Q6

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## We-R-Finished

##   
## Attaching package: 'dplyr'

## The following object is masked from 'package:car':  
##   
## recode

## The following objects are masked from 'package:stats':  
##   
## filter, lag

## The following objects are masked from 'package:base':  
##   
## intersect, setdiff, setequal, union

### Question 6

When looking over at the three given questions, there was a common sub-question:

**Will the answer change if I take standard of living into account?**

While it leans more hypothetical, it did bring thoughts of perhaps we need to quantify it to answer it. In this question, we’re going to dive a bit deeper on that question using the Cost of Living and the salary data set.

### What is standard/cost of living?

From <https://worldpopulationreview.com/state-rankings/cost-of-living-index-by-state>:

“Cost of living refers to the amount needed to cover basic expenses, such as food, shelter, transportation, and healthcare.”

Of course, each state will vary in their cost of living. From what we know, California is one of the most expensive states to live in. Let’s take the shelter expense for example. We know that housing prices have risen to insane numbers in this state. For example, in San Mateo, a single family home can cost upwards to 2 million USD. If one goes to Hillsborough, known to be an expensive area, is double that. Rent is also extremely high, a one bedroom apartment can range between 2 thousand to 4 thousand USD.

There could be many reasons for this such as the population density, tax rates, etc. When moving out of California, or at least the highly populated areas of the state, the costs will go down. Let’s say perhaps somewhere in the Midwest or the South. Housing prices are more likely to be less than 1 million USD, therefore the cost of living index may lower.

### Why is it important?

In our particular project, having data on the cost of living for each region helps employers determine the wage of the job. Of course, certain *genre* of jobs will have higher pay than others, and specific *types* of jobs within that genre will have better wage than the others. When we take the salary dataset into account, we can use this data to find out if one would be able to live in a state with the salary they will receive. Of course, I will only use the top 10 states for data-related jobs I found in Q2.

## Warning: Coercing text to numeric in Y146963 / R146963C25: '45870'

## Warning: Coercing text to numeric in Y164631 / R164631C25: '76700'

### About the data set

The Cost of Living data set is from the same site I have mentioned in the previous question, which was found by Russell Chan.

## # A tibble: 6 × 16  
## state densi…¹ pop2023 pop2022 pop2020 pop2019 pop2010 growth…² growth growth…³  
## <chr> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>  
## 1 Miss… 63.1 2.96e6 2.96e6 2.96e6 2.96e6 2967297 -0.0002 -602 -0.00264  
## 2 Kans… 36.2 2.96e6 2.95e6 2.94e6 2.93e6 2853118 0.00287 8476 0.0386   
## 3 Alab… 101. 5.10e6 5.07e6 5.02e6 5.00e6 4779736 0.00482 24454 0.0665   
## 4 Okla… 58.6 4.02e6 4.00e6 3.96e6 3.94e6 3751351 0.0052 20800 0.0721   
## 5 Geor… 192. 1.10e7 1.09e7 1.07e7 1.06e7 9687653 0.00938 102426 0.137   
## 6 Tenn… 172. 7.08e6 7.02e6 6.91e6 6.85e6 6346105 0.00804 56474 0.116   
## # … with 6 more variables: costIndex <dbl>, groceryCost <dbl>,  
## # housingCost <dbl>, utilitiesCost <dbl>, transportationCost <dbl>,  
## # miscCost <dbl>, and abbreviated variable names ¹​densityMi, ²​growthRate,  
## # ³​growthSince2010

Within this dataset, there are 50 entries, one for each state in the USA. It contains data on the population, the growth, and various cost indexes for each state. The main columns we are interested in are the cost and the state, because we are planning to merge the CoL and salary dataset.

### Prepping the dataset

We first create a subset in coldf with only the state and costIndex columns before merging it with the salary dataset.

Next, we will make a new column to create an adjusted wage, where we divide the paid wage per year by the cost index to even the field. We will also have a specific subset that only includes: employer name, job title sub, work state, paid wage per year, adjusted year, and Cost index.

### The Question

* **Which are the top and bottom states in terms of salary and what change when we consider adjusted wage.**

Here we will look at the top 5 states median wage, and see how much the wages change when taking into consideration the cost of living in these countries.

