Untitled

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```
##Q1
#load the data
polls_data_2016 = read.csv("president_general_polls_sorted_end_date_2016.csv")
library(lubridate)
```

```
##
## Attaching package: 'lubridate'

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

```
##dimension of this dataset
dim(polls_data_2016)
```

```
## [1] 12621    29
```

```
##variable name of the data
names(polls_data_2016)
```

```
##  [1] "cycle"            "branch"           "type"             "matchup"
##  [5] "forecastdate"     "state"            "startdate"        "enddate"
##  [9] "pollster"         "grade"            "samplesize"       "population"
## [13] "poll_wt"          "rawpoll_clinton"  "rawpoll_trump"    "rawpoll_johnson"
## [17] "rawpoll_mcmullin" "adjpoll_clinton"  "adjpoll_trump"    "adjpoll_johnson"
## [21] "adjpoll_mcmullin" "multiversions"    "url"              "poll_id"
## [25] "question_id"      "createddate"      "timestamp"        "total.clinton"
## [29] "total.trump"
```

```
#Filter the data
date_2016= mdy(polls_data_2016$createddate)
index_selected=which(date_2016>='2016-08-01' & date_2016<='2016-11-02')
polls_data_2016 = polls_data_2016[index_selected,]
```

```
# Part a
index_Mic=which(polls_data_2016$state=="Michigan")

n1=sum(polls_data_2016$total.clinton[index_Mic])
n2=sum(polls_data_2016$total.trump[index_Mic])

n1/(n1+n2)
```

```
## [1] 0.5182924
```

```
n2/(n1+n2)
```

```
## [1] 0.4817076
```

```
n1/(n1+n2)-n2/(n1+n2)
```

```
## [1] 0.0365849
```

```
#The final result is 0.0365849, which shows Clinton was ahead with 3.65849%
```

```
index_Geo=which(polls_data_2016$state=="Georgia")

n1=sum(polls_data_2016$total.clinton[index_Geo])
n2=sum(polls_data_2016$total.trump[index_Geo])

n1/(n1+n2)
```

```
## [1] 0.4664512
```

```
n2/(n1+n2)
```

```
## [1] 0.5335488
```

```
n1/(n1+n2)-n2/(n1+n2)
```

```
## [1] -0.0670975
```

```
#The final result is -0.0670975, which shows Trump was ahead with 6.70975%
```

```
index_Nor=which(polls_data_2016$state=="North Carolina")

n1=sum(polls_data_2016$total.clinton[index_Nor])
n2=sum(polls_data_2016$total.trump[index_Nor])

n1/(n1+n2)
```

```
## [1] 0.4978619
```

```
n2/(n1+n2)
```

```
## [1] 0.5021381
```

```
n1/(n1+n2)-n2/(n1+n2)
```

```
## [1] -0.004276271
```

```
#The final result is -0.004276271, which shows Trump was ahead with 0.4276271%
```

```
# Part b
polls_data_2016$enddate
```

```
##    [1] "1/12/16"  "1/12/16"  "1/12/16"  "2/16/16"  "2/16/16"  "2/16/16"
##    [7] "2/16/16"  "2/16/16"  "2/16/16"  "3/17/16"  "3/17/16"  "3/17/16"
##   [13] "3/17/16"  "3/17/16"  "3/17/16"  "3/21/16"  "3/21/16"  "3/21/16"
##   [19] "3/24/16"  "3/24/16"  "3/24/16"  "6/20/16"  "6/20/16"  "6/20/16"
##   [25] "6/23/16"  "6/23/16"  "6/23/16"  "7/5/16"   "7/5/16"   "7/5/16"
##   [31] "7/5/16"   "7/5/16"   "7/5/16"   "7/6/16"   "7/6/16"   "7/6/16"
##   [37] "7/14/16"  "7/14/16"  "7/14/16"  "7/14/16"  "7/14/16"  "7/14/16"
##   [43] "7/15/16"  "7/15/16"  "7/15/16"  "7/16/16"  "7/16/16"  "7/16/16"
##   [49] "7/17/16"  "7/17/16"  "7/17/16"  "7/17/16"  "7/17/16"  "7/17/16"
##   [55] "7/18/16"  "7/18/16"  "7/18/16"  "7/19/16"  "7/19/16"  "7/19/16"
##   [61] "7/19/16"  "7/19/16"  "7/19/16"  "7/20/16"  "7/20/16"  "7/20/16"
##   [67] "7/21/16"  "7/21/16"  "7/21/16"  "7/22/16"  "7/22/16"  "7/22/16"
##   [73] "7/23/16"  "7/23/16"  "7/23/16"  "7/24/16"  "7/24/16"  "7/24/16"
##   [79] "7/24/16"  "7/24/16"  "7/24/16"  "7/25/16"  "7/25/16"  "7/25/16"
##   [85] "7/26/16"  "7/26/16"  "7/26/16"  "7/26/16"  "7/26/16"  "7/26/16"
##   [91] "7/27/16"  "7/27/16"  "7/27/16"  "7/27/16"  "7/27/16"  "7/27/16"
##   [97] "7/27/16"  "7/27/16"  "7/27/16"  "7/28/16"  "7/28/16"  "7/28/16"
##  [103] "7/29/16"  "7/29/16"  "7/29/16"  "7/30/16"  "7/30/16"  "7/30/16"
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##  [139] "7/31/16"  "7/31/16"  "7/31/16"  "8/1/16"   "8/1/16"   "8/1/16"
##  [145] "8/1/16"   "8/1/16"   "8/1/16"   "8/1/16"   "8/1/16"   "8/1/16"
##  [151] "8/1/16"   "8/1/16"   "8/1/16"   "8/1/16"   "8/1/16"   "8/1/16"
##  [157] "8/1/16"   "8/1/16"   "8/1/16"   "8/1/16"   "8/1/16"   "8/1/16"
##  [163] "8/1/16"   "8/1/16"   "8/1/16"   "8/1/16"   "8/1/16"   "8/1/16"
##  [169] "8/1/16"   "8/1/16"   "8/1/16"   "8/1/16"   "8/1/16"   "8/1/16"
##  [175] "8/2/16"   "8/2/16"   "8/2/16"   "8/2/16"   "8/2/16"   "8/2/16"
##  [181] "8/2/16"   "8/2/16"   "8/2/16"   "8/2/16"   "8/2/16"   "8/2/16"
##  [187] "8/2/16"   "8/2/16"   "8/2/16"   "8/2/16"   "8/2/16"   "8/2/16"
##  [193] "8/2/16"   "8/2/16"   "8/2/16"   "8/3/16"   "8/3/16"   "8/3/16"
##  [199] "8/3/16"   "8/3/16"   "8/3/16"   "8/3/16"   "8/3/16"   "8/3/16"
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##  [217] "8/3/16"   "8/3/16"   "8/3/16"   "8/3/16"   "8/3/16"   "8/3/16"
##  [223] "8/4/16"   "8/4/16"   "8/4/16"   "8/4/16"   "8/4/16"   "8/4/16"
##  [229] "8/4/16"   "8/4/16"   "8/4/16"   "8/4/16"   "8/4/16"   "8/4/16"
##  [235] "8/4/16"   "8/4/16"   "8/4/16"   "8/4/16"   "8/4/16"   "8/4/16"
##  [241] "8/4/16"   "8/4/16"   "8/4/16"   "8/4/16"   "8/4/16"   "8/4/16"
##  [247] "8/4/16"   "8/4/16"   "8/4/16"   "8/4/16"   "8/4/16"   "8/4/16"
##  [253] "8/4/16"   "8/4/16"   "8/4/16"   "8/4/16"   "8/4/16"   "8/4/16"
##  [259] "8/4/16"   "8/4/16"   "8/4/16"   "8/5/16"   "8/5/16"   "8/5/16"
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##  [271] "8/5/16"   "8/5/16"   "8/5/16"   "8/5/16"   "8/5/16"   "8/5/16"
##  [277] "8/5/16"   "8/5/16"   "8/5/16"   "8/5/16"   "8/5/16"   "8/5/16"
##  [283] "8/5/16"   "8/5/16"   "8/5/16"   "8/6/16"   "8/6/16"   "8/6/16"
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##  [289] "8/6/16"   "8/6/16"   "8/6/16"   "8/6/16"   "8/6/16"   "8/6/16"
##  [295] "8/6/16"   "8/6/16"   "8/6/16"   "8/6/16"   "8/6/16"   "8/6/16"
##  [301] "8/7/16"   "8/7/16"   "8/7/16"   "8/7/16"   "8/7/16"   "8/7/16"
##  [307] "8/7/16"   "8/7/16"   "8/7/16"   "8/7/16"   "8/7/16"   "8/7/16"
##  [313] "8/7/16"   "8/7/16"   "8/7/16"   "8/7/16"   "8/7/16"   "8/7/16"
##  [319] "8/7/16"   "8/7/16"   "8/7/16"   "8/7/16"   "8/7/16"   "8/7/16"
##  [325] "8/7/16"   "8/7/16"   "8/7/16"   "8/7/16"   "8/7/16"   "8/7/16"
##  [331] "8/7/16"   "8/7/16"   "8/7/16"   "8/7/16"   "8/7/16"   "8/7/16"
##  [337] "8/7/16"   "8/7/16"   "8/7/16"   "8/7/16"   "8/7/16"   "8/7/16"
##  [343] "8/7/16"   "8/7/16"   "8/7/16"   "8/7/16"   "8/7/16"   "8/7/16"
##  [349] "8/7/16"   "8/7/16"   "8/7/16"   "8/7/16"   "8/7/16"   "8/7/16"
##  [355] "8/7/16"   "8/7/16"   "8/7/16"   "8/8/16"   "8/8/16"   "8/8/16"
##  [361] "8/8/16"   "8/8/16"   "8/8/16"   "8/8/16"   "8/8/16"   "8/8/16"
##  [367] "8/8/16"   "8/8/16"   "8/8/16"   "8/8/16"   "8/8/16"   "8/8/16"
##  [373] "8/8/16"   "8/8/16"   "8/8/16"   "8/8/16"   "8/8/16"   "8/8/16"
##  [379] "8/8/16"   "8/8/16"   "8/8/16"   "8/8/16"   "8/8/16"   "8/8/16"
##  [385] "8/8/16"   "8/8/16"   "8/8/16"   "8/9/16"   "8/9/16"   "8/9/16"
##  [391] "8/9/16"   "8/9/16"   "8/9/16"   "8/9/16"   "8/9/16"   "8/9/16"
##  [397] "8/9/16"   "8/9/16"   "8/9/16"   "8/9/16"   "8/9/16"   "8/9/16"
##  [403] "8/9/16"   "8/9/16"   "8/9/16"   "8/9/16"   "8/9/16"   "8/9/16"
##  [409] "8/9/16"   "8/9/16"   "8/9/16"   "8/9/16"   "8/9/16"   "8/9/16"
##  [415] "8/9/16"   "8/9/16"   "8/9/16"   "8/10/16"  "8/10/16"  "8/10/16"
##  [421] "8/10/16"  "8/10/16"  "8/10/16"  "8/10/16"  "8/10/16"  "8/10/16"
##  [427] "8/10/16"  "8/10/16"  "8/10/16"  "8/10/16"  "8/10/16"  "8/10/16"
##  [433] "8/10/16"  "8/10/16"  "8/10/16"  "8/10/16"  "8/10/16"  "8/10/16"
##  [439] "8/10/16"  "8/10/16"  "8/10/16"  "8/10/16"  "8/10/16"  "8/10/16"
##  [445] "8/10/16"  "8/10/16"  "8/10/16"  "8/10/16"  "8/10/16"  "8/10/16"
##  [451] "8/10/16"  "8/10/16"  "8/10/16"  "8/10/16"  "8/10/16"  "8/10/16"
##  [457] "8/10/16"  "8/10/16"  "8/10/16"  "8/11/16"  "8/11/16"  "8/11/16"
##  [463] "8/11/16"  "8/11/16"  "8/11/16"  "8/11/16"  "8/11/16"  "8/11/16"
##  [469] "8/11/16"  "8/11/16"  "8/11/16"  "8/11/16"  "8/11/16"  "8/11/16"
##  [475] "8/11/16"  "8/11/16"  "8/11/16"  "8/12/16"  "8/12/16"  "8/12/16"
##  [481] "8/12/16"  "8/12/16"  "8/12/16"  "8/12/16"  "8/12/16"  "8/12/16"
##  [487] "8/12/16"  "8/12/16"  "8/12/16"  "8/12/16"  "8/12/16"  "8/12/16"
##  [493] "8/12/16"  "8/12/16"  "8/12/16"  "8/12/16"  "8/12/16"  "8/12/16"
##  [499] "8/13/16"  "8/13/16"  "8/13/16"  "8/13/16"  "8/13/16"  "8/13/16"
##  [505] "8/13/16"  "8/13/16"  "8/13/16"  "8/13/16"  "8/13/16"  "8/13/16"
##  [511] "8/13/16"  "8/13/16"  "8/13/16"  "8/13/16"  "8/13/16"  "8/13/16"
##  [517] "8/14/16"  "8/14/16"  "8/14/16"  "8/14/16"  "8/14/16"  "8/14/16"
##  [523] "8/14/16"  "8/14/16"  "8/14/16"  "8/14/16"  "8/14/16"  "8/14/16"
##  [529] "8/14/16"  "8/14/16"  "8/14/16"  "8/14/16"  "8/14/16"  "8/14/16"
##  [535] "8/14/16"  "8/14/16"  "8/14/16"  "8/14/16"  "8/14/16"  "8/14/16"
##  [541] "8/14/16"  "8/14/16"  "8/14/16"  "8/15/16"  "8/15/16"  "8/15/16"
##  [547] "8/15/16"  "8/15/16"  "8/15/16"  "8/15/16"  "8/15/16"  "8/15/16"
##  [553] "8/15/16"  "8/15/16"  "8/15/16"  "8/15/16"  "8/15/16"  "8/15/16"
##  [559] "8/15/16"  "8/15/16"  "8/15/16"  "8/15/16"  "8/15/16"  "8/15/16"
##  [565] "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"
##  [571] "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"
##  [577] "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"
##  [583] "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"
##  [589] "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"
##  [595] "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"
##  [601] "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"
##  [607] "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"
```

