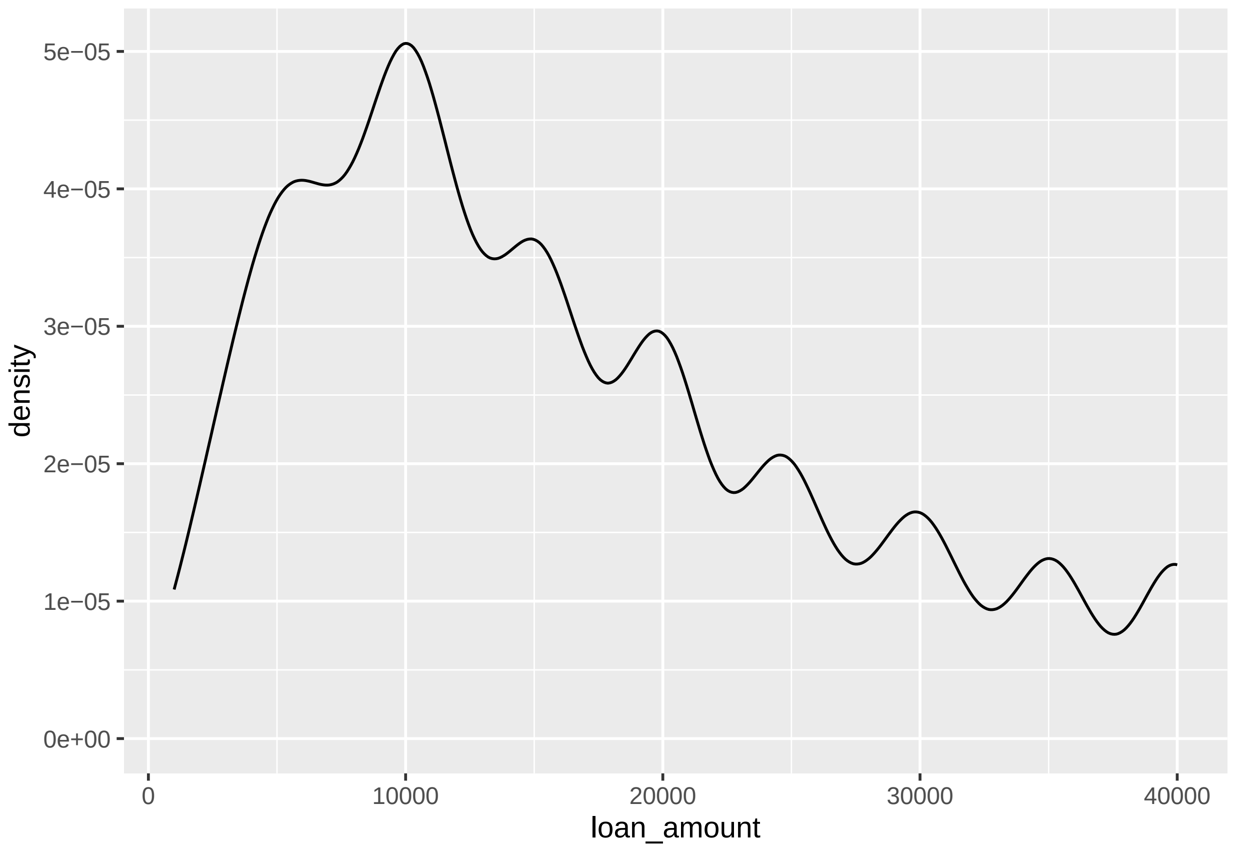
```
# density plots
ggplot(loans, aes(x = loan_amount)) +
 geom_density()
```



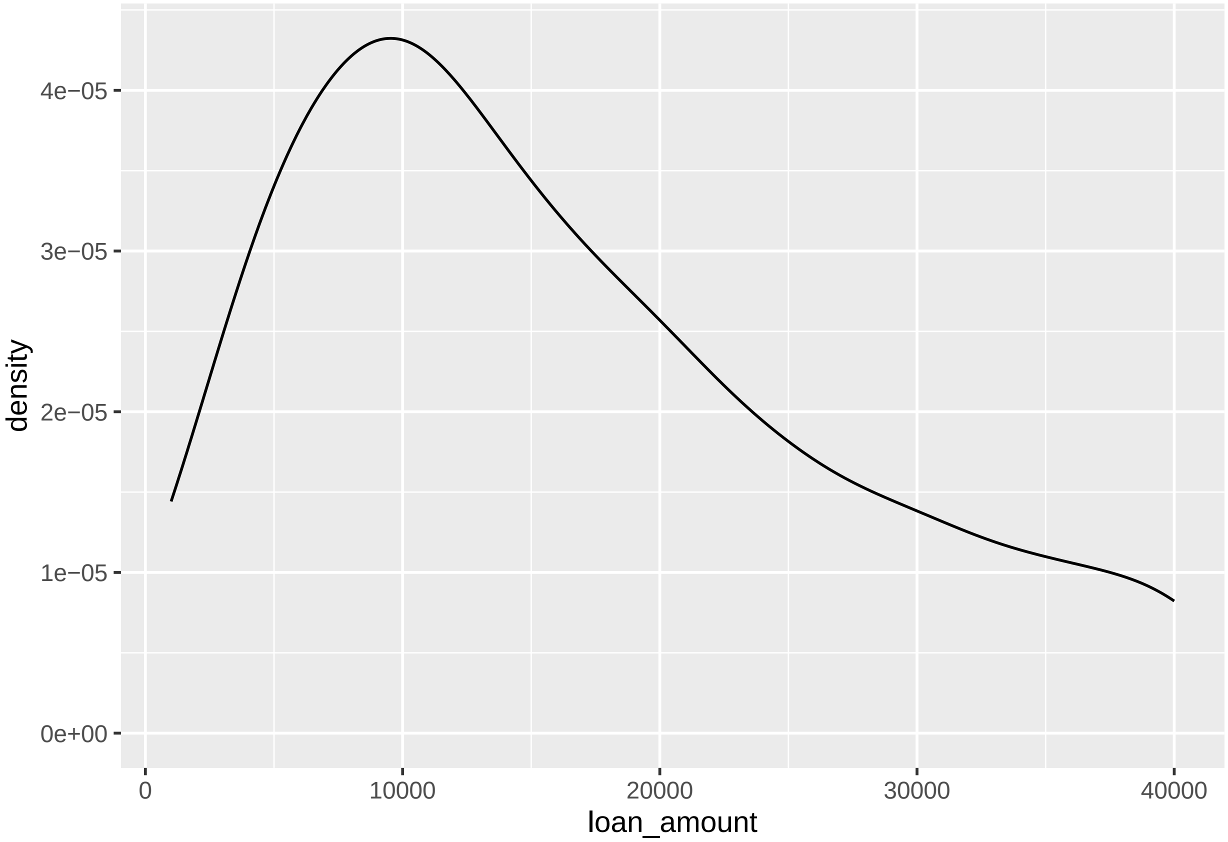
```
# bandwidth = 0.5
ggplot(loans, aes(x = loan_amount)) +
 geom_density(adjust = 0.5)
```



