Exploratory data analysis

Visualising categorical data

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The following content is based on Mine Çetinkaya-Rundel's excellent book Data Science in a Box

Recap

Variables

- **Numerical** variables can be classified as **continuous** or **discrete** based on whether or not the variable can take on an infinite number of values or only non-negative whole numbers, respectively.
- If the variable is **categorical**, we can determine if it is **ordinal** based on whether or not the levels have a natural ordering.

Data

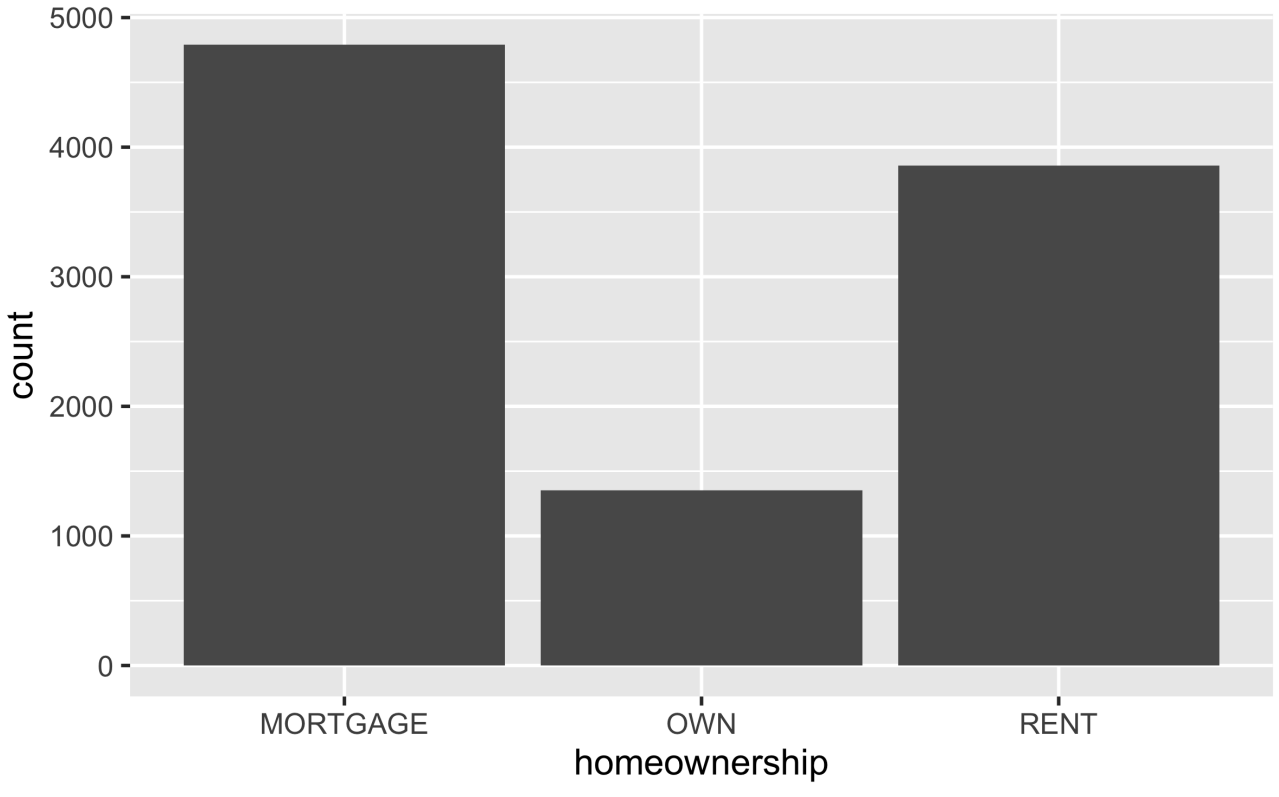
```
library(openintro)
loans <- loans_full_schema %>%
  select(loan_amount, interest_rate, term, grade,
         state, annual_income, homeownership, debt_to_income)
glimpse(loans)
```

```
## Rows: 10,000
## Columns: 8
## $ loan_amount    <int> 28000, 5000, 2000, 21600, 23000, 5000, …
## $ interest_rate  <dbl> 14.07, 12.61, 17.09, 6.72, 14.07, 6.72,…
## $ term           <dbl> 60, 36, 36, 36, 36, 36, 60, 60, 36, 36,…
## $ grade          <ord> C, C, D, A, C, A, C, B, C, A, C, B, C, …
## $ state          <fct> NJ, HI, WI, PA, CA, KY, MI, AZ, NV, IL,…
## $ annual_income  <dbl> 90000, 40000, 40000, 30000, 35000, 3400…
## $ homeownership  <fct> MORTGAGE, RENT, RENT, RENT, RENT, OWN, …
## $ debt_to_income <dbl> 18.01, 5.04, 21.15, 10.16, 57.96, 6.46,…
```

