Class 5: Data Visualization with ggplot2

Krysten Jones (A10553682)

Using ggplot2

To use ggplot2, first we need to install it on our computers. To do this we will use the function`install.packages()` We could put this in a code chunk, but every time we click render it will install the package again. Instead install in the consule (only need to do once)

Before we use any package functions, we have to load them up with a 'library' call, like below:

```
library(ggplot2)
```

First let's examine the structure of our data frame. You can use the head or tail functions here to view the first or last 6 rows respectively

```
head(cars)
```

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

The structure function will give you even more information

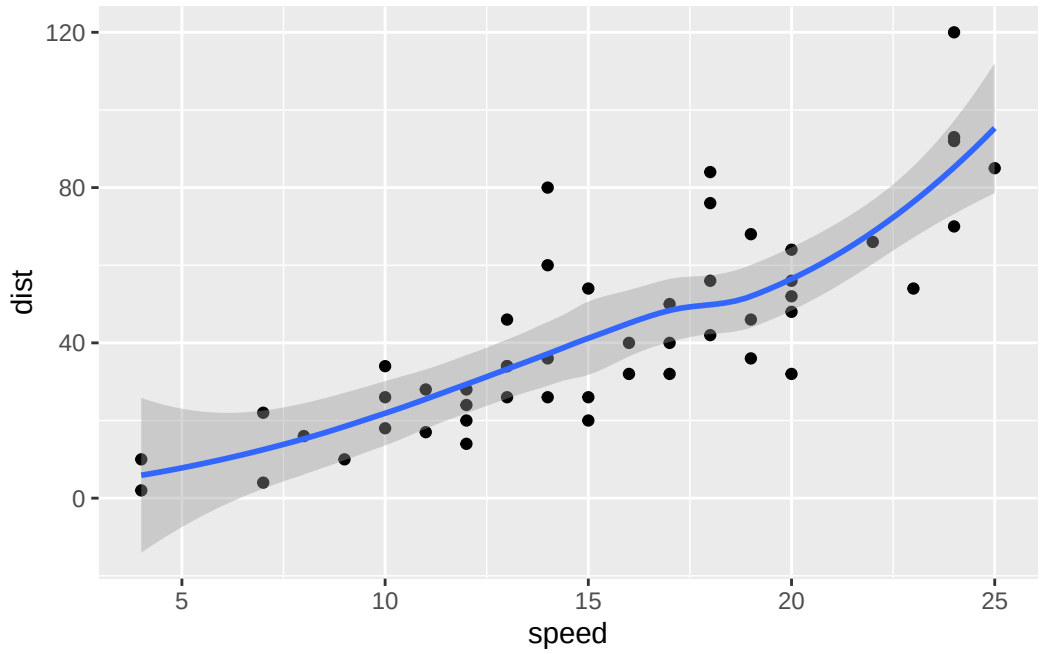
```
str(cars)
```

```
'data.frame':   50 obs. of  2 variables:
 $ speed: num  4 4 7 7 8 9 10 10 10 11 ...
 $ dist : num  2 10 4 22 16 10 18 26 34 17 ...
```

Plotting in ggplot: requires 3 different aspects. The first is the data, than the aesthetics `aes()` than the geometry/graph type `geom()` - data (the stuff we want to plot as a data.frame) - aesthetics (how the data map to the plot/what it looks like) - geometry (how we want something drawn)

```
ggplot(cars, aes(speed, dist)) +
  geom_point() +
  geom_smooth()
```

```
`geom_smooth()` using method = 'loess' and formula = 'y ~ x'
```

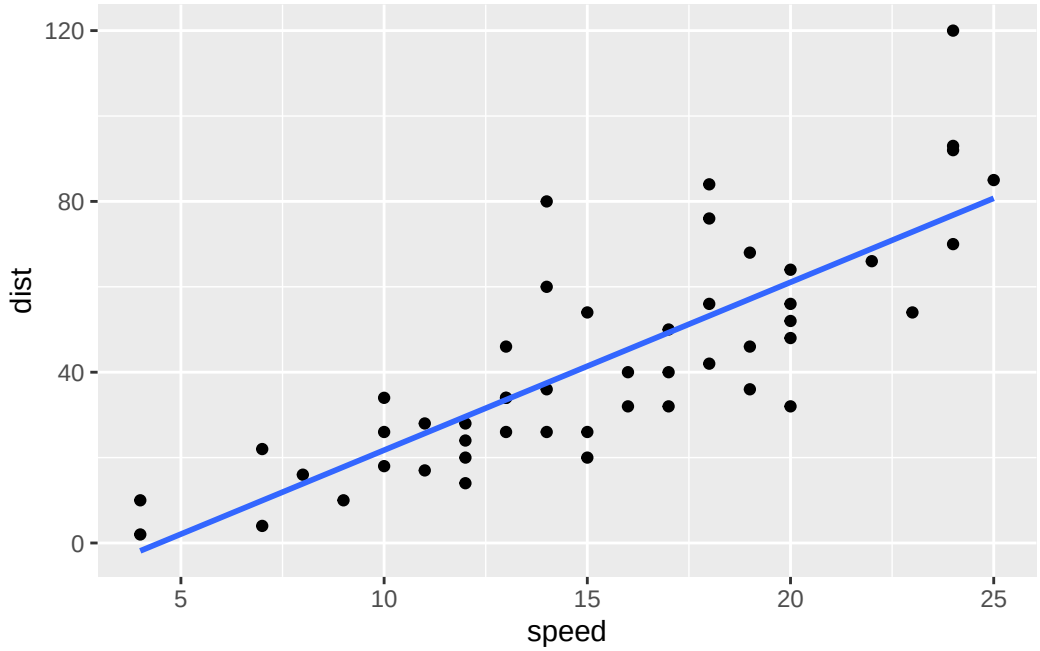



```
#best practice here to code on different lines, makes it easier to find errors later
```

`method = "lm"` asks for a trend line, the gray area around it is the standard error of the mean (SEM) Will add things line by line, so if want something overlaid, then add it at the end