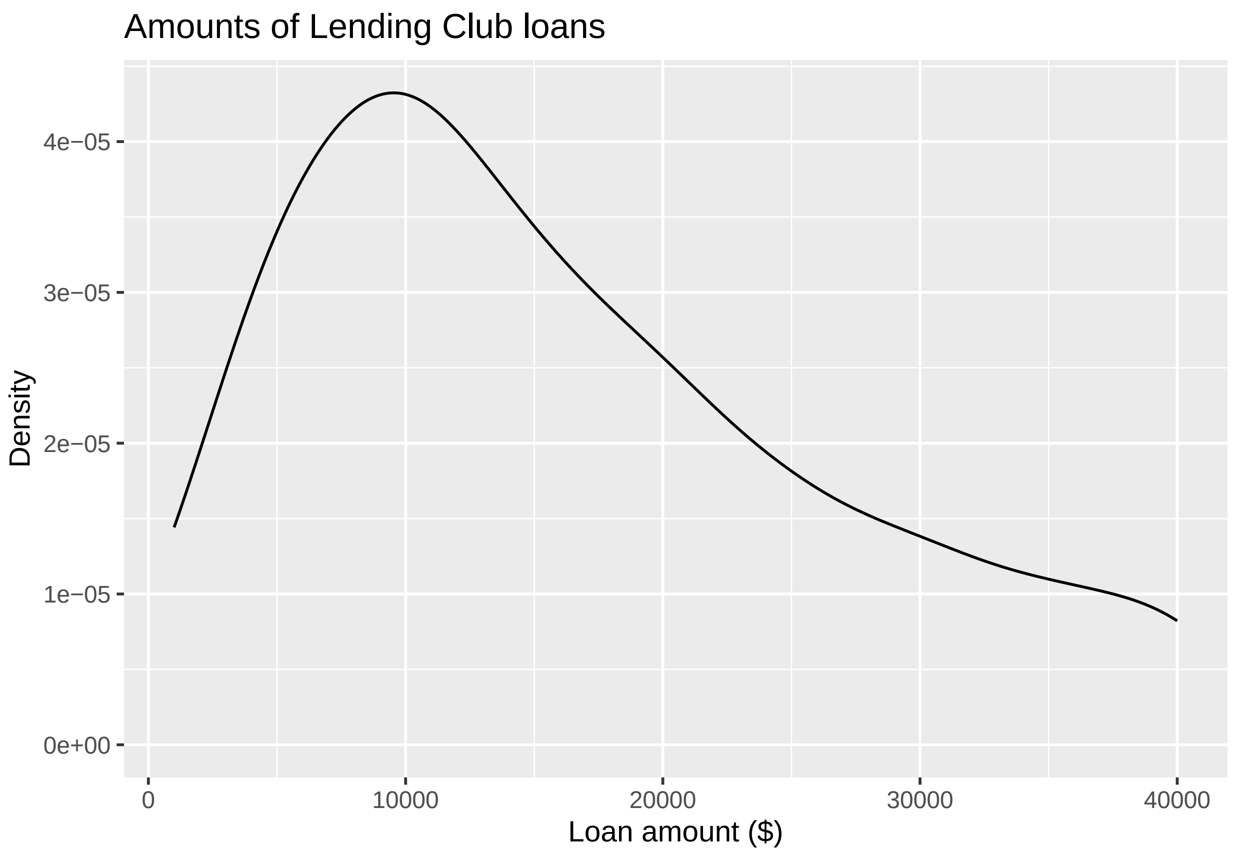
```
# bandwidth = 1 (default bandwidth)
ggplot(loans, aes(x = loan_amount)) +
 geom_density(adjust = 1)
```



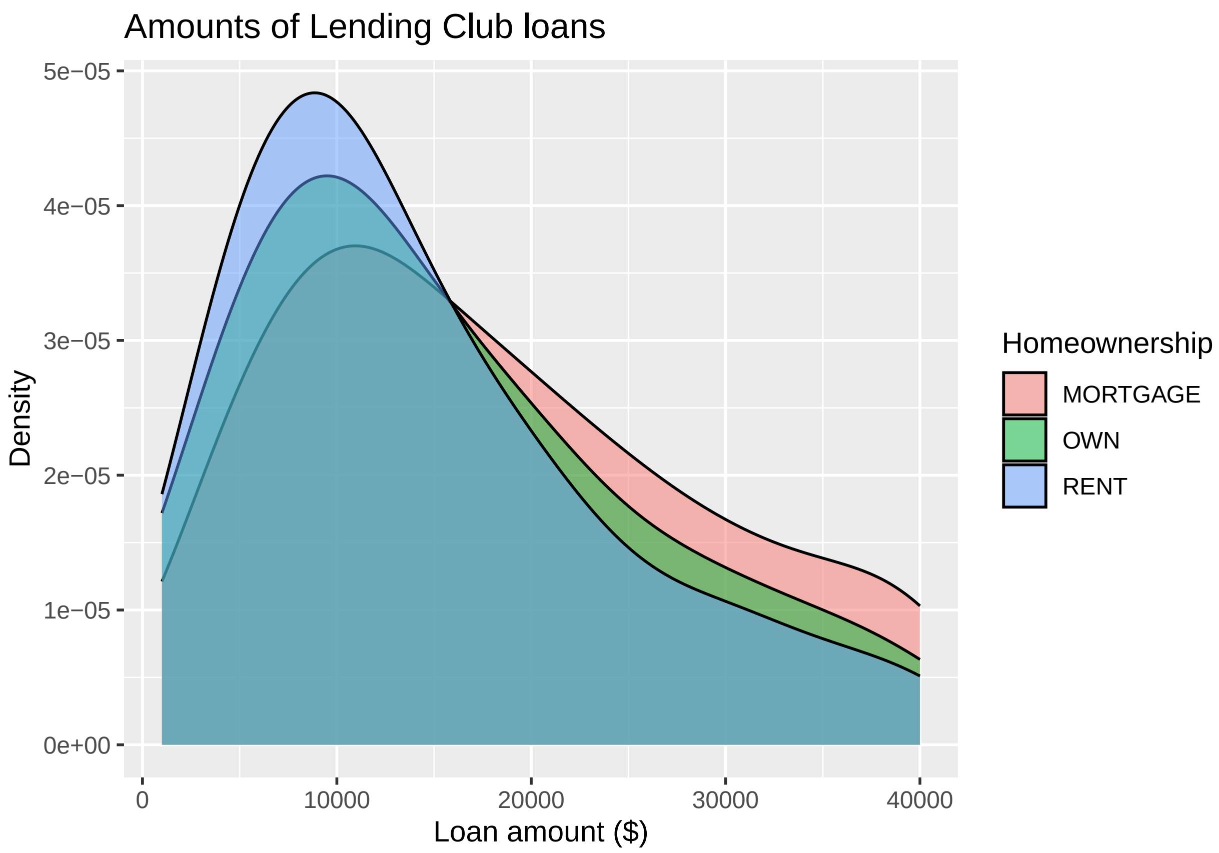
```
# bandwidth = 2
ggplot(loans, aes(x = loan_amount)) +
 geom_density(adjust = 2)
```