Bar plot

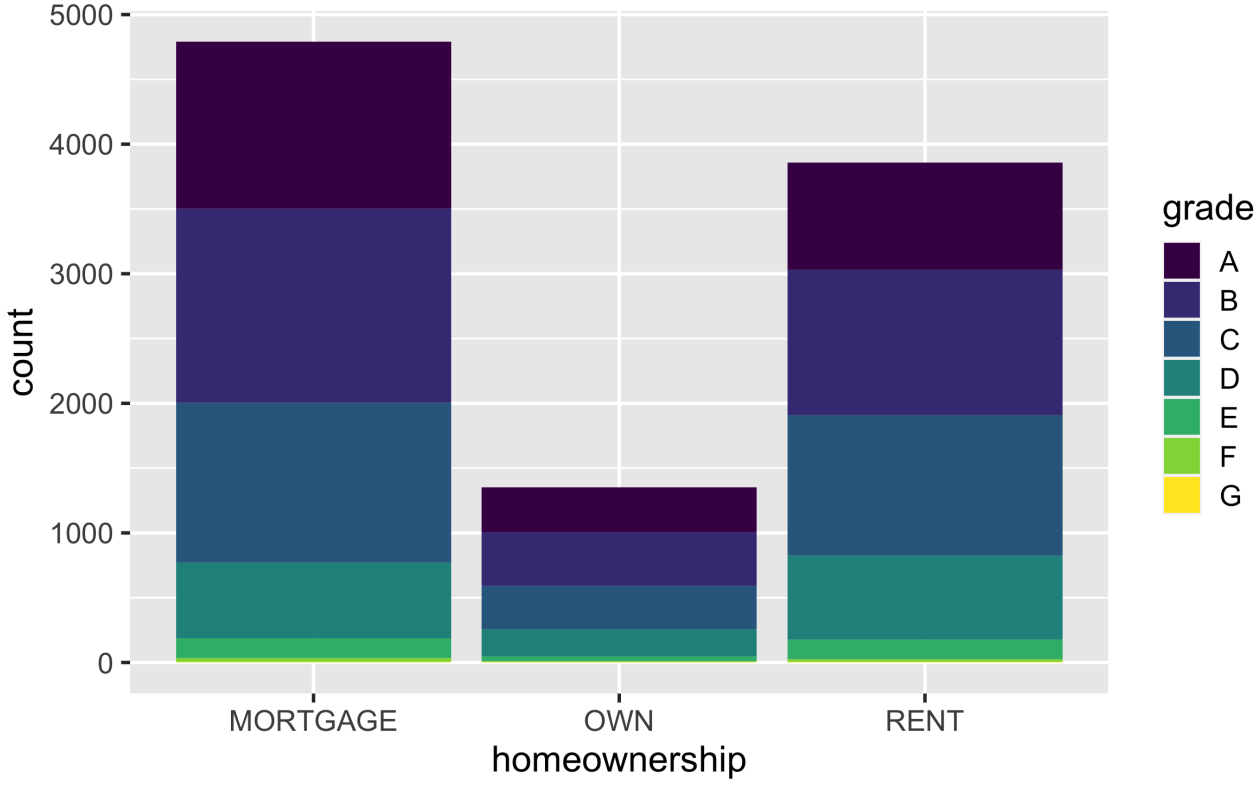
Bar plot

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



Segmented bar plot

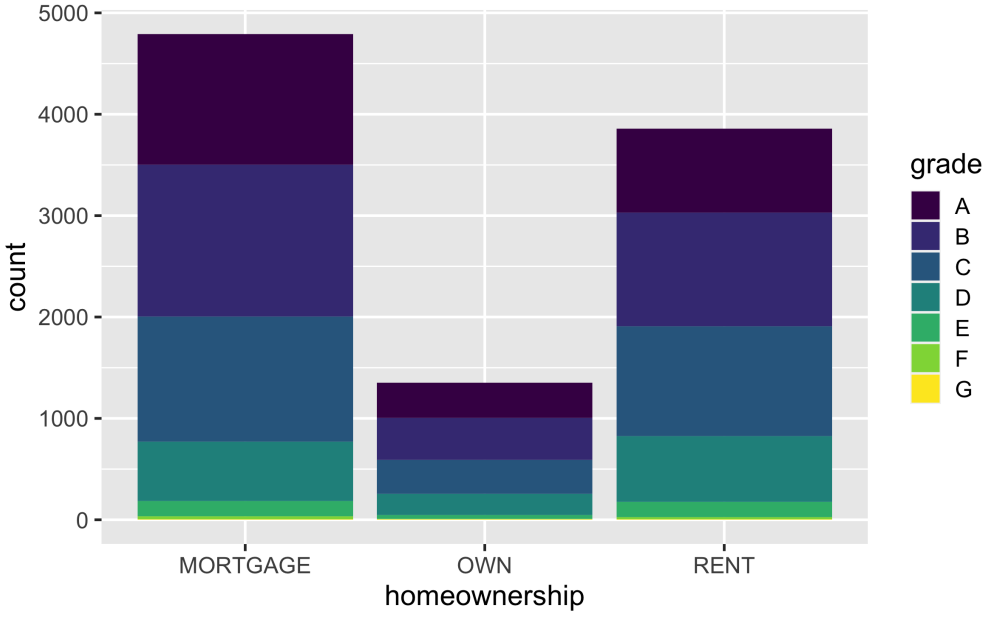
```
ggplot(loans, aes(x = homeownership,
                  fill = grade)) +
  geom_bar()
```



Segmented bar plot

```
ggplot(loans, aes(x = homeownership, fill = grade)) +
  geom_bar(position = "fill")
```

Which bar plot is a more useful representation for visualizing the relationship between homeownership and grade?



Customizing bar plots

Plot Code

```
ggplot(loans, aes(y = homeownership,