Top 5 states:

| Top 5 States | Paid Wage | Adjusted Wage |
| --- | --- | --- |
| California | 105000.0 | 73839.66 |
| Washington | 102000.0 | 91397.85 |
| Massachusetts | 85000.0 | 62962.96 |
| New York | 85000.0 | 57354.93 |
| Oregon | 82846.0 | 63678.71 |

Bottom 5 sates

| Bottom 5 States | Paid Wage | Adjusted Wage |
| --- | --- | --- |
| Arkansas | 63001.5 | 69308.58 |
| Oklahoma | 60840.0 | 69215.02 |
| Montana | 60000.0 | 59582.92 |
| Wyoming | 58205.0 | 61723.22 |
| West Virginia | 55000.0 | 60773.48 |

Then we can look at the updated list of top and bottom states which is:  
  
5 top:

| Top 5 States | Adjusted Wage | Bottom 5 States | Adjusted Wage |
| --- | --- | --- | --- |
| Washington | 91397.85 | Rhode Island | 59726.96 |
| Mississippi | 82232.89 | Montana | 59582.92 |
| Utah | 80531.31 | New York | 57354.93 |
| Kansas | 78612.72 | Alaska | 52731.71 |
| Tennessee | 78292.13 | Hawaii | 36646.66 |

## State Median\_paid\_Wage.x Median\_paid\_Wage.y  
## 1 Alabama 63731.0 63731.0  
## 2 Alaska 67022.0 67022.0  
## 3 Arizona 73403.0 73403.0  
## 4 Arkansas 63001.5 63001.5  
## 5 California 105000.0 105000.0  
## 6 Colorado 76960.0 76960.0  
## 7 Connecticut 73673.6 73673.6  
## 8 Delaware 65000.0 65000.0  
## 9 Florida 65000.0 65000.0  
## 10 Georgia 68662.0 68662.0  
## 11 Hawaii 70838.0 70838.0  
## 12 Idaho 66500.0 66500.0  
## 13 Illinois 71395.0 71395.0  
## 14 Indiana 64000.0 64000.0  
## 15 Iowa 68500.0 68500.0  
## 16 Kansas 68000.0 68000.0  
## 17 Kentucky 65800.0 65800.0  
## 18 Louisiana 72000.0 72000.0  
## 19 Maine 70000.0 70000.0  
## 20 Maryland 77000.0 77000.0  
## 21 Massachusetts 85000.0 85000.0  
## 22 Michigan 67267.0 67267.0  
## 23 Minnesota 72125.0 72125.0  
## 24 Mississippi 68500.0 68500.0  
## 25 Missouri 68000.0 68000.0  
## 26 Montana 60000.0 60000.0  
## 27 Nebraska 68037.0 68037.0  
## 28 Nevada 79563.0 79563.0  
## 29 New Hampshire 73760.4 73760.4  
## 30 New Jersey 71000.0 71000.0  
## 31 New Mexico 68200.0 68200.0  
## 32 New York 85000.0 85000.0  
## 33 North Carolina 72600.0 72600.0  
## 34 North Dakota 65000.0 65000.0  
## 35 Ohio 67000.0 67000.0  
## 36 Oklahoma 60840.0 60840.0  
## 37 Oregon 82846.0 82846.0  
## 38 Pennsylvania 75000.0 75000.0  
## 39 Rhode Island 70000.0 70000.0  
## 40 South Carolina 65000.0 65000.0  
## 41 South Dakota 63419.0 63419.0  
## 42 Tennessee 69680.0 69680.0  
## 43 Texas 70000.0 70000.0  
## 44 Utah 79726.0 79726.0  
## 45 Vermont 80250.0 80250.0  
## 46 Virginia 71614.0 71614.0  
## 47 Washington 102000.0 102000.0  
## 48 West Virginia 55000.0 55000.0  
## 49 Wisconsin 70000.0 70000.0  
## 50 Wyoming 58205.0 58205.0

* **If we look at job subtitles, how does salary change for top and bottom 5 considering the cost of living?**

When examining job subtitles, we can observe significant changes in salaries based on the cost of living in the top and bottom five states. The top five states, which have the highest median salary, show a considerable decrease in wages after accounting for the cost of living. Conversely, the bottom five states, with the lowest median salary, exhibit a substantial increase in wages after adjusting for the cost of living, except for Montana and for management consultants in Oklahoma.

