Class 5: Data Visualization with ggplot

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Using GGPlot

##Basics with cars Load ggplot2 package before use.

```
library(ggplot2)

ggplot(cars)
```

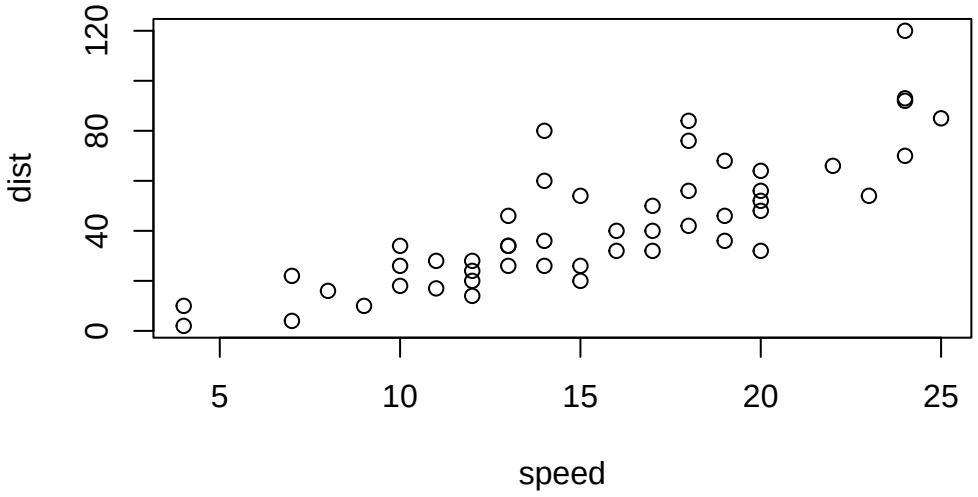


```
head(cars)
```

```
  speed dist
1     4    2
2     4   10
3     7    4
4     7   22
5     8   16
6     9   10
```

We can use the base R graphics system to plot.

```
plot(cars)
```

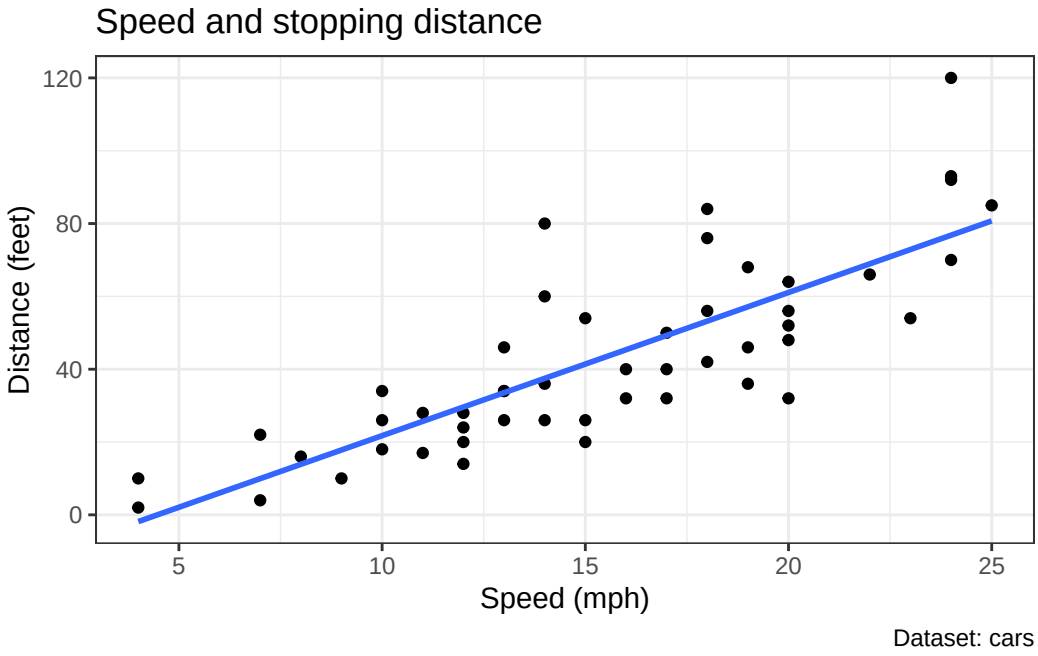


ggplot requires more information than the base `plot()` function: - Data, in a `data.frame` - aes - how the data map to the plot - geoms - how things are drawn

```
ggplot(cars)+
  aes(x = speed, y = dist) +
  geom_point() +
  geom_smooth(method = "lm", se = FALSE) +
  labs(title = "Speed and stopping distance",
       x = "Speed (mph)",
```

```
        y = "Distance (feet)",
        caption = "Dataset: cars") +
    theme_bw()
```

```
`geom_smooth()` using formula = 'y ~ x'
```