                  fill = grade)) +
  geom_bar(position = "fill") +
  labs(
    x = "Proportion",
    y = "Homeownership",
    fill = "Grade",
    title = "Grades of Lending Club loans",
    subtitle = "and homeownership of lendee"
  )
```

Segmented bar plot

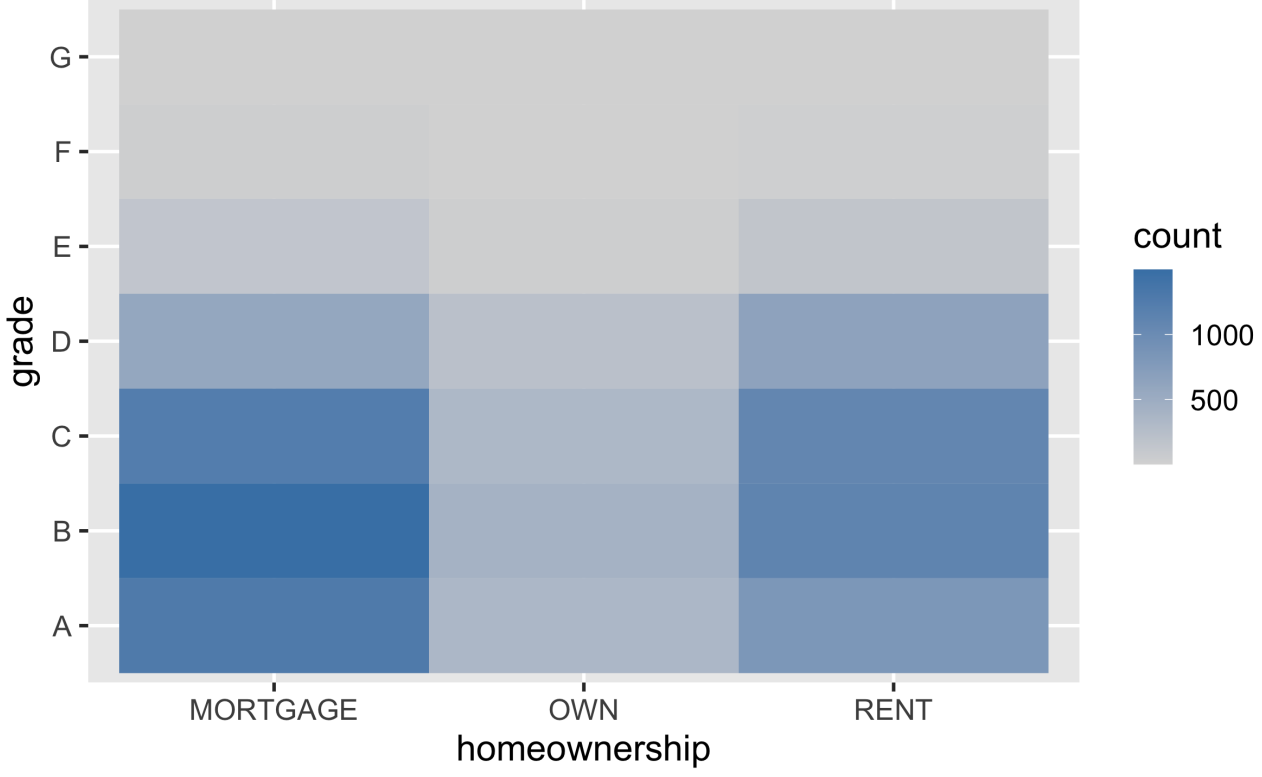
Plot Code

```
ggplot(loans, aes(y = homeownership,
                  fill = grade)) +
  geom_bar(position = "dodge") +
  labs(
    x = "Proportion",
    y = "Homeownership",
    fill = "Grade",
    title = "Grades of Lending Club loans",
    subtitle = "and homeownership of lendee"
  )
```

