Lab 02 - Portland Thorns

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In this lab we will be working with data from 2016-23 of the Portland Thorns, a highly successful National Women's Soccer League (NWSL) team located in Portland, OR. Our goals include

- visualizing categorial data
- investigating associations between categorial data
- investigating associations with numerical data

We will also see some new ways of working with data with R.

1 Packages and Data

> **i** There's nothing in this section that you actually need to do – just read through to make sure you understand what's happening.

The `tidyverse` package includes many of the R commands we need to work with data.

```
library(tidyverse)
library(wesanderson)
```

The data for this lab was sourced from the `nwslR` package on Github. The code below reads this data from a csv file and then assigns the name `thorns` to the dataset.

```
thorns <- read_csv("thorns.csv")
```

The `thorns` dataset has 197 rows and 9 variables. The observations are all the Thorns games up through the 2013 season. The variables are as follows:

Variable	Descripton
`game_id`	An unique ID for the game
`game_date`	Game date
`home_team`	Name of the home team, abbreviated
`away_team`	Name of the away team, abbreviated
`opponent`	The team Thorns played against
`home_pts`	Number of points by the home team
`away_pts`	Number of points by the away team
`result`	Result of the game for Thorns (win, loss, tie)
`year`	Season (2017-2023)

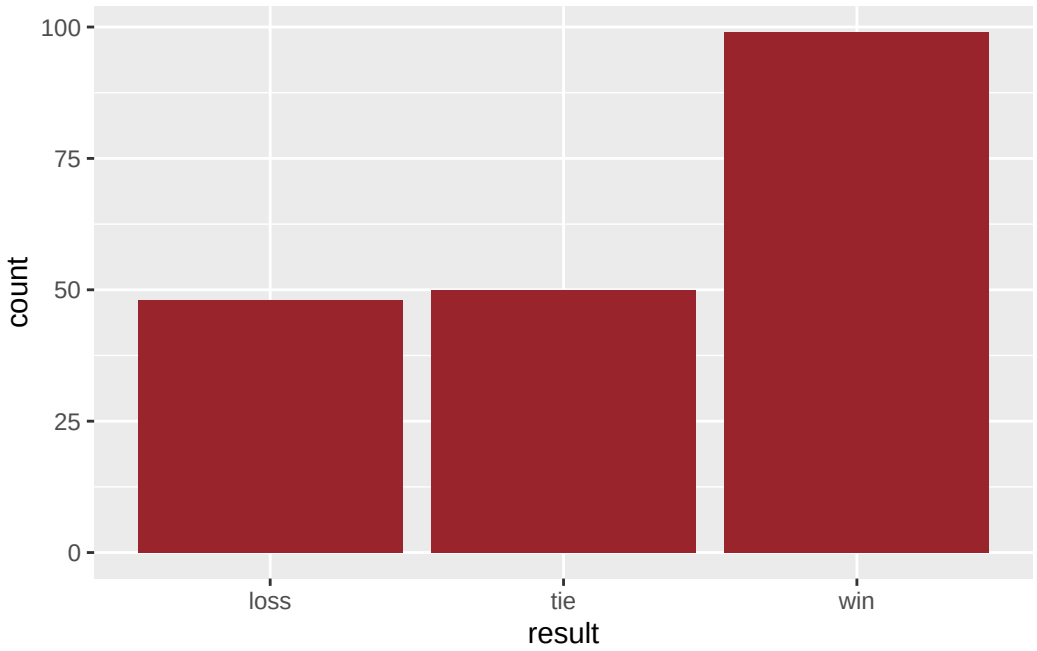
2 Thorns `results`

In this section we want to start looking at the categorical variable `results` which records the result (win, loss, or tie) for each game.

Task 1

Create a bar plot for the variable `result`. Additionally, calculate the numbers of wins, losses, and ties. Hint: in previous activities, we have used the `count()` function to do this kind of calculation.

```
ggplot(thorns, aes(x=result)) +
  geom_bar(fill = "#99242B")
```



> Response
>
> Thorns win more than they lose or tie

Task 2

One question we might ask about the Thorns is whether there's a difference in how often they win if we control for whether they're playing at home or away.