Switching to gene expression dataset

```
url <- "https://bioboot.github.io/bimm143_S20/class-material/up_down_expression.txt"
genes <- read.delim(url)
head(genes)
```

```
        Gene Condition1 Condition2      State
1      A4GNT -3.6808610 -3.4401355 unchanging
2       AAAS  4.5479580  4.3864126 unchanging
3      AASDH  3.7190695  3.4787276 unchanging
4       AATF  5.0784720  5.0151916 unchanging
5       AATK  0.4711421  0.5598642 unchanging
6 AB015752.4 -3.6808610 -3.5921390 unchanging
```

Exploring the dataset

```
nrow(genes)
```

```
[1] 5196
```

```
colnames(genes)
```

```
[1] "Gene"       "Condition1" "Condition2" "State"
```

```
ncol(genes)
```

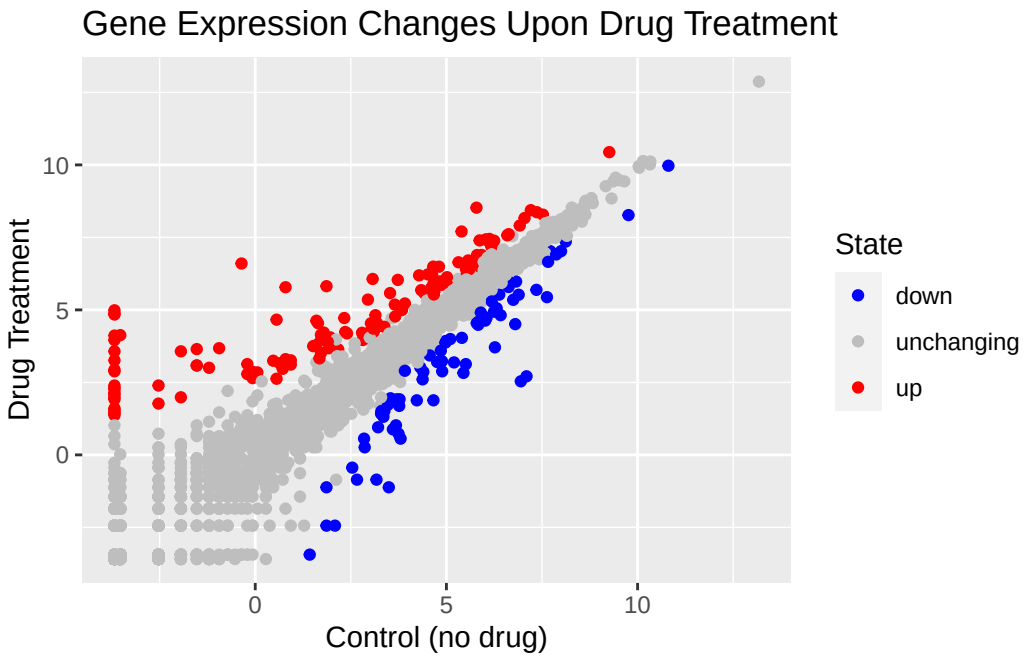
```
[1] 4
```

```
table(genes$State)
```

```
      down unchanging         up
        72       4997        127
```

Plot the dataset

```
p <- ggplot(genes) +
  aes(x = Condition1, y = Condition2, col=State)+
  geom_point() +
  scale_color_manual(values=c("blue", "gray", "red")) +
  labs(title = "Gene Expression Changes Upon Drug Treatment",
       x = "Control (no drug)",
       y = "Drug Treatment")
p
```



Switch to gapminder dataset

```
# File location online
url <- "https://raw.githubusercontent.com/jennybc/gapminder/master/inst/extdata/gapminder.

gapminder <- read.delim(url)
head(gapminder)
```

```
      country continent year lifeExp      pop gdpPercap
1 Afghanistan      Asia 1952  28.801  8425333  779.4453
2 Afghanistan      Asia 1957  30.332  9240934  820.8530
3 Afghanistan      Asia 1962  31.997 10267083  853.1007
4 Afghanistan      Asia 1967  34.020 11537966  836.1971
5 Afghanistan      Asia 1972  36.088 13079460  739.9811
6 Afghanistan      Asia 1977  38.438 14880372  786.1134
```