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##  [613] "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"
##  [619] "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"
##  [625] "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"
##  [631] "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"
##  [637] "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"
##  [643] "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"
##  [649] "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"
##  [655] "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"
##  [661] "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"
##  [667] "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"
##  [673] "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"
##  [679] "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"
##  [685] "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"
##  [691] "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"
##  [697] "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"
##  [703] "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"
##  [709] "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"
##  [715] "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"
##  [721] "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"
##  [727] "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"
##  [733] "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"
##  [739] "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"
##  [745] "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"
##  [751] "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"  "8/16/16"
##  [757] "8/17/16"  "8/17/16"  "8/17/16"  "8/17/16"  "8/17/16"  "8/17/16"
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## [1657] "8/30/16"  "8/30/16"  "8/30/16"  "8/30/16"  "8/30/16"  "8/30/16"
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## [1669] "8/30/16"  "8/30/16"  "8/30/16"  "8/30/16"  "8/30/16"  "8/30/16"
## [1675] "8/30/16"  "8/30/16"  "8/30/16"  "8/30/16"  "8/30/16"  "8/30/16"
## [1681] "8/30/16"  "8/30/16"  "8/30/16"  "8/30/16"  "8/30/16"  "8/30/16"
## [1687] "8/30/16"  "8/30/16"  "8/30/16"  "8/31/16"  "8/31/16"  "8/31/16"
## [1693] "8/31/16"  "8/31/16"  "8/31/16"  "8/31/16"  "8/31/16"  "8/31/16"
## [1699] "8/31/16"  "8/31/16"  "8/31/16"  "8/31/16"  "8/31/16"  "8/31/16"
## [1705] "8/31/16"  "8/31/16"  "8/31/16"  "8/31/16"  "8/31/16"  "8/31/16"
## [1711] "8/31/16"  "8/31/16"  "8/31/16"  "8/31/16"  "8/31/16"  "8/31/16"
## [1717] "8/31/16"  "8/31/16"  "8/31/16"  "9/1/16"   "9/1/16"   "9/1/16"
## [1723] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1729] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1735] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1741] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1747] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1753] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1759] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1765] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1771] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1777] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1783] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1789] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1795] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1801] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1807] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1813] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1819] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1825] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1831] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1837] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1843] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1849] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1855] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1861] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1867] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1873] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1879] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1885] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1891] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1897] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1903] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
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## [1909] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1915] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1921] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1927] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1933] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1939] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1945] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1951] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1957] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1963] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1969] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1975] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1981] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1987] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1993] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [1999] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [2005] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [2011] "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"   "9/1/16"
## [2017] "9/1/16"   "9/1/16"   "9/1/16"   "9/2/16"   "9/2/16"   "9/2/16"
## [2023] "9/2/16"   "9/2/16"   "9/2/16"   "9/2/16"   "9/2/16"   "9/2/16"
## [2029] "9/2/16"   "9/2/16"   "9/2/16"   "9/2/16"   "9/2/16"   "9/2/16"
## [2035] "9/2/16"   "9/2/16"   "9/2/16"   "9/2/16"   "9/2/16"   "9/2/16"
## [2041] "9/2/16"   "9/2/16"   "9/2/16"   "9/3/16"   "9/3/16"   "9/3/16"
## [2047] "9/3/16"   "9/3/16"   "9/3/16"   "9/3/16"   "9/3/16"   "9/3/16"
## [2053] "9/4/16"   "9/4/16"   "9/4/16"   "9/4/16"   "9/4/16"   "9/4/16"
## [2059] "9/4/16"   "9/4/16"   "9/4/16"   "9/4/16"   "9/4/16"   "9/4/16"
## [2065] "9/4/16"   "9/4/16"   "9/4/16"   "9/4/16"   "9/4/16"   "9/4/16"
## [2071] "9/5/16"   "9/5/16"   "9/5/16"   "9/5/16"   "9/5/16"   "9/5/16"
## [2077] "9/5/16"   "9/5/16"   "9/5/16"   "9/5/16"   "9/5/16"   "9/5/16"
## [2083] "9/5/16"   "9/5/16"   "9/5/16"   "9/5/16"   "9/5/16"   "9/5/16"
## [2089] "9/5/16"   "9/5/16"   "9/5/16"   "9/5/16"   "9/5/16"   "9/5/16"
## [2095] "9/5/16"   "9/5/16"   "9/5/16"   "9/5/16"   "9/5/16"   "9/5/16"
## [2101] "9/5/16"   "9/5/16"   "9/5/16"   "9/5/16"   "9/5/16"   "9/5/16"
## [2107] "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"
## [2113] "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"
## [2119] "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"
## [2125] "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"
## [2131] "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"
## [2137] "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"
## [2143] "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"
## [2149] "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"
## [2155] "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"
## [2161] "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"
## [2167] "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"
## [2173] "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"
## [2179] "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"
## [2185] "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"
## [2191] "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"
## [2197] "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"
## [2203] "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"
## [2209] "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"
## [2215] "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"
## [2221] "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"
## [2227] "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"
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## [2233] "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"
## [2239] "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"
## [2245] "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"
## [2251] "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"
## [2257] "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"
## [2263] "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"
## [2269] "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"
## [2275] "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"   "9/6/16"
## [2281] "9/6/16"   "9/6/16"   "9/6/16"   "9/7/16"   "9/7/16"   "9/7/16"
## [2287] "9/7/16"   "9/7/16"   "9/7/16"   "9/7/16"   "9/7/16"   "9/7/16"
## [2293] "9/7/16"   "9/7/16"   "9/7/16"   "9/7/16"   "9/7/16"   "9/7/16"
## [2299] "9/7/16"   "9/7/16"   "9/7/16"   "9/7/16"   "9/7/16"   "9/7/16"
## [2305] "9/7/16"   "9/7/16"   "9/7/16"   "9/7/16"   "9/7/16"   "9/7/16"
## [2311] "9/7/16"   "9/7/16"   "9/7/16"   "9/7/16"   "9/7/16"   "9/7/16"
## [2317] "9/7/16"   "9/7/16"   "9/7/16"   "9/7/16"   "9/7/16"   "9/7/16"
## [2323] "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"
## [2329] "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"
## [2335] "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"
## [2341] "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"
## [2347] "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"
## [2353] "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"
## [2359] "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"
## [2365] "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"
## [2371] "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"
## [2377] "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"
## [2383] "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"
## [2389] "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"
## [2395] "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"
## [2401] "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"
## [2407] "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"
## [2413] "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"
## [2419] "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"
## [2425] "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"
## [2431] "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"
## [2437] "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"
## [2443] "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"
## [2449] "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"
## [2455] "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"
## [2461] "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"
## [2467] "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"
## [2473] "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"
## [2479] "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"
## [2485] "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"
## [2491] "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"   "9/8/16"
## [2497] "9/9/16"   "9/9/16"   "9/9/16"   "9/9/16"   "9/9/16"   "9/9/16"
## [2503] "9/9/16"   "9/9/16"   "9/9/16"   "9/9/16"   "9/9/16"   "9/9/16"
## [2509] "9/9/16"   "9/9/16"   "9/9/16"   "9/9/16"   "9/9/16"   "9/9/16"
## [2515] "9/9/16"   "9/9/16"   "9/9/16"   "9/9/16"   "9/9/16"   "9/9/16"
## [2521] "9/10/16"  "9/10/16"  "9/10/16"  "9/10/16"  "9/10/16"  "9/10/16"
## [2527] "9/10/16"  "9/10/16"  "9/10/16"  "9/10/16"  "9/10/16"  "9/10/16"
## [2533] "9/10/16"  "9/10/16"  "9/10/16"  "9/10/16"  "9/10/16"  "9/10/16"
## [2539] "9/10/16"  "9/10/16"  "9/10/16"  "9/10/16"  "9/10/16"  "9/10/16"
## [2545] "9/10/16"  "9/10/16"  "9/10/16"  "9/10/16"  "9/10/16"  "9/10/16"
## [2551] "9/10/16"  "9/10/16"  "9/10/16"  "9/11/16"  "9/11/16"  "9/11/16"
```

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## [8215] "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"
## [8221] "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"
## [8227] "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"
## [8233] "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"
## [8239] "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"
## [8245] "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"
## [8251] "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"
## [8257] "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"
## [8263] "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"
## [8269] "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"
## [8275] "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"
## [8281] "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"
## [8287] "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"
## [8293] "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"
## [8299] "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"
## [8305] "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"
## [8311] "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"
## [8317] "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"
## [8323] "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"
## [8329] "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"
## [8335] "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"
## [8341] "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"
## [8347] "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"
## [8353] "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"
## [8359] "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"
## [8365] "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"
## [8371] "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"
## [8377] "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"
## [8383] "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"
```

```
## [8389] "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"
## [8395] "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"
## [8401] "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"
## [8407] "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"
## [8413] "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"
## [8419] "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"  "11/1/16"
```

```
t.test(polls_data_2016$total.clinton[index_Mic]-
         polls_data_2016$total.trump[index_Mic],alternative='greater')
```

```
##
##  One Sample t-test
##
## data:  polls_data_2016$total.clinton[index_Mic] - polls_data_2016$total.trump[index_Mic]
## t = 10.484, df = 167, p-value < 2.2e-16
## alternative hypothesis: true mean is greater than 0
## 95 percent confidence interval:
##  22.52678      Inf
## sample estimates:
## mean of x
##  26.74654
```

```
##The t-test result shows a t-value of 10.484 with 167 degrees of freedom.
#The test's p-value is less than 2.2e-16, which is effectively zero and therefore
#statistically significant. This means there's a statistically significant
#difference between the counts in polls for Clinton and Trump in favor of
#Clinton. The confidence interval does not include 0 (22.52678 to infinity),
#and the estimated mean difference is 26.74654, both of which further support
#Clinton being favored in this state.
```

```
t.test(polls_data_2016$total.clinton[index_Geo]-
         polls_data_2016$total.trump[index_Geo],alternative='greater')
```

```
##
##  One Sample t-test
##
## data:  polls_data_2016$total.clinton[index_Geo] - polls_data_2016$total.trump[index_Geo]
## t = -19.191, df = 164, p-value = 1
## alternative hypothesis: true mean is greater than 0
## 95 percent confidence interval:
##  -56.48463       Inf
## sample estimates:
## mean of x
## -52.00212
```

```
##Here, the t-value is -19.191 with 164 degrees of freedom.
#The test's p-value is 1, indicating that the result is not statistically
#significant under a traditional alpha level (such as 0.05). The confidence
#interval goes from -56.48463 to infinity and the mean difference is negative
#(-52.00212). This suggests that Trump was favored in this state, but because
#the p-value is not statistically significant, we cannot conclude that
#the observed difference is not due to chance.
```

```r
t.test(polls_data_2016$total.clinton[index_Nor]-
         polls_data_2016$total.trump[index_Nor],alternative='greater')
```

```
##
##  One Sample t-test
##
## data:  polls_data_2016$total.clinton[index_Nor] - polls_data_2016$total.trump[index_Nor]
## t = -1.5907, df = 263, p-value = 0.9436
## alternative hypothesis: true mean is greater than 0
## 95 percent confidence interval:
##  -6.27371      Inf
## sample estimates:
## mean of x
##  -3.07883
```

```r
#The t-value is -1.5907 with 263 degrees of freedom. The p-value is 0.9436,
#suggesting that the result is not statistically significant at the usual
#alpha levels. The confidence interval ranges from -6.27371 to infinity,
#and the mean difference is negative (-3.07883). This implies that Trump
#has a higher count in polls, but as the p-value is not statistically
#significant, the observed difference could be due to chance.

#A potential problem with these tests could be the assumption of normality.
#The t-test assumes that the differences in the data are normally distributed.
#If this assumption is not met, the results may not be valid. Additionally,
#outliers could affect the results of the t-test, leading to biased results.
#Finally, these tests do not account for other factors that could influence
#the election results, such as demographic variables or the timing of the polls.
```

```r
# Part c

wilcox.test(polls_data_2016$total.clinton[index_Mic], polls_data_2016$total.trump[index_Mic], alternati
```

```
##
##  Wilcoxon rank sum test with continuity correction
##
## data:  polls_data_2016$total.clinton[index_Mic] and polls_data_2016$total.trump[index_Mic]
## W = 16505, p-value = 0.003601
## alternative hypothesis: true location shift is greater than 0
```

```r
#The Wilcoxon rank sum test shows a W-value of 16505 and a p-value of 0.003601.
#Because the p-value is less than the traditional alpha level of 0.05, we can
#conclude that there is a statistically significant difference between the
#counts in polls for Clinton and Trump in favor of Clinton. This is because
#the test's alternative hypothesis is that the true location shift is greater
#than 0, which suggests a preference for Clinton.
```

```r
wilcox.test(polls_data_2016$total.clinton[index_Geo], polls_data_2016$total.trump[index_Geo], alternati
```

```
##
##  Wilcoxon rank sum test with continuity correction
```

```
##
## data:  polls_data_2016$total.clinton[index_Geo] and polls_data_2016$total.trump[index_Geo]
## W = 9341, p-value = 1
## alternative hypothesis: true location shift is greater than 0
```

```
#Here, the W-value is 9341, and the p-value is 1. Given that the p-value is not
#less than the usual alpha level of 0.05, we can't conclude that there is a
#statistically significant difference between the counts in polls for Clinton
#and Trump. Despite this, the alternative hypothesis suggests a preference for
#Clinton, but we can't confidently affirm this due to the lack of statistical #significance.
```

```
wilcox.test(polls_data_2016$total.clinton[index_Nor], polls_data_2016$total.trump[index_Nor], alternati
```

```
##
##  Wilcoxon rank sum test with continuity correction
##
## data:  polls_data_2016$total.clinton[index_Nor] and polls_data_2016$total.trump[index_Nor]
## W = 33778, p-value = 0.7293
## alternative hypothesis: true location shift is greater than 0
```

```
#The W-value is 33778, and the p-value is 0.7293. Since the p-value is not less
#than the standard alpha level of 0.05, the result is not statistically
#significant. Thus, there is no significant difference between the counts in
#polls for Clinton and Trump in this state. Although the alternative hypothesis
#implies a preference for Clinton, we can't confirm this because of the test's
#non-significant outcome.

##Potential issues with the Wilcoxon signed-rank test include the assumption of
#symmetry, i.e., the distribution of differences between the pairs should be
#symmetrical. If this assumption is not met, the results may not be valid.
#Furthermore, outliers can impact the Wilcoxon test as the rank of the outliers
#will be affected, thereby influencing the test results. As with the t-test,
#these tests do not account for other factors that could influence the election
#results, such as demographic variables or the timing of the polls.
```

```
# Part d

date_Mic <- mdy(polls_data_2016$enddate[index_Mic])
date_Geo <- mdy(polls_data_2016$enddate[index_Geo])
date_Nor <- mdy(polls_data_2016$enddate[index_Nor])

counts_Mic_for_lm <- data.frame(
  data_date = date_Mic,
  percentage_diff = (polls_data_2016$total.clinton[index_Mic]-
                       polls_data_2016$total.trump[index_Mic])/
    (polls_data_2016$total.clinton[index_Mic]+
       polls_data_2016$total.trump[index_Mic])
)
as.numeric(date_Mic)
```