Heatmap

Heatmap

```
ggplot(loans, aes(x = homeownership, grade)) +
geom_bin2d() +
scale_fill_gradient(low = "gray85", high = "steelblue")
```



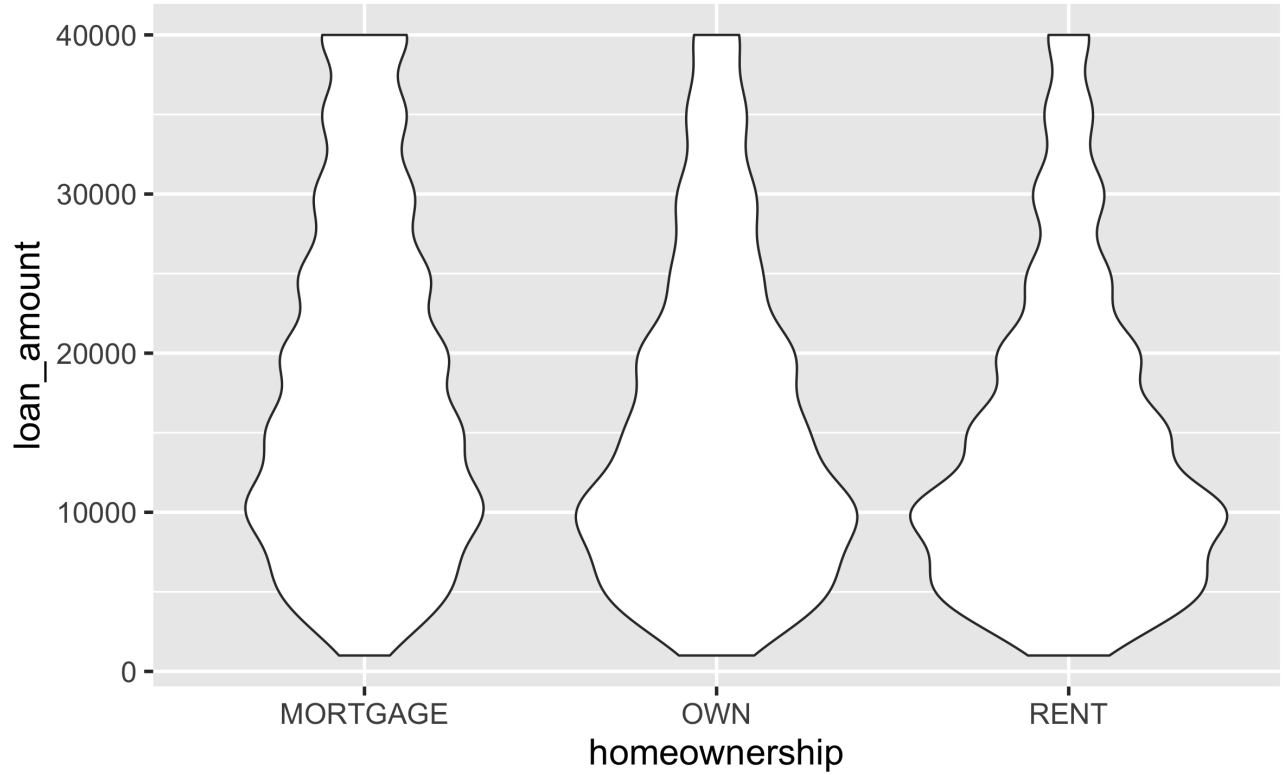
Relationships between numerical and categorical variables