Add dplyr and filter for the year 2007

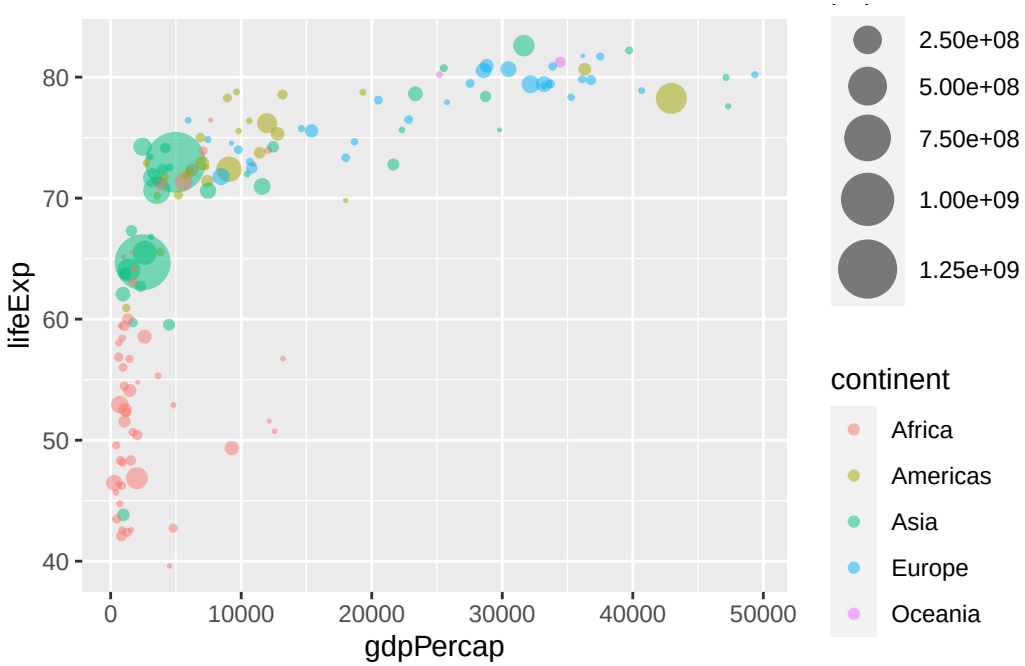
```
library(dplyr)
```

```
Attaching package: 'dplyr'

The following objects are masked from 'package:stats':

    filter, lag

The following objects are masked from 'package:base':

    intersect, setdiff, setequal, union
```

```
gapminder_2007 <- gapminder %>% filter(year==2007)
```

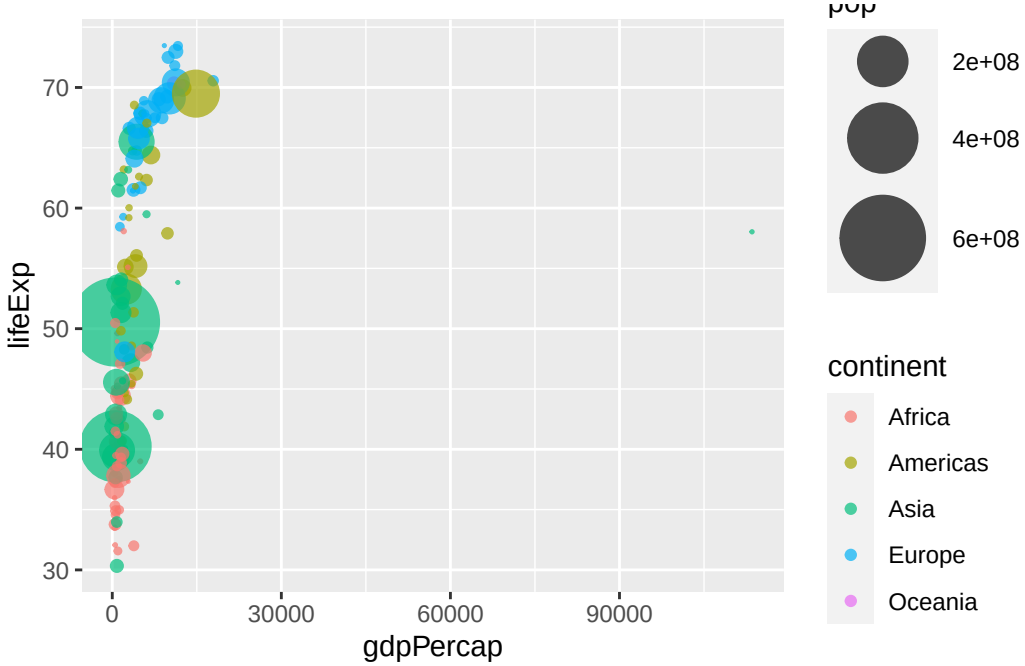
Simple scatterplot for 2007

```
ggplot(gapminder_2007) +
  aes(x = gdpPercap, y = lifeExp, col = continent, size = pop) +
  geom_point(alpha = 0.5) +
  scale_size_area(max_size = 10)
```