It’s worth noting that, in the graph depicting the top states, the adjusted wage falls below $50,000 for most business and data analysts, while these job titles in the bottom states remain above $50,000.

The states with the most significant decrease in adjusted wages experience a decrease of approximately $40,000 to $50,000. However, not all job sub-titles exhibit an increase in adjusted wages; only business analysts and software engineers appear in all the states. The adjusted wage for business analysts indicates that low cost-of-living states provide better compensation than high cost-of-living states. Conversely, software engineers’ paid wages show that they receive better compensation in high cost-of-living states, while adjusted wages demonstrate that they are compensated similarly across the board.

##   
## Attaching package: 'scales'

## The following object is masked from 'package:readr':  
##   
## col\_factor

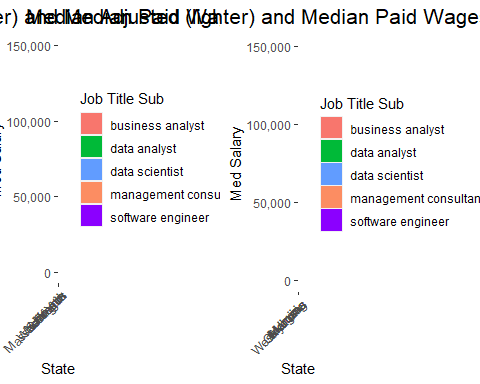
## State Job\_Title\_Sub Median\_Adjusted\_Wage Med\_Paid\_Wage  
## 1 California business analyst 49226.44 70000.0  
## 2 California data analyst 52774.96 75046.0  
## 3 California data scientist 84247.54 119800.0  
## 4 California management consultant 68527.43 97446.0  
## 5 California software engineer 74523.56 105972.5  
## 6 Massachusetts business analyst 49629.63 67000.0  
## 7 Massachusetts data analyst 48148.15 65000.0  
## 8 Massachusetts data scientist 75925.93 102500.0  
## 9 Massachusetts management consultant 71851.85 97000.0  
## 10 Massachusetts software engineer 65697.04 88691.0  
## 11 New York business analyst 46556.68 68997.0  
## 12 New York data analyst 43859.65 65000.0  
## 13 New York data scientist 70850.20 105000.0  
## 14 New York management consultant 80968.42 119995.2  
## 15 New York software engineer 63172.06 93621.0  
## 16 Oregon business analyst 52759.42 68640.0  
## 17 Oregon data analyst 49225.98 64043.0  
## 18 Oregon data scientist 80573.79 104826.5  
## 19 Oregon management consultant 41568.02 54080.0  
## 20 Oregon software engineer 63678.71 82846.0  
## 21 Washington business analyst 67204.30 75000.0  
## 22 Washington data analyst 61827.96 69000.0  
## 23 Washington data scientist 103046.59 115000.0  
## 24 Washington management consultant 96774.19 108000.0  
## 25 Washington software engineer 94086.02 105000.0

## State Job\_Title\_Sub Med\_Adjusted\_Wage Med\_Paid\_Wage  
## 1 Arkansas business analyst 66006.60 60000.0  
## 2 Arkansas data analyst 60506.05 55000.0  
## 3 Arkansas data scientist 85258.53 77500.0  
## 4 Arkansas management consultant 56655.67 51500.0  
## 5 Arkansas software engineer 71507.15 65000.0  
## 6 Montana business analyst 84409.14 85000.0  
## 7 Montana software engineer 59582.92 60000.0  
## 8 Oklahoma business analyst 73947.67 65000.0  
## 9 Oklahoma data analyst 64732.65 56900.0  
## 10 Oklahoma management consultant 161373.72 141847.5  
## 11 Oklahoma software engineer 68812.29 60486.0  
## 12 West Virginia business analyst 60356.91 54623.0  
## 13 West Virginia software engineer 63535.91 57500.0  
## 14 Wyoming business analyst 85896.08 81000.0  
## 15 Wyoming software engineer 58324.50 55000.0

##   
## Attaching package: 'gridExtra'

## The following object is masked from 'package:dplyr':  
##   
## combine

## Warning: Removed 1 rows containing missing values (`geom\_bar()`).



**What are the states with the largest percentage change in adjusted wage?**

We take look into the percentage change in Wages after cost of living is taken into account. A positive percentage change indicates an increase in wages, while a negative percentage change indicates a decrease in wages.

