Class 05: Data Visualization with GGPLOT

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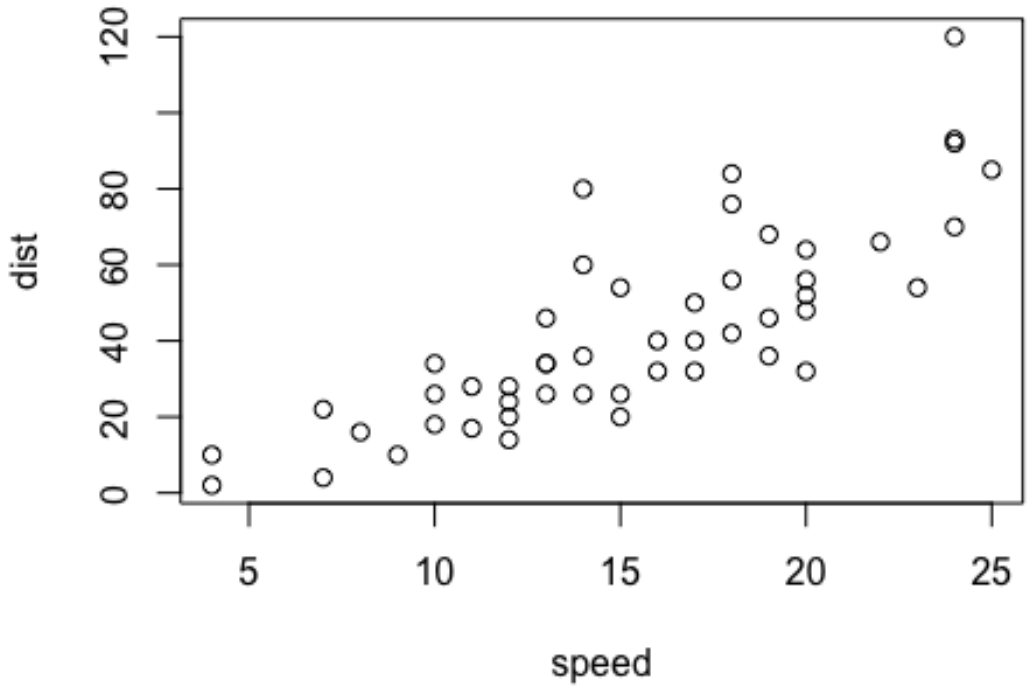
Plotting in R

R has lot's of ways to make plots and figures. This includes so-called **base** graphics and packages like **ggplot2**

```
plot(cars)
```



This is a **base** R plot of the in-built `cars` dataset that has only two columns:

```
cars
```

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

```
6      9   10
7     10   18
8     10   26
9     10   34
10    11   17
11    11   28
12    12   14
13    12   20
14    12   24
15    12   28
16    13   26
17    13   34
18    13   34
19    13   46
20    14   26
21    14   36
22    14   60
23    14   80
24    15   20
25    15   26
26    15   54
27    16   32
28    16   40
29    17   32
30    17   40
31    17   50
32    18   42
33    18   56
34    18   76
35    18   84
36    19   36
37    19   46
38    19   68
39    20   32
40    20   48
41    20   52
42    20   56
43    20   64
44    22   66
45    23   54
46    24   70
47    24   92
48    24   93
49    24  120
50    25   85
```

Q. How would we plot this wee dataset with **ggplot2**?

All ggplot figures have at least 3 layers:

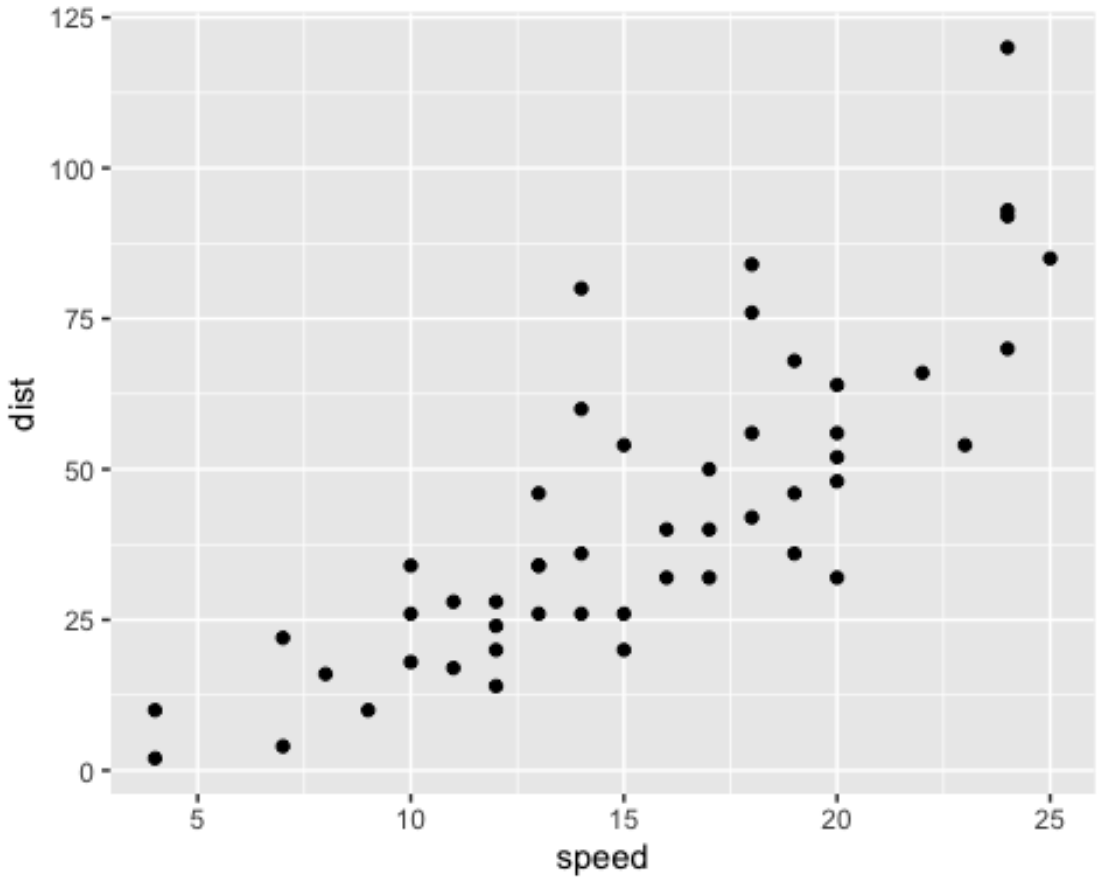
-**data** -**aes** (how data map to the plot) -**geoms** (how we draw the plot, lines, points, etc)

Before I use any new packages I need to download and install it with the `install.packages()` command.

I never use `install.packages()` within my quarto document otherwise I will install the package over and over and over again, which is silly!

Once a package is installed I can load it up with the `libraary()` function

```
# install.packages("ggplot2")
library(ggplot2)
ggplot(cars) +
  aes(x=speed, y=dist) +
  geom_point()
```

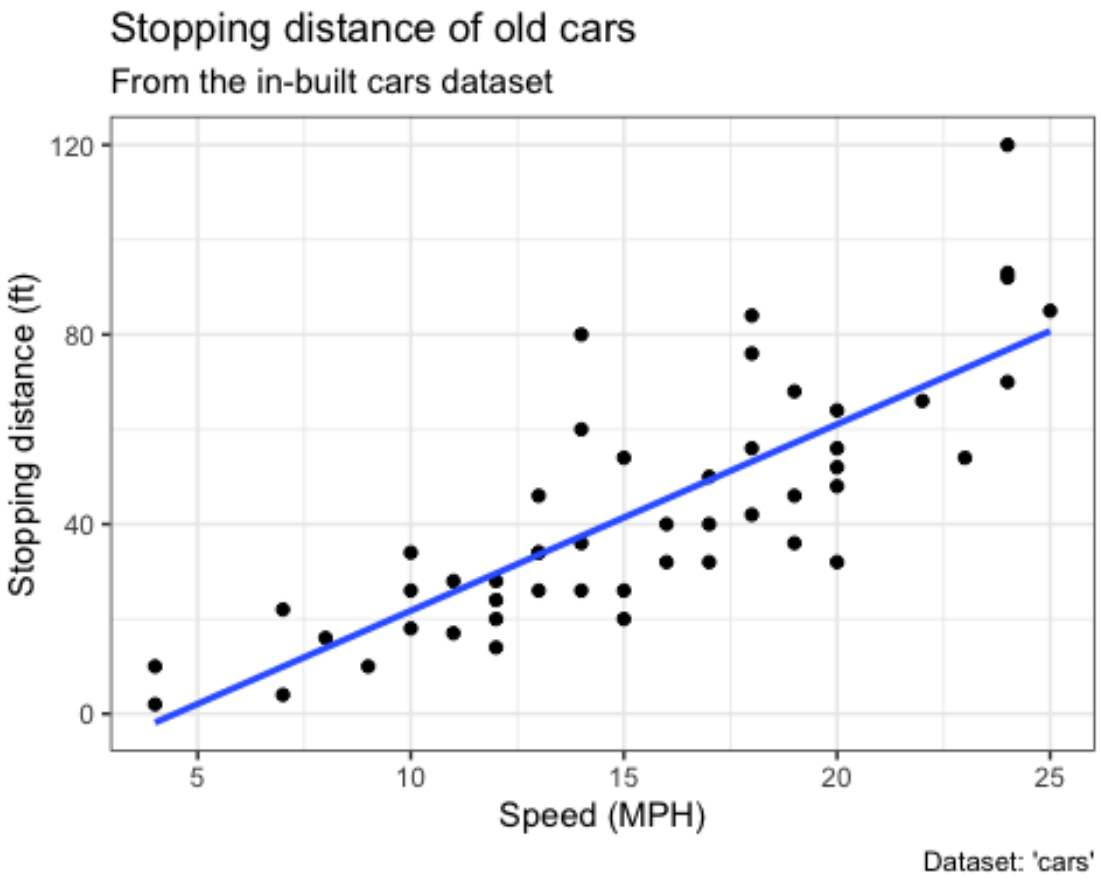


Key point: For simple plots (like the one above) ggplot is more verbose (we need to do more typing) but as plots get more complicated ggplot starts to be more clear and simple than base R plot()

```
ggplot(cars) +
  aes(x=speed, y=dist) +
  geom_point() +
  geom_smooth(method="lm",se = FALSE ) +
```

```
  labs(title="Stopping distance of old cars", x="Speed (MPH)", y="Stopping
distance (ft)", subtitle = "From the in-built cars dataset",
caption="Dataset: 'cars'") +
  theme_bw()
```

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




```
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
```

```
nrow(genes)
```

```
[1] 5196
```

```
colnames(genes)
```