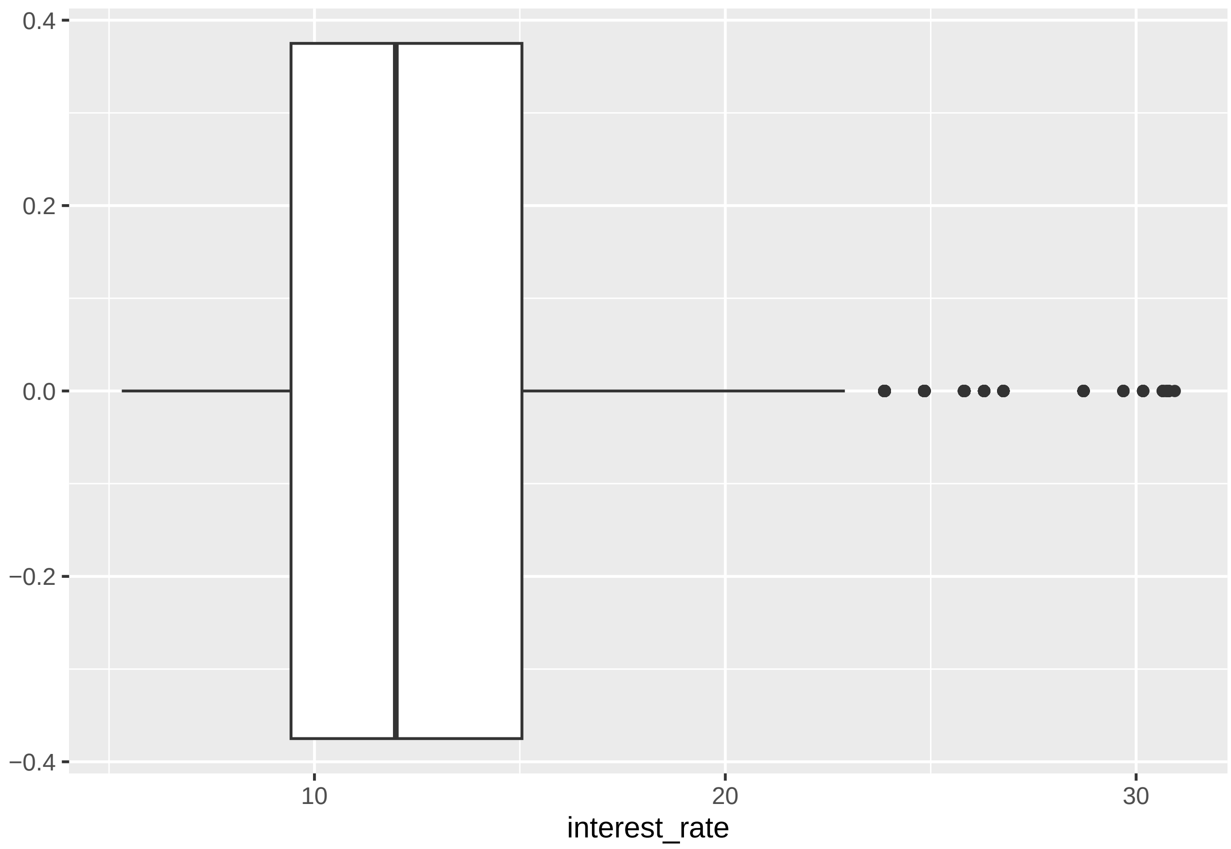
```
# customizing density plots
ggplot(loans, aes(x = loan_amount)) +
 geom_density(adjust = 2) +
 labs( x = "Loan amount ($)", y = "Density", title = "Amounts of Lending Club loans" )
```



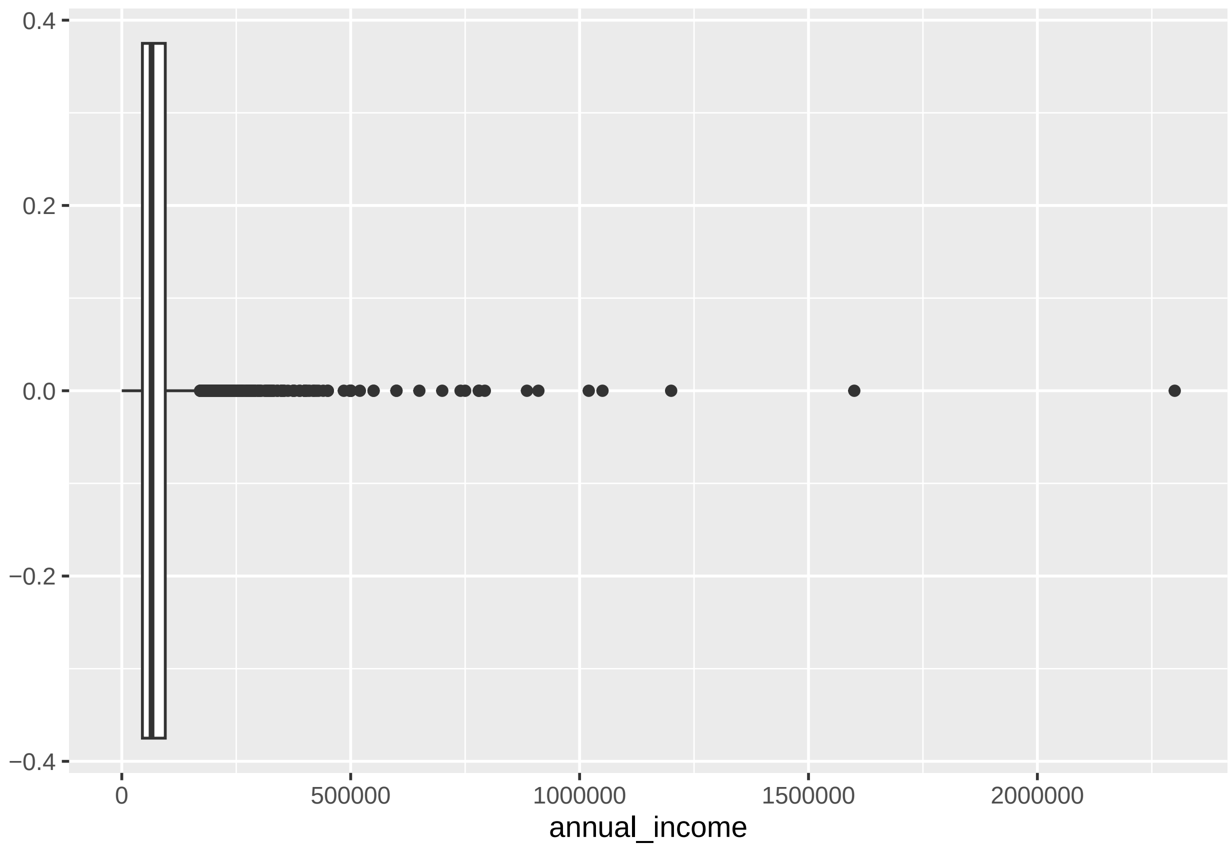
```
# adding categorical variables
ggplot(loans, aes(x = loan_amount, fill = homeownership)) +
 geom_density(adjust = 2, alpha = 0.5) +
 labs(x = "Loan amount ($)",y = "Density",title = "Amounts of Lending Club loans", fill = "Homeownershi
```