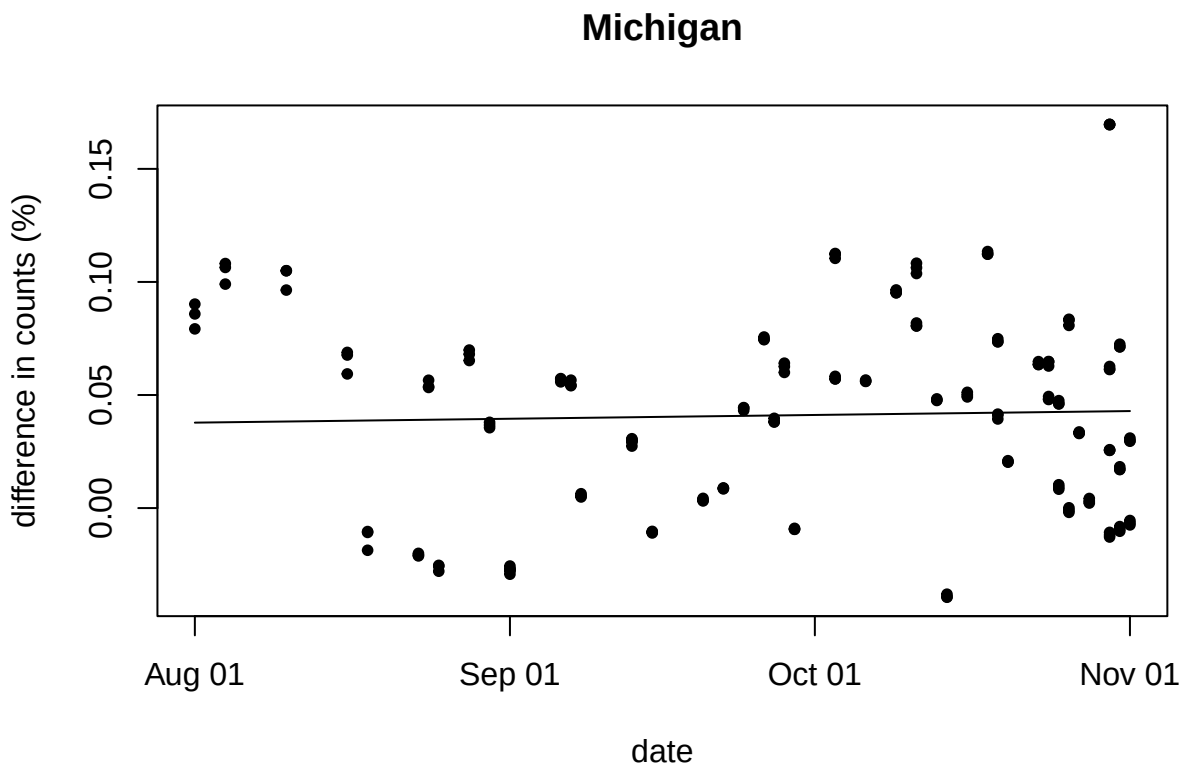
```
##   [1] 17014 17014 17014 17017 17017 17017 17023 17023 17023 17029 17029 17029
##  [13] 17031 17031 17031 17036 17036 17036 17037 17037 17037 17038 17038 17038
```

```
##  [25] 17041 17041 17041 17043 17043 17043 17045 17045 17045 17045 17045 17045
##  [37] 17050 17050 17050 17051 17051 17051 17052 17052 17052 17057 17057 17057
##  [49] 17057 17057 17057 17059 17059 17059 17064 17064 17064 17066 17066 17066
##  [61] 17068 17068 17068 17070 17070 17070 17071 17071 17071 17072 17072 17072
##  [73] 17073 17073 17073 17077 17077 17077 17077 17077 17077 17080 17080 17080
##  [85] 17083 17083 17083 17085 17085 17085 17085 17085 17085 17087 17087 17087
##  [97] 17088 17088 17088 17090 17090 17090 17092 17092 17092 17093 17093 17093
## [109] 17093 17093 17093 17094 17094 17094 17097 17097 17097 17098 17098 17098
## [121] 17098 17098 17098 17099 17099 17099 17099 17099 17099 17100 17100 17100
## [133] 17100 17100 17100 17101 17101 17101 17102 17102 17102 17104 17104 17104
## [145] 17104 17104 17104 17104 17104 17104 17104 17104 17104 17105 17105 17105
## [157] 17105 17105 17105 17105 17105 17105 17106 17106 17106 17106 17106 17106
```

```
lm_model_Mic=lm(percentage_diff~(data_date),data=counts_Mic_for_lm)
summary(lm_model_Mic)
```

```
##
## Call:
## lm(formula = percentage_diff ~ (data_date), data = counts_Mic_for_lm)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.081321 -0.035304  0.003581  0.028445  0.126897
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) -9.087e-01  2.123e+00  -0.428    0.669
## data_date    5.563e-05  1.243e-04   0.447    0.655
##
## Residual standard error: 0.04336 on 166 degrees of freedom
## Multiple R-squared:  0.001205,   Adjusted R-squared:  -0.004812
## F-statistic: 0.2002 on 1 and 166 DF,  p-value: 0.6551
```

```
#The fitted linear model's coefficient for data_date (representing time) is
#5.563e-05, which is not statistically significant (p = 0.655).
#This means there is no statistically significant linear trend in the percentage
#difference in polls over time for this state. The Adjusted R-squared value is
#-0.004812, indicating the model explains very little of the variance in the data.

plot(counts_Mic_for_lm$data_date,counts_Mic_for_lm$percentage_diff,
     col='black',pch=20,type='p',xlab='date',ylab='difference in counts (%)',main='Michigan')
lines(counts_Mic_for_lm$data_date,lm_model_Mic$fitted.values,
      col='black',pch=20,type='l',xlab='date',ylab='difference in counts (%)',main='Michigan')
```




```
#The plot is slightly increasing, showing that the winning rate for Clinton is
#increasing slowly.
```

```
counts_Geo_for_lm <- data.frame(
  data_date = date_Geo,
  percentage_diff = (polls_data_2016$total.clinton[index_Geo]-
                       polls_data_2016$total.trump[index_Geo])/
    (polls_data_2016$total.clinton[index_Geo]+
       polls_data_2016$total.trump[index_Geo])
)
as.numeric(date_Geo)
```

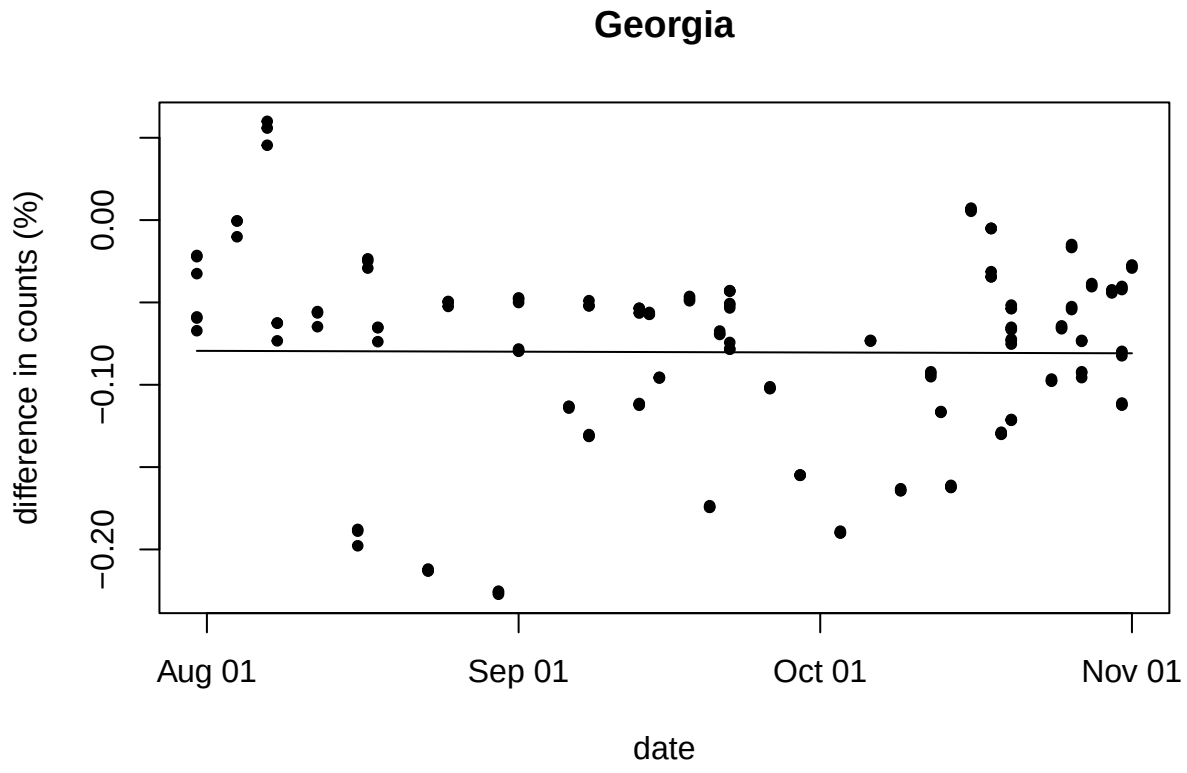
```
##   [1] 17013 17013 17013 17013 17013 17013 17017 17017 17017 17020 17020 17020
##  [13] 17021 17021 17021 17025 17025 17025 17029 17029 17029 17030 17030 17030
##  [25] 17031 17031 17031 17036 17036 17036 17038 17038 17038 17043 17043 17043
##  [37] 17045 17045 17045 17045 17045 17045 17050 17050 17050 17052 17052 17052
##  [49] 17052 17052 17052 17057 17057 17057 17057 17057 17057 17058 17058 17058
##  [61] 17059 17059 17059 17062 17062 17062 17064 17064 17064 17065 17065 17065
##  [73] 17066 17066 17066 17066 17066 17066 17066 17066 17066 17070 17070 17070
##  [85] 17073 17073 17073 17077 17077 17077 17080 17080 17080 17083 17083 17083
##  [97] 17086 17086 17086 17087 17087 17087 17088 17088 17088 17090 17090 17090
## [109] 17092 17092 17092 17092 17092 17092 17093 17093 17093 17094 17094 17094
## [121] 17094 17094 17094 17094 17094 17094 17094 17094 17094 17098 17098 17098
## [133] 17099 17099 17099 17100 17100 17100 17100 17100 17100 17101 17101 17101
## [145] 17101 17101 17101 17102 17102 17102 17104 17104 17104 17105 17105 17105
```

```
## [157] 17105 17105 17105 17105 17105 17105 17106 17106 17106
```

```
lm_model_Geo=lm(percentage_diff~(data_date),data=counts_Geo_for_lm)
summary(lm_model_Geo)
```

```
##
## Call:
## lm(formula = percentage_diff ~ (data_date), data = counts_Geo_for_lm)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.14732 -0.03146  0.01223  0.03239  0.13947
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  1.920e-01  2.610e+00   0.074    0.941
## data_date   -1.595e-05  1.529e-04  -0.104    0.917
##
## Residual standard error: 0.05609 on 163 degrees of freedom
## Multiple R-squared:  6.675e-05,  Adjusted R-squared:  -0.006068
## F-statistic: 0.01088 on 1 and 163 DF,  p-value: 0.917
```

```
#Here, the coefficient for data_date is -1.595e-05, which is also not
#statistically significant (p = 0.917). This means there is no significant
#linear trend in the percentage difference in polls over time for this state.
#The Adjusted R-squared value is -0.006068, suggesting that the model doesn't
#explain the variance in the data well.

plot(counts_Geo_for_lm$data_date,counts_Geo_for_lm$percentage_diff,
     col='black',pch=20,type='p',xlab='date',ylab='difference in counts (%)',main='Georgia')
lines(counts_Geo_for_lm$data_date,lm_model_Geo$fitted.values,
      col='black',pch=20,type='l',xlab='date',ylab='difference in counts (%)',main='Georgia')
```




```
#The plot is almost horizontal, showing that the winning rate for Clinton/Trimp
#is not significantly changing. So it would be the closest race.
```

```
counts_Nor_for_lm <- data.frame(
  data_date = date_Nor,
  percentage_diff = (polls_data_2016$total.clinton[index_Nor]-
                       polls_data_2016$total.trump[index_Nor])/
    (polls_data_2016$total.clinton[index_Nor]+
       polls_data_2016$total.trump[index_Nor])
)
as.numeric(date_Nor)
```