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

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

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

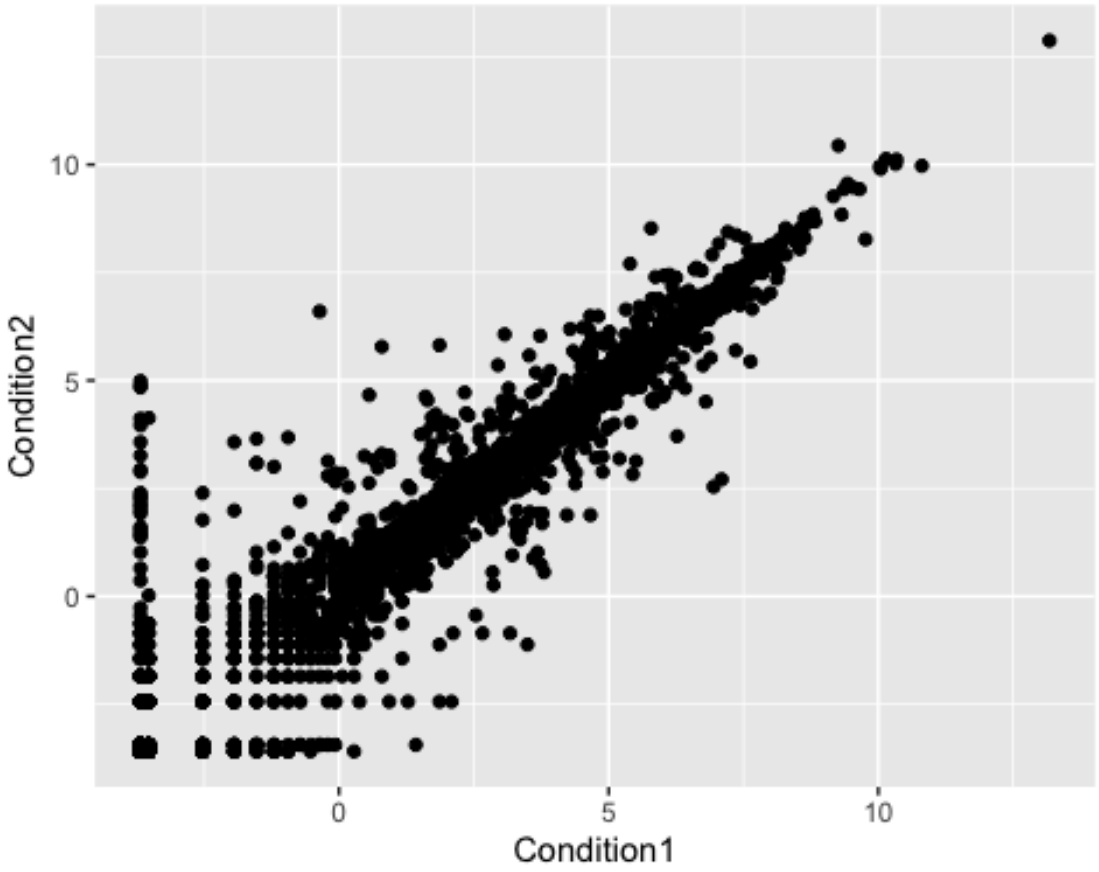
```
round( table(genes$State)/nrow(genes) * 100,2)
```

```
      down unchanging         up
      1.39      96.17       2.44
```

The key functions here were: `nrow()` and `ncol()` `table()` is very useful for getting counts finally `round()`

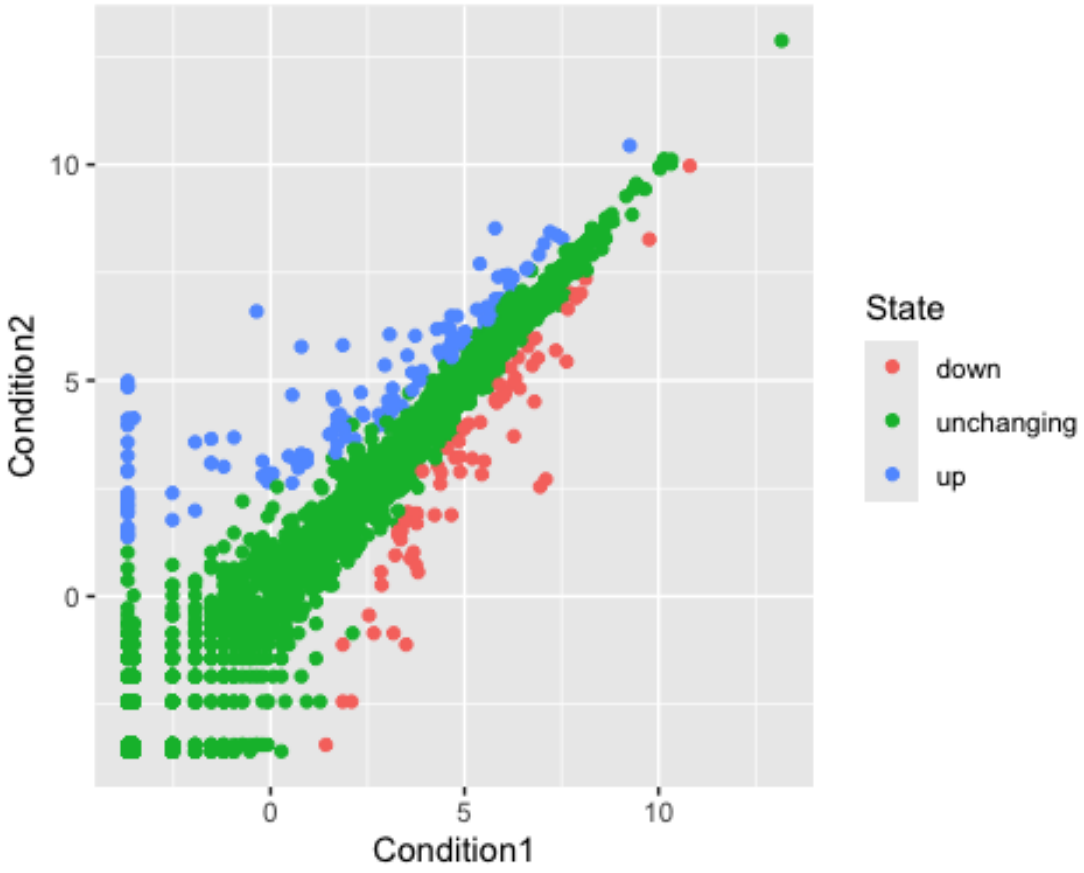
A first plot:

```
ggplot(genes) +
    aes(x=Condition1, y=Condition2) +
    geom_point()
```



A Second Plot:

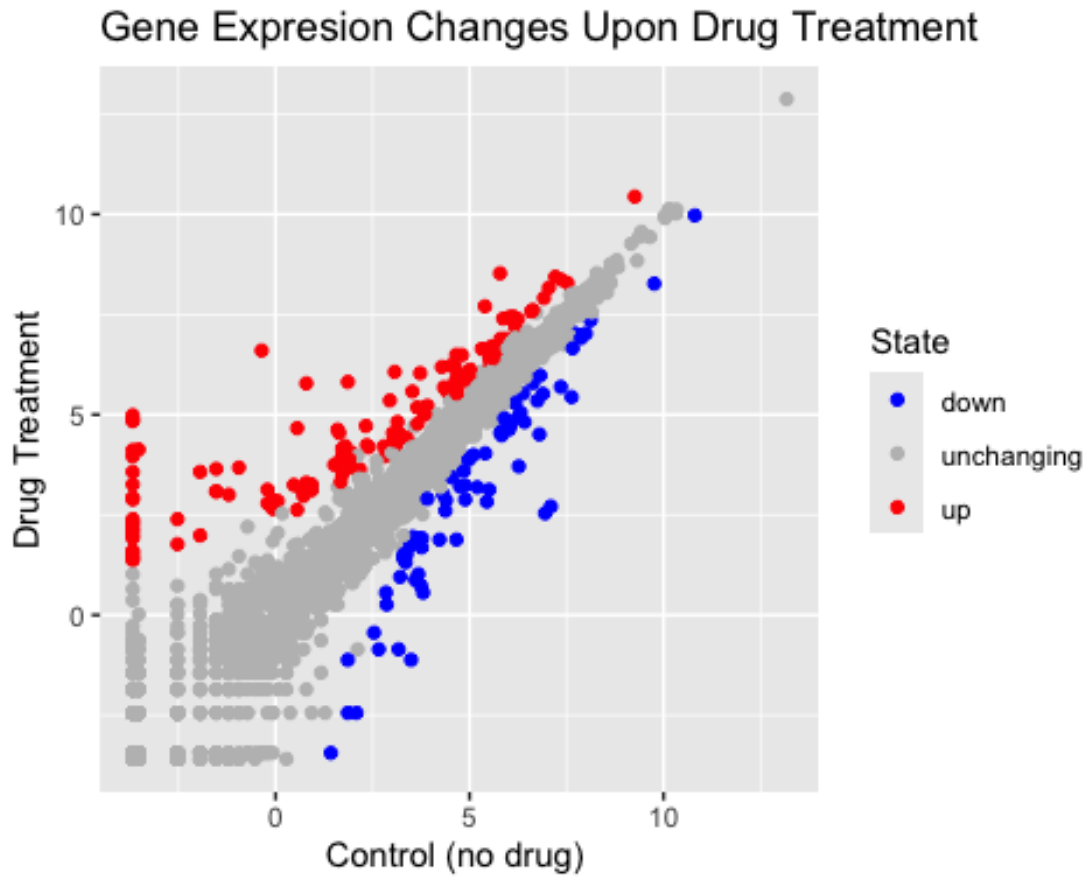
```
ggplot(genes) +
    aes(x=Condition1, y=Condition2, col=State) +
    geom_point()
```



Change the color

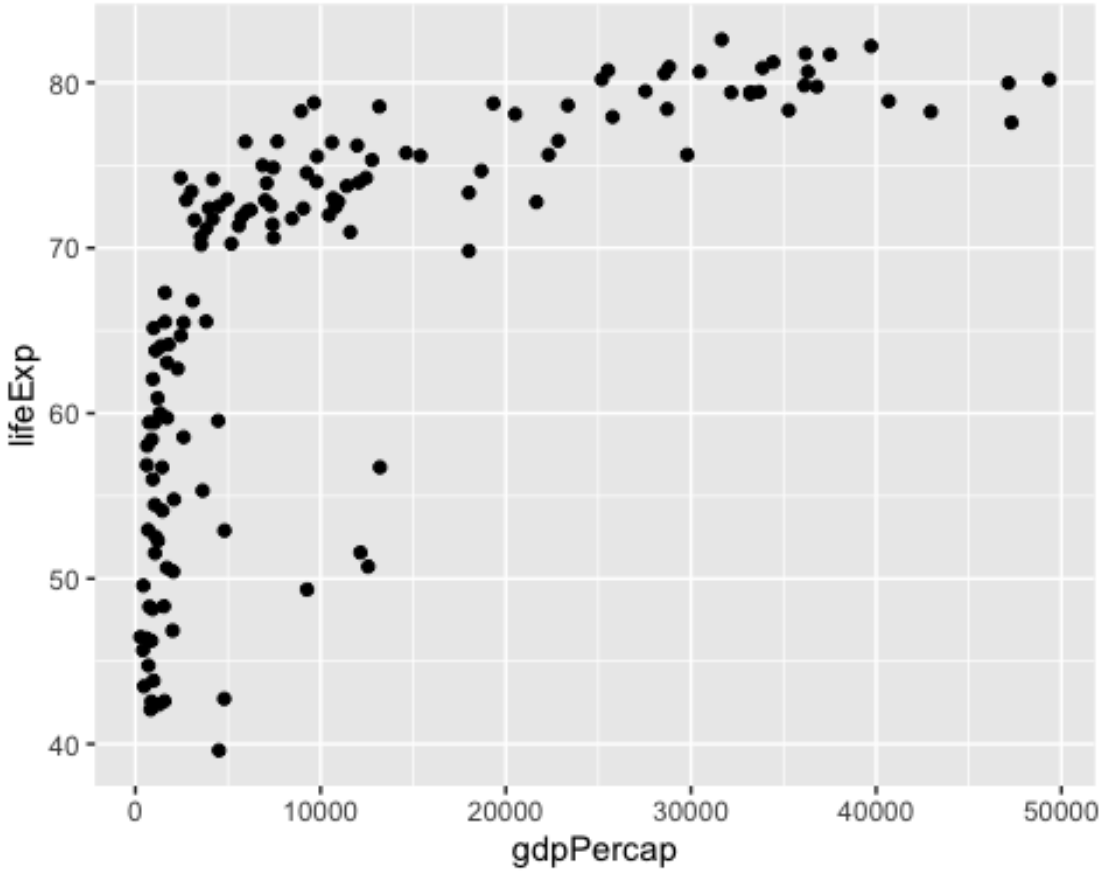
A Third Plot:

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

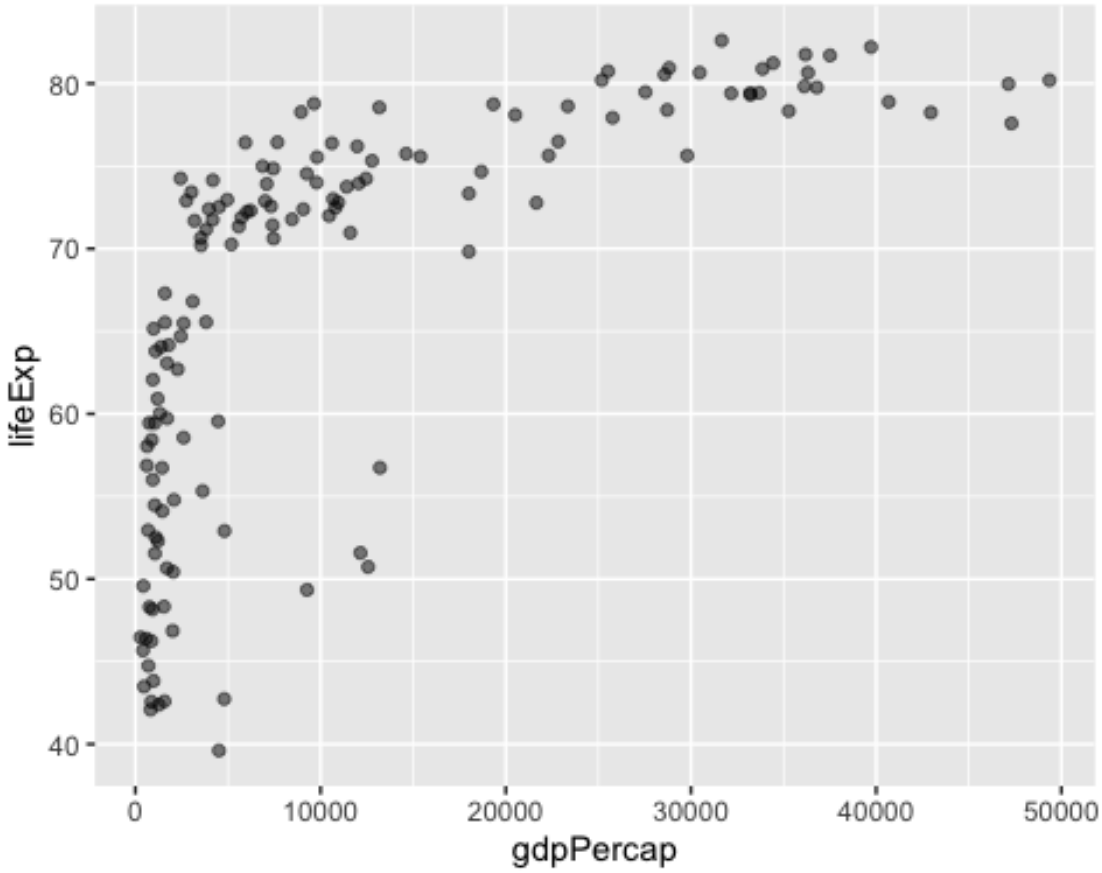



```
# File location online
url <-
"https://raw.githubusercontent.com/jennybc/gapminder/master/inst/extdata/gapminder.tsv"

gapminder <- read.delim(url)

# install.packages("dplyr")
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)
```

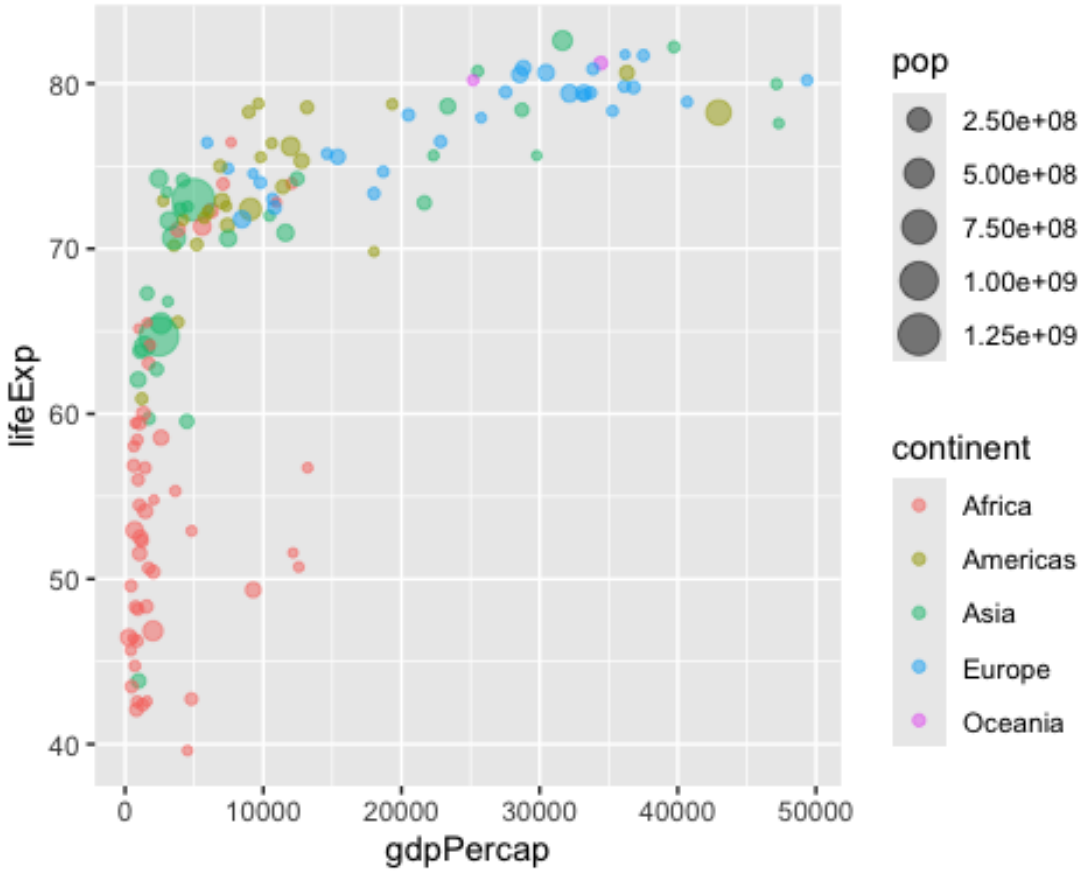
```
library(ggplot2)
ggplot(gapminder_2007) +
  aes(x=gdpPercap, y=lifeExp) +
  geom_point()
```



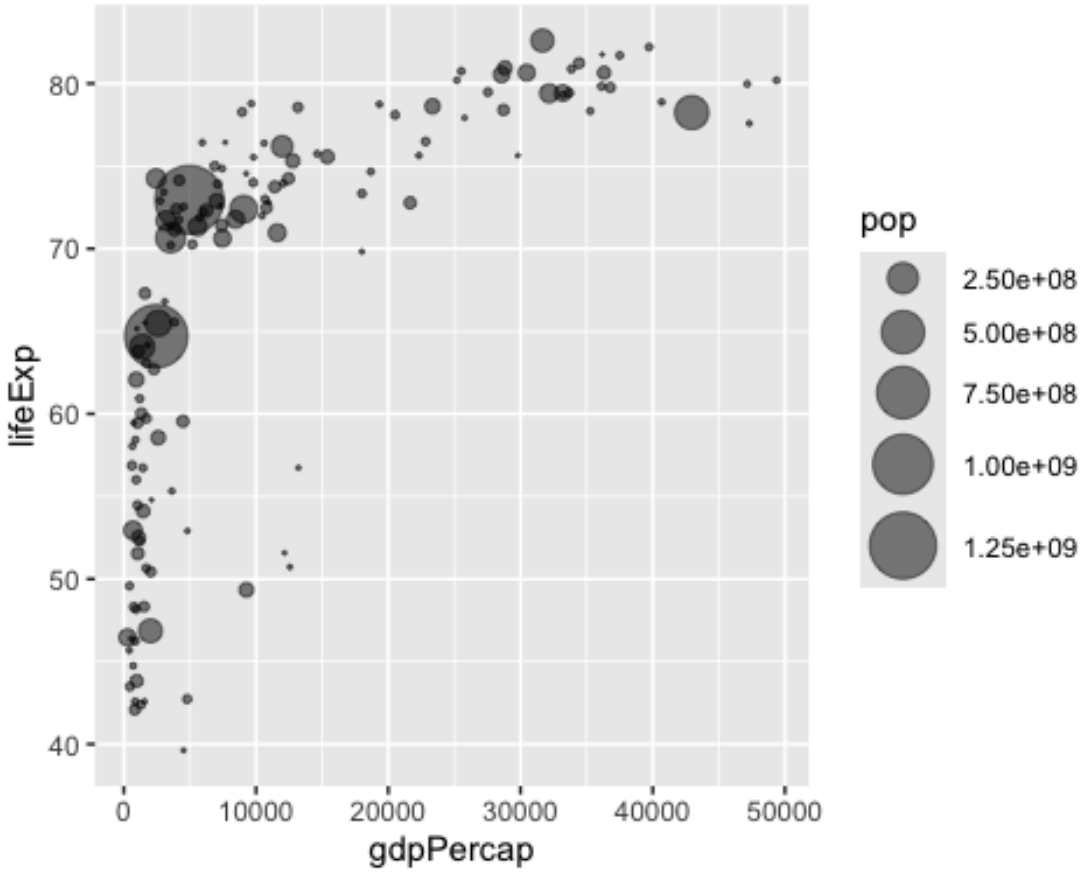

```
ggplot(gapminder_2007) +
  aes(x=gdpPercap, y=lifeExp) +
  geom_point(alpha=0.5)
```




```
ggplot(gapminder_2007) +
  aes(x=gdpPercap, y=lifeExp, color=continent, size=pop) +
  geom_point(alpha=0.5)
```