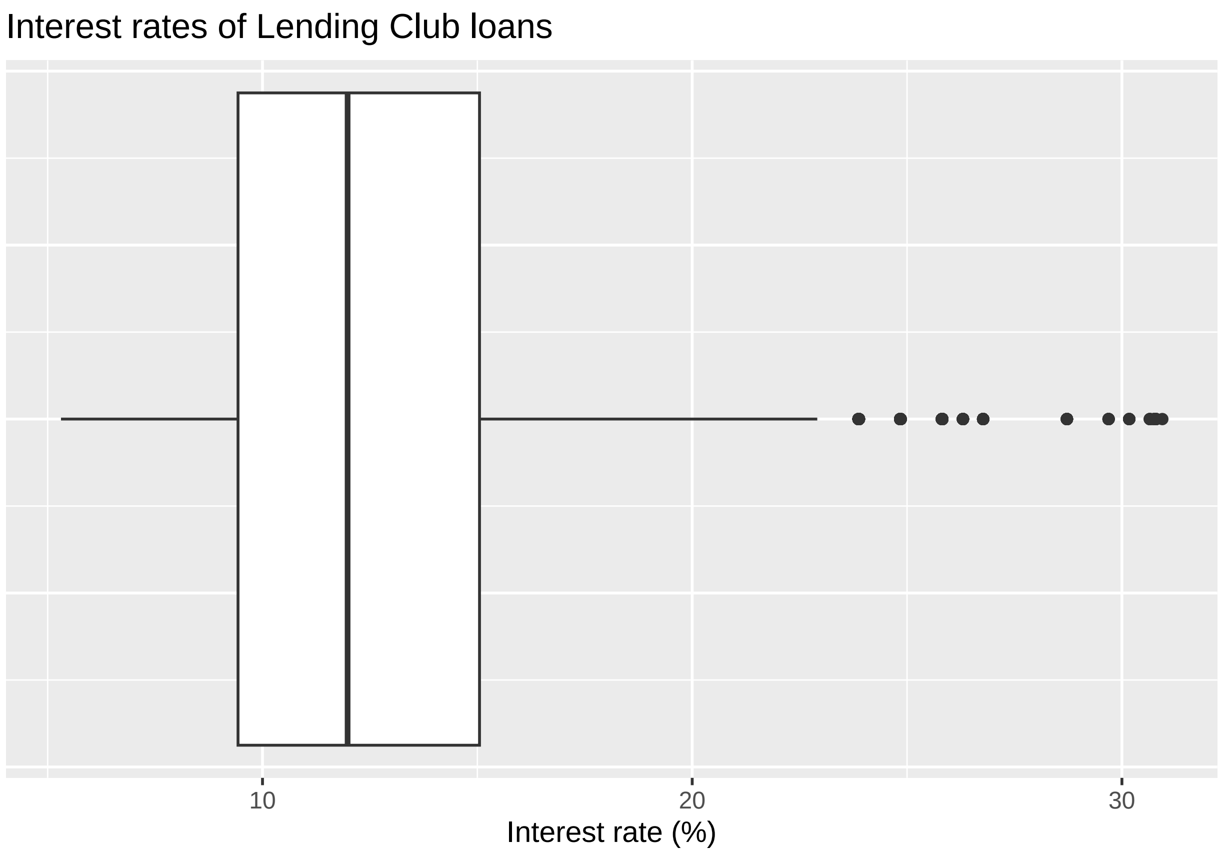
```
# box plots
ggplot(loans, aes(x = interest_rate)) +
 geom_boxplot()
```



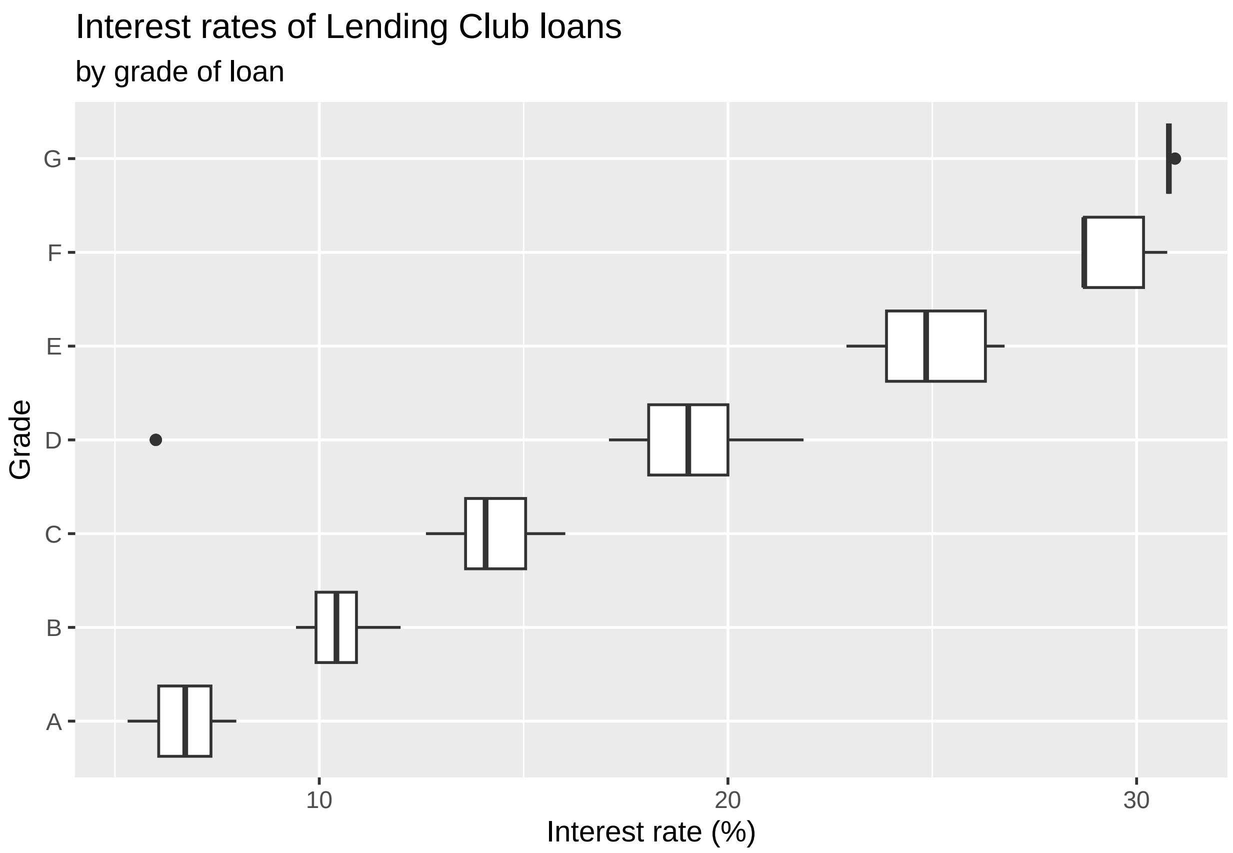
```r
# box plot with outliers
ggplot(loans, aes(x = annual_income)) +
 geom_boxplot()
```



```
# customizing box plots
ggplot(loans, aes(x = interest_rate)) +geom_boxplot() +labs(x = "Interest rate (%)",y = NULL,
 title = "Interest rates of Lending Club loans") +
 theme( axis.ticks.y = element_blank(), axis.text.y = element_blank() )
```