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

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

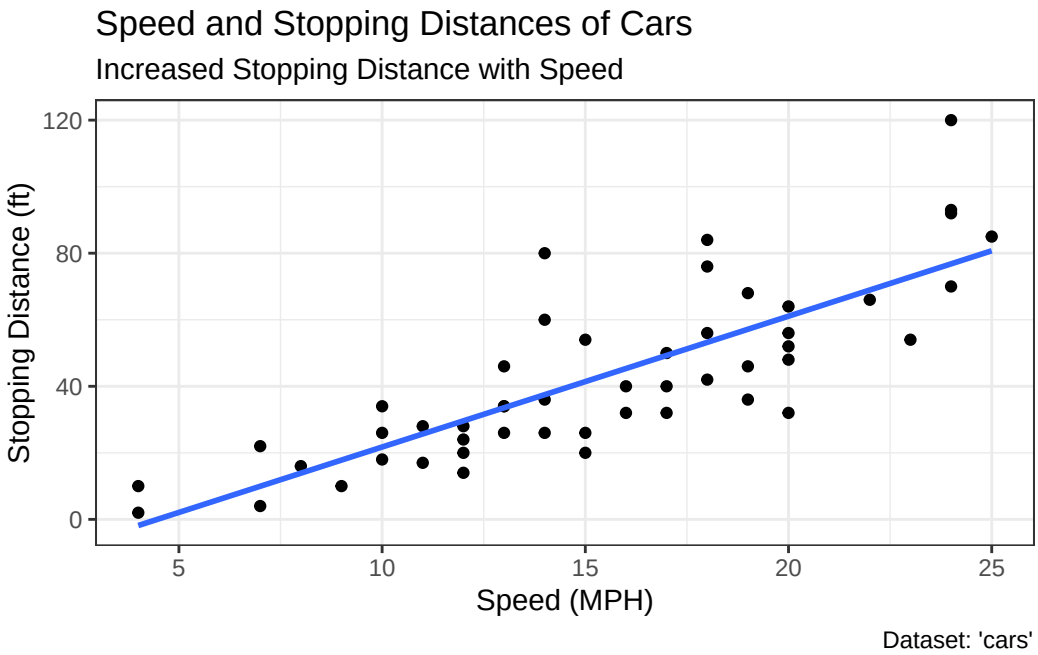


`se = FALSE` will remove the standard error line

Now we're going to add more labels. The `aes( )` function will decide what DATA to put on the x and y axis. The `labs()` function is where you can customize what you want each axis to say.

```
ggplot(cars, aes(speed, dist)) +
  geom_point() +
  geom_smooth(method ="lm", se=FALSE) +
  labs(title="Speed and Stopping Distances of Cars",
       x="Speed (MPH)",
       y="Stopping Distance (ft)",
       subtitle = "Increased Stopping Distance with Speed",
       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"
```

```
ncol(genes)
```

```
[1] 4
```

```
genes$State
```

```
  [1] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
  [6] "unchanging" "unchanging" "unchanging" "unchanging" "up"
 [11] "up"         "unchanging" "unchanging" "unchanging" "unchanging"
 [16] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [21] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [26] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [31] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [36] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [41] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [46] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [51] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [56] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [61] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [66] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [71] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [76] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [81] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [86] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [91] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [96] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[101] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[106] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[111] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[116] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[121] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[126] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[131] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[136] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[141] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[146] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[151] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[156] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[161] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[166] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
```

```
[171] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[176] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[181] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[186] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[191] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[196] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[201] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[206] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[211] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[216] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[221] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[226] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[231] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[236] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[241] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[246] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[251] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[256] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[261] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[266] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[271] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[276] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[281] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[286] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[291] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[296] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[301] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[306] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[311] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[316] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[321] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[326] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[331] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[336] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[341] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[346] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[351] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[356] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[361] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[366] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[371] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[376] "unchanging" "unchanging" "down"       "unchanging" "unchanging"
[381] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
```

```
[386] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[391] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[396] "down"       "unchanging" "unchanging" "unchanging" "unchanging"
[401] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[406] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[411] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[416] "unchanging" "unchanging" "unchanging" "unchanging" "up"
[421] "up"         "unchanging" "unchanging" "unchanging" "unchanging"
[426] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[431] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[436] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[441] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[446] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[451] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[456] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[461] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[466] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[471] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[476] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[481] "unchanging" "unchanging" "unchanging" "down"       "unchanging"
[486] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[491] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[496] "up"         "unchanging" "unchanging" "unchanging" "up"
[501] "unchanging" "unchanging" "up"         "unchanging" "unchanging"
[506] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[511] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[516] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[521] "unchanging" "unchanging" "unchanging" "down"       "up"
[526] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[531] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[536] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[541] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[546] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[551] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[556] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[561] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[566] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[571] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[576] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[581] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[586] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[591] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[596] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
```

```
[601] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[606] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[611] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[616] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[621] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[626] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[631] "unchanging" "down"       "unchanging" "unchanging" "unchanging"
[636] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[641] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[646] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[651] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[656] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[661] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[666] "unchanging" "down"       "down"       "unchanging" "unchanging"
[671] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[676] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[681] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[686] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[691] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[696] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[701] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[706] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[711] "unchanging" "unchanging" "up"         "unchanging" "unchanging"
[716] "unchanging" "unchanging" "down"       "unchanging" "unchanging"
[721] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[726] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[731] "unchanging" "down"       "up"         "unchanging" "unchanging"
[736] "up"         "unchanging" "unchanging" "unchanging" "unchanging"
[741] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[746] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[751] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[756] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[761] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[766] "unchanging" "unchanging" "unchanging" "unchanging" "down"
[771] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[776] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[781] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[786] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[791] "unchanging" "unchanging" "unchanging" "unchanging" "down"
[796] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[801] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[806] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[811] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
```

```
 [816] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [821] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [826] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [831] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [836] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [841] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [846] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [851] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [856] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [861] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [866] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [871] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [876] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [881] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [886] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [891] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [896] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [901] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [906] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [911] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [916] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [921] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [926] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [931] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [936] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [941] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [946] "unchanging" "unchanging" "unchanging" "up"         "unchanging"
 [951] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [956] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [961] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [966] "unchanging" "unchanging" "unchanging" "unchanging" "up"
 [971] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [976] "down"       "unchanging" "unchanging" "unchanging" "unchanging"
 [981] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [986] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [991] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
 [996] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1001] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1006] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1011] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1016] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1021] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1026] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
```

```
[1031] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1036] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1041] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1046] "unchanging" "down"       "unchanging" "unchanging" "up"
[1051] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1056] "unchanging" "up"         "unchanging" "unchanging" "unchanging"
[1061] "unchanging" "up"         "unchanging" "unchanging" "unchanging"
[1066] "unchanging" "up"         "up"         "unchanging" "unchanging"
[1071] "down"       "unchanging" "unchanging" "unchanging" "unchanging"
[1076] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1081] "down"       "unchanging" "unchanging" "unchanging" "unchanging"
[1086] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1091] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1096] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1101] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1106] "unchanging" "unchanging" "down"       "unchanging" "unchanging"
[1111] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1116] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1121] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1126] "unchanging" "down"       "unchanging" "unchanging" "unchanging"
[1131] "unchanging" "unchanging" "unchanging" "up"         "unchanging"
[1136] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1141] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1146] "unchanging" "unchanging" "unchanging" "unchanging" "down"
[1151] "up"         "down"       "down"       "unchanging" "unchanging"
[1156] "down"       "unchanging" "up"         "unchanging" "unchanging"
[1161] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1166] "unchanging" "unchanging" "up"         "unchanging" "unchanging"
[1171] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1176] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1181] "unchanging" "unchanging" "up"         "unchanging" "unchanging"
[1186] "up"         "unchanging" "unchanging" "unchanging" "unchanging"
[1191] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1196] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1201] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1206] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1211] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1216] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1221] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1226] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1231] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1236] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1241] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
```

```
[1246] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1251] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1256] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1261] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1266] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1271] "unchanging" "unchanging" "unchanging" "up"         "unchanging"
[1276] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1281] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1286] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1291] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1296] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1301] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1306] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1311] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1316] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1321] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1326] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1331] "unchanging" "unchanging" "up"         "unchanging" "unchanging"
[1336] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1341] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1346] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1351] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1356] "up"         "unchanging" "up"         "unchanging" "unchanging"
[1361] "unchanging" "unchanging" "unchanging" "up"         "unchanging"
[1366] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1371] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1376] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1381] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1386] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1391] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1396] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1401] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1406] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1411] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1416] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1421] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1426] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1431] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1436] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1441] "unchanging" "down"       "unchanging" "unchanging" "unchanging"
[1446] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1451] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1456] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
```

```
[1461] "up"          "up"          "unchanging" "unchanging" "unchanging"
[1466] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1471] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1476] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1481] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1486] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1491] "unchanging" "up"          "down"        "unchanging" "unchanging"
[1496] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1501] "down"        "down"        "unchanging" "unchanging" "unchanging"
[1506] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1511] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1516] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1521] "unchanging" "unchanging" "up"          "unchanging" "unchanging"
[1526] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1531] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1536] "up"          "unchanging" "unchanging" "unchanging" "unchanging"
[1541] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1546] "up"          "unchanging" "unchanging" "unchanging" "unchanging"
[1551] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1556] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1561] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1566] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1571] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1576] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1581] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1586] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1591] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1596] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1601] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1606] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1611] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1616] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1621] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1626] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1631] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1636] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1641] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1646] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1651] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1656] "unchanging" "unchanging" "unchanging" "up"          "unchanging"
[1661] "up"          "unchanging" "unchanging" "unchanging" "unchanging"
[1666] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1671] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
```

```
[1676] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1681] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1686] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1691] "up"         "unchanging" "unchanging" "unchanging" "unchanging"