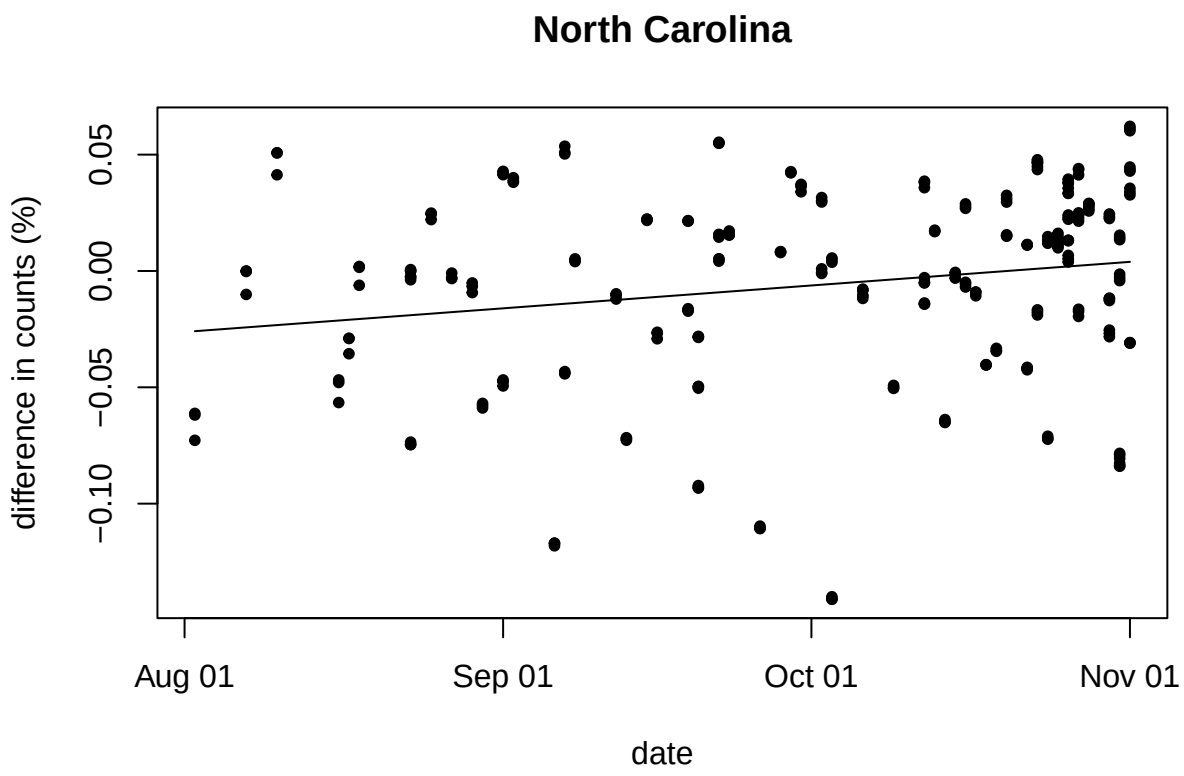
```
##   [1] 17015 17015 17015 17020 17020 17020 17023 17023 17023 17029 17029 17029
##  [13] 17030 17030 17030 17031 17031 17031 17036 17036 17036 17036 17036 17036
##  [25] 17036 17036 17036 17038 17038 17038 17040 17040 17040 17042 17042 17042
##  [37] 17043 17043 17043 17045 17045 17045 17045 17045 17045 17046 17046 17046
##  [49] 17050 17050 17050 17051 17051 17051 17051 17051 17051 17052 17052 17052
##  [61] 17056 17056 17056 17057 17057 17057 17059 17059 17059 17060 17060 17060
##  [73] 17063 17063 17063 17063 17063 17063 17064 17064 17064 17064 17064 17064
##  [85] 17064 17064 17064 17066 17066 17066 17066 17066 17066 17066 17066 17066
##  [97] 17067 17067 17067 17070 17070 17070 17072 17072 17072 17073 17073 17073
## [109] 17074 17074 17074 17076 17076 17076 17076 17076 17076 17077 17077 17077
## [121] 17077 17077 17077 17080 17080 17080 17080 17080 17080 17083 17083 17083
## [133] 17086 17086 17086 17086 17086 17086 17086 17086 17086 17087 17087 17087
## [145] 17088 17088 17088 17089 17089 17089 17090 17090 17090 17090 17090 17090
```

```
## [157] 17091 17091 17091 17092 17092 17092 17093 17093 17093 17094 17094 17094
## [169] 17094 17094 17094 17096 17096 17096 17096 17096 17096 17097 17097 17097
## [181] 17097 17097 17097 17097 17097 17097 17098 17098 17098 17098 17098 17098
## [193] 17099 17099 17099 17099 17099 17099 17100 17100 17100 17100 17100 17100
## [205] 17100 17100 17100 17100 17100 17100 17100 17100 17100 17101 17101 17101
## [217] 17101 17101 17101 17101 17101 17101 17101 17101 17101 17102 17102 17102
## [229] 17102 17102 17102 17104 17104 17104 17104 17104 17104 17104 17104 17104
## [241] 17105 17105 17105 17105 17105 17105 17105 17105 17105 17105 17105 17105
## [253] 17106 17106 17106 17106 17106 17106 17106 17106 17106 17106 17106 17106
```

```
lm_model_Nor=lm(percentage_diff~(data_date),data=counts_Nor_for_lm)
summary(lm_model_Nor)
```

```
##
## Call:
## lm(formula = percentage_diff ~ (data_date), data = counts_Nor_for_lm)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.13551 -0.02274  0.01072  0.02690  0.07406
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) -5.5960539  1.7205518  -3.252  0.00129 **
## data_date    0.0003274  0.0001008   3.249  0.00131 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.04147 on 262 degrees of freedom
## Multiple R-squared:  0.03873,    Adjusted R-squared:  0.03506
## F-statistic: 10.56 on 1 and 262 DF,  p-value: 0.001309
```

```
#The coefficient for data_date is 0.0003274, which is statistically
#significant (p = 0.00131). This suggests there is a significant positive
#linear trend in the percentage difference in polls over time for this state.
#The Adjusted R-squared value is 0.03506, indicating that the model explains
#about 3.5% of the variance in the data, which is relatively low, but higher
#than the other two states.

plot(counts_Nor_for_lm$data_date,counts_Nor_for_lm$percentage_diff,
     col='black',pch=20,type='p',xlab='date',ylab='difference in counts (%)',main='North Carolina')
lines(counts_Nor_for_lm$data_date,lm_model_Nor$fitted.values,
      col='black',pch=20,type='l',xlab='date',ylab='difference in counts (%)',main='North Carolina')
```




```
#The plot is slightly increasing, showing that the winning rate for Clinton is
#increasing slowly.
```

```
##Part e
#In reality North Carolina voted 49.83% Trump 46.17% Clinton,
#Michigan voted 47.25% Trump 47.03% Clinton and Georgia voted 50.38%
#Trump 45.29% Clinton. The smallest margin was in Michigan with 0.22%
#Based on the provided real election data, indeed, the state with the smallest
#margin in the 2016 election is Georgia, with a difference of only 0.22%.
#However, if we compare these results with the predictions from the polls,
#there might be some discrepancies. As per the polls, the state of Michigan was
#expected to favor Clinton significantly, whereas the actual results show a rather
#close election. Similarly, in Georgia and North Carolina, the margin of
#difference between the two candidates in actual results appears to be
#smaller than predicted by the polls.

##Potential problems:
#1. Sampling bias: Polls are based on a sample of voters rather than the entire
#population of voters.
#2. Late decision-makers: Some voters might not have made up their minds when
#they were polled but decided later on, and these late deciders might have
#favored Trump over Biden. These changes would not have been captured in polls.
```

```
##Part f
#In Michigan, the polls indicated that Clinton would win (average of 26.7% more
```

```
#votes than Trump). According to the data we got, Clinton won,
#but the margin was only 2.78%. This indicates a significant overestimation of #Democratic support in t

#In Georgia, the polls showed Trump winning (average of 52% more votes than
#Clinton). The actual result, however, was a narrow win for Clinton (0.23%
#margin). This suggests a significant underestimation of Democratic support
#in the polls.

#In North Carolina, the polls indicated a close race, but slightly favored Trump
#(average of 3.08% more votes than Clinton). The actual results showed a
#win for Clinton, albeit with a -1.34% margin.
#This again suggests an underestimation of Democratic support in the polls.

##Potential problems:
#1. ifferential turnout: The voters who actually turn up to vote on Election Day
#may not be the same as those who responded to the polls. For example,
#if Trump supporters were more motivated to vote than Biden supporters,
#this could have led to Trump receiving a higher proportion of the votes than
#expected.

#2. Shy Trump voters: Some research suggests that there may be a subset of Trump
#voters who were reluctant to express their support for him in a polling
#situation, but who did vote for him on Election Day. If this were the case,
#it could explain why Trump's actual vote share was higher than the polls
#predicted.
```

Untitled

Haocheng Zhang

2023-05-28

```
##Q2
#load the data
polls_data_2020 = read.csv("president_polls_2020.csv")
library(lubridate)
```

```
##
## Attaching package: 'lubridate'
```

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

```
#Filter the data
date_2020= mdy(polls_data_2020$end_date)
index_selected=which(date_2020>='2020-08-01' & date_2020<='2020-11-02')
polls_data_2020 = polls_data_2020[index_selected,]

polls_data_2020_question_id_num=unique(polls_data_2020$question_id)

for(i in 1:length(unique(polls_data_2020$question_id)) ){
  index_set=which(polls_data_2020$question_id==
  polls_data_2020_question_id_num[i])
  if(length(index_set)!=2){
    polls_data_2020=polls_data_2020[-index_set,]
  }
}
index_NA=which(is.na(polls_data_2020$sample_size)==T)
index_NA
```

```
## [1] 6459 6460
```

```
polls_data_2020=polls_data_2020[-index_NA,]
```

```
# Part a
index_biden_Mic_2020=which(polls_data_2020$answer=='Biden' & polls_data_2020$state=="Michigan")
index_trump_Mic_2020=which(polls_data_2020$answer=='Trump' & polls_data_2020$state=="Michigan")

counts_biden_Mic_2020=polls_data_2020$pct[index_biden_Mic_2020]*
polls_data_2020$sample_size[index_biden_Mic_2020]
counts_trump_Mic_2020=polls_data_2020$pct[index_trump_Mic_2020]*
```

```
polls_data_2020$sample_size[index_trump_Mic_2020]

n1_2020_Mic=sum(counts_biden_Mic_2020)
n2_2020_Mic=sum(counts_trump_Mic_2020)

n1_2020_Mic
```

```
## [1] 15356023
```

```
n2_2020_Mic
```

```
## [1] 13020191
```

```
(n1_2020_Mic-n2_2020_Mic)/(n1_2020_Mic+n2_2020_Mic)
```

```
## [1] 0.08231654
```

```
#The final result is 0.08231654, which shows Biden was ahead with 8.231654%
```

```
index_biden_Geo_2020=which(polls_data_2020$answer=='Biden' & polls_data_2020$state=="Georgia")
index_trump_Geo_2020=which(polls_data_2020$answer=='Trump' & polls_data_2020$state=="Georgia")

counts_biden_Geo_2020=polls_data_2020$pct[index_biden_Geo_2020]*
polls_data_2020$sample_size[index_biden_Geo_2020]
counts_trump_Geo_2020=polls_data_2020$pct[index_trump_Geo_2020]*
polls_data_2020$sample_size[index_trump_Geo_2020]

n1_2020_Geo=sum(counts_biden_Geo_2020)
n2_2020_Geo=sum(counts_trump_Geo_2020)

n1_2020_Geo
```

```
## [1] 13307078
```

```
n2_2020_Geo
```

```
## [1] 12437490
```

```
(n1_2020_Geo-n2_2020_Geo)/(n1_2020_Geo+n2_2020_Geo)
```

```
## [1] 0.03377752
```

```
#The final result is 0.03377752, which shows Biden was ahead with 3.377752%
```

```
index_biden_Nor_2020=which(polls_data_2020$answer=='Biden' & polls_data_2020$state=="North Carolina")
index_trump_Nor_2020=which(polls_data_2020$answer=='Trump' & polls_data_2020$state=="North Carolina")

counts_biden_Nor_2020=polls_data_2020$pct[index_biden_Nor_2020]*
```

```
polls_data_2020$sample_size[index_biden_Nor_2020]
counts_trump_Nor_2020=polls_data_2020$pct[index_trump_Nor_2020]*
polls_data_2020$sample_size[index_trump_Nor_2020]

n1_2020_Nor=sum(counts_biden_Nor_2020)
n2_2020_Nor=sum(counts_trump_Nor_2020)

n1_2020_Nor
```

```
## [1] 16857852
```

```
n2_2020_Nor
```

```
## [1] 14997186
```

```
(n1_2020_Nor-n2_2020_Nor)/(n1_2020_Nor+n2_2020_Nor)
```

```
## [1] 0.05841043
```

```
#The final result is 0.05841043, which shows Biden was ahead with 5.841043%
```

```
# Part b
library(lubridate)
polls_data_2020$enddate
```

```
## NULL
```

```
t.test(polls_data_2020$pct[index_biden_Mic_2020]*polls_data_2020$
sample_size[index_biden_Mic_2020]-polls_data_2020$pct[index_trump_Mic_2020]*
polls_data_2020$sample_size[index_trump_Mic_2020],alternative='greater')
```

```
##
##  One Sample t-test
##
## data:  polls_data_2020$pct[index_biden_Mic_2020] * polls_data_2020$sample_size[index_biden_Mic_2020]
## t = 10.147, df = 101, p-value < 2.2e-16
## alternative hypothesis: true mean is greater than 0
## 95 percent confidence interval:
##  19153.57      Inf
## sample estimates:
## mean of x
##  22900.31
```

```
##The t-test result shows a t-value of 10.147 with 101 degrees of freedom.
#The test's p-value is less than 2.2e-16, which is effectively zero and therefore
#statistically significant. This means there's a statistically significant
#difference between the counts in polls for Biden and Trump in favor of
#Biden. The confidence interval does not include 0 (22.52678 to infinity),
#and the estimated mean difference is 22900, both of which further support
#Biden being favored in this state.
```

```
t.test(polls_data_2020$pct[index_biden_Geo_2020]*polls_data_2020$
sample_size[index_biden_Geo_2020]-polls_data_2020$pct[index_trump_Geo_2020]*
polls_data_2020$sample_size[index_trump_Geo_2020],alternative='greater')
```

```
##
##  One Sample t-test
##
## data:  polls_data_2020$pct[index_biden_Geo_2020] * polls_data_2020$sample_size[index_biden_Geo_2020]
## t = 6.8926, df = 76, p-value = 6.991e-10
## alternative hypothesis: true mean is greater than 0
## 95 percent confidence interval:
##  8565.036      Inf
## sample estimates:
## mean of x
##  11293.34
```

```
##The t-test result shows a t-value of 6.8926 with 76 degrees of freedom.
#The test's p-value is less than 6.991e-10, which is effectively zero and
#therefore statistically significant. This means there's a statistically
#significant difference between the counts in polls for Biden and Trump in favor
#Biden. The confidence interval does not include 0 (22.52678 to infinity),
#and the estimated mean difference is 11293.34, both of which further support
#Biden being favored in this state.
```

```
t.test(polls_data_2020$pct[index_biden_Nor_2020]*polls_data_2020$
sample_size[index_biden_Nor_2020]-polls_data_2020$pct[index_trump_Nor_2020]*
polls_data_2020$sample_size[index_trump_Nor_2020],alternative='greater')
```

```
##
##  One Sample t-test
##
## data:  polls_data_2020$pct[index_biden_Nor_2020] * polls_data_2020$sample_size[index_biden_Nor_2020]
## t = 8.4302, df = 107, p-value = 8.801e-14
## alternative hypothesis: true mean is greater than 0
## 95 percent confidence interval:
##  13837.52      Inf
## sample estimates:
## mean of x
##  17228.39
```

```
##The t-test result shows a t-value of 8.4302 with 107 degrees of freedom.
#The test's p-value is less than 8.801e-14, which is effectively zero and
#therefore statistically significant. This means there's a statistically
#significant difference between the counts in polls for Biden and Trump in favor
#Biden. The confidence interval does not include 0 (22.52678 to infinity),
#and the estimated mean difference is 17228.39, both of which further support
#Biden being favored in this state.

#A potential problem with these tests could be the assumption of normality.
#The t-test assumes that the differences in the data are normally distributed.
#If this assumption is not met, the results may not be valid. Additionally,
#outliers could affect the results of the t-test, leading to biased results.
```

```
#Finally, these tests do not account for other factors that could influence
#the election results, such as demographic variables or the timing of the polls.
```

```
# Part c

wilcox.test(polls_data_2020$pct[index_biden_Mic_2020]*polls_data_2020$
              sample_size[index_biden_Mic_2020],polls_data_2020$
              pct[index_trump_Mic_2020]*
              polls_data_2020$sample_size[index_trump_Mic_2020],
            alternative = "greater")
```

```
##
##  Wilcoxon rank sum test with continuity correction
##
## data:  polls_data_2020$pct[index_biden_Mic_2020] * polls_data_2020$sample_size[index_biden_Mic_2020]
## W = 6042, p-value = 0.02322
## alternative hypothesis: true location shift is greater than 0
```

```
#The Wilcoxon rank sum test shows a W-value of 6042 and a p-value of 0.02322.
#Because the p-value is less than the traditional alpha level of 0.05, we can
#conclude that there is a statistically significant difference between the
#counts in polls for Biden and Trump in favor of Clinton. This is because
#the test's alternative hypothesis is that the true location shift is greater
#than 0, which suggests a preference for Biden.
```

```
wilcox.test(polls_data_2020$pct[index_biden_Geo_2020]*
              polls_data_2020$sample_size[index_biden_Geo_2020],
            polls_data_2020$pct[index_trump_Geo_2020]*
              polls_data_2020$sample_size[index_trump_Geo_2020],
            alternative='greater')
```

```
##
##  Wilcoxon rank sum test with continuity correction
##
## data:  polls_data_2020$pct[index_biden_Geo_2020] * polls_data_2020$sample_size[index_biden_Geo_2020]
## W = 3203, p-value = 0.1949
## alternative hypothesis: true location shift is greater than 0
```

```
#The Wilcoxon rank sum test shows a W-value of 3203 and a p-value of 0.1949.
#Because the p-value is greater than the traditional alpha level of 0.05,
#we can't conclude that there is a
#statistically significant difference between the counts in polls for Biden
#and Trump. Despite this, the alternative hypothesis suggests a preference for
#Biden, but we can't confidently affirm this due to the lack of statistical #significance.
```

```
wilcox.test(polls_data_2020$pct[index_biden_Nor_2020]*polls_data_2020$
              sample_size[index_biden_Nor_2020]-polls_data_2020$
              pct[index_trump_Nor_2020]*polls_data_2020$
              sample_size[index_trump_Nor_2020],
            alternative='greater')
```