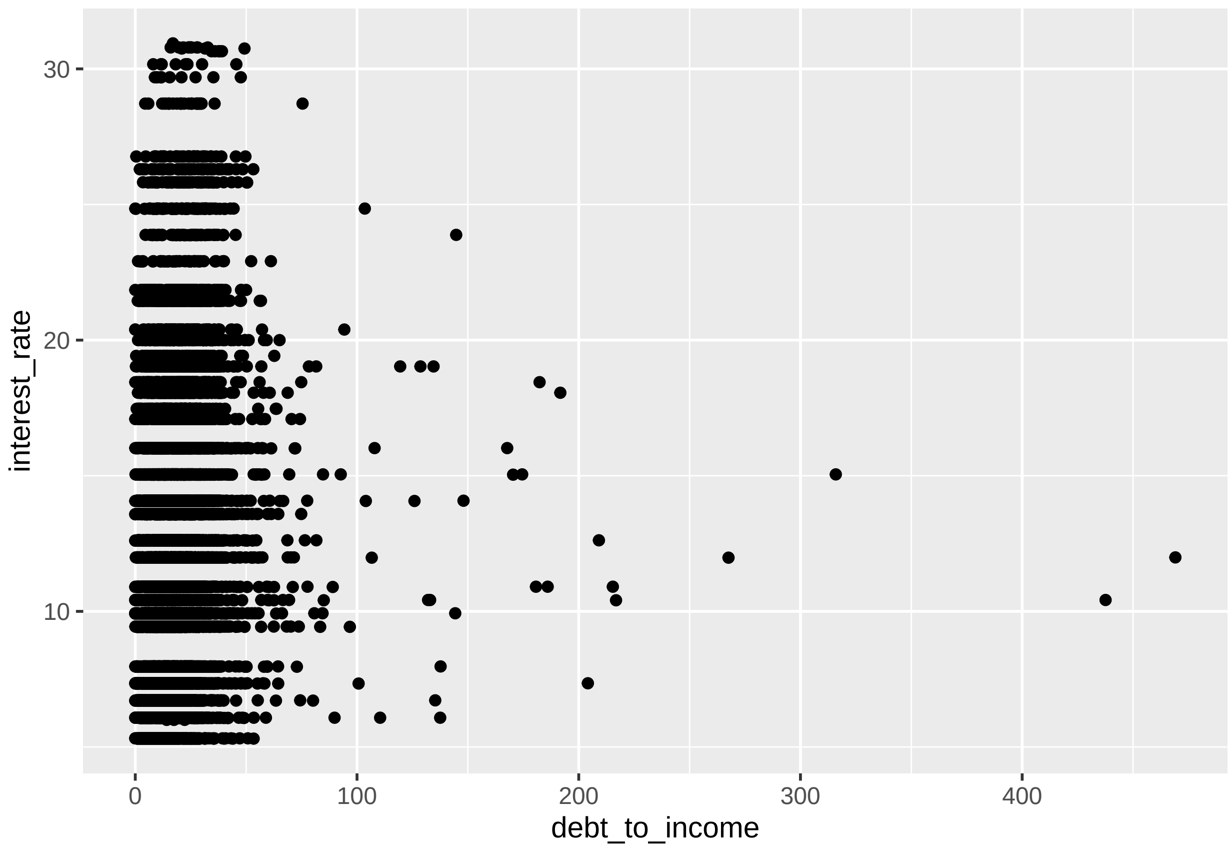


```
# adding categorical variables to box plots
ggplot(loans, aes(x = interest_rate,
 y = grade)) +
 geom_boxplot() +
 labs(x = "Interest rate (%)",y = "Grade",title = "Interest rates of Lending Club loans",subtitle = "by
```



```
# scatterplots
ggplot(loans, aes(x = debt_to_income, y = interest_rate)) +
 geom_point()
```

```
## Warning: Removed 24 rows containing missing values (‘geom_point()‘).
```

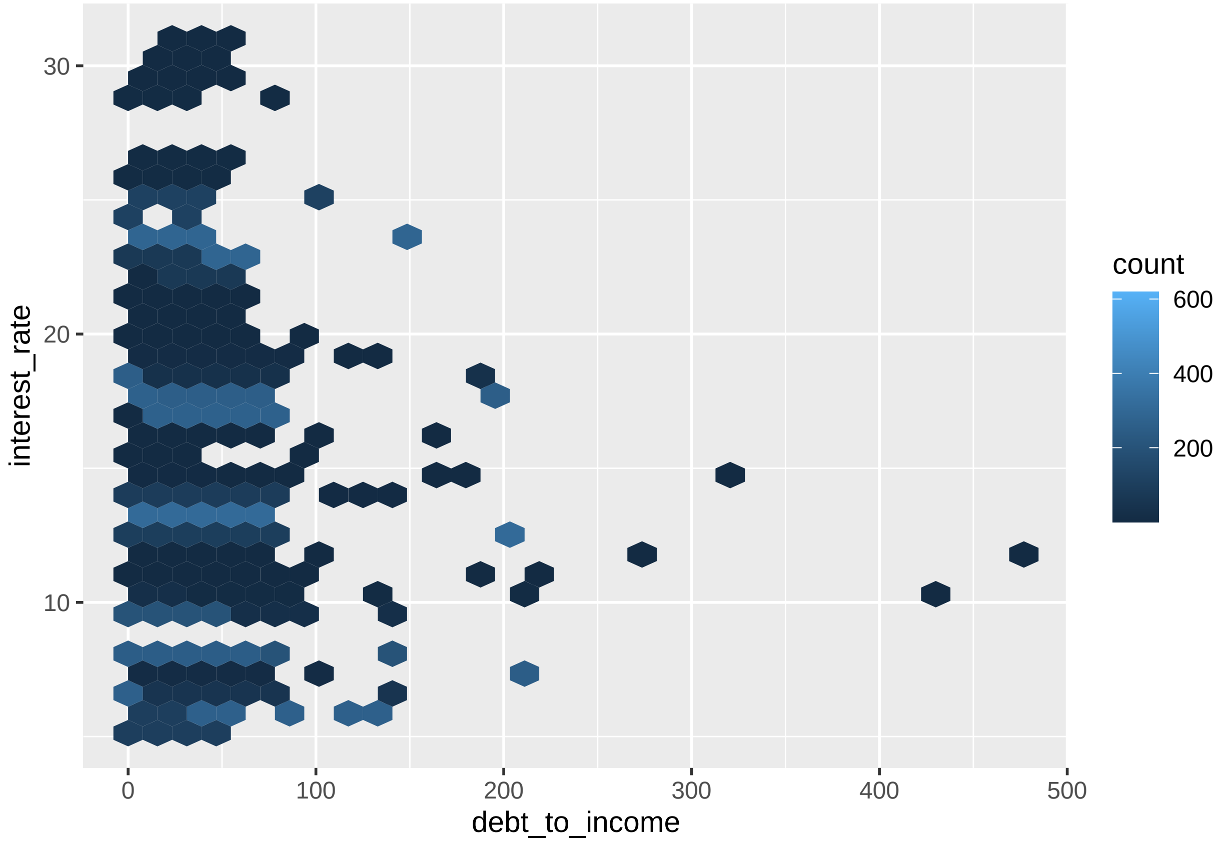


```
#install packages
# install.packages("hexbin")
library(hexbin)
```

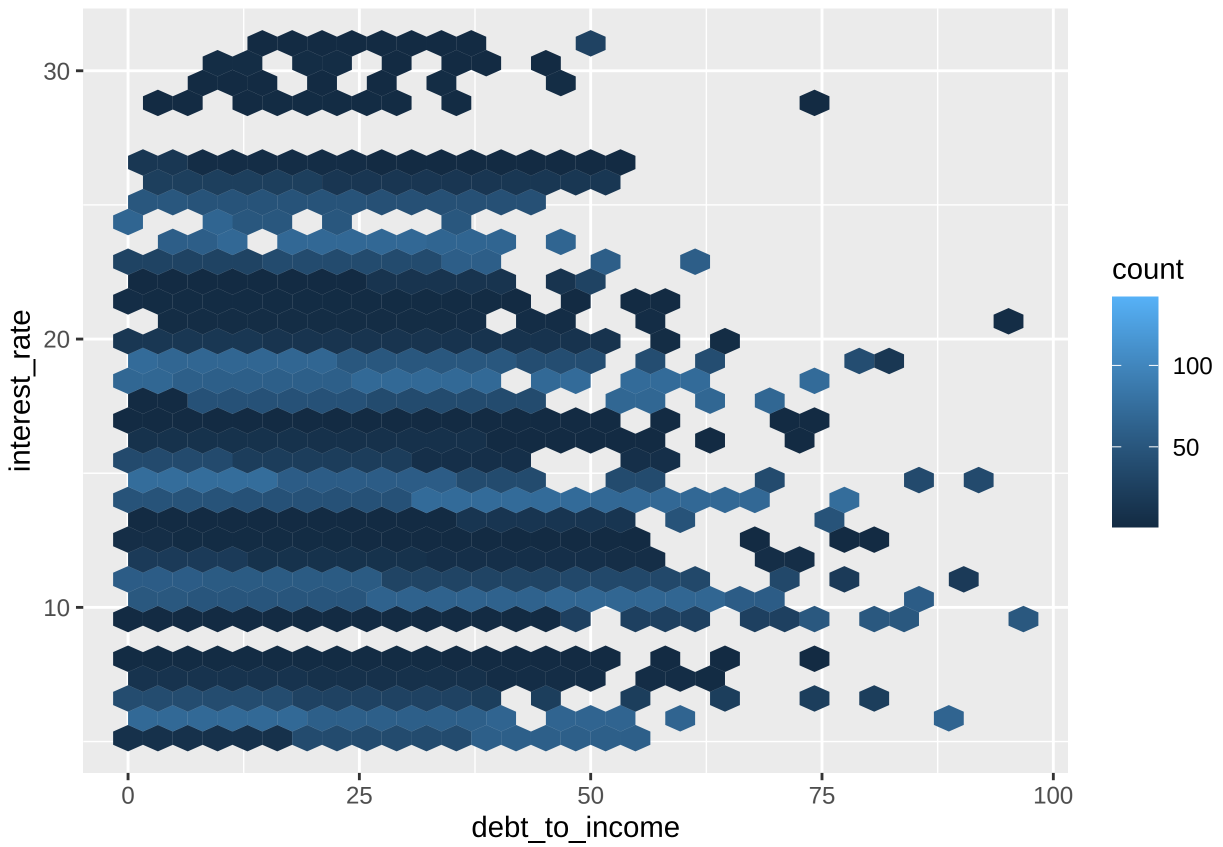
```
## Warning: package 'hexbin' was built under R version 4.2.3
```

```
# hex plots
ggplot(loans, aes(x = debt_to_income, y = interest_rate)) +
 geom_hex()
```