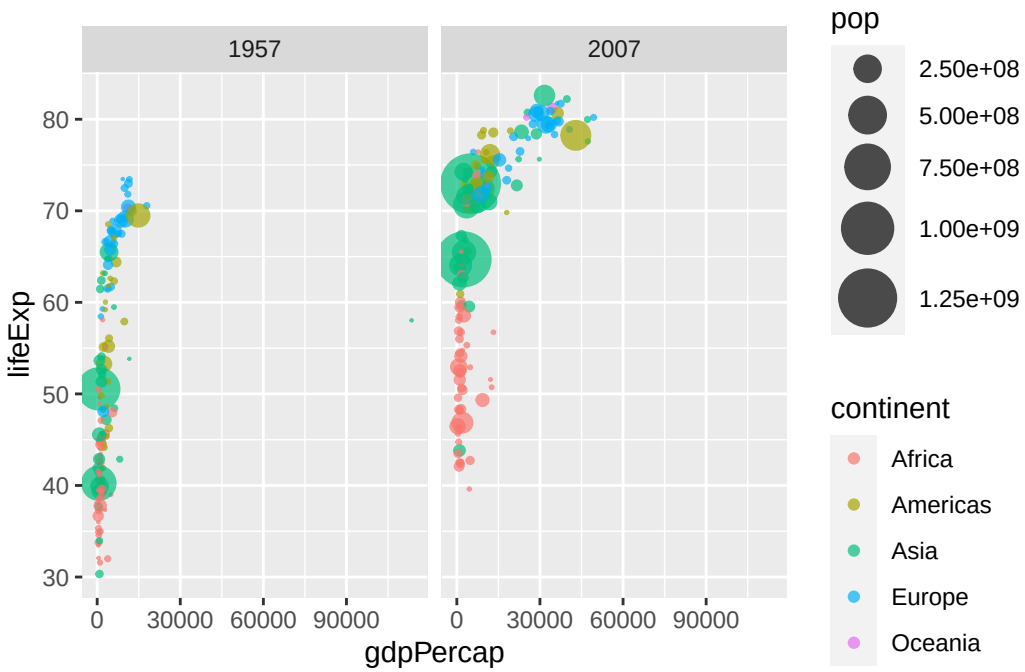
###Recapitulate the above process for 1957

```
gapminder_1957 <- gapminder %>% filter(year==1957)

ggplot(gapminder_1957) +
  aes(x = gdpPercap, y = lifeExp, col = continent, size = pop) +
  geom_point(alpha = 0.7) +
  scale_size_area(max_size = 15)
```



Graph both 2007 and 1957

```
gapminder_1957_2007 <- gapminder %>% filter(year==1957 | year==2007)

ggplot(gapminder_1957_2007) +
  aes(x = gdpPercap, y = lifeExp, col = continent, size = pop) +
  geom_point(alpha = 0.7) +
  scale_size_area(max_size = 10) +
  facet_wrap(~year)
```