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

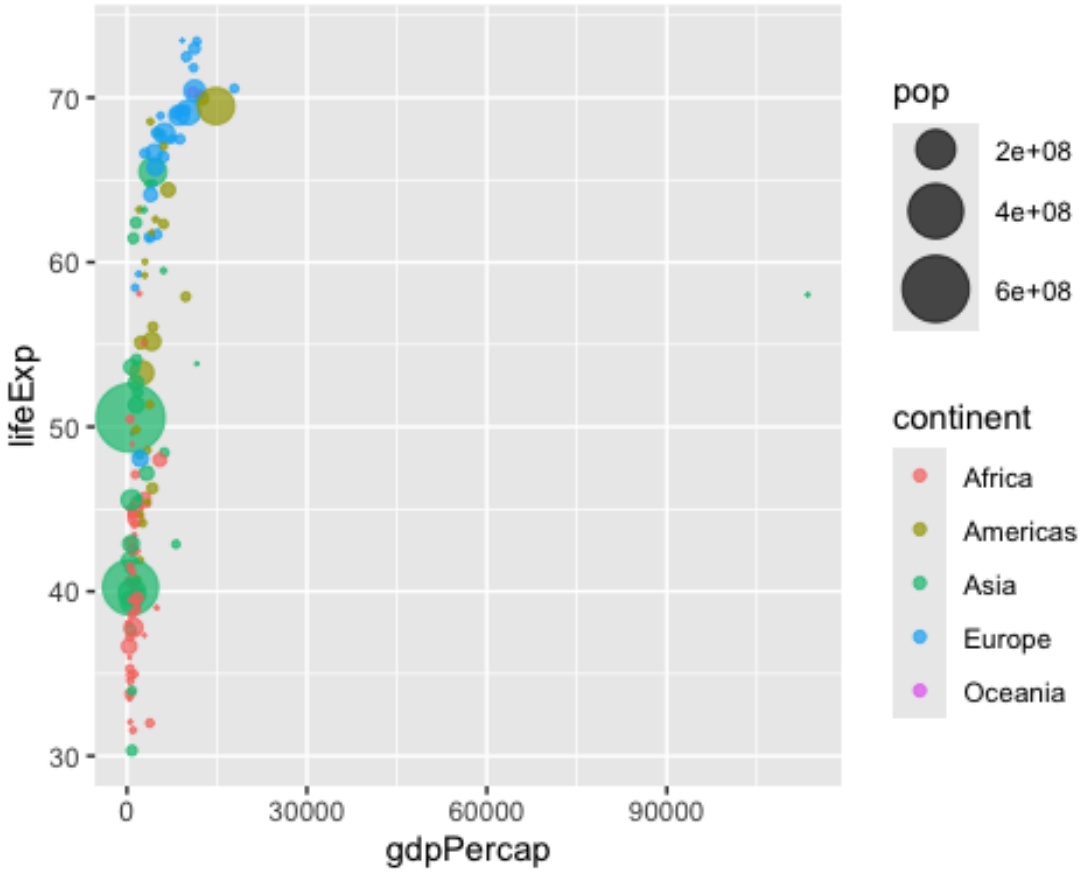


How many years are in this data set?

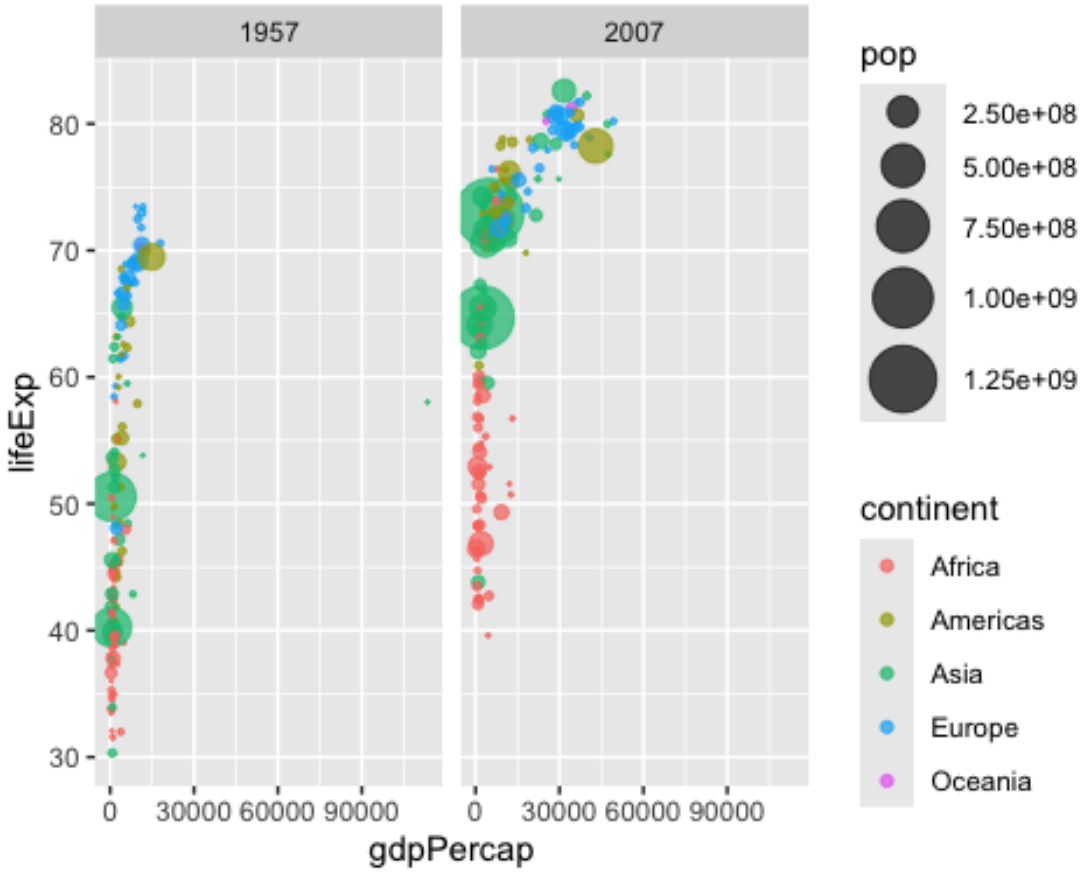
```
length(gapminder$year)
```

```
[1] 1704
```

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

ggplot(gapminder_1957) +
  aes(x = gdpPercap, y = lifeExp, color=continent,
                  size = pop) +
  geom_point(alpha=0.7) +
  scale_size_area(max_size = 10)
```



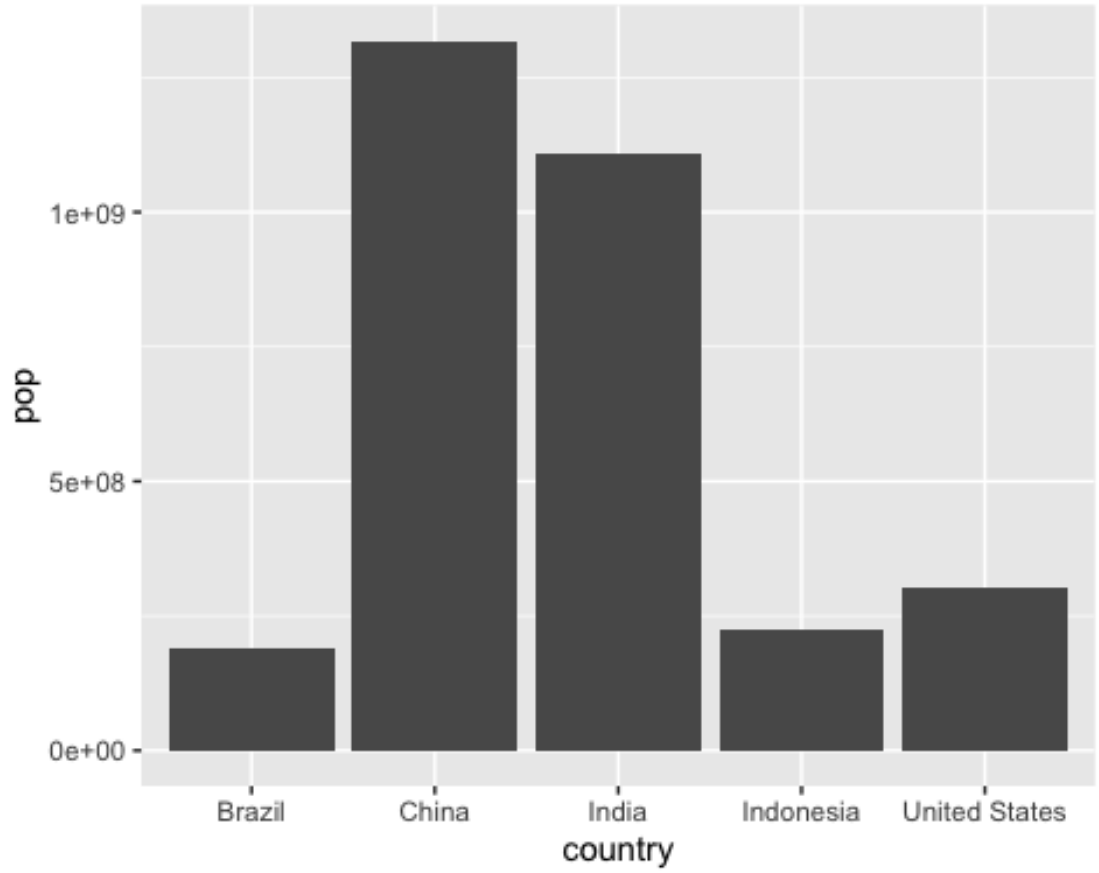

```
gapminder_1957 <- gapminder %>% filter(year==1957 | year==2007)

ggplot(gapminder_1957) +
  geom_point(aes(x = gdpPercap, y = lifeExp, color=continent,
                 size = pop), alpha=0.7) +
  scale_size_area(max_size = 10) +
  facet_wrap(~year)
```




```
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))
```




```
table(gapminder$year)


1952 1957 1962 1967 1972 1977 1982 1987 1992 1997 2002 2007
 142  142  142  142  142  142  142  142  142  142  142  142

length( unique(gapminder$year))

[1] 12
```

Q. Extract data for US in 1992

```
filter(gapminder, country=="United States", year==1992)

        country continent year lifeExp       pop gdpPercap
1 United States  Americas 1992   76.09 256894189  32003.93
```

What is the population of Australia in the last year we have data

```
filter(gapminder, country=="Australia")

     country continent year lifeExp      pop gdpPercap
1  Australia   Oceania 1952  69.120  8691212  10039.60
2  Australia   Oceania 1957  70.330  9712569  10949.65
3  Australia   Oceania 1962  70.930 10794968  12217.23
```