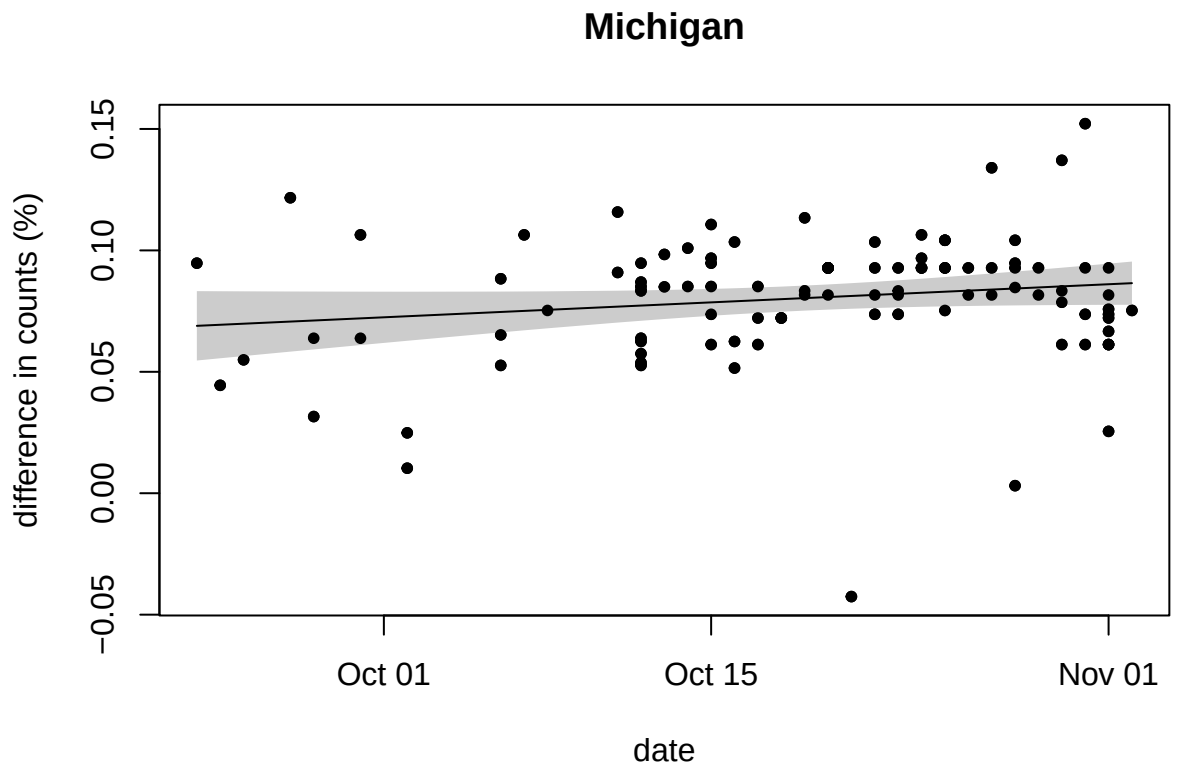
```
##
##  Wilcoxon signed rank test with continuity correction
##
## data:  polls_data_2020$pct[index_biden_Nor_2020] * polls_data_2020$sample_size[index_biden_Nor_2020]
## V = 4999, p-value = 1.205e-15
## alternative hypothesis: true location is greater than 0
```

```
#The Wilcoxon rank sum test shows a W-value of 4999 and a p-value of 1.205e-15.
#Because the p-value is less than the traditional alpha level of 0.05, we can
#conclude that there is a statistically significant difference between the
#counts in polls for Biden and Trump in favor of Clinton. This is because
#the test's alternative hypothesis is that the true location shift is greater
#than 0, which suggests a preference for Biden.

##Potential issues with the Wilcoxon signed-rank test include the assumption of
#symmetry, i.e., the distribution of differences between the pairs should be
#symmetrical. If this assumption is not met, the results may not be valid.
#Furthermore, outliers can impact the Wilcoxon test as the rank of the outliers
#will be affected, thereby influencing the test results. As with the t-test,
#these tests do not account for other factors that could influence the election
#results, such as demographic variables or the timing of the polls.
```

```
# Part d

counts_Mic_for_lm_2020 <- data.frame(
  data_date = date_2020[index_trump_Mic_2020],
  percentage_diff = (counts_biden_Mic_2020-counts_trump_Mic_2020)/
    (counts_biden_Mic_2020+counts_trump_Mic_2020)
)

lm_model_Mic_2020=lm(percentage_diff~(data_date),data=counts_Mic_for_lm_2020)
summary(lm_model_Mic_2020)
```

```
##
## Call:
## lm(formula = percentage_diff ~ (data_date), data = counts_Mic_for_lm_2020)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.123785 -0.011763  0.002129  0.011990  0.066550
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) -8.0684484  4.8076060  -1.678   0.0964 .
## data_date    0.0004392  0.0002591   1.695   0.0932 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.02624 on 100 degrees of freedom
## Multiple R-squared:  0.02793,    Adjusted R-squared:  0.01821
## F-statistic: 2.873 on 1 and 100 DF,  p-value: 0.09319
```

```r
conf_interval_Mic_fitted_2020= predict(lm_model_Mic_2020, newdata=counts_Mic_for_lm_2020, interval="con
                                       level = 0.95)

plot(counts_Mic_for_lm_2020$data_date,counts_Mic_for_lm_2020$percentage_diff,
     col='black',pch=20,type='p',xlab='date',ylab='difference in counts (%)',main='Michigan')
polygon(c(rev(counts_Mic_for_lm_2020$data_date),
          counts_Mic_for_lm_2020$data_date),
        c(rev(conf_interval_Mic_fitted_2020[,2]),
          conf_interval_Mic_fitted_2020[ ,3]), col = 'grey80', border = NA)
lines(counts_Mic_for_lm_2020$data_date,lm_model_Mic_2020$fitted.values,
      col='black',pch=20,type='l',xlab='date',ylab='difference in counts (%)',main='Michigan')
lines(counts_Mic_for_lm_2020$data_date,counts_Mic_for_lm_2020$percentage_diff,
      col='black',pch=20,type='p',xlab='date',ylab='difference in counts (%)',main='Michigan')
```

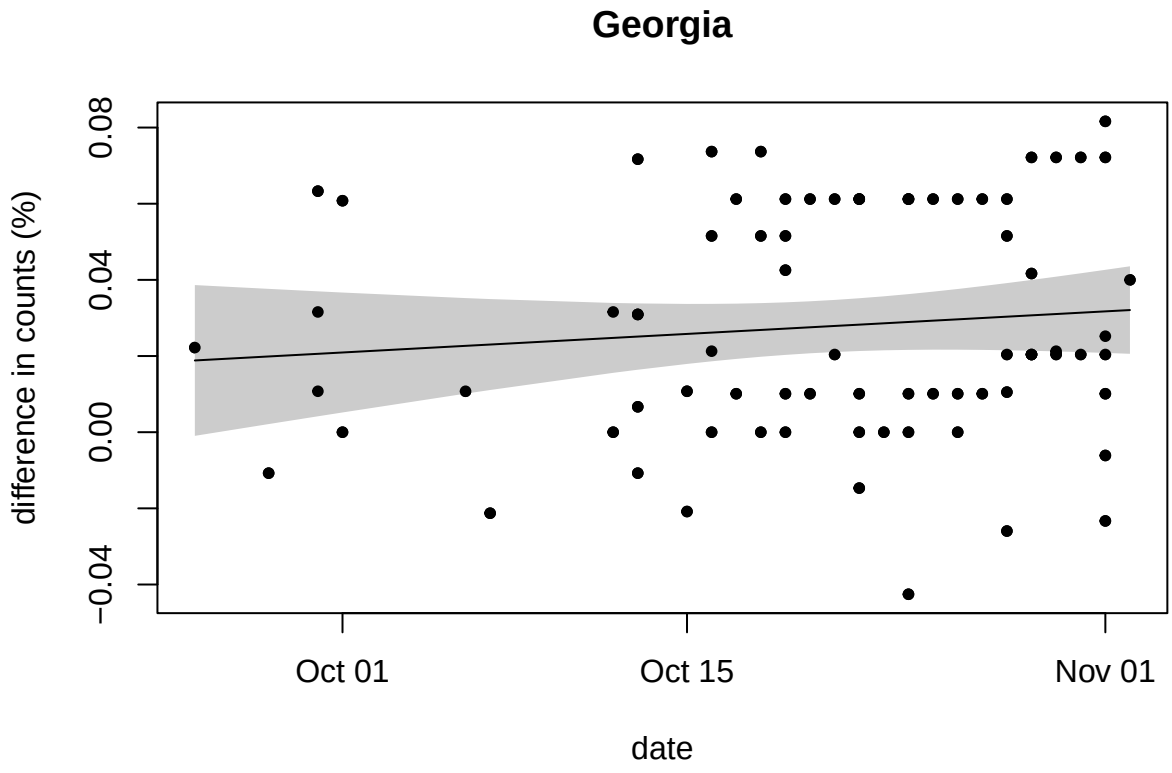



```r
#The plot is slightly increasing, showing that the winning rate for Biden is
#increasing slowly.
```

```r
counts_Geo_for_lm_2020 <- data.frame(
  data_date = date_2020[index_trump_Geo_2020],
  percentage_diff = (counts_biden_Geo_2020-counts_trump_Geo_2020)/(counts_biden_Geo_2020+counts_trump_G
)

lm_model_Geo_2020=lm(percentage_diff~(data_date),data=counts_Geo_for_lm_2020)
summary(lm_model_Geo_2020)
```

```
##
## Call:
## lm(formula = percentage_diff ~ (data_date), data = counts_Geo_for_lm_2020)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.071497 -0.019887 -0.009757  0.031584  0.049903
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) -6.4355049  6.8214883  -0.943    0.348
## data_date    0.0003483  0.0003676   0.947    0.346
##
## Residual standard error: 0.03006 on 75 degrees of freedom
## Multiple R-squared:  0.01183,    Adjusted R-squared:  -0.001348
## F-statistic: 0.8977 on 1 and 75 DF,  p-value: 0.3464
```

```
conf_interval_Geo_fitted_2020= predict(lm_model_Geo_2020, newdata=counts_Geo_for_lm_2020, interval="con
                                       level = 0.95)

plot(counts_Geo_for_lm_2020$data_date,counts_Geo_for_lm_2020$percentage_diff,
     col='black',pch=20,type='p',xlab='date',ylab='difference in counts (%)',main='Georgia')
polygon(c(rev(counts_Geo_for_lm_2020$data_date), counts_Geo_for_lm_2020$data_date),
        c(rev(conf_interval_Geo_fitted_2020[,2]), conf_interval_Geo_fitted_2020[ ,3]), col = 'grey80', b
lines(counts_Geo_for_lm_2020$data_date,lm_model_Geo_2020$fitted.values,
      col='black',pch=20,type='l',xlab='date',ylab='difference in counts (%)',main='Georgia')
lines(counts_Geo_for_lm_2020$data_date,counts_Geo_for_lm_2020$percentage_diff,
      col='black',pch=20,type='p',xlab='date',ylab='difference in counts (%)',main='Georgia')
```



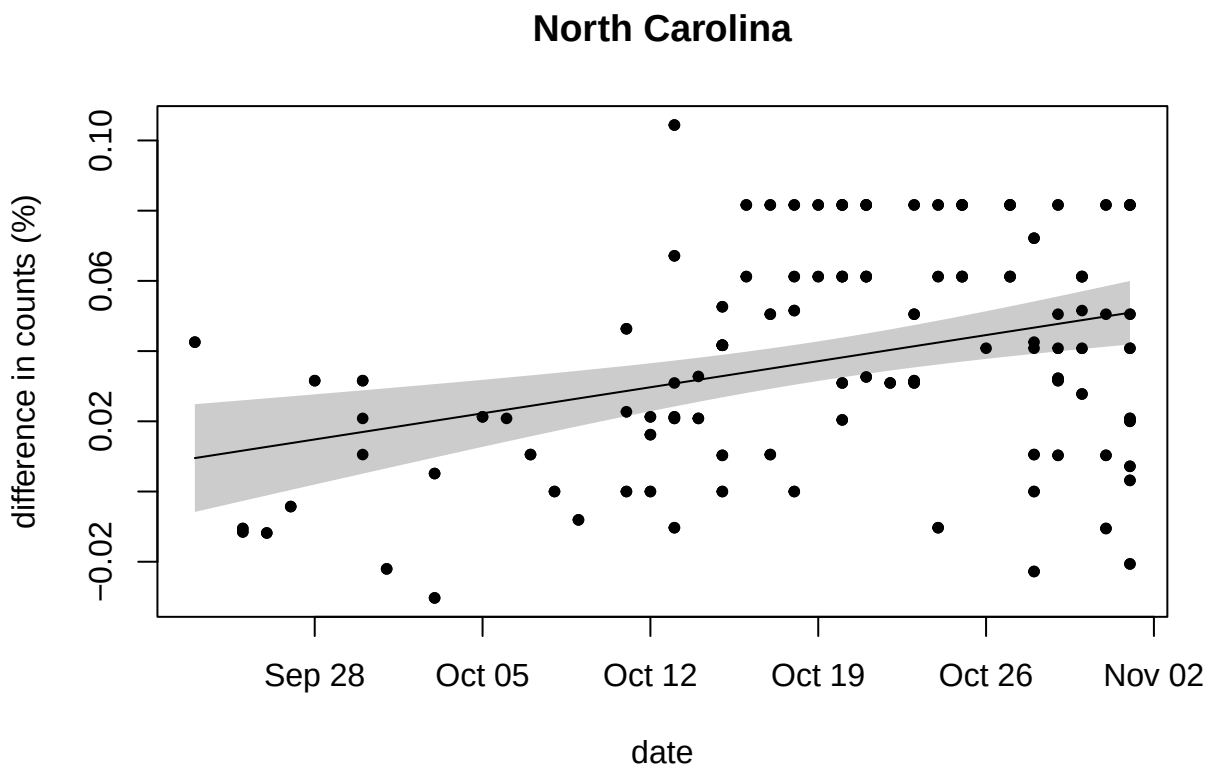

```
#The plot is slightly increasing, showing that the winning rate for Biden is
#increasing slowly.
```

```
counts_Nor_for_lm_2020 <- data.frame(
  data_date = date_2020[index_trump_Nor_2020],
  percentage_diff = (counts_biden_Nor_2020-counts_trump_Nor_2020)/(counts_biden_Nor_2020+counts_trump_N
)

lm_model_Nor_2020=lm(percentage_diff~(data_date),data=counts_Nor_for_lm_2020)
summary(lm_model_Nor_2020)
```

```
##
## Call:
## lm(formula = percentage_diff ~ (data_date), data = counts_Nor_for_lm_2020)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.071556 -0.021322 -0.000993  0.022232  0.073634
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) -1.966e+01  5.124e+00  -3.838 0.000211 ***
## data_date    1.062e-03  2.761e-04   3.845 0.000206 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## Residual standard error: 0.02954 on 106 degrees of freedom
## Multiple R-squared:  0.1224, Adjusted R-squared:  0.1141
## F-statistic: 14.78 on 1 and 106 DF,  p-value: 0.0002061
```

```
conf_interval_Nor_fitted_2020= predict(lm_model_Nor_2020, newdata=counts_Nor_for_lm_2020, interval="con
                                       level = 0.95)

plot(counts_Nor_for_lm_2020$data_date,counts_Nor_for_lm_2020$percentage_diff,
     col='black',pch=20,type='p',xlab='date',ylab='difference in counts (%)',main='North Carolina')
polygon(c(rev(counts_Nor_for_lm_2020$data_date), counts_Nor_for_lm_2020$data_date),
        c(rev(conf_interval_Nor_fitted_2020[,2]), conf_interval_Nor_fitted_2020[ ,3]), col = 'grey80', l
lines(counts_Nor_for_lm_2020$data_date,lm_model_Nor_2020$fitted.values,
      col='black',pch=20,type='l',xlab='date',ylab='difference in counts (%)',main='North Carolina')
lines(counts_Nor_for_lm_2020$data_date,counts_Nor_for_lm_2020$percentage_diff,
      col='black',pch=20,type='p',xlab='date',ylab='difference in counts (%)',main='North Carolina')
```




```
#The plot is significantly increasing, showing that the winning rate for Biden is
#increasing significantly.
```

```
##Part e
#In Michigan the true difference was 50.62% Biden - 47.84% Trump = 2.78%.
#In Georgia the difference was 49.47% Biden - 49.24% Trump = 0.23%.
#In North Carolina the difference was 49.93% Biden - 48.59% Trump = -1.34%.
#The state with the closest margin was Georgia. The polls were correct
```

```
#that Georgia would be the closest race. However they were incorrect on the #prediction that Biden woul
#As per the polls, the state of Michigan was expected to favor Biden
#significantly, whereas the actual results show a rather close election.

##Potential problems:
#1. Sampling bias: Polls are based on a sample of voters rather than the entire
#population of voters.
#2. Late decision-makers: Some voters might not have made up their minds when
#they were polled but decided later on, and these late deciders might have
#favored Trump over Biden. These changes would not have been captured in polls.
```

```
##Part f
#In Michigan, the polls indicated that Biden would win
#According to the data we got, Biden won,

#In Georgia, the polls indicated that Biden would win
#According to the data we got, Biden won,

#In North Carolina, the polls indicated Biden would win, but
#as a result, Trump won.

##Potential problems:
#1. ifferential turnout: The voters who actually turn up to vote on Election Day
#may not be the same as those who responded to the polls. For example,
#if Trump supporters were more motivated to vote than Biden supporters,
#this could have led to Trump receiving a higher proportion of the votes than
#expected.

#2. Shy Trump voters: Some research suggests that there may be a subset of Trump
#voters who were reluctant to express their support for him in a polling
#situation, but who did vote for him on Election Day. If this were the case,
#it could explain why Trump's actual vote share was higher than the polls
#predicted.
```