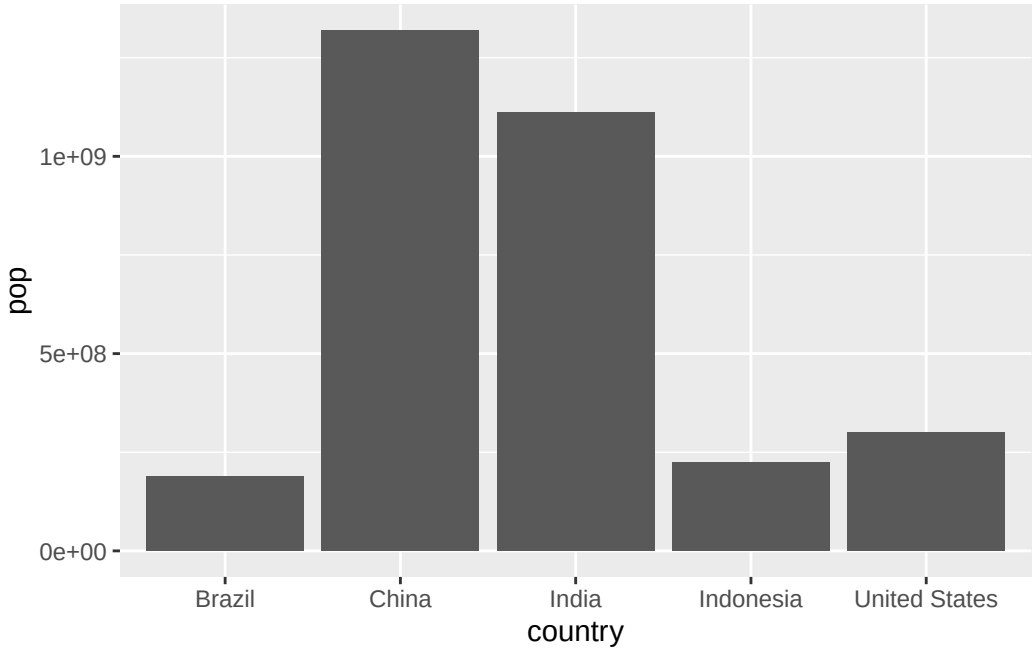
Bar charts

Filter for the 5 biggest countries

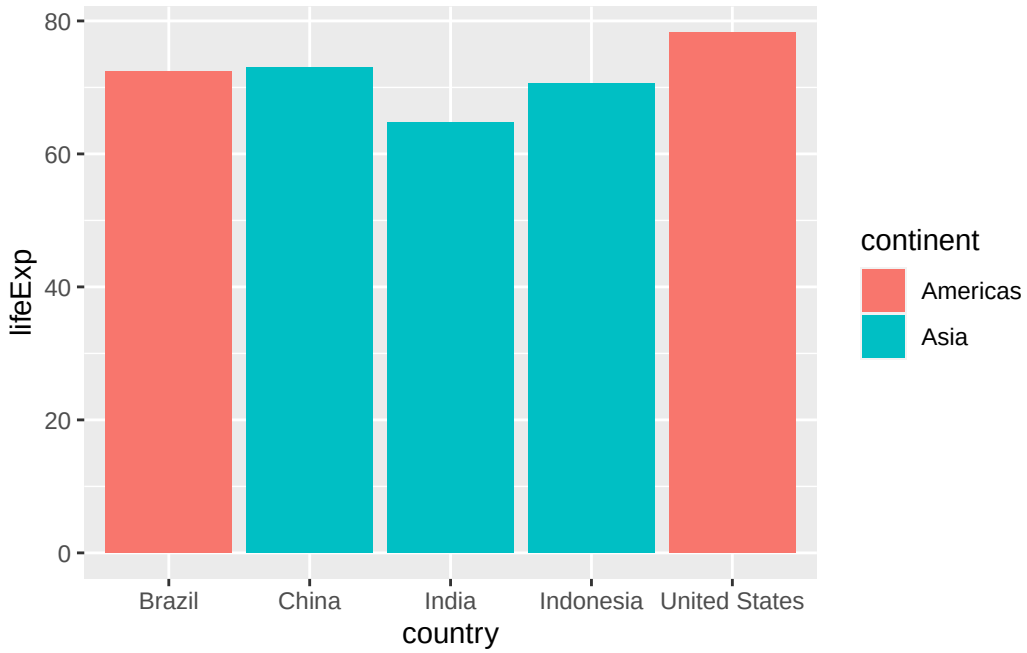
```
gapminder_top5 <- gapminder %>%
  filter(year==2007) %>%
  arrange(desc(pop)) %>%
  top_n(5, pop)

gapminder_top5
```

```
        country continent year lifeExp        pop gdpPercap
1         China      Asia 2007  72.961 1318683096  4959.115
2         India      Asia 2007  64.698 1110396331  2452.210
3 United States  Americas 2007  78.242  301139947 42951.653
4     Indonesia      Asia 2007  70.650  223547000  3540.652
5        Brazil  Americas 2007  72.390  190010647  9065.801
```