```
4  Australia   Oceania 1967  71.100 11872264  14526.12
5  Australia   Oceania 1972  71.930 13177000  16788.63
6  Australia   Oceania 1977  73.490 14074100  18334.20
7  Australia   Oceania 1982  74.740 15184200  19477.01
8  Australia   Oceania 1987  76.320 16257249  21888.89
9  Australia   Oceania 1992  77.560 17481977  23424.77
10 Australia   Oceania 1997  78.830 18565243  26997.94
11 Australia   Oceania 2002  80.370 19546792  30687.75
12 Australia   Oceania 2007  81.235 20434176  34435.37
```

```
filter(gapminder, country=="Australia", year==2007)
```

```
    country continent year lifeExp      pop gdpPercap
1 Australia   Oceania 2007  81.235 20434176  34435.37
```

Q. What countries in the data set had a population smaller than Australia in 2007?

-First limit/subset the dataset to the year 2007

```
filter(gapminder, year==2007)
```

```
                     country continent year lifeExp        pop  gdpPercap
1                Afghanistan      Asia 2007  43.828   31889923   974.5803
2                    Albania    Europe 2007  76.423    3600523  5937.0295
3                    Algeria    Africa 2007  72.301   33333216  6223.3675
4                     Angola    Africa 2007  42.731   12420476  4797.2313
5                  Argentina  Americas 2007  75.320   40301927 12779.3796
6                  Australia   Oceania 2007  81.235   20434176 34435.3674
7                    Austria    Europe 2007  79.829    8199783 36126.4927
8                    Bahrain      Asia 2007  75.635     708573 29796.0483
9                 Bangladesh      Asia 2007  64.062  150448339  1391.2538
10                   Belgium    Europe 2007  79.441   10392226 33692.6051
11                     Benin    Africa 2007  56.728    8078314  1441.2849
12                   Bolivia  Americas 2007  65.554    9119152  3822.1371
13    Bosnia and Herzegovina    Europe 2007  74.852    4552198  7446.2988
14                  Botswana    Africa 2007  50.728    1639131 12569.8518
15                    Brazil  Americas 2007  72.390  190010647  9065.8008
16                  Bulgaria    Europe 2007  73.005    7322858 10680.7928
17              Burkina Faso    Africa 2007  52.295   14326203  1217.0330
18                   Burundi    Africa 2007  49.580    8390505   430.0707
19                  Cambodia      Asia 2007  59.723   14131858  1713.7787
20                  Cameroon    Africa 2007  50.430   17696293  2042.0952
21                    Canada  Americas 2007  80.653   33390141 36319.2350
22  Central African Republic    Africa 2007  44.741    4369038   706.0165
23                      Chad    Africa 2007  50.651   10238807  1704.0637
24                     Chile  Americas 2007  78.553   16284741 13171.6388
25                     China      Asia 2007  72.961 1318683096  4959.1149
26                  Colombia  Americas 2007  72.889   44227550  7006.5804
27                   Comoros    Africa 2007  65.152     710960   986.1479
28          Congo, Dem. Rep.    Africa 2007  46.462   64606759   277.5519
```

29	Congo, Rep.	Africa	2007	55.322	3800610	3632.5578
30	Costa Rica	Americas	2007	78.782	4133884	9645.0614
31	Cote d'Ivoire	Africa	2007	48.328	18013409	1544.7501
32	Croatia	Europe	2007	75.748	4493312	14619.2227
33	Cuba	Americas	2007	78.273	11416987	8948.1029
34	Czech Republic	Europe	2007	76.486	10228744	22833.3085
35	Denmark	Europe	2007	78.332	5468120	35278.4187
36	Djibouti	Africa	2007	54.791	496374	2082.4816
37	Dominican Republic	Americas	2007	72.235	9319622	6025.3748
38	Ecuador	Americas	2007	74.994	13755680	6873.2623
39	Egypt	Africa	2007	71.338	80264543	5581.1810
40	El Salvador	Americas	2007	71.878	6939688	5728.3535
41	Equatorial Guinea	Africa	2007	51.579	551201	12154.0897
42	Eritrea	Africa	2007	58.040	4906585	641.3695
43	Ethiopia	Africa	2007	52.947	76511887	690.8056
44	Finland	Europe	2007	79.313	5238460	33207.0844
45	France	Europe	2007	80.657	61083916	30470.0167
46	Gabon	Africa	2007	56.735	1454867	13206.4845
47	Gambia	Africa	2007	59.448	1688359	752.7497
48	Germany	Europe	2007	79.406	82400996	32170.3744
49	Ghana	Africa	2007	60.022	22873338	1327.6089
50	Greece	Europe	2007	79.483	10706290	27538.4119
51	Guatemala	Americas	2007	70.259	12572928	5186.0500
52	Guinea	Africa	2007	56.007	9947814	942.6542
53	Guinea-Bissau	Africa	2007	46.388	1472041	579.2317
54	Haiti	Americas	2007	60.916	8502814	1201.6372
55	Honduras	Americas	2007	70.198	7483763	3548.3308
56	Hong Kong, China	Asia	2007	82.208	6980412	39724.9787
57	Hungary	Europe	2007	73.338	9956108	18008.9444
58	Iceland	Europe	2007	81.757	301931	36180.7892
59	India	Asia	2007	64.698	1110396331	2452.2104
60	Indonesia	Asia	2007	70.650	223547000	3540.6516
61	Iran	Asia	2007	70.964	69453570	11605.7145
62	Iraq	Asia	2007	59.545	27499638	4471.0619
63	Ireland	Europe	2007	78.885	4109086	40675.9964
64	Israel	Asia	2007	80.745	6426679	25523.2771
65	Italy	Europe	2007	80.546	58147733	28569.7197
66	Jamaica	Americas	2007	72.567	2780132	7320.8803
67	Japan	Asia	2007	82.603	127467972	31656.0681
68	Jordan	Asia	2007	72.535	6053193	4519.4612
69	Kenya	Africa	2007	54.110	35610177	1463.2493
70	Korea, Dem. Rep.	Asia	2007	67.297	23301725	1593.0655
71	Korea, Rep.	Asia	2007	78.623	49044790	23348.1397
72	Kuwait	Asia	2007	77.588	2505559	47306.9898
73	Lebanon	Asia	2007	71.993	3921278	10461.0587
74	Lesotho	Africa	2007	42.592	2012649	1569.3314
75	Liberia	Africa	2007	45.678	3193942	414.5073
76	Libya	Africa	2007	73.952	6036914	12057.4993
77	Madagascar	Africa	2007	59.443	19167654	1044.7701
78	Malawi	Africa	2007	48.303	13327079	759.3499

79	Malaysia	Asia	2007	74.241	24821286	12451.6558
80	Mali	Africa	2007	54.467	12031795	1042.5816
81	Mauritania	Africa	2007	64.164	3270065	1803.1515
82	Mauritius	Africa	2007	72.801	1250882	10956.9911
83	Mexico	Americas	2007	76.195	108700891	11977.5750
84	Mongolia	Asia	2007	66.803	2874127	3095.7723
85	Montenegro	Europe	2007	74.543	684736	9253.8961
86	Morocco	Africa	2007	71.164	33757175	3820.1752
87	Mozambique	Africa	2007	42.082	19951656	823.6856
88	Myanmar	Asia	2007	62.069	47761980	944.0000
89	Namibia	Africa	2007	52.906	2055080	4811.0604
90	Nepal	Asia	2007	63.785	28901790	1091.3598
91	Netherlands	Europe	2007	79.762	16570613	36797.9333
92	New Zealand	Oceania	2007	80.204	4115771	25185.0091
93	Nicaragua	Americas	2007	72.899	5675356	2749.3210
94	Niger	Africa	2007	56.867	12894865	619.6769
95	Nigeria	Africa	2007	46.859	135031164	2013.9773
96	Norway	Europe	2007	80.196	4627926	49357.1902
97	Oman	Asia	2007	75.640	3204897	22316.1929
98	Pakistan	Asia	2007	65.483	169270617	2605.9476
99	Panama	Americas	2007	75.537	3242173	9809.1856
100	Paraguay	Americas	2007	71.752	6667147	4172.8385
101	Peru	Americas	2007	71.421	28674757	7408.9056
102	Philippines	Asia	2007	71.688	91077287	3190.4810
103	Poland	Europe	2007	75.563	38518241	15389.9247
104	Portugal	Europe	2007	78.098	10642836	20509.6478
105	Puerto Rico	Americas	2007	78.746	3942491	19328.7090
106	Reunion	Africa	2007	76.442	798094	7670.1226
107	Romania	Europe	2007	72.476	22276056	10808.4756
108	Rwanda	Africa	2007	46.242	8860588	863.0885
109	Sao Tome and Principe	Africa	2007	65.528	199579	1598.4351
110	Saudi Arabia	Asia	2007	72.777	27601038	21654.8319
111	Senegal	Africa	2007	63.062	12267493	1712.4721
112	Serbia	Europe	2007	74.002	10150265	9786.5347
113	Sierra Leone	Africa	2007	42.568	6144562	862.5408
114	Singapore	Asia	2007	79.972	4553009	47143.1796
115	Slovak Republic	Europe	2007	74.663	5447502	18678.3144
116	Slovenia	Europe	2007	77.926	2009245	25768.2576
117	Somalia	Africa	2007	48.159	9118773	926.1411
118	South Africa	Africa	2007	49.339	43997828	9269.6578
119	Spain	Europe	2007	80.941	40448191	28821.0637
120	Sri Lanka	Asia	2007	72.396	20378239	3970.0954
121	Sudan	Africa	2007	58.556	42292929	2602.3950
122	Swaziland	Africa	2007	39.613	1133066	4513.4806
123	Sweden	Europe	2007	80.884	9031088	33859.7484
124	Switzerland	Europe	2007	81.701	7554661	37506.4191
125	Syria	Asia	2007	74.143	19314747	4184.5481
126	Taiwan	Asia	2007	78.400	23174294	28718.2768
127	Tanzania	Africa	2007	52.517	38139640	1107.4822
128	Thailand	Asia	2007	70.616	65068149	7458.3963

```
129                     Togo    Africa 2007  58.420    5701579   882.9699
130      Trinidad and Tobago  Americas 2007  69.819    1056608 18008.5092
131                  Tunisia    Africa 2007  73.923   10276158  7092.9230
132                   Turkey    Europe 2007  71.777   71158647  8458.2764
133                   Uganda    Africa 2007  51.542   29170398  1056.3801
134           United Kingdom    Europe 2007  79.425   60776238 33203.2613
135            United States  Americas 2007  78.242  301139947 42951.6531
136                  Uruguay  Americas 2007  76.384    3447496 10611.4630
137                Venezuela  Americas 2007  73.747   26084662 11415.8057
138                  Vietnam      Asia 2007  74.249   85262356  2441.5764
139       West Bank and Gaza      Asia 2007  73.422    4018332  3025.3498
140              Yemen, Rep.      Asia 2007  62.698   22211743  2280.7699
141                   Zambia    Africa 2007  42.384   11746035  1271.2116
142                 Zimbabwe    Africa 2007  43.487   12311143   469.7093
```

-Then find the pop value of Australia