Untitled

Haocheng Zhang

2023-05-28

```
##Q3
#Load the data
polls_data_2016 = read.csv("president_general_polls_sorted_end_date_2016.csv")
polls_data_2020 = read.csv("president_polls_2020.csv")
library(lubridate)
```

```
##
## Attaching package: 'lubridate'

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

```
library(usmap)
library(ggplot2)

date_2016= mdy(polls_data_2016$createddate)
index_selected=which(date_2016>='2016-09-01' & date_2016<='2016-11-02')
polls_data_2016 = polls_data_2016[index_selected,]

date_2020= mdy(polls_data_2020$end_date)

index_selected=which(date_2020>='2020-09-01' & date_2020<='2020-11-02')
polls_data_2020=polls_data_2020[index_selected,]

index_na=which(is.na(polls_data_2020$sample_size)==T)

polls_data_2020=polls_data_2020[which(polls_data_2020$answer==
                                        'Biden'|polls_data_2020$answer=='Trump'),]

delete_index=which( (polls_data_2020$pollster_id==
                       1610|polls_data_2020$pollster_id==1193)&
                      mdy(polls_data_2020$end_date)!= "2020-11-01")
polls_data_2020=polls_data_2020[-delete_index,]

##now let's delete those poll that only contains one candidate
polls_data_2020_question_id_num=unique(polls_data_2020$question_id)
##clean the data
for(i in 1:length(unique(polls_data_2020$question_id)) ){
  index_set=which(polls_data_2020$question_id==
                    polls_data_2020_question_id_num[i])
```

```
  if(length(index_set)!=2){
    polls_data_2020=polls_data_2020[-index_set,]
  }
}

index_NA=which(is.na(polls_data_2020$sample_size)==T)

polls_data_2020=polls_data_2020[-index_NA,]

polls_data_2016_enddate=mdy(polls_data_2016$enddate)

poll_state_sum_clinton_2016=aggregate(polls_data_2016$total.clinton,
                                      by=list(State=polls_data_2016$state),
                                      FUN=sum)
poll_state_sum_trump_2016=aggregate(polls_data_2016$total.trump,
                                    by=list(State=polls_data_2016$state),
                                    FUN=sum)

poll_state_diff_percentage=poll_state_sum_clinton_2016
poll_state_diff_percentage[,2]=(poll_state_sum_clinton_2016[,2]-
                                  poll_state_sum_trump_2016[,2])/
  (poll_state_sum_clinton_2016[,2]+poll_state_sum_trump_2016[,2])
delete_index=which(levels(poll_state_diff_percentage[,1])=='U.S.')
if(length(delete_index)>0){
  poll_state_diff_percentage=poll_state_diff_percentage[-delete_index,]
  poll_state_diff_percentage[,1]
}

state_poll_2016 <- data.frame(
  state =poll_state_diff_percentage[,1],
  diff_percentage=poll_state_diff_percentage[,2]
)

index_biden_2020=which(polls_data_2020$answer=='Biden')
index_trump_2020=which(polls_data_2020$answer=='Trump' )

counts_biden_2020=polls_data_2020$pct[index_biden_2020]*
  polls_data_2020$sample_size[index_biden_2020]
counts_trump_2020=polls_data_2020$pct[index_trump_2020]*
  polls_data_2020$sample_size[index_trump_2020]

polls_data_2020$total.biden=rep(0,dim(polls_data_2020)[1])
polls_data_2020$total.trump=rep(0,dim(polls_data_2020)[1])

polls_data_2020$total.biden[index_biden_2020]=counts_biden_2020
polls_data_2020$total.trump[index_trump_2020]=counts_trump_2020

poll_state_sum_biden_2020=aggregate(polls_data_2020$total.biden,
                                    by=list(State=polls_data_2020$state),
                                    FUN=sum)
poll_state_sum_trump_2020=aggregate(polls_data_2020$total.trump,
                                    by=list(State=polls_data_2020$state),
                                    FUN=sum)
```

```
poll_state_sum_biden_2020=poll_state_sum_biden_2020[-1,]
poll_state_sum_trump_2020=poll_state_sum_trump_2020[-1,]

state_poll_2020 <- data.frame(
  state =poll_state_sum_biden_2020[,1],
  diff_percentage=(poll_state_sum_biden_2020[,2]-
                     poll_state_sum_trump_2020[,2])/
    (poll_state_sum_biden_2020[,2]+poll_state_sum_trump_2020[,2])
)

limit_val=c(min(state_poll_2016$diff_percentage,state_poll_2020$diff_percentage),
            max(state_poll_2016$diff_percentage,state_poll_2020$diff_percentage))



##difference between 2020 and 2016
##delete nebrask CD-1 and CD-3, US, as 2020 does not have it
state_poll_2016$state
```

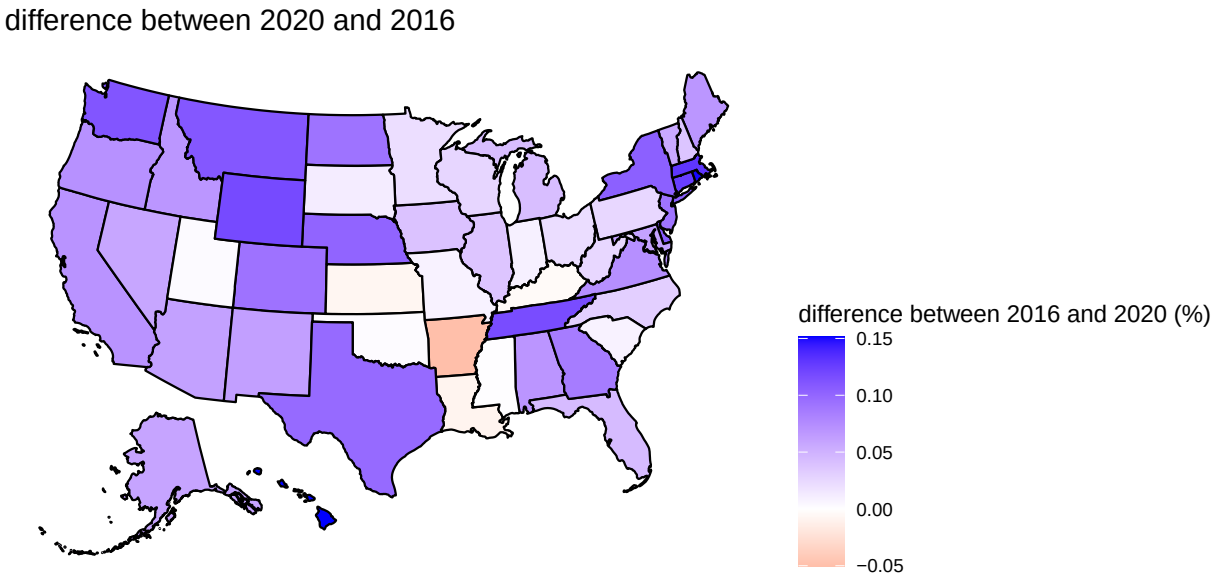
```
##  [1] "Alabama"              "Alaska"               "Arizona"
##  [4] "Arkansas"             "California"           "Colorado"
##  [7] "Connecticut"          "Delaware"             "District of Columbia"
## [10] "Florida"              "Georgia"              "Hawaii"
## [13] "Idaho"                "Illinois"             "Indiana"
## [16] "Iowa"                 "Kansas"               "Kentucky"
## [19] "Louisiana"            "Maine"                "Maine CD-1"
## [22] "Maine CD-2"           "Maryland"             "Massachusetts"
## [25] "Michigan"             "Minnesota"            "Mississippi"
## [28] "Missouri"             "Montana"              "Nebraska"
## [31] "Nebraska CD-1"        "Nebraska CD-2"        "Nebraska CD-3"
## [34] "Nevada"               "New Hampshire"        "New Jersey"
## [37] "New Mexico"           "New York"             "North Carolina"
## [40] "North Dakota"         "Ohio"                 "Oklahoma"
## [43] "Oregon"               "Pennsylvania"         "Rhode Island"
## [46] "South Carolina"       "South Dakota"         "Tennessee"
## [49] "Texas"                "U.S."                 "Utah"
## [52] "Vermont"              "Virginia"             "Washington"
## [55] "West Virginia"        "Wisconsin"            "Wyoming"
```

```
state_poll_2020$state
```

```
##  [1] "Alabama"              "Alaska"               "Arizona"
##  [4] "Arkansas"             "California"           "Colorado"
##  [7] "Connecticut"          "Delaware"             "District of Columbia"
## [10] "Florida"              "Georgia"              "Hawaii"
## [13] "Idaho"                "Illinois"             "Indiana"
## [16] "Iowa"                 "Kansas"               "Kentucky"
## [19] "Louisiana"            "Maine"                "Maine CD-1"
## [22] "Maine CD-2"           "Maryland"             "Massachusetts"
## [25] "Michigan"             "Minnesota"            "Mississippi"
## [28] "Missouri"             "Montana"              "Nebraska"
## [31] "Nebraska CD-2"        "Nevada"               "New Hampshire"
```

```
## [34] "New Jersey"          "New Mexico"          "New York"
## [37] "North Carolina"      "North Dakota"        "Ohio"
## [40] "Oklahoma"            "Oregon"              "Pennsylvania"
## [43] "Rhode Island"        "South Carolina"      "South Dakota"
## [46] "Tennessee"           "Texas"               "Utah"
## [49] "Vermont"             "Virginia"            "Washington"
## [52] "West Virginia"       "Wisconsin"           "Wyoming"
```

```
state_poll_2016=state_poll_2016[-c(31,33,50),]


state_poll_2020_2016_diff <- data.frame(
  state =state_poll_2020$state,
  diff=state_poll_2020$diff_percentage-state_poll_2016$diff_percentage
)

plot_usmap(data = state_poll_2020_2016_diff, values = "diff", color = "black") +
  scale_fill_gradient2(name = "difference between 2016 and 2020 (%)",
                       low= "red",
                       mid = "white",
                       high = "blue",
                       midpoint = 0)+
  theme(legend.position = "right")+
  ggtitle("difference between 2020 and 2016")
```



```
##The visual representation in these graphs suggests an increased polarization
#between the two major political parties from 2016 to 2020, with an apparent
#overall shift towards the Democratic party across the map. This shift could
#potentially be attributed to dissatisfaction with the Republican response
#to the pandemic. Additionally, it appears that discontentment with
#President Trump's administration may have contributed to this trend.
```

```
# Part b
sort_diff <- state_poll_2020_2016_diff[order(state_poll_2020_2016_diff$diff),]
sort_diff
```

```
##                  state          diff
## 4             Arkansas -0.0505050342
## 19           Louisiana -0.0090943552
## 17              Kansas -0.0072425960
## 18            Kentucky -0.0038330859
## 27         Mississippi  0.0009961673
## 40            Oklahoma  0.0027909051
## 48                Utah  0.0031269857
## 28            Missouri  0.0082034611
## 44      South Carolina  0.0085093402
## 15             Indiana  0.0097141655
## 45        South Dakota  0.0124156189
## 26           Minnesota  0.0215032573
## 39                Ohio  0.0219281680
## 52       West Virginia  0.0255757019
## 42        Pennsylvania  0.0259456912
## 53           Wisconsin  0.0267207138
## 37      North Carolina  0.0310821930
## 14             Illinois  0.0373040776
## 33       New Hampshire  0.0376230501
## 16                Iowa  0.0392003319
## 25            Michigan  0.0419562005
## 10             Florida  0.0441124664
## 49             Vermont  0.0561286088
## 32              Nevada  0.0579893834
## 2               Alaska  0.0593615071
## 23            Maryland  0.0607202788
## 3               Arizona  0.0614151801
## 35          New Mexico  0.0623467550
## 22          Maine CD-2  0.0644133478
## 20               Maine  0.0685616033
## 13               Idaho  0.0689032507
## 1              Alabama  0.0692322291
## 5           California  0.0707219888
## 41              Oregon  0.0720323199
## 50            Virginia  0.0731736945
## 11             Georgia  0.0858615596
## 34          New Jersey  0.0911912704
## 38        North Dakota  0.0920670720
## 6             Colorado  0.0923346812
## 21          Maine CD-1  0.0936457976
## 47               Texas  0.0978514945
```

```
## 30             Nebraska  0.1018085818
## 36             New York  0.1046349413
## 8              Delaware  0.1065771992
## 29              Montana  0.1098752389
## 51           Washington  0.1114424912
## 46            Tennessee  0.1168463358
## 54              Wyoming  0.1185112001
## 7           Connecticut  0.1256462051
## 24        Massachusetts  0.1302587034
## 31        Nebraska CD-2  0.1455258422
## 9  District of Columbia  0.1467290357
## 43         Rhode Island  0.1499907313
## 12               Hawaii  0.1515343018
```

```
##Based on the results, the ten battleground states in 2020 --
#defined as those with the smallest percentage differences between the two major #candidates -- would b