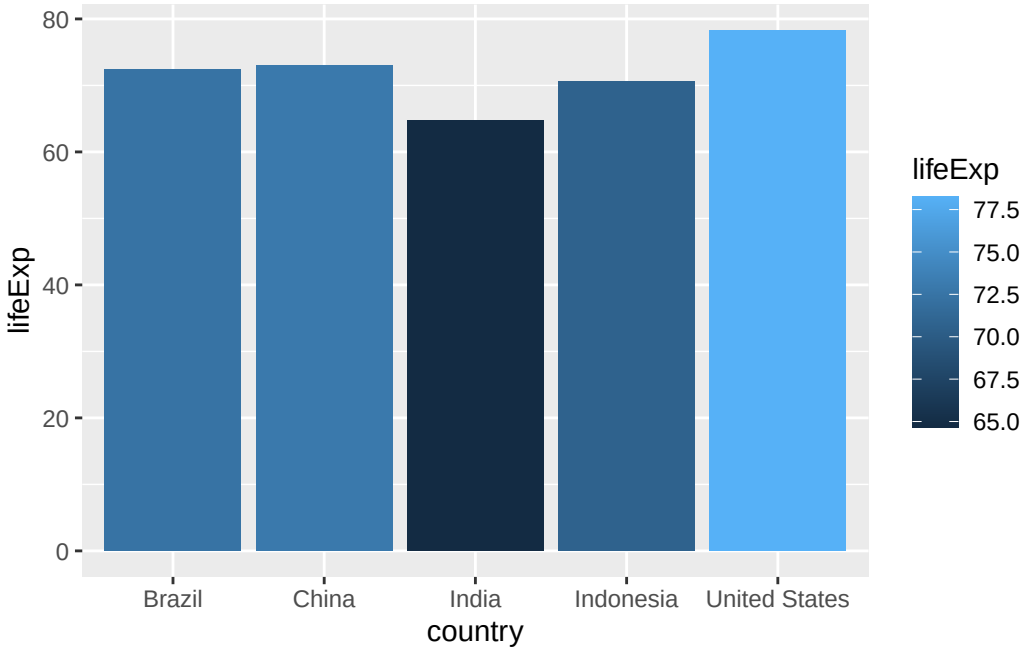
```
ggplot(gapminder_top5) +
  geom_col() +
  aes(x = country, y = pop)
```



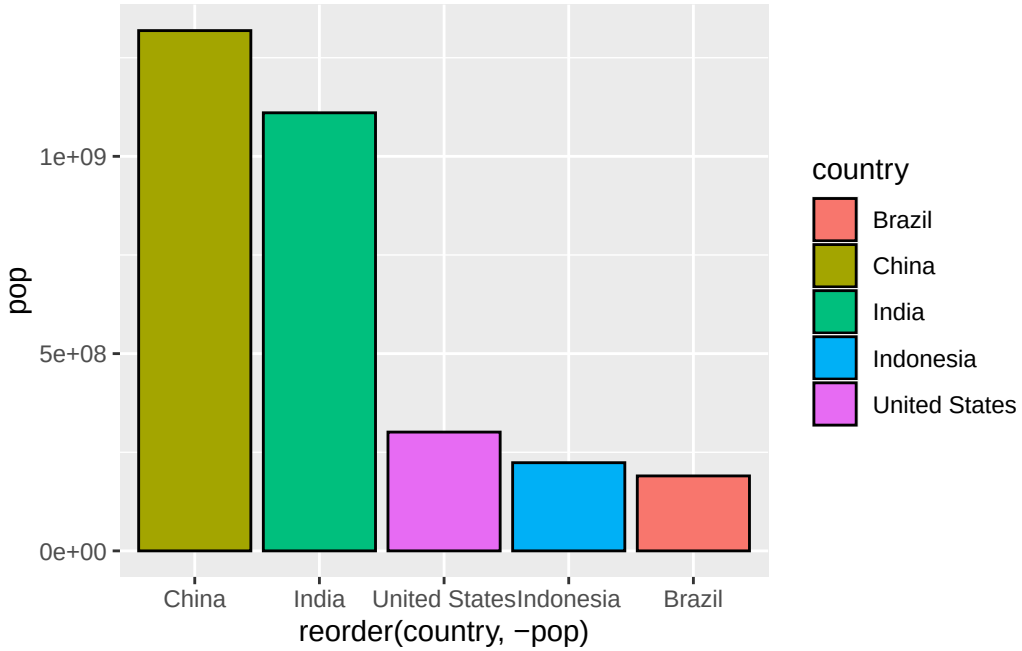

```
ggplot(gapminder_top5) +
  aes(x = country, y = lifeExp, fill = continent) +
  geom_col()
```




```
ggplot(gapminder_top5) +
  aes(x = country, y = lifeExp, fill = lifeExp) +
  geom_col()
```