```
filter(gapminder, year==2007, country=="Australia")

    country continent year lifeExp      pop gdpPercap
1 Australia   Oceania 2007  81.235 20434176  34435.37
```

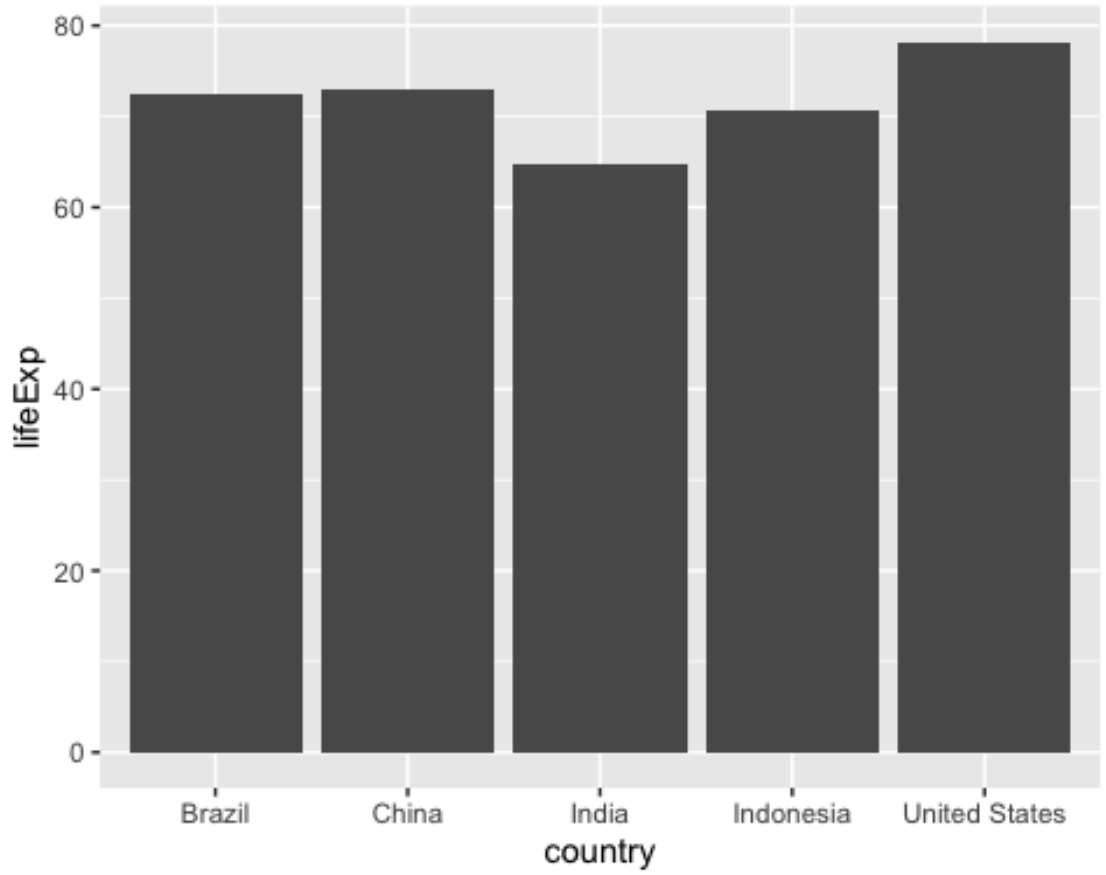
-Then extract all rows with pop less than Australia's

```
filter(gapminder, year==2007, pop<20434176)

                    country continent year lifeExp      pop  gdpPercap
1                   Albania    Europe 2007  76.423  3600523  5937.0295
2                    Angola    Africa 2007  42.731 12420476  4797.2313
3                   Austria    Europe 2007  79.829  8199783 36126.4927
4                   Bahrain      Asia 2007  75.635   708573 29796.0483
5                   Belgium    Europe 2007  79.441 10392226 33692.6051
6                     Benin    Africa 2007  56.728  8078314  1441.2849
7                   Bolivia  Americas 2007  65.554  9119152  3822.1371
8    Bosnia and Herzegovina    Europe 2007  74.852  4552198  7446.2988
9                  Botswana    Africa 2007  50.728  1639131 12569.8518
10                 Bulgaria    Europe 2007  73.005  7322858 10680.7928
11             Burkina Faso    Africa 2007  52.295 14326203  1217.0330
12                  Burundi    Africa 2007  49.580  8390505   430.0707
13                 Cambodia      Asia 2007  59.723 14131858  1713.7787
14                 Cameroon    Africa 2007  50.430 17696293  2042.0952
15 Central African Republic    Africa 2007  44.741  4369038   706.0165
16                     Chad    Africa 2007  50.651 10238807  1704.0637
17                    Chile  Americas 2007  78.553 16284741 13171.6388
18                  Comoros    Africa 2007  65.152   710960   986.1479
19              Congo, Rep.    Africa 2007  55.322  3800610  3632.5578
20               Costa Rica  Americas 2007  78.782  4133884  9645.0614
21            Cote d'Ivoire    Africa 2007  48.328 18013409  1544.7501
22                  Croatia    Europe 2007  75.748  4493312 14619.2227
23                     Cuba  Americas 2007  78.273 11416987  8948.1029
24           Czech Republic    Europe 2007  76.486 10228744 22833.3085
```

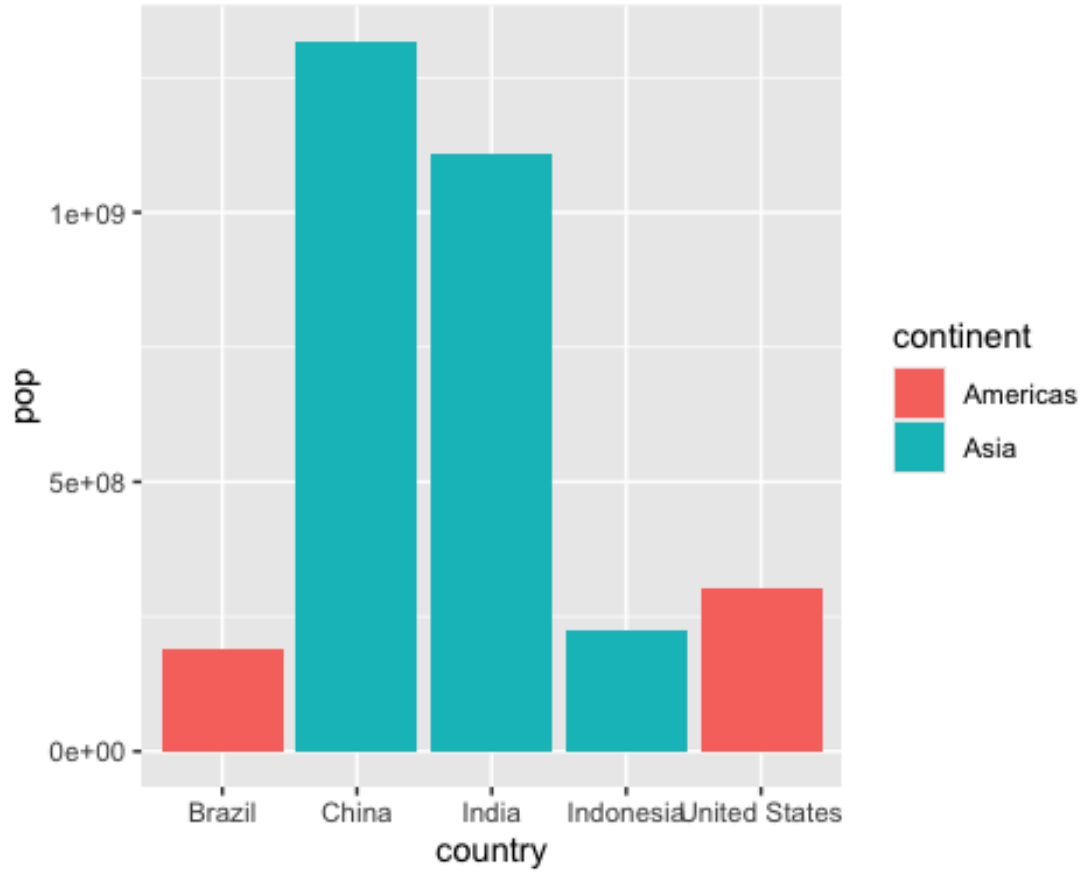
25	Denmark	Europe	2007	78.332	5468120	35278.4187
26	Djibouti	Africa	2007	54.791	496374	2082.4816
27	Dominican Republic	Americas	2007	72.235	9319622	6025.3748
28	Ecuador	Americas	2007	74.994	13755680	6873.2623
29	El Salvador	Americas	2007	71.878	6939688	5728.3535
30	Equatorial Guinea	Africa	2007	51.579	551201	12154.0897
31	Eritrea	Africa	2007	58.040	4906585	641.3695
32	Finland	Europe	2007	79.313	5238460	33207.0844
33	Gabon	Africa	2007	56.735	1454867	13206.4845
34	Gambia	Africa	2007	59.448	1688359	752.7497
35	Greece	Europe	2007	79.483	10706290	27538.4119
36	Guatemala	Americas	2007	70.259	12572928	5186.0500
37	Guinea	Africa	2007	56.007	9947814	942.6542
38	Guinea-Bissau	Africa	2007	46.388	1472041	579.2317
39	Haiti	Americas	2007	60.916	8502814	1201.6372
40	Honduras	Americas	2007	70.198	7483763	3548.3308
41	Hong Kong, China	Asia	2007	82.208	6980412	39724.9787
42	Hungary	Europe	2007	73.338	9956108	18008.9444
43	Iceland	Europe	2007	81.757	301931	36180.7892
44	Ireland	Europe	2007	78.885	4109086	40675.9964
45	Israel	Asia	2007	80.745	6426679	25523.2771
46	Jamaica	Americas	2007	72.567	2780132	7320.8803
47	Jordan	Asia	2007	72.535	6053193	4519.4612
48	Kuwait	Asia	2007	77.588	2505559	47306.9898
49	Lebanon	Asia	2007	71.993	3921278	10461.0587
50	Lesotho	Africa	2007	42.592	2012649	1569.3314
51	Liberia	Africa	2007	45.678	3193942	414.5073
52	Libya	Africa	2007	73.952	6036914	12057.4993
53	Madagascar	Africa	2007	59.443	19167654	1044.7701
54	Malawi	Africa	2007	48.303	13327079	759.3499
55	Mali	Africa	2007	54.467	12031795	1042.5816
56	Mauritania	Africa	2007	64.164	3270065	1803.1515
57	Mauritius	Africa	2007	72.801	1250882	10956.9911
58	Mongolia	Asia	2007	66.803	2874127	3095.7723
59	Montenegro	Europe	2007	74.543	684736	9253.8961
60	Mozambique	Africa	2007	42.082	19951656	823.6856
61	Namibia	Africa	2007	52.906	2055080	4811.0604
62	Netherlands	Europe	2007	79.762	16570613	36797.9333
63	New Zealand	Oceania	2007	80.204	4115771	25185.0091
64	Nicaragua	Americas	2007	72.899	5675356	2749.3210
65	Niger	Africa	2007	56.867	12894865	619.6769
66	Norway	Europe	2007	80.196	4627926	49357.1902
67	Oman	Asia	2007	75.640	3204897	22316.1929
68	Panama	Americas	2007	75.537	3242173	9809.1856
69	Paraguay	Americas	2007	71.752	6667147	4172.8385
70	Portugal	Europe	2007	78.098	10642836	20509.6478
71	Puerto Rico	Americas	2007	78.746	3942491	19328.7090
72	Reunion	Africa	2007	76.442	798094	7670.1226
73	Rwanda	Africa	2007	46.242	8860588	863.0885
74	Sao Tome and Principe	Africa	2007	65.528	199579	1598.4351