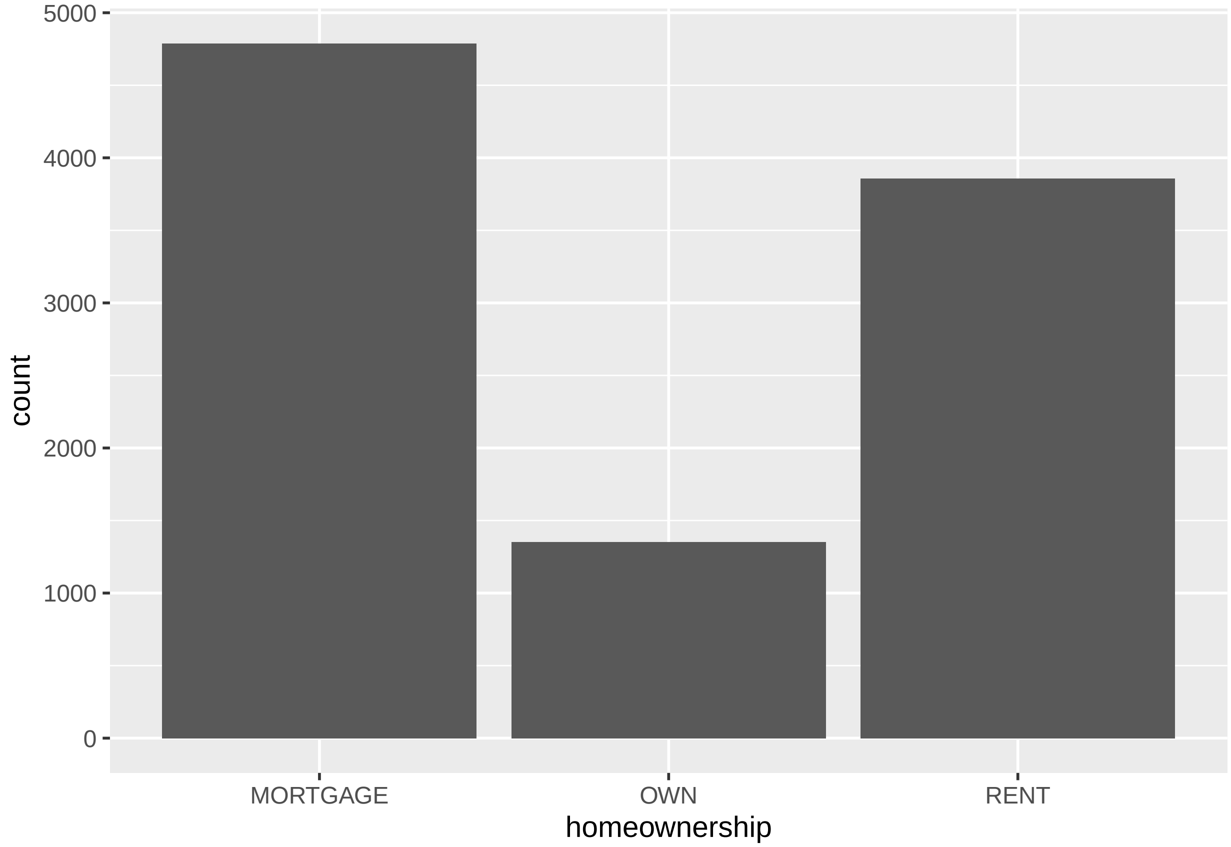
```
## Warning: Removed 24 rows containing non-finite values (`stat_binhex()`).
```



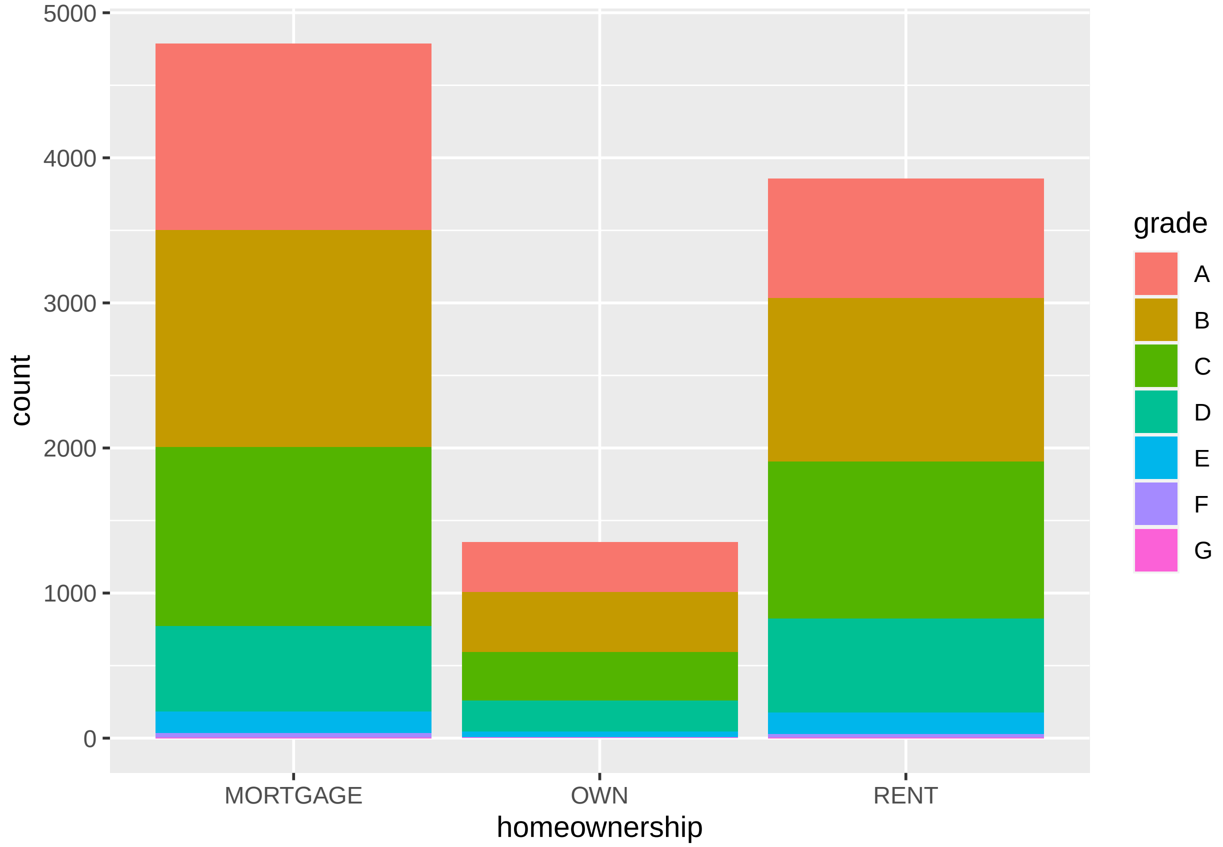
```r
# filtered hex plot
ggplot(loans %>% filter(debt_to_income < 100),
 aes(x = debt_to_income, y = interest_rate)) +
 geom_hex()
```