[1696] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1701] "unchanging" "unchanging" "unchanging" "unchanging" "up"
[1706] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1711] "unchanging" "up"         "unchanging" "unchanging" "unchanging"
[1716] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1721] "unchanging" "unchanging" "down"       "unchanging" "unchanging"
[1726] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1731] "up"         "unchanging" "unchanging" "unchanging" "unchanging"
[1736] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1741] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1746] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1751] "unchanging" "unchanging" "unchanging" "up"         "unchanging"
[1756] "unchanging" "unchanging" "unchanging" "down"       "down"
[1761] "unchanging" "unchanging" "down"       "unchanging" "unchanging"
[1766] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1771] "unchanging" "up"         "unchanging" "unchanging" "unchanging"
[1776] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1781] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1786] "unchanging" "unchanging" "up"         "unchanging" "unchanging"
[1791] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1796] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1801] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1806] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1811] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1816] "unchanging" "unchanging" "unchanging" "up"         "unchanging"
[1821] "up"         "up"         "unchanging" "unchanging" "unchanging"
[1826] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1831] "unchanging" "unchanging" "unchanging" "up"         "unchanging"
[1836] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1841] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1846] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1851] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1856] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1861] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1866] "unchanging" "unchanging" "unchanging" "up"         "unchanging"
[1871] "unchanging" "unchanging" "unchanging" "unchanging" "up"
[1876] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1881] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1886] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
```

```
[1891] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1896] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1901] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1906] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1911] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1916] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1921] "unchanging" "up"         "unchanging" "unchanging" "up"
[1926] "up"         "unchanging" "unchanging" "unchanging" "unchanging"
[1931] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1936] "up"         "unchanging" "unchanging" "unchanging" "unchanging"
[1941] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1946] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1951] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1956] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1961] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1966] "unchanging" "unchanging" "up"         "unchanging" "unchanging"
[1971] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1976] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1981] "up"         "unchanging" "unchanging" "unchanging" "unchanging"
[1986] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[1991] "unchanging" "unchanging" "unchanging" "unchanging" "down"
[1996] "up"         "up"         "unchanging" "unchanging" "unchanging"
[2001] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2006] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2011] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2016] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2021] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2026] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2031] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2036] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2041] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2046] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2051] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2056] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2061] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2066] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2071] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2076] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2081] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2086] "up"         "unchanging" "unchanging" "unchanging" "unchanging"
[2091] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2096] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2101] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
```

```
[2106] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2111] "up"         "unchanging" "unchanging" "unchanging" "unchanging"
[2116] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2121] "unchanging" "unchanging" "unchanging" "up"         "unchanging"
[2126] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2131] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2136] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2141] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2146] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2151] "unchanging" "unchanging" "unchanging" "up"         "unchanging"
[2156] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2161] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2166] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2171] "up"         "up"         "unchanging" "unchanging" "unchanging"
[2176] "unchanging" "down"       "unchanging" "unchanging" "unchanging"
[2181] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2186] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2191] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2196] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2201] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2206] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2211] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2216] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2221] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2226] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2231] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2236] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2241] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2246] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2251] "up"         "unchanging" "up"         "unchanging" "unchanging"
[2256] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2261] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2266] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2271] "unchanging" "unchanging" "down"       "unchanging" "unchanging"
[2276] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2281] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2286] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2291] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2296] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2301] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2306] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2311] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2316] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
```

```
[2321] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2326] "unchanging" "unchanging" "unchanging" "unchanging" "down"
[2331] "up"         "up"         "unchanging" "unchanging" "unchanging"
[2336] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2341] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2346] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2351] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2356] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2361] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2366] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2371] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2376] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2381] "down"       "unchanging" "unchanging" "unchanging" "unchanging"
[2386] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2391] "up"         "unchanging" "unchanging" "unchanging" "unchanging"
[2396] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2401] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2406] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2411] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2416] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2421] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2426] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2431] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2436] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2441] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2446] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2451] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2456] "unchanging" "up"         "unchanging" "unchanging" "unchanging"
[2461] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2466] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2471] "up"         "up"         "unchanging" "unchanging" "up"
[2476] "down"       "unchanging" "unchanging" "unchanging" "up"
[2481] "unchanging" "unchanging" "unchanging" "unchanging" "up"
[2486] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2491] "unchanging" "up"         "unchanging" "unchanging" "unchanging"
[2496] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2501] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2506] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2511] "unchanging" "unchanging" "down"       "unchanging" "unchanging"
[2516] "unchanging" "unchanging" "unchanging" "down"       "unchanging"
[2521] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2526] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2531] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
```

```
[2536] "unchanging" "up"         "unchanging" "unchanging" "unchanging"
[2541] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2546] "unchanging" "down"       "unchanging" "unchanging" "unchanging"
[2551] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2556] "unchanging" "unchanging" "unchanging" "down"       "unchanging"
[2561] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2566] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2571] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2576] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2581] "down"       "unchanging" "unchanging" "unchanging" "unchanging"
[2586] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2591] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2596] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2601] "unchanging" "unchanging" "unchanging" "unchanging" "up"
[2606] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2611] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2616] "unchanging" "unchanging" "up"         "unchanging" "unchanging"
[2621] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2626] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2631] "unchanging" "unchanging" "unchanging" "unchanging" "up"
[2636] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2641] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2646] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2651] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2656] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2661] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2666] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2671] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2676] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2681] "unchanging" "unchanging" "unchanging" "up"         "unchanging"
[2686] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2691] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2696] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2701] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2706] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2711] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2716] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2721] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2726] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2731] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2736] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2741] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2746] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
```

```
[2751] "unchanging" "unchanging" "unchanging" "unchanging" "down"
[2756] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2761] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2766] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2771] "unchanging" "unchanging" "down"       "unchanging" "unchanging"
[2776] "down"       "unchanging" "unchanging" "unchanging" "unchanging"
[2781] "unchanging" "unchanging" "up"         "unchanging" "unchanging"
[2786] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2791] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2796] "up"         "unchanging" "unchanging" "unchanging" "unchanging"
[2801] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2806] "unchanging" "unchanging" "unchanging" "up"         "unchanging"
[2811] "down"       "unchanging" "unchanging" "unchanging" "unchanging"
[2816] "unchanging" "unchanging" "down"       "unchanging" "up"
[2821] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2826] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2831] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2836] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2841] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2846] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2851] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2856] "unchanging" "unchanging" "unchanging" "up"         "unchanging"
[2861] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2866] "unchanging" "unchanging" "up"         "unchanging" "unchanging"
[2871] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2876] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2881] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2886] "unchanging" "unchanging" "down"       "unchanging" "unchanging"
[2891] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2896] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2901] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2906] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2911] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2916] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2921] "unchanging" "unchanging" "unchanging" "up"         "down"
[2926] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2931] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2936] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2941] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2946] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2951] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2956] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2961] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
```

```
[2966] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2971] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2976] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2981] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2986] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2991] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[2996] "unchanging" "unchanging" "down"       "unchanging" "unchanging"
[3001] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3006] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3011] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3016] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3021] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3026] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3031] "unchanging" "unchanging" "unchanging" "down"       "unchanging"
[3036] "unchanging" "unchanging" "unchanging" "up"         "unchanging"
[3041] "unchanging" "unchanging" "down"       "unchanging" "unchanging"
[3046] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3051] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3056] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3061] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3066] "unchanging" "unchanging" "unchanging" "up"         "unchanging"
[3071] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3076] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3081] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3086] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3091] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3096] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3101] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3106] "unchanging" "down"       "unchanging" "up"         "unchanging"
[3111] "unchanging" "unchanging" "unchanging" "unchanging" "up"
[3116] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3121] "unchanging" "unchanging" "up"         "unchanging" "unchanging"
[3126] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3131] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3136] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3141] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3146] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3151] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3156] "down"       "unchanging" "unchanging" "unchanging" "unchanging"
[3161] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3166] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3171] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3176] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
```

```
[3181] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3186] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3191] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3196] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3201] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3206] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3211] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3216] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3221] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3226] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3231] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3236] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3241] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3246] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3251] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3256] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3261] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3266] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3271] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3276] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3281] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3286] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3291] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3296] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3301] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3306] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3311] "down"       "unchanging" "unchanging" "unchanging" "unchanging"
[3316] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3321] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3326] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3331] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3336] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3341] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3346] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3351] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3356] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3361] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3366] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3371] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3376] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3381] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3386] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3391] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
```

```