> Response
>
> Do you have a guess about what we might find when we look for an association between these two variables?

To help us investigate this question, we will create a new variable that captures whether the game was played at home or away. We will call this variable `home_thorns` and give it the value "home" if Thorns are the home team and "away" if Thorns are the away team. Here is the code that does this:

```
thorns <- thorns |>
  mutate(home_thorns = if_else(home_team == "POR", "home", "away"))
```

There are two things to notice here:

- The use of the assignment operator (`<-`) to assign the resulting data frame to `thorns`, thus overwriting the `thorns` dataset to contain this new column. We do this because we will use this new variable, `home_thorns`, in a subsequent exercise.
- The use of a new function, `if_else()` to determine whether the game is played at home or away.
  - `home_team == "POR"` finds all rows where the home team is Portland.
  - If the home team is Portland, then we set the value of `home_thorns` to "home".
  - Otherwise (else) Thorns must be the away team and we set the value of `home_thorns` to `"away"`.

> Summary
>
> Fill in the blank in the code chunk below with your new variable to calculate the number of home and away games and write a one sentence narrative for your findings. Remember to change `eval:false` to `eval:true`.
> *add your response here*

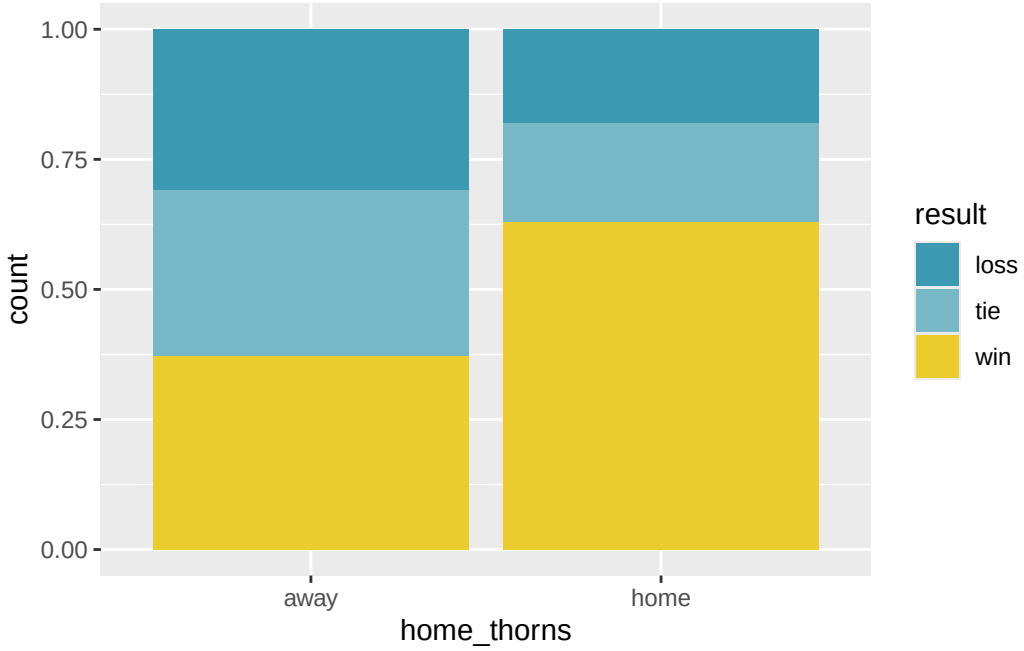
```
thorns |>
  count(home_thorns)
```

```
# A tibble: 2 x 2
  home_thorns     n
  <chr>       <int>
1 away           97
2 home          100
```