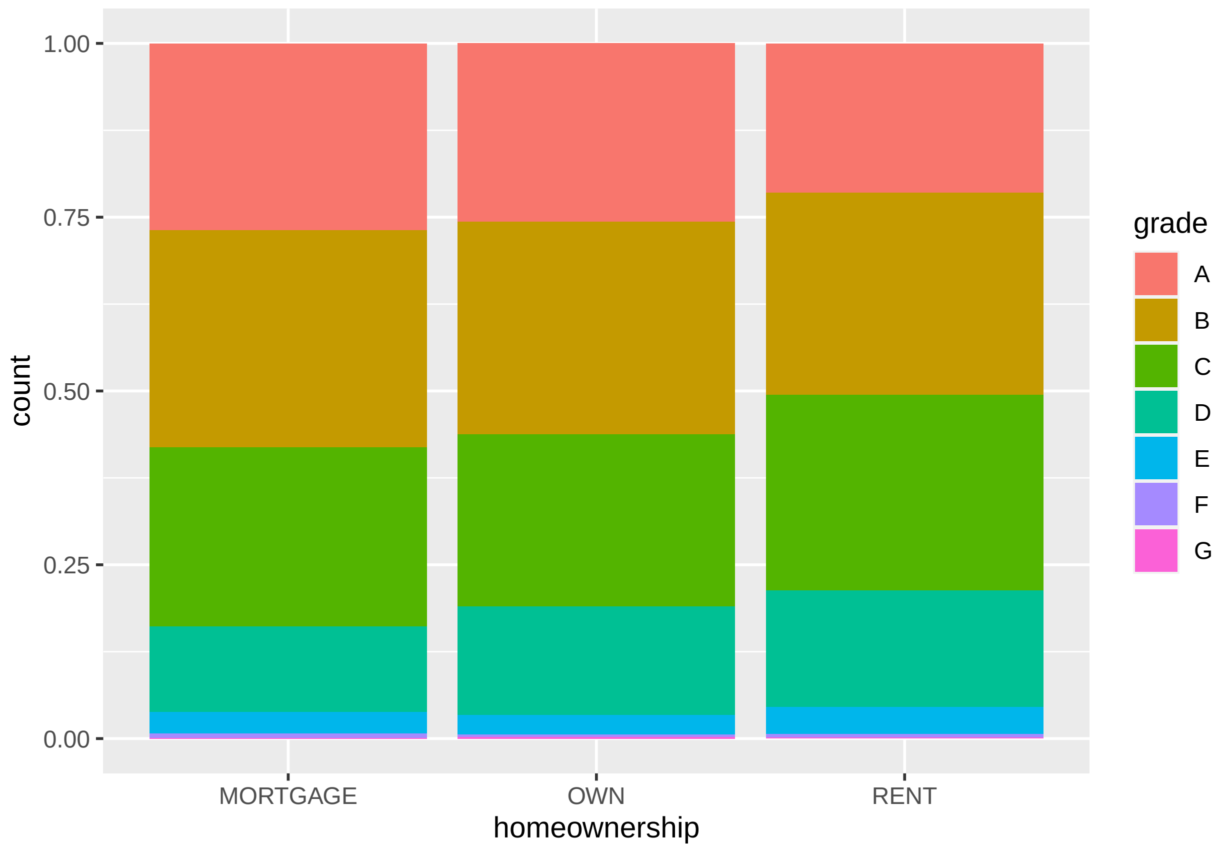
```
# bar plot
ggplot(loans, aes(x = homeownership)) +
 geom_bar()
```



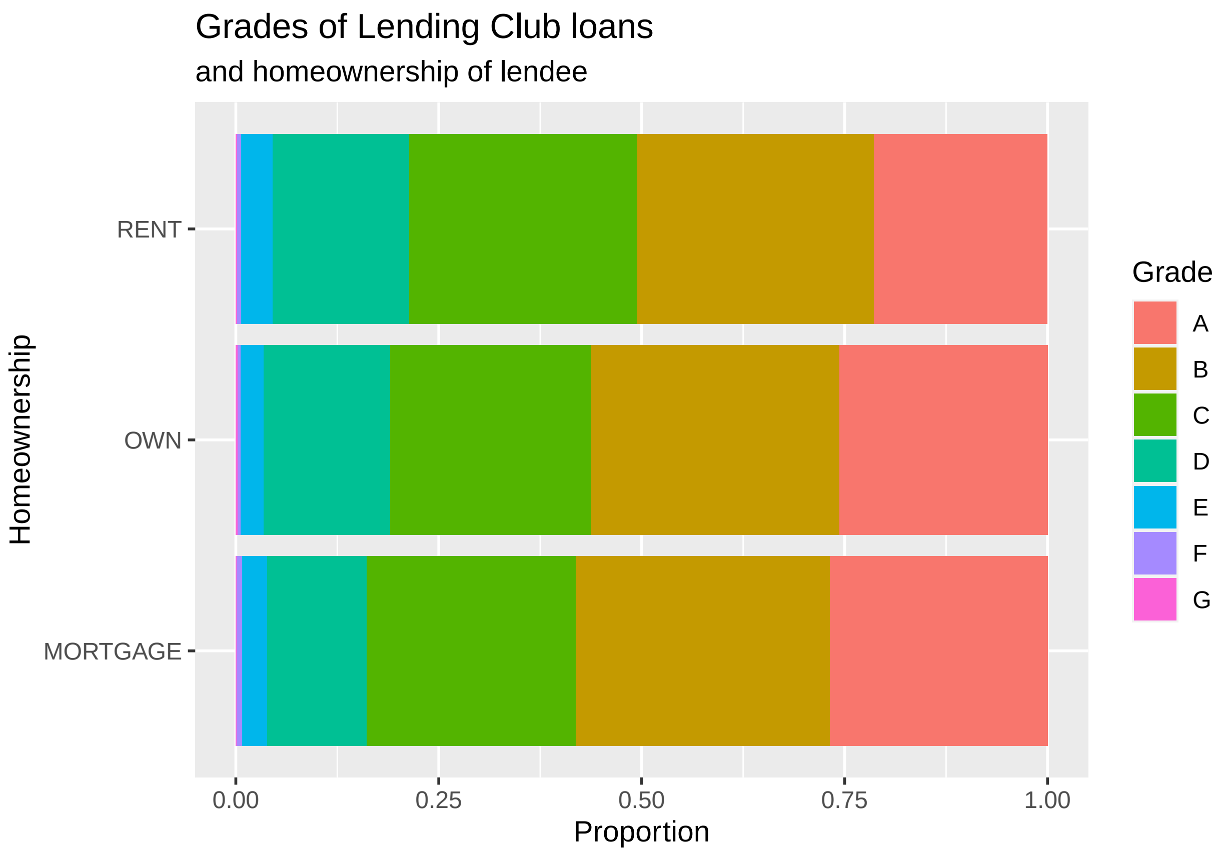
```
# segmented bar plot
ggplot(loans, aes(x = homeownership,
 fill = grade)) +
 geom_bar()
```