[3396] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3401] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3406] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3411] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3416] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3421] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3426] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3431] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3436] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3441] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3446] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3451] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3456] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3461] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3466] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3471] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3476] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3481] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3486] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3491] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3496] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3501] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3506] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3511] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3516] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3521] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3526] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3531] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3536] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3541] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3546] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3551] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3556] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3561] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3566] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3571] "unchanging" "unchanging" "unchanging" "unchanging" "up"
[3576] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3581] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3586] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3591] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3596] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3601] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3606] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
```

```
[3611] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3616] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3621] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3626] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3631] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3636] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3641] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3646] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3651] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3656] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3661] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3666] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3671] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3676] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3681] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3686] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3691] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3696] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3701] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3706] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3711] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3716] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3721] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3726] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3731] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3736] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3741] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3746] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3751] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3756] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3761] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3766] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3771] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3776] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3781] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3786] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3791] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3796] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3801] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3806] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3811] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3816] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3821] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
```

```
[3826] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3831] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3836] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3841] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3846] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3851] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3856] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3861] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3866] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3871] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3876] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3881] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3886] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3891] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3896] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3901] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3906] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3911] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3916] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3921] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3926] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3931] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3936] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3941] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3946] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3951] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3956] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3961] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3966] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3971] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3976] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3981] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3986] "unchanging" "unchanging" "unchanging" "unchanging" "up"
[3991] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[3996] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4001] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4006] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4011] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4016] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4021] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4026] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4031] "unchanging" "unchanging" "unchanging" "up"         "unchanging"
[4036] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
```

```
[4041] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4046] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4051] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4056] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4061] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4066] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4071] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4076] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4081] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4086] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4091] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4096] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4101] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4106] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4111] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4116] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4121] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4126] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4131] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4136] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4141] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4146] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4151] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4156] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4161] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4166] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4171] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4176] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4181] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4186] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4191] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4196] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4201] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4206] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4211] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4216] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4221] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4226] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4231] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4236] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4241] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4246] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4251] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
```

```
[4256] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4261] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4266] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4271] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4276] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4281] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4286] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4291] "unchanging" "up"         "unchanging" "unchanging" "unchanging"
[4296] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4301] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4306] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4311] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4316] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4321] "unchanging" "unchanging" "unchanging" "unchanging" "up"
[4326] "unchanging" "unchanging" "unchanging" "unchanging" "down"
[4331] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4336] "unchanging" "unchanging" "unchanging" "up"         "up"
[4341] "unchanging" "unchanging" "unchanging" "up"         "unchanging"
[4346] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4351] "unchanging" "unchanging" "unchanging" "unchanging" "down"
[4356] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4361] "unchanging" "unchanging" "down"       "down"       "unchanging"
[4366] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4371] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4376] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4381] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4386] "unchanging" "unchanging" "unchanging" "up"         "unchanging"
[4391] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4396] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4401] "up"         "unchanging" "unchanging" "unchanging" "unchanging"
[4406] "unchanging" "unchanging" "unchanging" "unchanging" "up"
[4411] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4416] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4421] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4426] "unchanging" "unchanging" "unchanging" "unchanging" "up"
[4431] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4436] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4441] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4446] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4451] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4456] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4461] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4466] "unchanging" "unchanging" "unchanging" "down"       "unchanging"
```

```
[4471] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4476] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4481] "unchanging" "unchanging" "up"         "unchanging" "unchanging"
[4486] "unchanging" "unchanging" "unchanging" "unchanging" "up"
[4491] "unchanging" "unchanging" "down"       "unchanging" "unchanging"
[4496] "unchanging" "unchanging" "unchanging" "unchanging" "up"
[4501] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4506] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4511] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4516] "unchanging" "unchanging" "unchanging" "down"       "unchanging"
[4521] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4526] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4531] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4536] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4541] "unchanging" "unchanging" "unchanging" "up"         "unchanging"
[4546] "down"       "unchanging" "unchanging" "unchanging" "unchanging"
[4551] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4556] "unchanging" "up"         "unchanging" "unchanging" "unchanging"
[4561] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4566] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4571] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4576] "unchanging" "unchanging" "up"         "unchanging" "unchanging"
[4581] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4586] "unchanging" "unchanging" "unchanging" "down"       "unchanging"
[4591] "unchanging" "unchanging" "up"         "unchanging" "unchanging"
[4596] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4601] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4606] "unchanging" "unchanging" "down"       "unchanging" "unchanging"
[4611] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4616] "unchanging" "unchanging" "unchanging" "down"       "unchanging"
[4621] "unchanging" "unchanging" "unchanging" "up"         "up"
[4626] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4631] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4636] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4641] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4646] "unchanging" "unchanging" "unchanging" "unchanging" "up"
[4651] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4656] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4661] "unchanging" "unchanging" "up"         "unchanging" "unchanging"
[4666] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4671] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4676] "unchanging" "up"         "unchanging" "unchanging" "unchanging"
[4681] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
```

```
[4686] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4691] "down"       "down"       "unchanging" "unchanging" "unchanging"
[4696] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4701] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4706] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4711] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4716] "unchanging" "unchanging" "unchanging" "up"         "unchanging"
[4721] "down"       "unchanging" "unchanging" "unchanging" "unchanging"
[4726] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4731] "unchanging" "up"         "unchanging" "unchanging" "unchanging"
[4736] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4741] "unchanging" "up"         "unchanging" "unchanging" "unchanging"
[4746] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4751] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4756] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4761] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4766] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4771] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4776] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4781] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4786] "unchanging" "unchanging" "down"       "unchanging" "unchanging"
[4791] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4796] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4801] "up"         "unchanging" "unchanging" "unchanging" "unchanging"
[4806] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4811] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4816] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4821] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4826] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4831] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4836] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4841] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4846] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4851] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4856] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4861] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4866] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4871] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4876] "unchanging" "unchanging" "unchanging" "unchanging" "up"
[4881] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4886] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4891] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4896] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
```

```
[4901] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4906] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4911] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4916] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4921] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4926] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4931] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4936] "down"       "unchanging" "unchanging" "unchanging" "unchanging"
[4941] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4946] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4951] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4956] "unchanging" "unchanging" "down"       "unchanging" "up"
[4961] "up"         "unchanging" "unchanging" "unchanging" "unchanging"
[4966] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4971] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4976] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4981] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4986] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4991] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[4996] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[5001] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[5006] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[5011] "unchanging" "down"       "unchanging" "unchanging" "down"
[5016] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[5021] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[5026] "unchanging" "up"         "unchanging" "unchanging" "unchanging"
[5031] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[5036] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[5041] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[5046] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[5051] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[5056] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[5061] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[5066] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[5071] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[5076] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[5081] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[5086] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[5091] "unchanging" "up"         "unchanging" "unchanging" "unchanging"
[5096] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[5101] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[5106] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[5111] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
```

```
[5116] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[5121] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[5126] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[5131] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[5136] "up"         "unchanging" "unchanging" "unchanging" "unchanging"
[5141] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[5146] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[5151] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[5156] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[5161] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[5166] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[5171] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[5176] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[5181] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[5186] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[5191] "unchanging" "unchanging" "unchanging" "unchanging" "unchanging"
[5196] "unchanging"
```