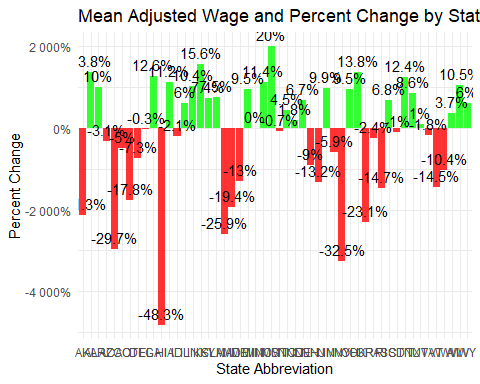
The states with higher positive percentage changes, namely Mississippi, Kansas, Alabama, Oklahoma, and Georgia, have low costs of living, which means that people can live comfortably with lower salaries. The positive percentage change indicates that people in these states are experiencing an increase in their purchasing power.

On the other hand, the states with highest negative percentage changes, namely Oregon, Massachusetts, California, New York, and Hawaii, have high costs of living, which means that people require higher salaries to maintain their standard of living. The negative percentage change indicates that people in these states are experiencing a decrease in their purchasing power.

Overall, the data suggests that people living in states with high costs of living, such as Hawaii and California, may be experiencing a decline in their purchasing power, while those living in states with low costs of living, such as Mississippi and Alabama, may be experiencing an increase in their purchasing power.

| State | Positive % Change | Negative % Change |
| --- | --- | --- |
| Mississippi | 20.05 |  |
| Kansas | 15.61 |  |
| Alabama | 13.77 |  |
| Oklahoma | 13.77 |  |
| Georgia | 12.61 |  |
| Oregon |  | -23.14 |
| Massachusetts |  | -25.93 |
| California |  | -29.68 |
| New York |  | -32.52 |
| Hawaii |  | -48.27 |

## State Mean\_Paid\_Wage\_Per\_Year Mean\_Adjusted\_Wage  
## 24 Mississippi 67566.38 81112.10  
## 16 Kansas 71375.30 82514.80  
## 1 Alabama 75558.06 85959.11  
## 36 Oklahoma 65121.79 74086.23  
## 10 Georgia 73190.31 82421.52  
## 42 Tennessee 71280.25 80090.16  
## 25 Missouri 72204.62 80406.04  
## 15 Iowa 70530.69 78454.61  
## 48 West Virginia 67361.66 74432.78  
## 14 Indiana 67881.47 74924.36  
## 4 Arkansas 65246.26 71778.06  
## 31 New Mexico 72902.82 80112.99  
## 35 Ohio 72649.49 79572.28  
## 22 Michigan 71967.91 78825.75  
## 43 Texas 75678.58 82170.01  
## 18 Louisiana 76327.89 82073.00  
## 17 Kentucky 69526.99 74679.91  
## 40 South Carolina 69351.69 74093.68  
## 27 Nebraska 72127.52 76977.08  
## 13 Illinois 76156.11 80759.39  
## 50 Wyoming 66474.17 70492.22  
## 33 North Carolina 76715.01 80161.97  
## 49 Wisconsin 72361.90 75064.21  
## 34 North Dakota 67724.88 68966.28  
## 44 Utah 80210.03 81020.23  
## 23 Minnesota 77631.98 77631.98  
## 9 Florida 69775.20 69566.50  
## 26 Montana 68423.74 67948.10  
## 41 South Dakota 65169.12 64523.89  
## 46 Virginia 76994.09 75632.70  
## 12 Idaho 70834.12 69377.20  
## 38 Pennsylvania 77917.83 76017.40  
## 3 Arizona 75396.53 73058.65  
## 6 Colorado 78685.09 74724.68  
## 28 Nevada 80084.35 75338.05  
## 8 Delaware 72022.69 66749.48  
## 29 New Hampshire 77822.03 70811.67  
## 47 Washington 103432.54 92681.49  
## 19 Maine 70789.61 61556.19  
## 30 New Jersey 76989.80 66831.43  
## 45 Vermont 81494.74 69653.62  
## 39 Rhode Island 74259.37 63361.24  
## 7 Connecticut 77894.12 64057.66  
## 20 Maryland 81110.47 65411.67  
## 2 Alaska 68908.09 54215.65  
## 37 Oregon 83427.39 64125.59  
## 21 Massachusetts 87257.53 64635.21  
## 5 California 105531.88 74213.70  
## 32 New York 91040.63 61430.92  
## 11 Hawaii 72260.59 37382.61  
## WORK\_STATE\_ABBREVIATION Percent\_Change Positive\_Change  
## 24 MS 20.0480192 Yes  
## 16 KS 15.6069364 Yes  
## 1 AL 13.7656428 Yes  
## 36 OK 13.7656428 Yes  
## 10 GA 12.6126126 Yes  
## 42 TN 12.3595506 Yes  
## 25 MO 11.3585746 Yes  
## 15 IA 11.2347052 Yes  
## 48 WV 10.4972376 Yes  
## 14 IN 10.3752759 Yes  
## 4 AR 10.0110011 Yes  
## 31 NM 9.8901099 Yes  
## 35 OH 9.5290252 Yes  
## 22 MI 9.5290252 Yes  
## 43 TX 8.5776330 Yes  
## 18 LA 7.5268817 Yes  
## 17 KY 7.4113856 Yes  
## 40 SC 6.8376068 Yes  
## 27 NE 6.7235859 Yes  
## 13 IL 6.0445387 Yes  
## 50 WY 6.0445387 Yes  
## 33 NC 4.4932079 Yes  
## 49 WI 3.7344398 Yes  
## 34 ND 1.8329939 Yes  
## 44 UT 1.0101010 Yes  
## 23 MN 0.0000000 No  
## 9 FL -0.2991027 No  
## 26 MT -0.6951341 No  
## 41 SD -0.9900990 No  
## 46 VA -1.7681729 No  
## 12 ID -2.0568071 No  
## 38 PA -2.4390244 No  
## 3 AZ -3.1007752 No  
## 6 CO -5.0332384 No  
## 28 NV -5.9266228 No  
## 8 DE -7.3215941 No  
## 29 NH -9.0081893 No  
## 47 WA -10.3942652 No  
## 19 ME -13.0434783 No  
## 30 NJ -13.1944444 No  
## 45 VT -14.5299145 No  
## 39 RI -14.6757679 No  
## 7 CT -17.7631579 No  
## 20 MD -19.3548387 No  
## 2 AK -21.3217939 No  
## 37 OR -23.1360492 No  
## 21 MA -25.9259259 No  
## 5 CA -29.6765120 No  
## 32 NY -32.5236167 No  
## 11 HI -48.2669426 No