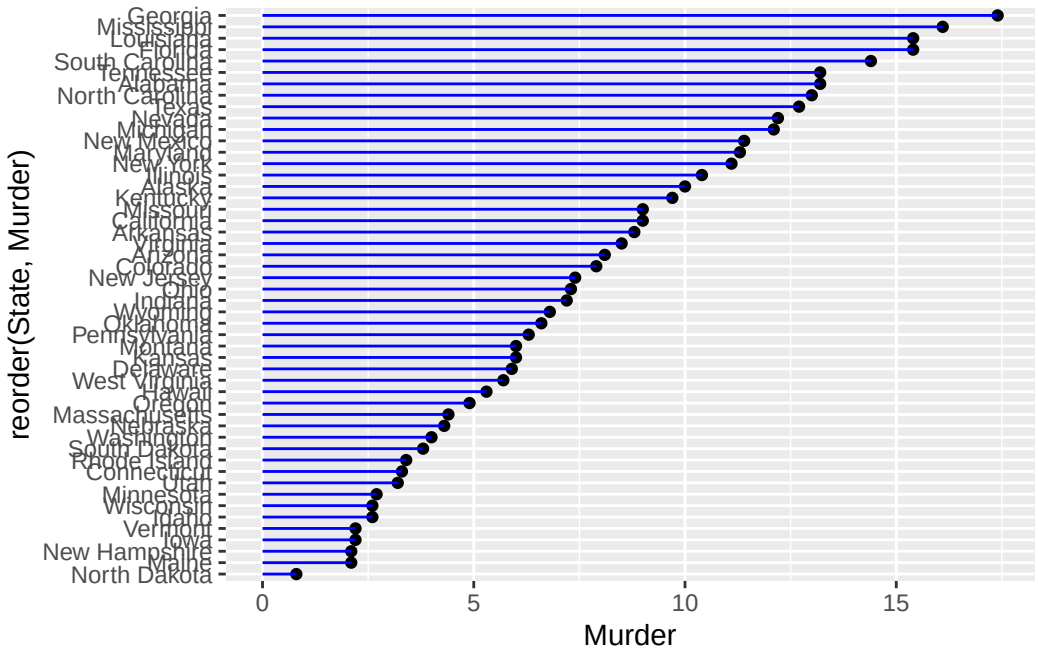



```
ggplot(gapminder_top5) +
  aes(x = reorder(country, -pop), y= pop, fill = country) +
  geom_col(col="black")
```



Flipping bar charts

```
USArrests$State <-rownames(USArrests)

ggplot(USArrests) +
  aes(x = reorder(State, Murder), y = Murder) +
  geom_point() +
  geom_segment(aes(x = State,
                   xend = State,
                   y = 0,
                   yend = Murder),
               color = "blue") +
  coord_flip()
```


reorder(State, Murder)
Georgia
Mississippi
Louisiana
Florida
South Carolina
Tennessee
Alabama
North Carolina
Texas
Nevada
Michigan
New Mexico
Maryland
New York
Illinois
Alaska
Kentucky
Missouri
California
Arkansas
Virginia
Arizona
Colorado
New Jersey
Ohio
Indiana
Wyoming
Oklahoma
Pennsylvania
Montana
Kansas
Delaware
West Virginia
Hawaii
Oregon
Massachusetts
Nebraska
Washington
South Dakota
Rhode Island
Connecticut
Utah
Minnesota
Wisconsin
Idaho
Vermont
Iowa
New Hampshire
Maine
North Dakota
0
5
10
15
Murder