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

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

so there are 5169 rows, and 4 different columns including state. So the above is saying from the genes data.frame, choose the "State" column.

```
sum(genes$State == "up")
```

```
[1] 127
```

The above code will first go through the state column and turn everything True or False, it will then sum it for you so you know how many are upregulated vs downregulated. This is an alternative to table above

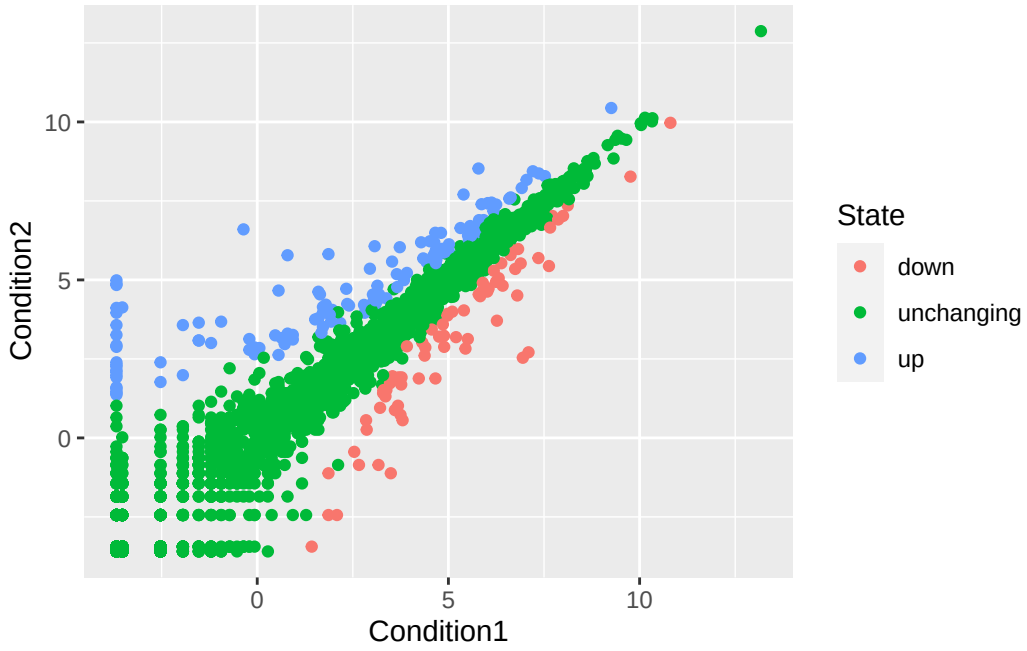
`#/ eval: false` or `echo=false` in a code box will make R not run the code in the code box. This is an alterantive to putting "#" in front of each line of cod you do not want run, but may still want included

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

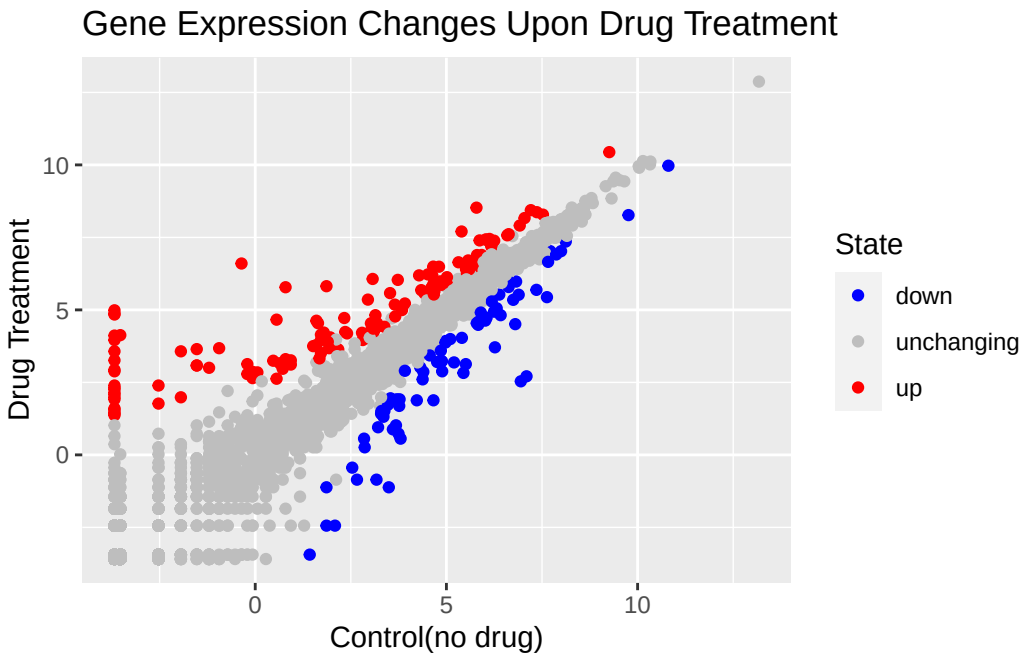
```
      down unchanging         up
      1.39      96.17       2.44
```