knitr::opts\_chunk$set(echo = FALSE)  
knitr::opts\_knit$set(root.dir = "C:/Users/pauli/OneDrive/Documentos/Classes 2023/311\_tech")  
  
library(car)  
  
library(readr)  
library(readxl)  
library(dplyr)  
# reading salary dataset  
salary <- read\_excel("salary\_data\_states.xlsx")  
#names(salary)  
#dim(salary)  
colnames(salary)[19] = "Work\_State"  
colnames(salary)[26] = "Job\_Title\_Sub"  
# filtering  
sal <- salary %>%  
 filter(!grepl("professor", `Job\_Title\_Sub`, ignore.case = TRUE) &  
 !grepl("attorney", `Job\_Title\_Sub`, ignore.case = TRUE) &  
 !grepl("assistant professor", `Job\_Title\_Sub`, ignore.case = TRUE) &  
 !grepl("teacher", `Job\_Title\_Sub`, ignore.case = TRUE))  
datsal <- sal %>%  
 filter(!grepl("Guam", `Work\_State`, ignore.case = TRUE) &  
 !grepl("Guamam", `Work\_State`, ignore.case = TRUE) &  
 !grepl("Palau", `Work\_State`, ignore.case = TRUE) &  
 !grepl("Northern Mariana Islands", `Work\_State`, ignore.case = TRUE) &  
 !grepl("Puerto Rico", `Work\_State`, ignore.case = TRUE) &  
 !grepl("Virgin Islands", `Work\_State`, ignore.case = TRUE))  
# reading CoL dataset  
COL <- read\_csv("CostOfLiving2023.csv", show\_col\_types = FALSE)  
coldf <- COL[, !(names(COL) %in% c("fips"))]  
head(coldf)  
# subset  
costate <- subset(coldf, select = c(state, costIndex))  
# merging  
salcost <- merge(datsal, costate, by.x = "Work\_State", by.y = "state")  
#head(salcost)  
  
salcost$ADJUSTED\_WAGE <- (salcost$PAID\_WAGE\_PER\_YEAR / salcost$costIndex)\*100  
  