```
75                  Senegal    Africa 2007  63.062 12267493  1712.4721
76                   Serbia    Europe 2007  74.002 10150265  9786.5347
77             Sierra Leone    Africa 2007  42.568  6144562   862.5408
78                Singapore      Asia 2007  79.972  4553009 47143.1796
79           Slovak Republic    Europe 2007  74.663  5447502 18678.3144
80                  Slovenia    Europe 2007  77.926  2009245 25768.2576
81                   Somalia    Africa 2007  48.159  9118773   926.1411
82                 Sri Lanka      Asia 2007  72.396 20378239  3970.0954
83                 Swaziland    Africa 2007  39.613  1133066  4513.4806
84                    Sweden    Europe 2007  80.884  9031088 33859.7484
85               Switzerland    Europe 2007  81.701  7554661 37506.4191
86                     Syria      Asia 2007  74.143 19314747  4184.5481
87                      Togo    Africa 2007  58.420  5701579   882.9699
88       Trinidad and Tobago  Americas 2007  69.819  1056608 18008.5092
89                   Tunisia    Africa 2007  73.923 10276158  7092.9230
90                   Uruguay  Americas 2007  76.384  3447496 10611.4630
91        West Bank and Gaza      Asia 2007  73.422  4018332  3025.3498
92                    Zambia    Africa 2007  42.384 11746035  1271.2116
93                  Zimbabwe    Africa 2007  43.487 12311143   469.7093
```

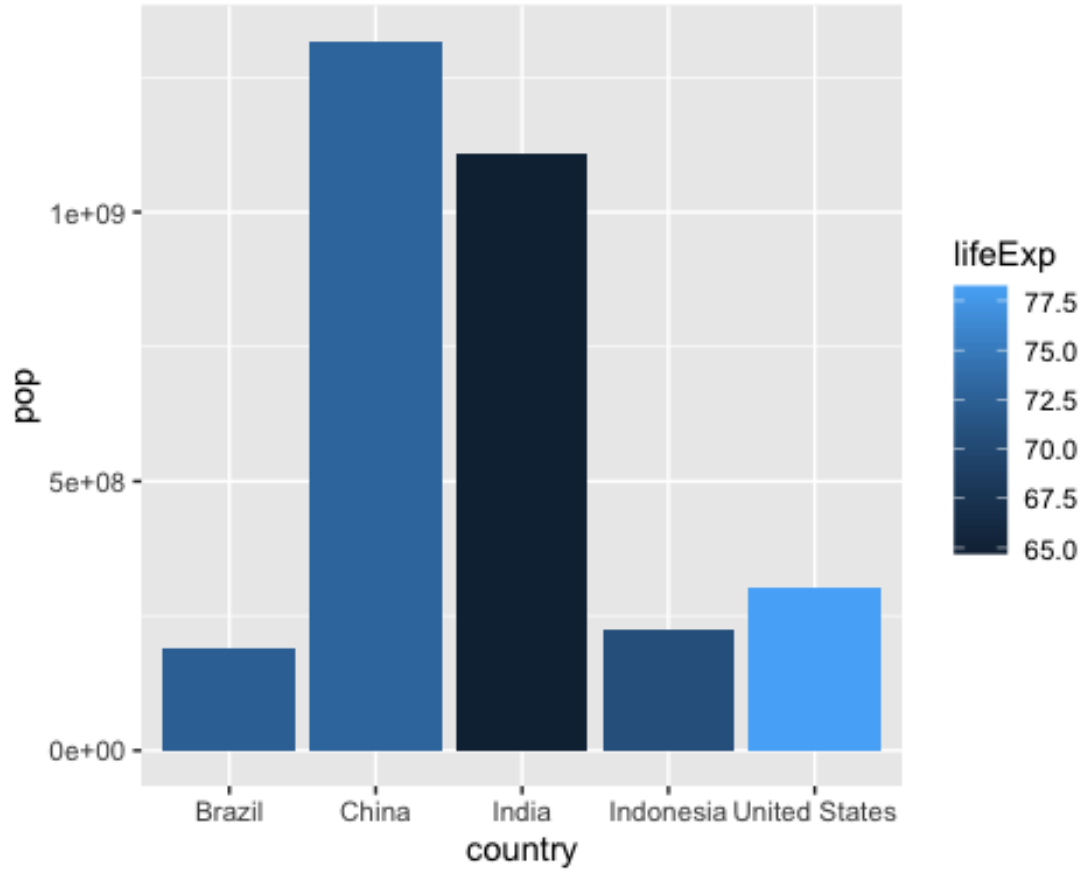
```
ggplot(gapminder_top5) +
  geom_col(aes(x = country, y = lifeExp))
```



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

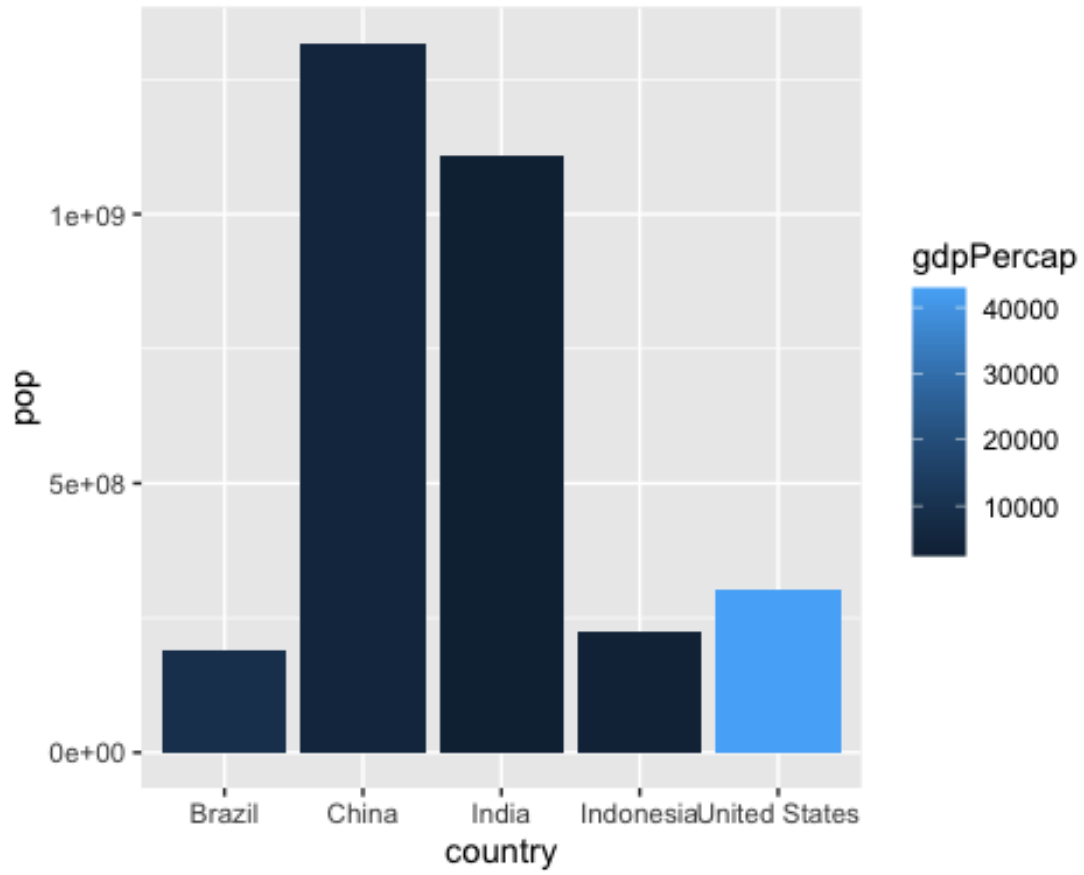