The above code is asking to use the dataframe genes, look at the state column and divide by the total numbers of rows in the genes data.frame.The Then multiply by 100 and finally round it to 2 significant figures (what the 2 in the code above is referring to).

```
p <- ggplot(genes, aes(Condition1, Condition2, col=State)) +
        geom_point()
p
```




```
p + scale_colour_manual( values=c("blue","gray","red") ) +
  labs(title = "Gene Expression Changes Upon Drug Treatment",
       x= "Control(no drug)",
       y= "Drug Treatment")
```



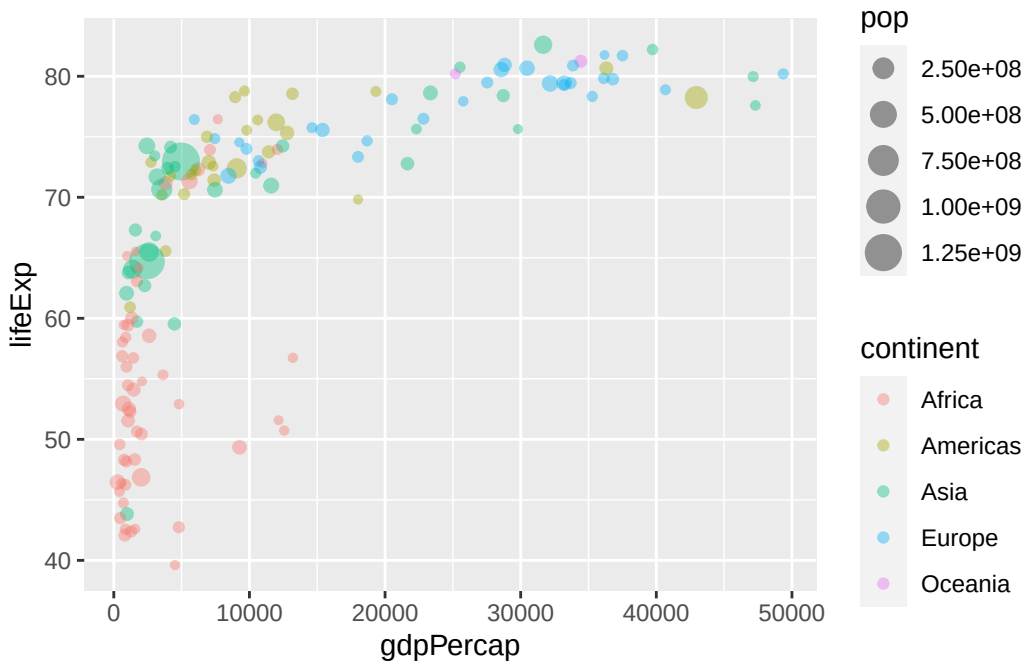
Order matters here, you can try different color combinations depending on what you want to highlight.

We're now going to use gapfinder dataset with the dplyr program. Just like for ggplot, you're going to want to install it from your console (and not have it run as part of this file) so you don't have to re-install it everytime you change something on this file.`install.packages("gapminder")` and `install.packages("dplyr")`

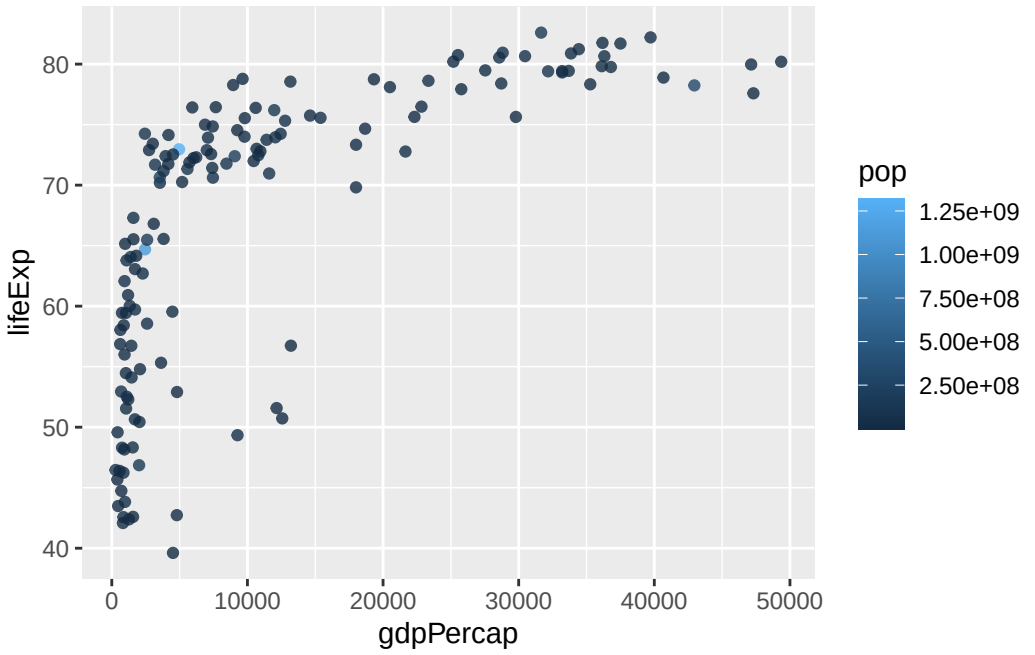
```
library(gapminder)
library(dplyr)
```

```
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)
ggplot(gapminder_2007,
       aes(gdpPercap, lifeExp, color = continent, size = pop)) +
  geom_point(alpha=0.4)
```