# new subset  
salcost <- salcost[, c("EMPLOYER\_NAME", "Job\_Title\_Sub", "Work\_State", "PAID\_WAGE\_PER\_YEAR", "ADJUSTED\_WAGE", "costIndex", "WORK\_STATE\_ABBREVIATION")]  
  
  
#unique(salcost$Job\_Title\_Sub)  
  
  
# ADJUSTED\_WAGE for all states  
all\_states\_med\_adjusted <- aggregate(salcost$ADJUSTED\_WAGE, by = list(salcost$Work\_State), FUN = median)  
names(all\_states\_med\_adjusted) <- c("State", "Median\_Adjusted\_Wage")  
  
# Sort the all\_states\_med\_adjusted data frame by median in descending order  
all\_states\_med\_adjusted <- all\_states\_med\_adjusted[order(-all\_states\_med\_adjusted$Median\_Adjusted\_Wage),]  
  
  
# PAID\_WAGE for all states  
all\_states\_med\_paid <- aggregate(salcost$PAID\_WAGE\_PER\_YEAR, by = list(salcost$Work\_State), FUN = median)  
  
names(all\_states\_med\_paid) <- c("State", "Median\_paid\_Wage")  
  
# Sort the all\_states\_med\_paid data frame by median in descending order  
all\_states\_med\_paid <- all\_states\_med\_paid[order(-all\_states\_med\_paid$Median\_paid\_Wage),]  
  
  
all\_states\_med <- merge(all\_states\_med\_paid, all\_states\_med\_paid, by = c("State"))  
  
print(all\_states\_med)  
  
  
  
  
###################################################  
  
#Looking at the median change of top 5 states by subtitle after adjusted wage  
# First, extract the top 5 states  
top\_states <- head(all\_states\_med\_paid, 5)$State  
  
# Filter the data by the top 5 states  
top\_states\_data <- salcost[salcost$Work\_State %in% top\_states, ]  
  
# Calculate the median ADJUSTED\_WAGE by job subtitle and state  
state\_job\_medians <- aggregate(top\_states\_data$ADJUSTED\_WAGE,   
 by = list(top\_states\_data$Work\_State, top\_states\_data$Job\_Title\_Sub),  
 FUN = median)  
  
# Rename the columns of the state\_job\_means data frame  
names(state\_job\_medians) <- c("State", "Job\_Title\_Sub", "Median\_Adjusted\_Wage")  
  
# Order the data frame by state and mean adjusted wage in descending order  
state\_job\_medians <- state\_job\_medians[order(state\_job\_medians$State, -state\_job\_medians$Median\_Adjusted\_Wage),]  
  
  
  
  
  
###################comparison paid wage##################  
########### comparison with payed wage ################  
  
  
# Calculate the mean PAID\_WAGE\_PER\_YEAR by job subtitle and state  
state\_job\_med\_paidwage <- aggregate(top\_states\_data$PAID\_WAGE\_PER\_YEAR,   
 by = list(top\_states\_data$Work\_State, top\_states\_data$Job\_Title\_Sub),  
 FUN = median)  
  
# Rename the columns of the state\_job\_means data frame  
names(state\_job\_med\_paidwage) <- c("State", "Job\_Title\_Sub", "Med\_Paid\_Wage")  
  
# Order the data frame by state and mean paid wage in descending order  
state\_job\_med\_paidwage <- state\_job\_med\_paidwage[order(state\_job\_med\_paidwage$State, -state\_job\_med\_paidwage$Med\_Paid\_Wage),]  
  
  
  
  
###############################  
  
# Load ggplot2 library  
library(ggplot2)  
library(scales)  
  
# Create a new data frame by merging state\_job\_means and state\_job\_means\_paidwage data frames  
state\_job\_means\_all <- merge(state\_job\_medians, state\_job\_med\_paidwage, by = c("State", "Job\_Title\_Sub"))  
  
  
  
print(state\_job\_means\_all)  
  
  
  
##########We can also look at the bottom states:   
  