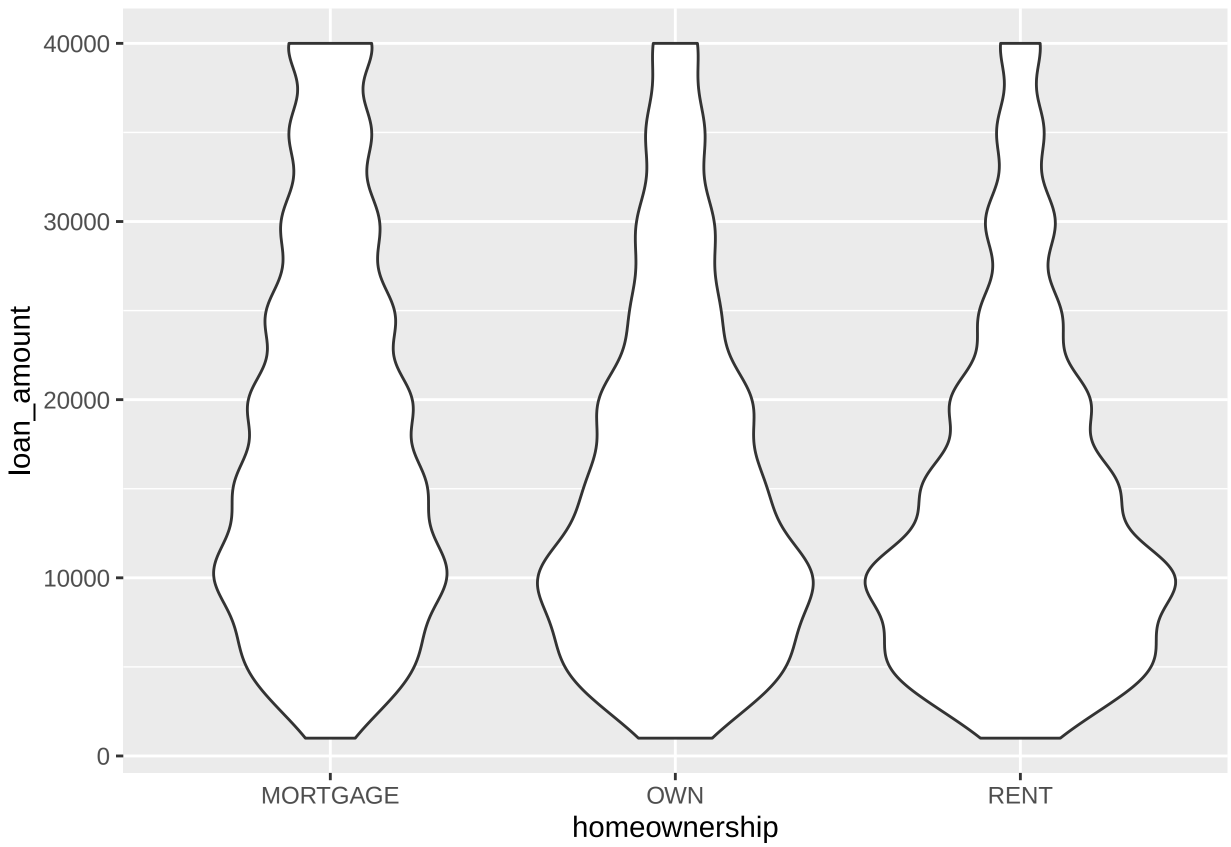
```
## segmented bar plot based on percentage
ggplot(loans, aes(x = homeownership, fill = grade)) +
 geom_bar(position = "fill")
```



```
# customising bar plots
ggplot(loans, aes(y = homeownership, fill = grade)) + geom_bar(position = "fill") +
labs( x = "Proportion", y = "Homeownership", fill = "Grade", title = "Grades of Lending Club loans", su
```



```
# violin plots
ggplot(loans, aes(x = homeownership, y = loan_amount)) +
 geom_violin()
```

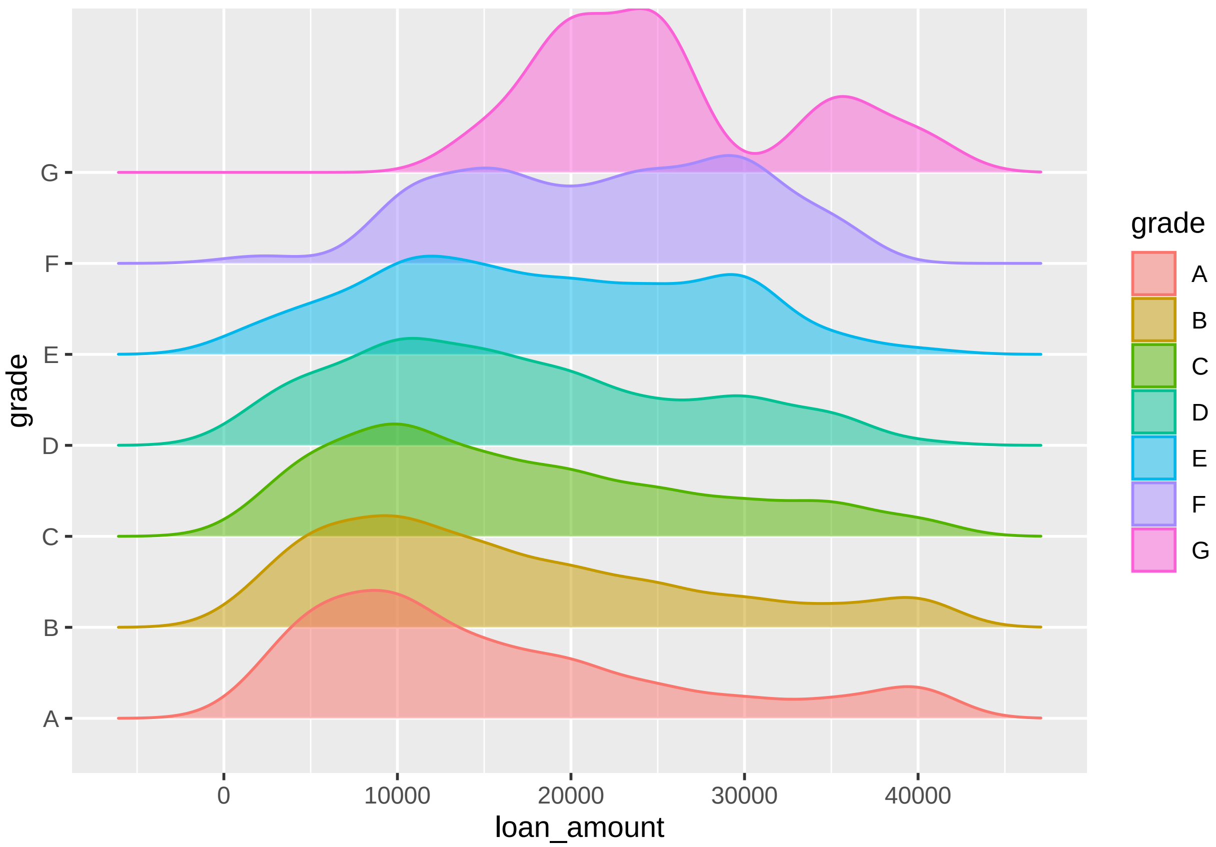


```
# ridge plots
# install.packages("ggridges")
library(ggridges)
```

```
## Warning: package 'ggridges' was built under R version 4.2.3
```

```
ggplot(loans, aes(x = loan_amount, y = grade, fill = grade, color = grade)) +
 geom_density_ridges(alpha = 0.5)
```

```
## Picking joint bandwidth of 2360
```


G
F
E
D
C
B
A
grade
0
10000
20000
30000
40000
loan_amount
grade
A
B
C
D
E
F
G