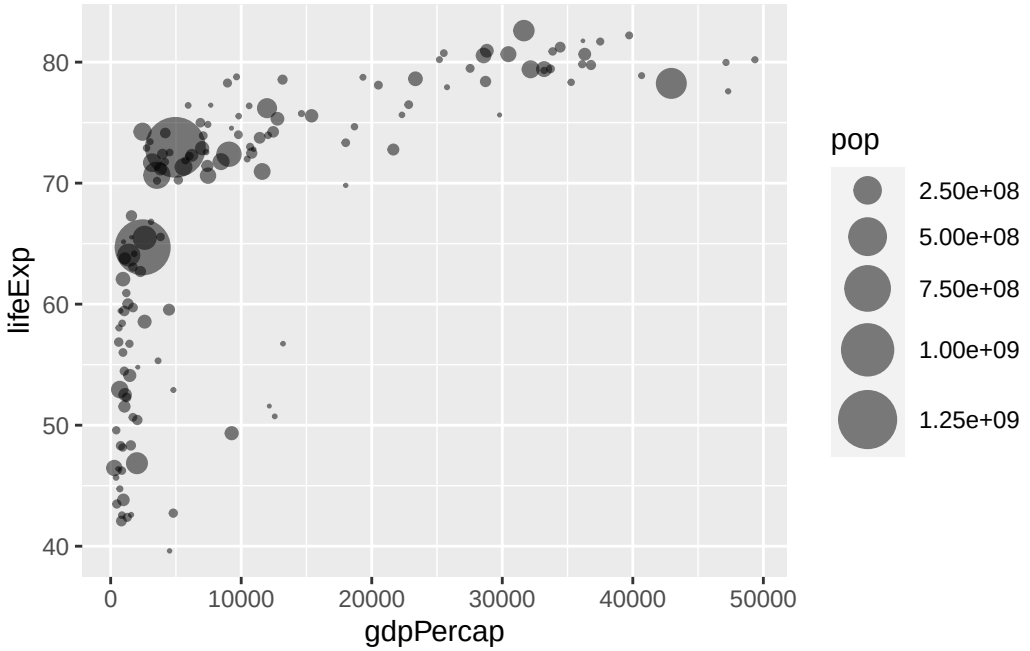



```
ggplot(gapminder_2007) +
  aes(x = gdpPercap, y = lifeExp, color = pop) +
  geom_point(alpha=0.8)
```



Now we've plotted a gradient of color based on polulation instead of using discrete categories

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

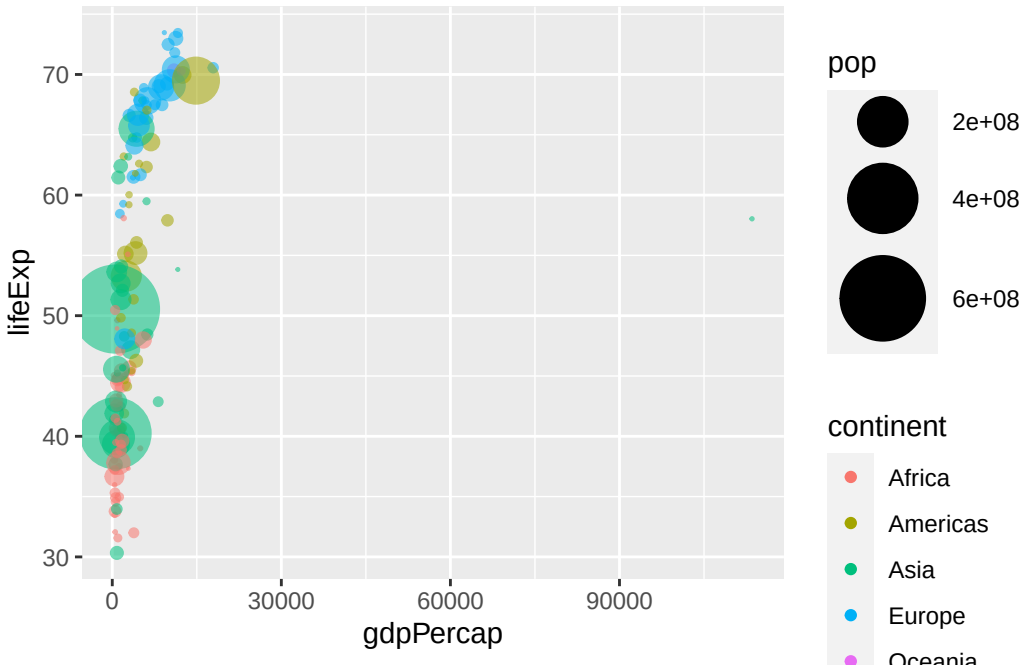


Here we are defining the size of our bubbles by population, but also making them partially transparent so we can see our data better

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

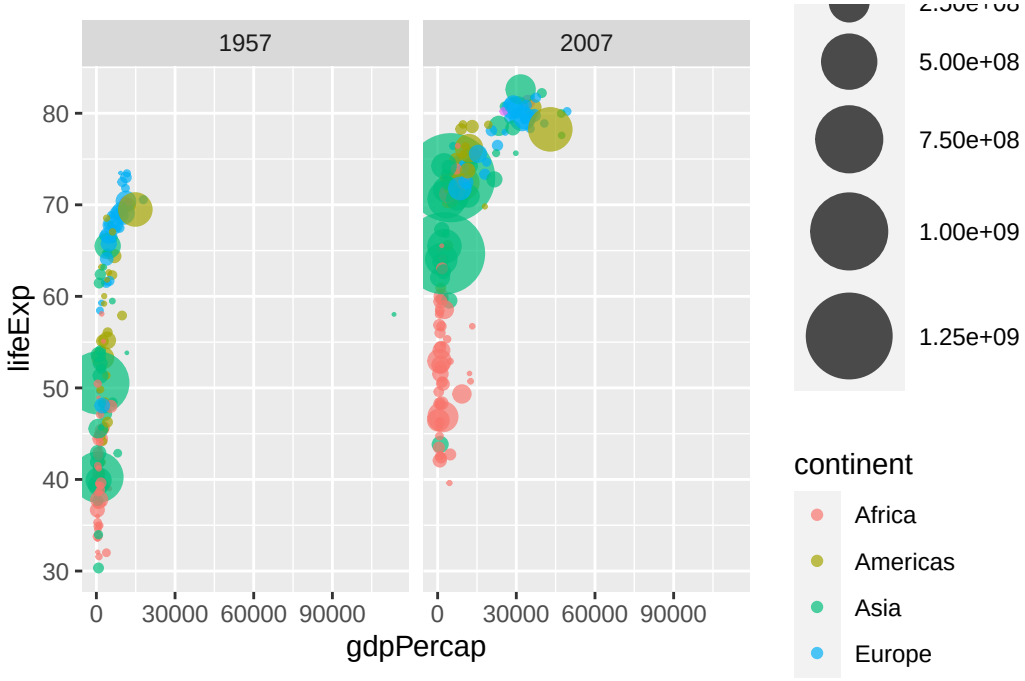
Now:Use `scale_size_area()` so that the point sizes reflect the actual population differences and set the max_size of each point to 15. Also, set the opacity/transparency of each point to 70% using the `alpha=0.7` parameter

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



Now facet it (aka split into different graphs)