  
# First, extract the bottom 5 states  
bottom\_states <- tail(all\_states\_med\_paid, 5)$State  
  
# Filter the data by the bottom 5 states  
bottom\_states\_data <- salcost[salcost$Work\_State %in% bottom\_states, ]  
  
# Calculate the mean ADJUSTED\_WAGE by job subtitle and state  
state\_job\_med\_b <- aggregate(bottom\_states\_data$ADJUSTED\_WAGE,   
 by = list(bottom\_states\_data$Work\_State, bottom\_states\_data$Job\_Title\_Sub),  
 FUN = median)  
  
# Rename the columns of the state\_job\_means data frame  
names(state\_job\_med\_b) <- c("State", "Job\_Title\_Sub", "Med\_Adjusted\_Wage")  
  
# Order the data frame by state and mean adjusted wage in descending order  
state\_job\_med\_b <- state\_job\_med\_b[order(state\_job\_med\_b$State, -state\_job\_med\_b$Med\_Adjusted\_Wage),]  
  
# Print the state\_job\_means data frame  
#print(state\_job\_med\_b)  
  
########################  
  
# Calculate the median PAID\_WAGE\_PER\_YEAR by job subtitle and state  
state\_job\_med\_paidwage\_b <- aggregate(bottom\_states\_data$PAID\_WAGE\_PER\_YEAR,   
 by = list(bottom\_states\_data$Work\_State, bottom\_states\_data$Job\_Title\_Sub),  
 FUN = median)  
  
# Rename the columns of the state\_job\_means data frame  
names(state\_job\_med\_paidwage\_b) <- c("State", "Job\_Title\_Sub", "Med\_Paid\_Wage")  
  
# Order the data frame by state and mean paid wage in descending order  
state\_job\_med\_paidwage\_b <- state\_job\_med\_paidwage\_b[order(state\_job\_med\_paidwage\_b$State, -state\_job\_med\_paidwage\_b$Med\_Paid\_Wage),]  
  
# Print the state\_job\_means data frame  
#print(state\_job\_med\_paidwage\_b)  
  
############################### Here the colors are swaped. we have adjusted to be lighter and paid wage stronger color..   
  
# Load ggplot2 library graph for bottom 5  
library(ggplot2)  
library(dplyr)  
  
# Create a new data frame by merging state\_job\_means and state\_job\_means\_paidwage data frames  
state\_job\_means\_all\_b <- merge(state\_job\_med\_b, state\_job\_med\_paidwage\_b, by = c("State", "Job\_Title\_Sub"))  
  
print(state\_job\_means\_all\_b)  
  
  
  
###################################new  
library(ggplot2)  
library(dplyr)  
  
# Create the grouped bar plot  
p1 <- ggplot(state\_job\_means\_all, aes(x = State, y = Median\_Adjusted\_Wage, fill = Job\_Title\_Sub)) +  
 geom\_bar(position = "dodge", stat = "identity", width = 0.6) +  
 geom\_bar(aes(y = Med\_Paid\_Wage), position = "dodge", stat = "identity", width = 0.6, alpha = 0.5) +  
 scale\_fill\_manual(values = c("#F8766D", "#00BA38", "#619CFF", "#FC8D62", "#8B00FF")) +  
 labs(x = "State", y = "Med Salary", fill = "Job Title Sub") +  
 ggtitle("Median Adjusted (darker) and Median Paid Wages (lighter)") +  
 theme(plot.title = element\_text(size = 16, hjust = 0.5), axis.text.x = element\_text(angle = 45, hjust = 1)) +  
 scale\_y\_continuous(labels = scales::comma, limits = c(0, 150000))  
  
# Create the grouped bar plot  
p2 <- ggplot(state\_job\_means\_all\_b, aes(x = State, y = Med\_Paid\_Wage, fill = Job\_Title\_Sub)) +  
 geom\_bar(position = "dodge", stat = "identity", width = 0.6) +  
 geom\_bar(aes(y = Med\_Adjusted\_Wage), position = "dodge", stat = "identity", width = 0.6, alpha = 0.5) +  
 scale\_fill\_manual(values = c("#F8766D", "#00BA38", "#619CFF", "#FC8D62", "#8B00FF")) +  
 labs(x = "State", y = "Med Salary", fill = "Job Title Sub") +  
 ggtitle("Median Adjusted (lighter) and Median Paid Wages (darker)") +  
 theme(plot.title = element\_text(size = 16, hjust = 0.5), axis.text.x = element\_text(angle = 45, hjust = 1)) +  
 scale\_y\_continuous(labels = scales::comma, limits = c(0, 150000))  
  
