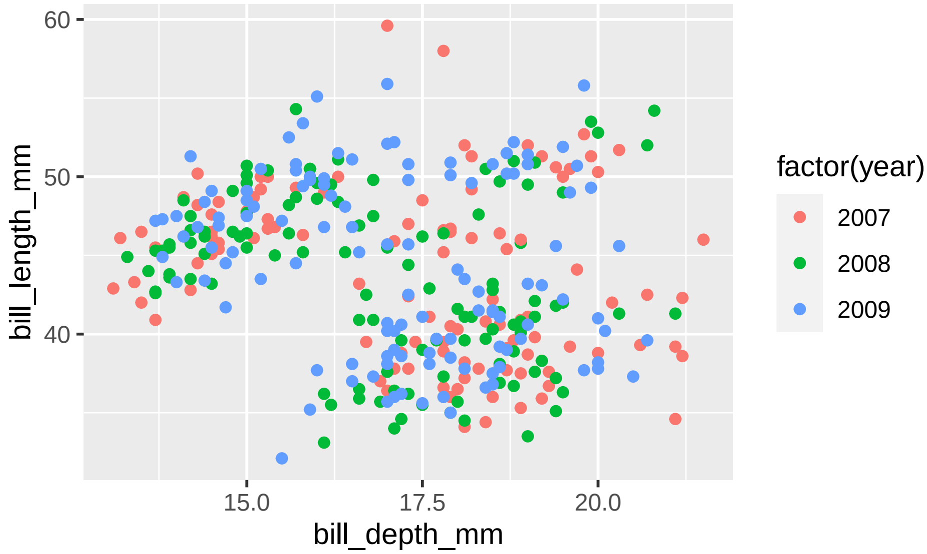
Lab 5: More practice with Penguins

Consider a plot that's a riff on the one you made in Lab 2. Here we plot penguin bill length vs bill depth, separated out by year.

```r
library(palmerpenguins)
library(ggplot2)
ggplot(penguins, aes(x = bill_depth_mm,
                     y = bill_length_mm,
                     color = factor(year))) +
  geom_point()
```



Previously, we used the strained functionality of a dictionary of lists to subset this data and replot it. In this lab, we'll be working with the data as a numpy array, which will give us a bit more power.

1. Load the `penguins` data from `{palmerpenguins}` in R and run it through `tidyr::drop_na()` to remove rows with missing values. Next, bring it into Python as `pypenguins`. Just to remind ourselves: what is the type of `pypenguins`? What is the type of the values of each of its elements (this you can just assess visually)?

2. Our goal is to change the type of `pypenguins` to be a numpy array, but we have a problem: currently it is type *heterogeneous*. Let's solve that by working only with the numerical data that it contains and drop the strings. Our tool for this will be a dictionary comprehension.

   A dictionary comprehension is very similar to a list comprehension - it's essentially short-hand for a for loop - but it returns a dictionary instead. Here is an example of such a construction:

   ```
   d = {'a': 1, 'b': 2, 'c': 3, 'd': 4}
   {k:v*2 for (k,v) in d.items() if k == 'd'}
   ```

   ```
   ## {'d': 8}
   ```

   Recall that you can access three forms of iterable elements in a dictionary `d` using `d.keys()`, `d.values()`, `d.items()`. 1. Using a dictionary comprehension, create a new dictionary from `pypenguins` that contains only numerical data. 1. Extract the values from this dictionary and put them into a numpy array called `pg_array`. You may need to fiddle with it to get it just right, but aim for a 344 x 5 array of floats.

3. Split the array into three separate arrays, each one containing data from a different year. This combines two steps: making a *boolean mask* (the familiar structure of, say, `x[x<7]`) and then slice indexing.

4. Compute the mean beak and bill length for each of the three years of data. Has there been any change over time?

5. In which year was the maximum bill length observed? What about the minimum bill length length? Check your answer by looking at the plot above.

6. Bring the 2007 data back into R and make a scatterplot of bill length vs bill depth. Though this procedure we through seems trivial, note that it actually wasn't possible with the dictionary techniques we used in Lab 2. To subset the rows of `bill_length` and `bill_depth` based on values of `year` requires a link between the `i` and `j` indices of a matrix, which is something made possible by the numpy array.