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

ggplot(both) +
  geom_point(aes(x = gdpPercap, y = lifeExp, color=continent,
                 size = pop), alpha=0.7) +
  scale_size_area(max_size = 15) +
  facet_wrap(~year)
```



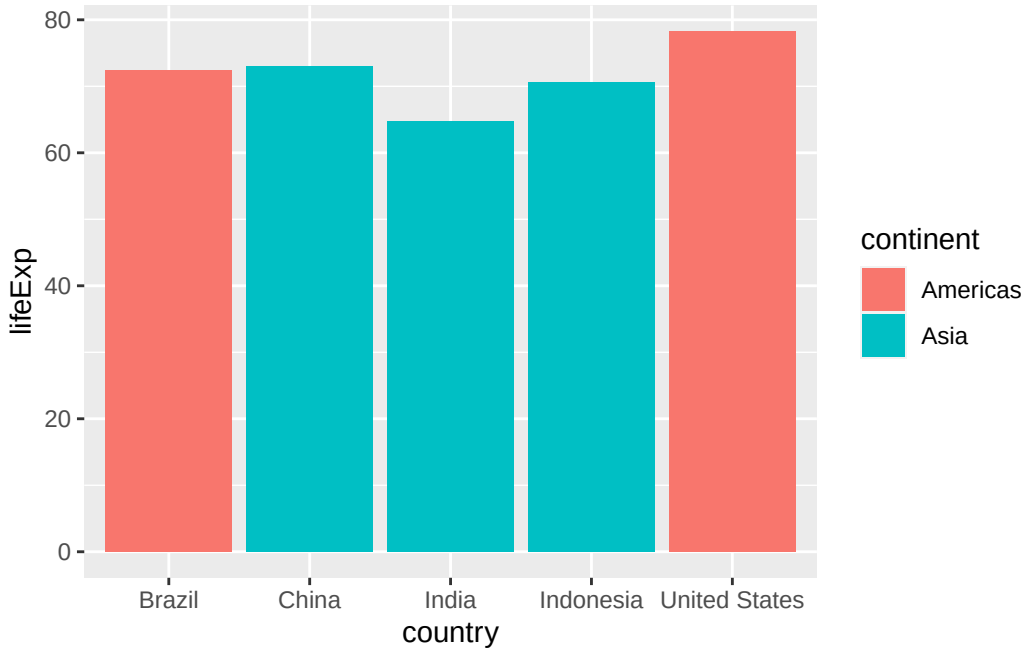
Section 8: Bar Charts

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

gapminder_top5
```

```
# A tibble: 5 x 6
  country       continent  year lifeExp        pop gdpPercap
  <fct>         <fct>     <int>   <dbl>      <int>     <dbl>
1 China         Asia       2007    73.0 1318683096     4959.
2 India         Asia       2007    64.7 1110396331     2452.
3 United States Americas   2007    78.2  301139947    42952.
4 Indonesia     Asia       2007    70.6  223547000     3541.
5 Brazil        Americas   2007    72.4  190010647     9066.
```

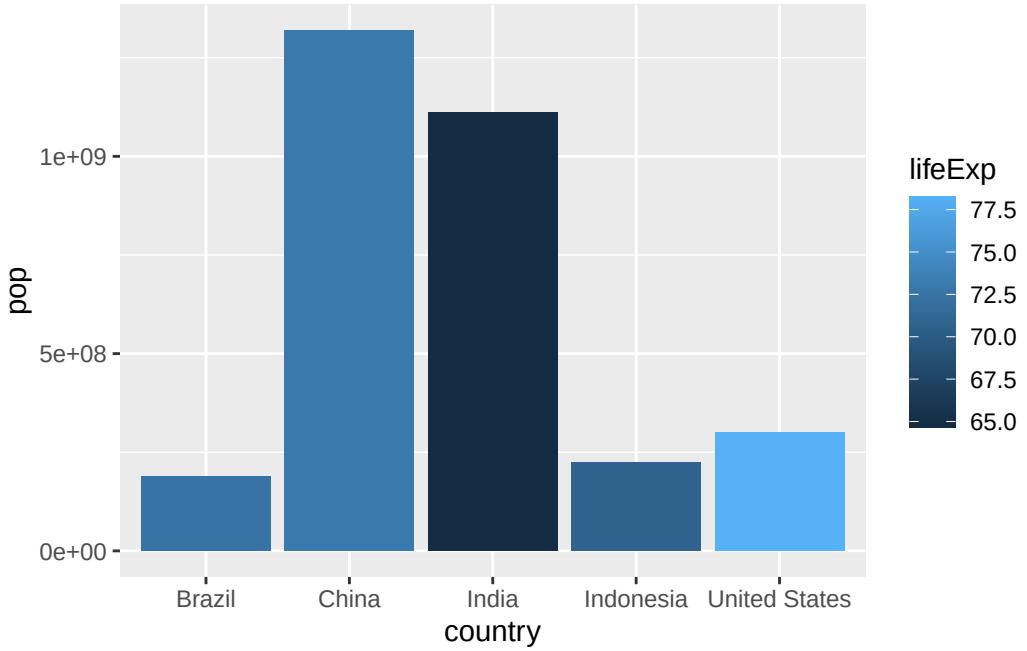
Life expectancy of the top 5 countries

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

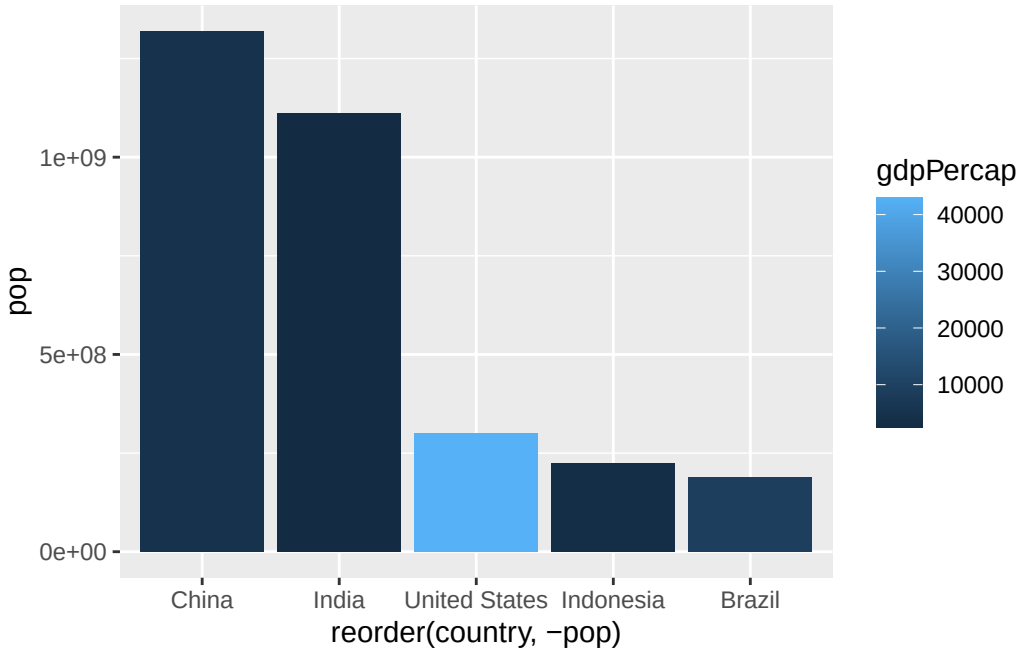


Let's try using a numerical value to color instead, so swich fill to life expectancy

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




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



The reorder function will allow you to reorder the bars based on what you put in your arguments.