Task 3

Now let's create a visualization that displays the relationship between `home_thorns` and `result`. Since we're now looking at *two* categorical variables, we now want a stacked bar graph.

```
ggplot(thorns, aes(x=home_thorns, fill = result) ) +
  geom_bar(position = "fill") +
  scale_fill_manual(values = wes_palette("Zissou1", n=5))
```




```
# scale_fill_manual(values = c("black", "#EE202F", "#99242b"))
```

Then, let's calculate the proportions of home and away games that the Thorns won.

```
thorns |>
  count(home_thorns, result)
```

```
# A tibble: 6 x 3
  home_thorns result     n
  <chr>       <chr>  <int>
1 away        loss      30
2 away        tie       31
3 away        win       36
4 home        loss      18
5 home        tie       19
6 home        win       63
```

```
thorns |>
  count(result, home_thorns) |>
  group_by(home_thorns) |>
  mutate( pct = n / sum(n)) |>
  pivot_wider(id_cols = home_thorns, names_from = result , values_from = pct )
```

```
# A tibble: 2 x 4
# Groups:   home_thorns [2]
  home_thorns  loss   tie   win
  <chr>       <dbl> <dbl> <dbl>
1 away        0.309 0.320 0.371
2 home        0.18  0.19  0.63
```

> Task 3 Response
>
> Based on your findings, do you think that `results` and `home_thorns` are associatated? Does this suggest the Thorns have a home-field advantage? Why or why not?
> *Thorns win more at home than they do when they're away. These variables do seem to have an association.*

3 Thorns `points`

So far we have focused on whether the game was at home or away and whether the Thorns won – both of which are categorical variables. Now let's look at the number of goals that the Thorns score, a numerical variable, and whether that might be associated with where they play.

Unfortunately, we don't actually have a variable (yet) whose value is the number of goals the Thorns score! But we do have two variables that track the scores of the home and away teams. And earlier, we created a variable that tracks whether the Thorns were the home team or away each game. So we again create a new variable for the quantity we're interested in.

```
thorns <- thorns |>
  mutate(thorns_pts = if_else(home_team == "POR", home_pts, away_pts))
```

Now that we have a variable for goals scored by Thorns each game we can calculuate its average (mean) value:

```
thorns |>
  summarize(mean = mean(thorns_pts))
```

```
# A tibble: 1 x 1
   mean
  <dbl>
1  1.65
```

Task 5

> Exercise 5
>
> Examine the following code block and its output and in your own words, summarize the results.
> *thorns score an average of about 2 goals per game at home. in away games, they score an average of 1.25 goals.*

```
thorns |>
  group_by(home_thorns) |>
  summarize(mean = mean(thorns_pts))
```

```
# A tibble: 2 x 2
  home_thorns  mean
  <chr>       <dbl>
1 away         1.25
2 home         2.05
```

> Exercise 6
>
> In the code block below, fill in the blank to determine the average number of goals the Thorns score in games they win.

```
thorns |>
  group_by(result) |>
  summarize(mean = mean(thorns_pts))
```

```
# A tibble: 3 x 2
  result  mean
  <chr>  <dbl>
1 loss   0.562
2 tie    1.12
3 win    2.45
```

Task 6

The code chunk below extends our investigation by looking at average number of goals scored when we control for both `home_thorns` and `result`.

```r
thorns |>
  group_by(home_thorns, result) |>
  summarize(mean = mean(thorns_pts))
```

```
# A tibble: 6 x 3
# Groups:   home_thorns [2]
  home_thorns result  mean
  <chr>       <chr>  <dbl>
1 away        loss   0.5
2 away        tie    1.23
3 away        win    1.89
4 home        loss   0.667
5 home        tie    0.947
6 home        win    2.78
```

> Exercise 7
>
> Examine this table and make some observations.