#Arkansas
#Louisiana
#Kansas
#Kentucky
#Mississippi
#Oklahoma
#Utah
#Missouri
#South Carolina
#Indiana
```

```
#Part(C)
print(state_poll_2020_2016_diff)
```

```
##                   state          diff
## 1               Alabama  0.0692322291
## 2                Alaska  0.0593615071
## 3               Arizona  0.0614151801
## 4              Arkansas -0.0505050342
## 5            California  0.0707219888
## 6              Colorado  0.0923346812
## 7           Connecticut  0.1256462051
## 8              Delaware  0.1065771992
## 9  District of Columbia  0.1467290357
## 10              Florida  0.0441124664
## 11              Georgia  0.0858615596
## 12               Hawaii  0.1515343018
## 13                Idaho  0.0689032507
## 14             Illinois  0.0373040776
## 15              Indiana  0.0097141655
## 16                 Iowa  0.0392003319
## 17               Kansas -0.0072425960
## 18             Kentucky -0.0038330859
## 19            Louisiana -0.0090943552
## 20                Maine  0.0685616033
## 21          Maine CD-1  0.0936457976
```

```
## 22           Maine CD-2  0.0644133478
## 23             Maryland  0.0607202788
## 24        Massachusetts  0.1302587034
## 25             Michigan  0.0419562005
## 26            Minnesota  0.0215032573
## 27          Mississippi  0.0009961673
## 28             Missouri  0.0082034611
## 29              Montana  0.1098752389
## 30             Nebraska  0.1018085818
## 31        Nebraska CD-2  0.1455258422
## 32               Nevada  0.0579893834
## 33        New Hampshire  0.0376230501
## 34           New Jersey  0.0911912704
## 35           New Mexico  0.0623467550
## 36             New York  0.1046349413
## 37       North Carolina  0.0310821930
## 38         North Dakota  0.0920670720
## 39                 Ohio  0.0219281680
## 40             Oklahoma  0.0027909051
## 41               Oregon  0.0720323199
## 42         Pennsylvania  0.0259456912
## 43         Rhode Island  0.1499907313
## 44       South Carolina  0.0085093402
## 45         South Dakota  0.0124156189
## 46            Tennessee  0.1168463358
## 47                Texas  0.0978514945
## 48                 Utah  0.0031269857
## 49              Vermont  0.0561286088
## 50             Virginia  0.0731736945
## 51           Washington  0.1114424912
## 52        West Virginia  0.0255757019
## 53            Wisconsin  0.0267207138
## 54              Wyoming  0.1185112001
```

```
##From the result in (C), in most of these states, polls may have underestimated
#the percentage of real votes received by one candidate in both 2016 and 2020,
#as most differences are positive.

#For example, in Alabama, the difference between the polling prediction and the
#actual result was approximately 6.92% in 2016 and likely a similar value in
#2020. This suggests that the candidate was predicted to get less support than
#they actually received. However, in Arkansas, the polls overestimated the
#support for the candidate by around 5.05%, as indicated by the negative
#difference.

#There can be several reasons for this bias in the polls:
#Nonresponse Bias: Some people are less likely to respond to polls,
#and these people might be more likely to vote for one candidate.
#If these individuals aren't adequately represented in the sample,
#the poll can be biased towards the other candidate.

#Shy Voter Theory: Some voters might be hesitant to reveal their true voting
#intention in a poll, especially if they feel their choice isn't the socially
#desirable one. This can result in underestimation of support for a candidate.
```

Untitled

Haocheng Zhang

2023-05-28

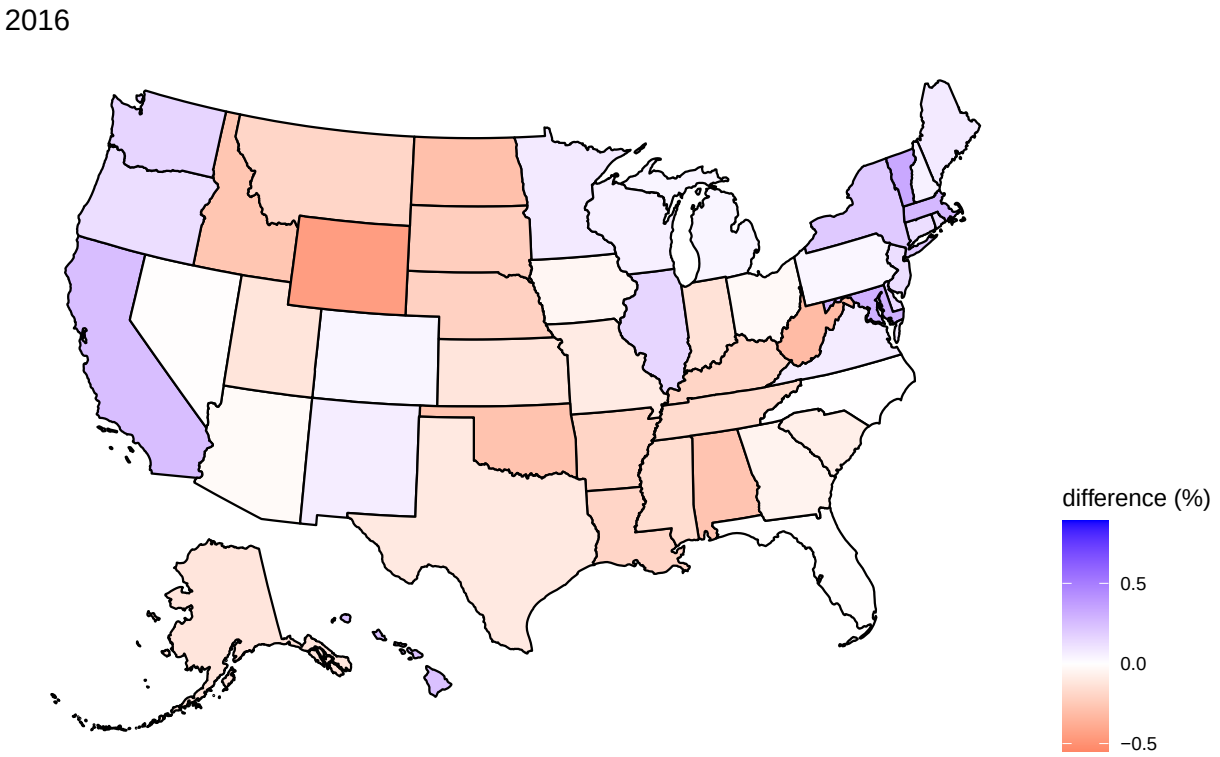
```
#Problem 4

#Load the data
polls_data_2016 = read.csv("president_general_polls_sorted_end_date_2016.csv")
polls_data_2020 = read.csv("president_polls_2020.csv")
library(lubridate)
```

```
##
## Attaching package: 'lubridate'

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

```
library(usmap)
library(ggplot2)


index_na=which(is.na(polls_data_2020$sample_size)==T)

polls_data_2020=polls_data_2020[which(polls_data_2020$answer==
                                        'Biden'|polls_data_2020$answer==
                                        'Trump'),]

delete_index=which( (polls_data_2020$pollster_id==
                       1610|polls_data_2020$pollster_id==1193)&
                       mdy(polls_data_2020$end_date)!= "2020-11-01")
polls_data_2020=polls_data_2020[-delete_index,]

##now let's delete those poll that only contains one candidate
polls_data_2020_question_id_num=unique(polls_data_2020$question_id)
##clean the data
for(i in 1:length(unique(polls_data_2020$question_id)) ){
  index_set=which(polls_data_2020$question_id==
                    polls_data_2020_question_id_num[i])
  if(length(index_set)!=2){
    polls_data_2020=polls_data_2020[-index_set,]
  }
}

index_NA=which(is.na(polls_data_2020$sample_size)==T)
```

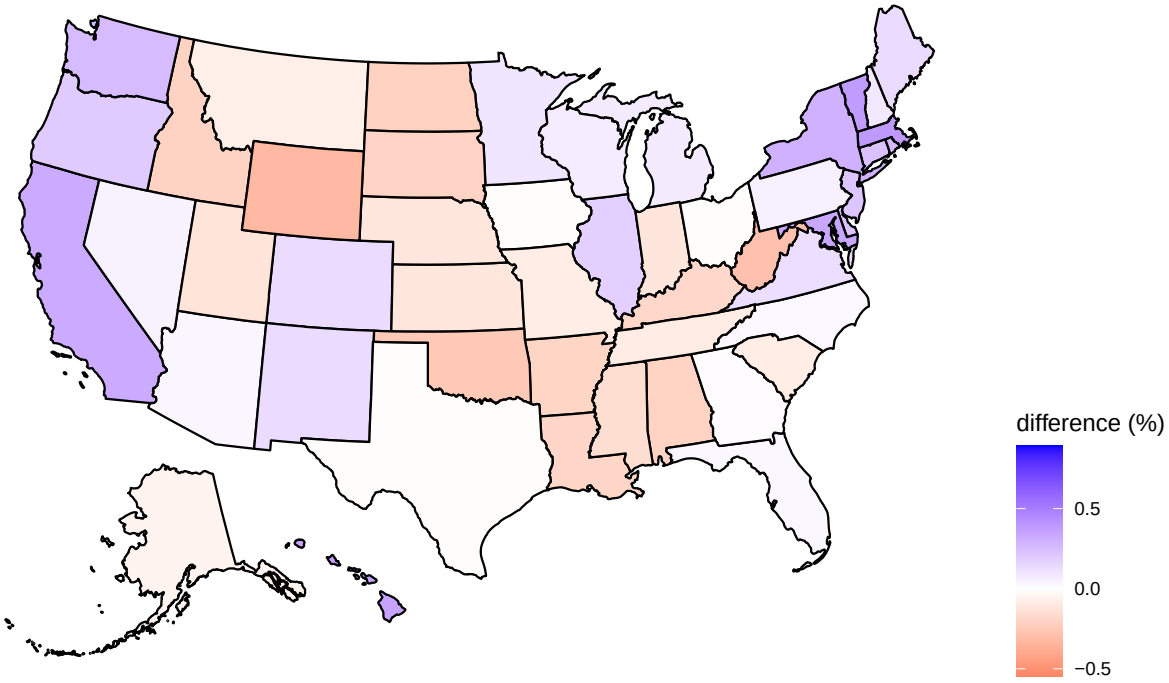
```
polls_data_2020=polls_data_2020[-index_NA,]

polls_data_2016_enddate=mdy(polls_data_2016$enddate)

poll_state_sum_clinton_2016=aggregate(polls_data_2016$total.clinton, by=list(State=polls_data_2016$stat
poll_state_sum_trump_2016=aggregate(polls_data_2016$total.trump, by=list(State=polls_data_2016$state),FU

poll_state_diff_percentage=poll_state_sum_clinton_2016
poll_state_diff_percentage[,2]=(poll_state_sum_clinton_2016[,2]-
                                  poll_state_sum_trump_2016[,2])/(poll_state_sum_clinton_2016[,2]+
                                                                    poll_state_sum_trump_2016[,2])
delete_index=which(levels(poll_state_diff_percentage[,1])=='U.S.')
if(length(delete_index)>0){
  poll_state_diff_percentage=poll_state_diff_percentage[-delete_index,]
  poll_state_diff_percentage[,1]
}

state_poll_2016 <- data.frame(
  state =poll_state_diff_percentage[,1],
  diff_percentage=poll_state_diff_percentage[,2]
)

index_biden_2020=which(polls_data_2020$answer=='Biden')
index_trump_2020=which(polls_data_2020$answer=='Trump' )

counts_biden_2020=polls_data_2020$pct[index_biden_2020]*polls_data_2020$
  sample_size[index_biden_2020]
counts_trump_2020=polls_data_2020$pct[index_trump_2020]*polls_data_2020$
  sample_size[index_trump_2020]

polls_data_2020$total.biden=rep(0,dim(polls_data_2020)[1])
polls_data_2020$total.trump=rep(0,dim(polls_data_2020)[1])

polls_data_2020$total.biden[index_biden_2020]=counts_biden_2020
polls_data_2020$total.trump[index_trump_2020]=counts_trump_2020

poll_state_sum_biden_2020=aggregate(polls_data_2020$total.biden, by=list(State=polls_data_2020$state),FU
poll_state_sum_trump_2020=aggregate(polls_data_2020$total.trump, by=list(State=polls_data_2020$state),FU

poll_state_sum_biden_2020=poll_state_sum_biden_2020[-1,]
poll_state_sum_trump_2020=poll_state_sum_trump_2020[-1,]

state_poll_2020 <- data.frame(
  state =poll_state_sum_biden_2020[,1],
  diff_percentage=(poll_state_sum_biden_2020[,2]-poll_state_sum_trump_2020[,2])/
    (poll_state_sum_biden_2020[,2]+poll_state_sum_trump_2020[,2])
)

limit_val=c(min(state_poll_2016$diff_percentage,state_poll_2020$diff_percentage),
            max(state_poll_2016$diff_percentage,state_poll_2020$diff_percentage))

plot_usmap(data = state_poll_2016, values = "diff_percentage", color = "black") +
  scale_fill_gradient2(name = "difference (%)",   low= "red",
```

```
                      mid = "white",
                      high = "blue",
                      midpoint = 0,limits=limit_val)+
  theme(legend.position = "right")+
  ggtitle("2016")
```




```
##2020
##it does not have poll from Nebraska. It does not plot the poll from
#congressional district
plot_usmap(data = state_poll_2020, values = "diff_percentage", color = "black")+
  scale_fill_gradient2(name = "difference (%)",   low= "red",
                      mid = "white",
                      high = "blue",
                      midpoint = 0,limits=limit_val)+
  theme(legend.position = "right")+
  ggtitle("2020")
```

2020




```
# Part b
state_poll_2016=state_poll_2016[-c(33,50),]

dif <- data.frame(
  state <- state_poll_2016$state,
  diff_2016 <- state_poll_2016$diff_percentage,
  diff_2020 <- state_poll_2020$diff_percentage
)
index_change = which(dif$diff_2016*dif$diff_2020<0)
dif$state[index_change]
```

```
## [1] "Arizona"       "Florida"       "Georgia"       "Maine CD-2"
## [5] "Nebraska CD-2" "Nevada"
```