```
ggplot(gapminder_top5) +
  geom_col(aes(x = country, y = pop, fill = lifeExp))
```

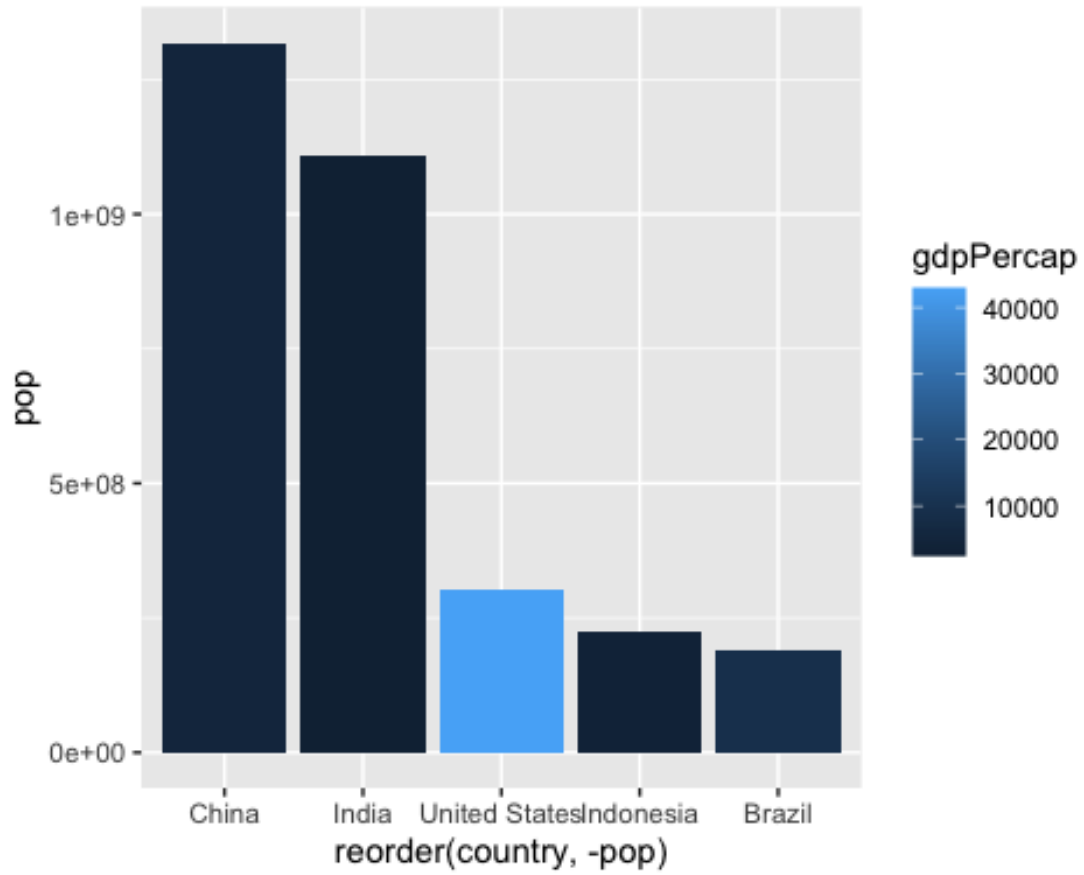


Q. Q. Plot population size by country. Create a bar chart showing the population (in millions) of the five biggest countries by population in 2007

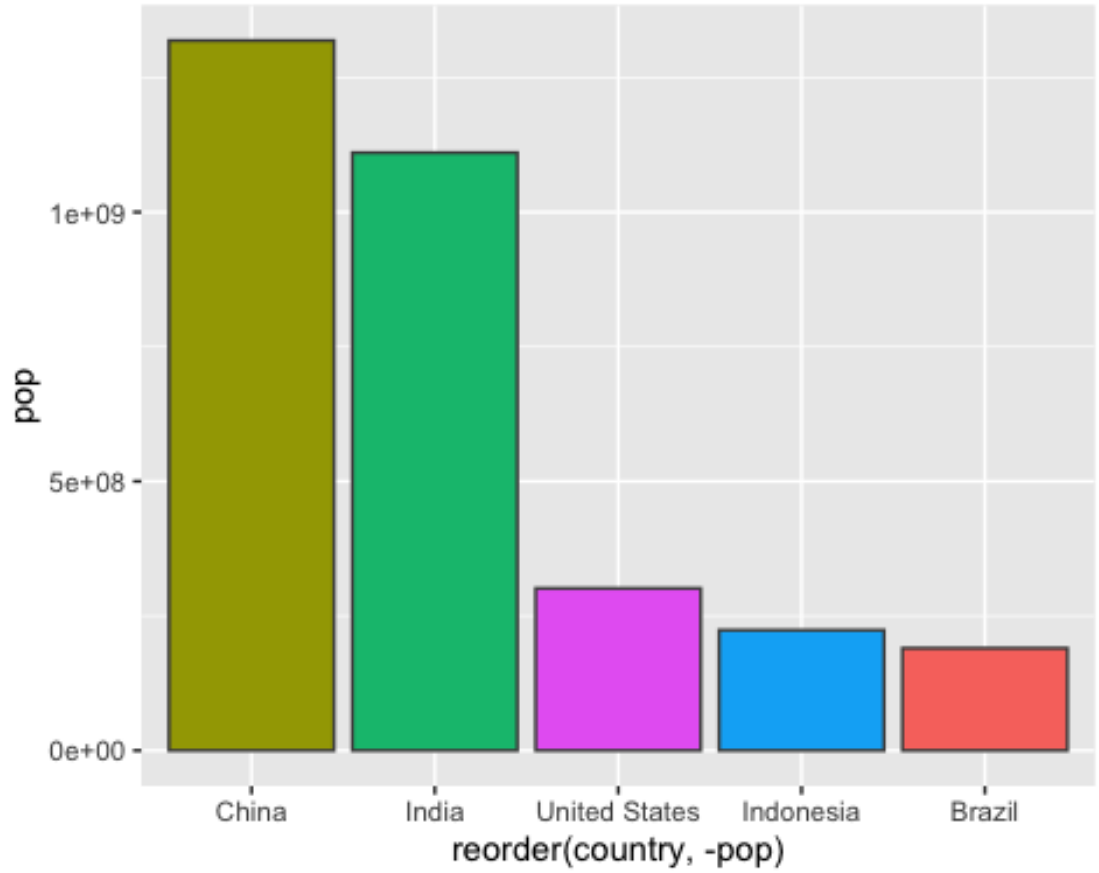
```
ggplot(gapminder_top5) +
  aes(x=country, y=pop, fill=gdpPercap) +
  geom_col()
```




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



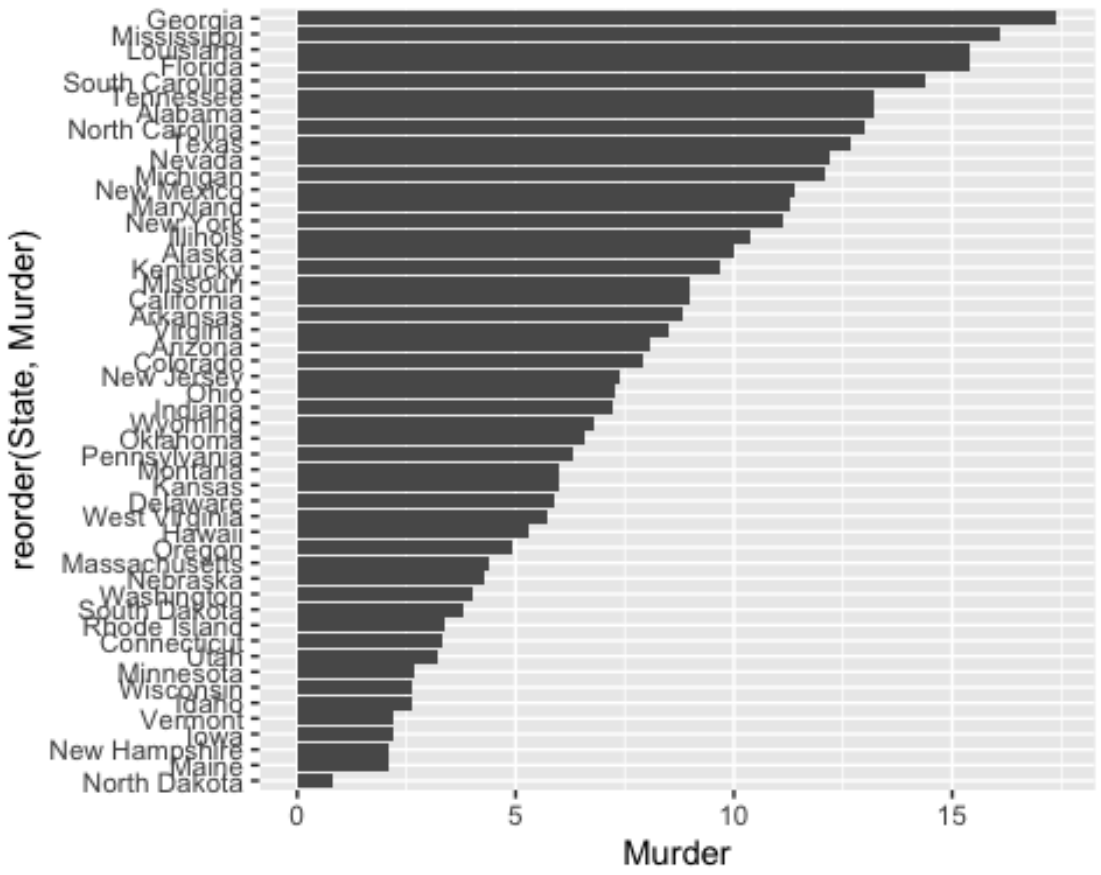

```
ggplot(gapminder_top5) +
  aes(x=reorder(country, -pop), y=pop, fill=country) +
  geom_col(col="gray30") +
  guides(fill="none")
```



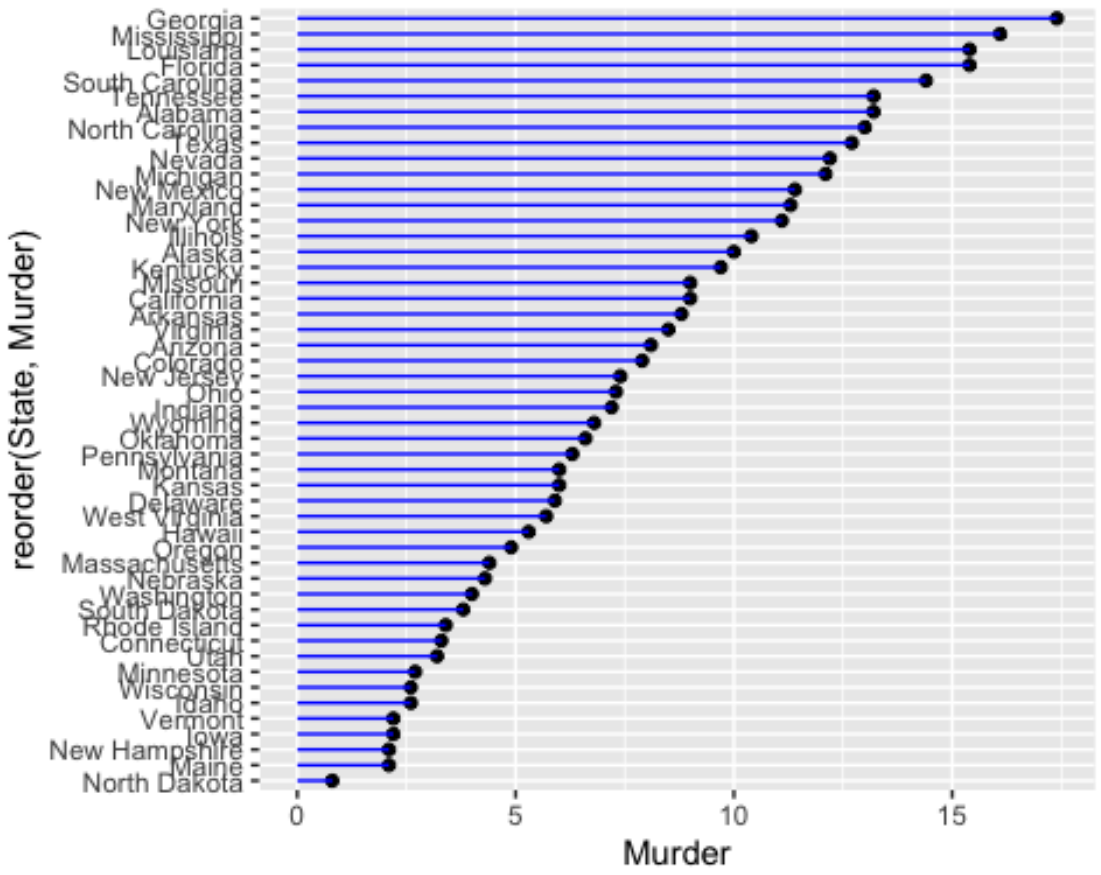

```
head(USArrests)
```

```
           Murder Assault UrbanPop Rape
Alabama      13.2     236       58 21.2
Alaska       10.0     263       48 44.5
Arizona       8.1     294       80 31.0
Arkansas      8.8     190       50 19.5
California    9.0     276       91 40.6
Colorado      7.9     204       78 38.7
```

```
USArrests$State <- rownames(USArrests)
ggplot(USArrests) +
  aes(x=reorder(State,Murder), y=Murder) +
  geom_col() +
  coord_flip()
```




```r
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()
```



Running Code

When you click the **Render** button a document will be generated that includes both content and the output of embedded code. You can embed code like this:

```
1 + 1
```

```
[1] 2
```

You can add options to executable code like this

```
[1] 4
```

The `echo: false` option disables the printing of code (only output is displayed).