Already talked about...

- Colouring and faceting histograms and density plots
- Side-by-side box plots

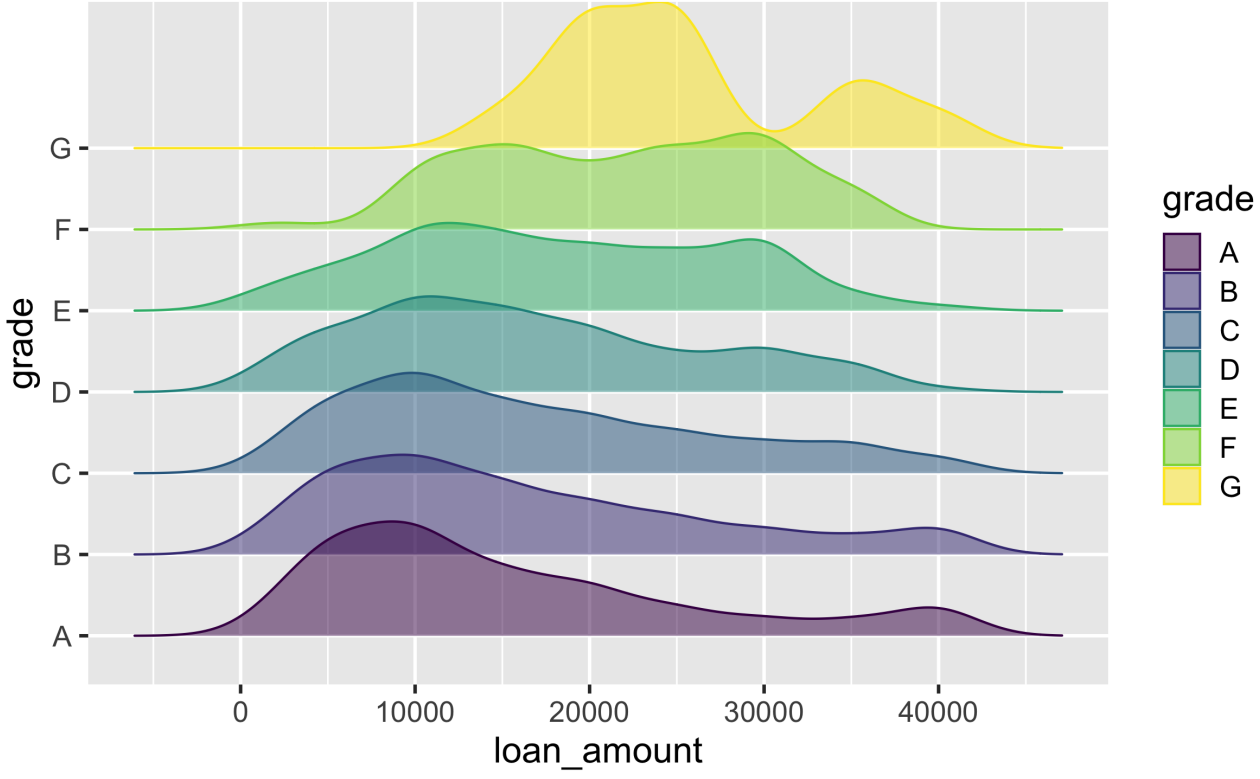
Violin plots

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



Ridge plots

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



Ridge plots

- A Ridgeline plot (sometimes called Joyplot) shows the distribution of a numeric value for several groups.
- Distribution can be represented using histograms or density plots, all aligned to the same horizontal scale and presented with a slight overlap (see data-to-viz) .