Task 7

For our last task, we want to visualize our investigation into number of goals scored with some scatterplots. First, we build on the `thorns` data frame by again creating some new variables to help us keep track of the points scored by the Thorns opponent in each game. The code below creates two new variables:

- `total_pts`: Sum of points scored by both teams, i.e. `home_pts + away_pts`.
- `opponent_pts`: Points scored by the opposing team, i.e., `total_pts - thorn_pts`.

```r
thorns <- thorns |>
  mutate(
    total_pts = home_pts + away_pts,
    opponent_pts = total_pts - thorns_pts
    )
```

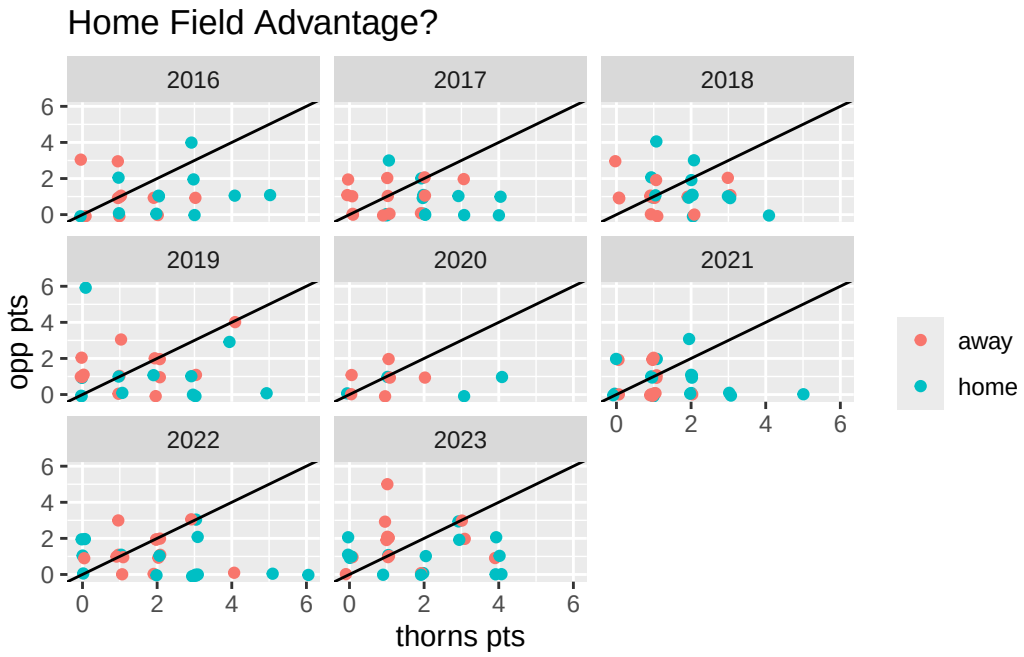
Finally, we create some scatterplots to do the following:

- graph `opponent_pts` (y) vs. `thorns_pts` (x)
- Color the scatter plot by whether Thorns are home or away.
- Represent the data with "jittered" points wth `geom_jitter()`.

- Overlay a $y = x$ line with `geom_abline()`.
- Facet by `year` (i.e. create a separate graph for each season).

Fill in the blanks in the blanks with the appropriate variable names. After producing the scatterplots, answer the questions below.

```
ggplot(thorns, aes(x = thorns_pts, y = opponent_pts, color = home_thorns)) +
  geom_jitter(width = 0.1, height = 0.1) +
  geom_abline(slope = 1, intercept = 0) +
  facet_wrap(~ year) +
  labs(
    x = "thorns pts",
    y = "opp pts",
    title = "Home Field Advantage?",
    color = ""
  )
```



Exercise 8

What observations can you make about the the scatterplots shown above? What does each point represent? What do the diagonal lines represent? What does it mean for a point to fall above the line? Below the line?
write response here

Wrap Up

If we really want to formally test whether the Thorns have a home-field advantage, then we must first define what this means! In your own words, what do you think a home-field advantage means? Then, now that you've defined what it means to have a home field advantage, define what it means to **not** have a home-field advantage.
write response here

4 Acknowledgements

This assignment was adapted from a similar exercise by Dr. Mine Çetinkaya-Rundel. Dataset was cleaned and prepared by Chris Hallstrom.