# Display plots side-by-side with shared y-axis limits  
library(gridExtra)  
grid.arrange(p1, p2, ncol = 2, widths = c(1, 1))  
  
  
# Calculate the median cost index by state  
state\_cost\_index <- aggregate(salcost$costIndex, by = list(salcost$Work\_State), FUN = median)  
  
# Rename the columns of the state\_cost\_index data frame  
names(state\_cost\_index) <- c("State", "Median\_Cost\_Index")  
  
# Order the data frame by mean cost index in descending order  
state\_cost\_index <- data.frame(state\_cost\_index[order(-state\_cost\_index$Median\_Cost\_Index), ])  
  
# Print the state\_cost\_index data frame  
#print(state\_cost\_index)  
  
#head(salcost)  
  
# Calculate the mean paid wage per year by state  
state\_all\_means\_paid <- aggregate(PAID\_WAGE\_PER\_YEAR ~ Work\_State, data = salcost, FUN = mean)  
  
# Rename the columns of the state\_means data frame  
names(state\_all\_means\_paid) <- c("State", "Mean\_Paid\_Wage\_Per\_Year")  
  
# Order the data frame by mean paid wage per year in descending order  
state\_all\_means\_paid <- state\_all\_means\_paid[order(-state\_all\_means\_paid$Mean\_Paid\_Wage\_Per\_Year),]  
  
# Print the state\_means data frame  
#print(state\_all\_means\_paid)  
# Print the state medians data frame  
#print(all\_states\_med\_paid)  
  
  
# Calculate the mean adjusted wage by state  
state\_all\_means\_adjusted <- aggregate(ADJUSTED\_WAGE ~ Work\_State, data = salcost, FUN = mean)  
  
# Rename the columns of the state\_means\_adjusted data frame  
names(state\_all\_means\_adjusted) <- c("State", "Mean\_Adjusted\_Wage")  
  
# Order the data frame by mean paid wage per year in descending order  
state\_all\_means\_adjusted <- state\_all\_means\_adjusted[order(-state\_all\_means\_adjusted$Mean\_Adjusted\_Wage),]  
  
# Print the state\_means data frame  
#print(state\_all\_means\_adjusted)  
# Print the state medians data frame  
#print(all\_states\_med\_adjusted)  
  
####################################################################  
#Graph of all states means percentage change in wage after adjusted mean wage  
  
# Merge the state\_means and state\_means\_adjusted data frames by state  
merged\_means <- merge(state\_all\_means\_paid, state\_all\_means\_adjusted, by = "State")  
  
  
# Add the WORK\_STATE\_ABBREVIATION column to merged\_means  
merged\_means$WORK\_STATE\_ABBREVIATION <- salcost$WORK\_STATE\_ABBREVIATION[match(merged\_means$State, salcost$Work\_State)]  
  
# Calculate the percentage change of the adjusted wage  
merged\_means$Percent\_Change <- (merged\_means$Mean\_Adjusted\_Wage - merged\_means$Mean\_Paid\_Wage\_Per\_Year) / merged\_means$Mean\_Paid\_Wage\_Per\_Year \* 100  
  
# Add a column indicating whether the percentage change is positive or negative  
merged\_means$Positive\_Change <- ifelse(merged\_means$Percent\_Change > 0, "Yes", "No")  
  
# Order the data frame by percent change in descending order  
merged\_means <- merged\_means[order(-merged\_means$Percent\_Change),]  
  
# Print the merged\_means data frame  
print(merged\_means)  
  
  
ggplot(data = merged\_means, aes(x = WORK\_STATE\_ABBREVIATION)) +  
 geom\_bar(aes(y = Percent\_Change, fill = Positive\_Change), alpha = 0.8, stat = "identity") +  
 scale\_fill\_manual(values = c("red", "green"), guide = "none" ) +  
 geom\_text(aes(y = Percent\_Change, label = paste0(round(Percent\_Change, 1), "%")), vjust = -0.5) +  
 scale\_y\_continuous(labels = scales::percent\_format()) +  
 labs(title = "Mean Adjusted Wage and Percent Change by State",  
 x = "State Abbreviation",  
 y = "Percent Change",  
 color = "Positive Change") +  
 theme\_minimal()