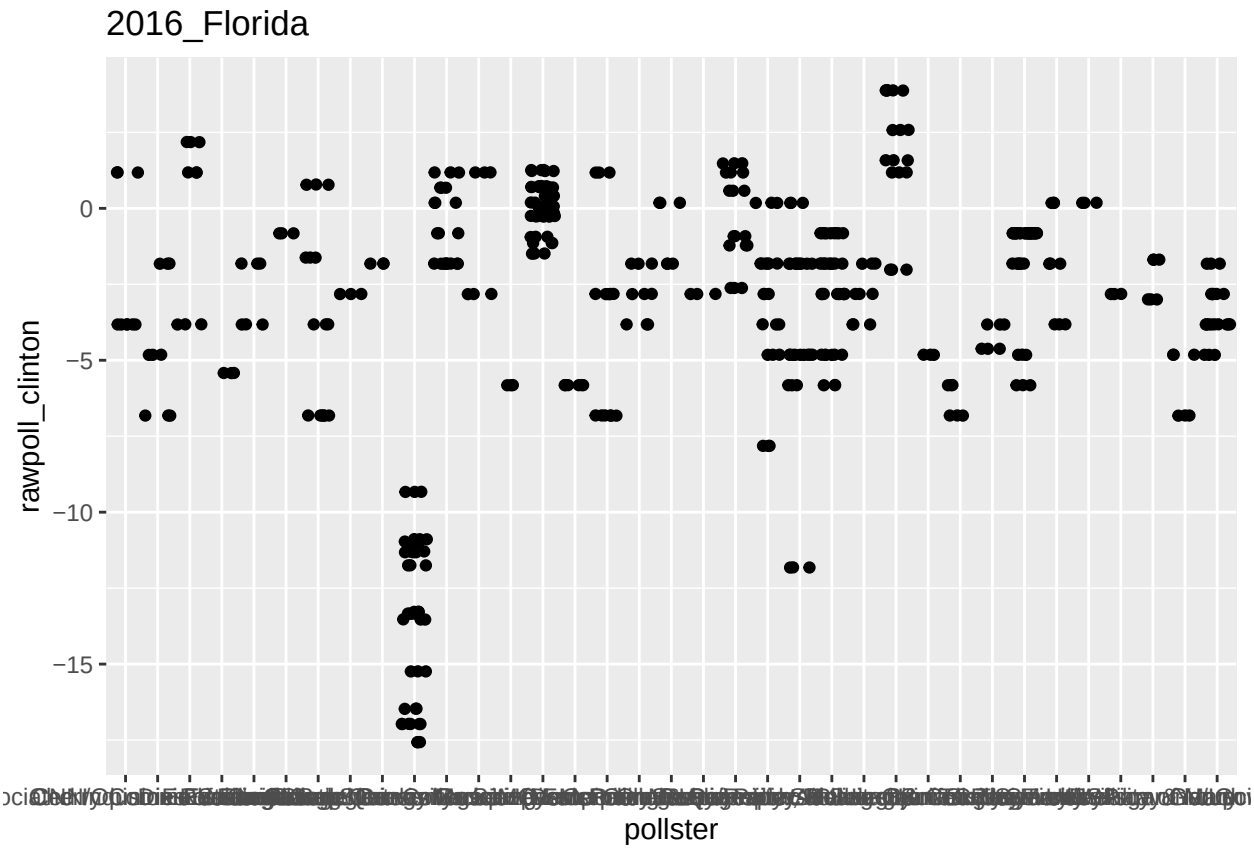
```
##part(C)

#No, there are not. The states I've listed that did not flip in reality --
#Florida and Nevada -- could have been identified as potential flips due to
#close polling results, demographic changes, or other state-specific factors. #However, many elements c
#predict, such as voter turnout, campaign strategies, and major events.
```

Untitled

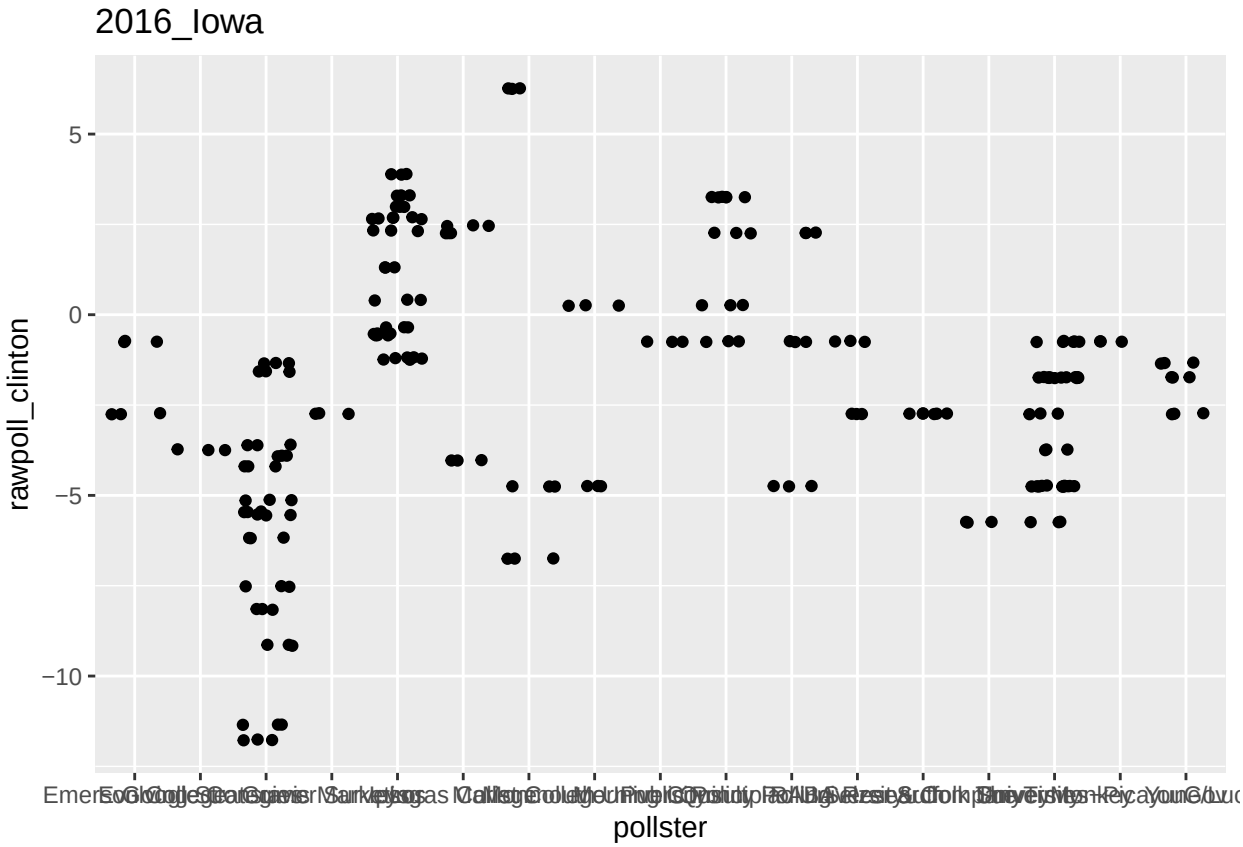
Haocheng Zhang

2023-05-28

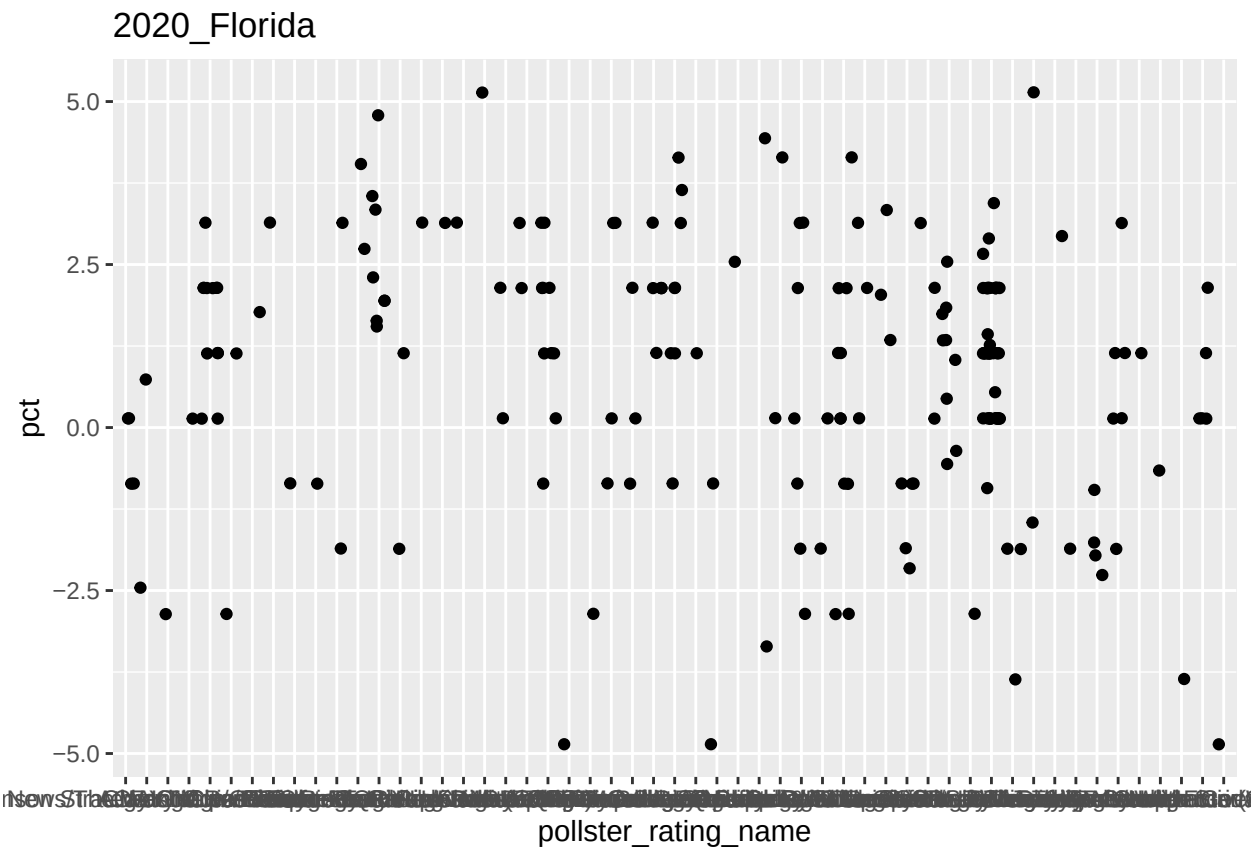
```
##Q5

#Load the data
polls_data_2016 = read.csv("president_general_polls_sorted_end_date_2016.csv")
polls_data_2020 = read.csv("president_polls_2020.csv")
library(ggplot2)

#2016
index_2016_Flo=which(polls_data_2016$state=="Florida")
index_2016_Iow=which(polls_data_2016$state=="Iowa")

Fol_2016_real_clinton = 47.82;
Iow_2016_real_clinton = 41.74;

polls_data_2016[index_2016_Flo,]$rawpoll_clinton = polls_data_2016[index_2016_Flo,]$rawpoll_clinton - Fo
polls_data_2016[index_2016_Iow,]$rawpoll_clinton = polls_data_2016[index_2016_Iow,]$rawpoll_clinton - Io

ggplot(data = polls_data_2016[index_2016_Flo,]) +
  aes(y = rawpoll_clinton, x = pollster) +
  geom_jitter()+
  ggtitle("2016_Florida")
```



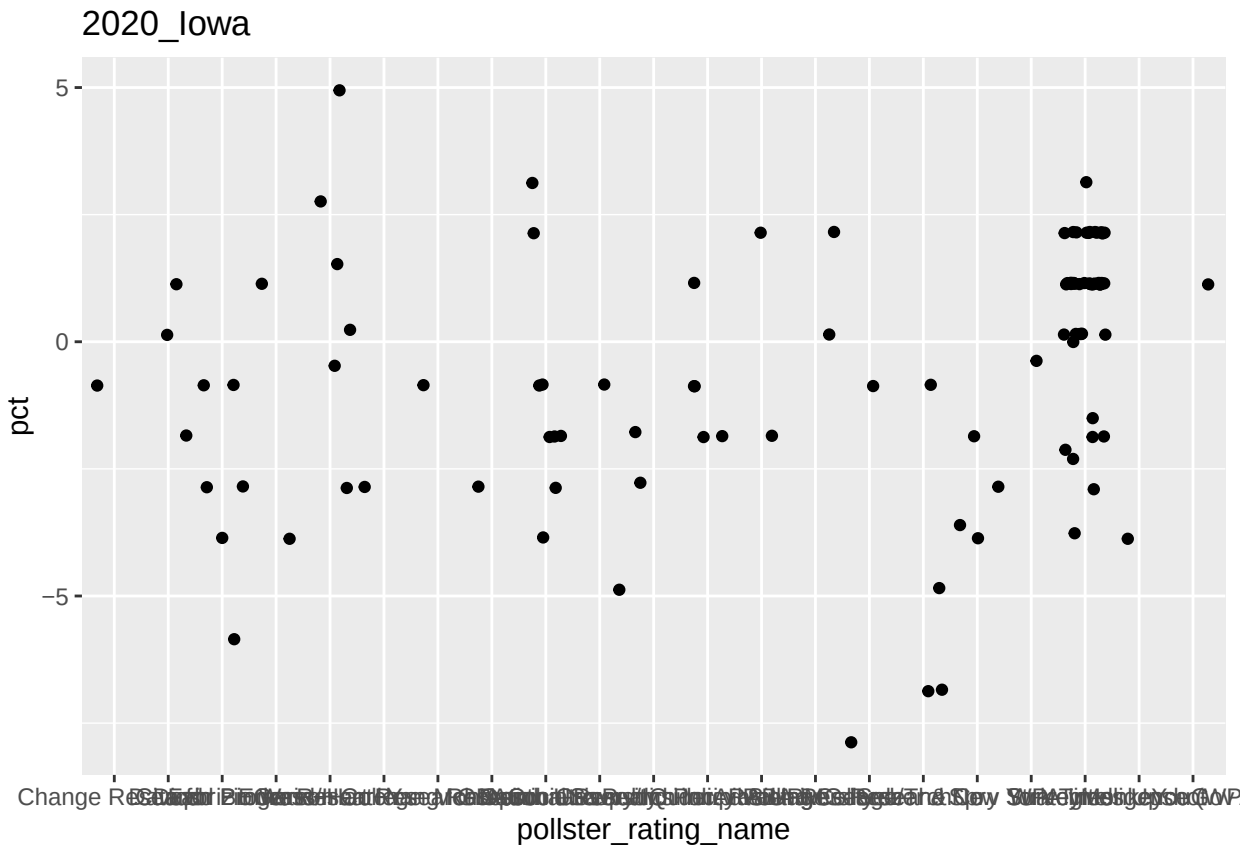

```
ggplot(data = polls_data_2016[index_2016_Iow,]) +
  aes(y = rawpoll_clinton, x = pollster) +
  geom_jitter()+
  ggtitle("2016_Iowa")
```




```
#2020
Flo_2020_real_biden = 47.86;
Iow_2020_real_biden = 44.89;

index_biden_Flo_2020=which(polls_data_2020$answer=='Biden' & polls_data_2020$state=="Florida")
index_biden_Iow_2020=which(polls_data_2020$answer=='Biden' & polls_data_2020$state=="Iowa")

polls_data_2020[index_biden_Flo_2020,]$pct = polls_data_2020[index_biden_Flo_2020,]$pct - Flo_2020_real
polls_data_2020[index_biden_Iow_2020,]$pct = polls_data_2020[index_biden_Iow_2020,]$pct - Flo_2020_real

ggplot(data = polls_data_2020[index_biden_Flo_2020,]) +
  aes(y = pct, x = pollster_rating_name) +
  geom_jitter()+
  ggtitle("2020_Florida")
```




```
ggplot(data = polls_data_2020[index_biden_Iow_2020,]) +
  aes(y = pct, x = pollster_rating_name) +
  geom_jitter()+
  ggtitle("2020_Iowa")
```




```
##part(a)
#They're not accurate, and there might be Response Bias: Even if the sample
#accurately represents the population, the individuals who choose to respond to
#the poll may be systematically different from those who do not. For instance,
#supporters of a particular candidate may be more or less likely to respond
#to a poll, creating a bias in the results.
```

```
##part(b)
#polling firms like Selzer & Co. have been noted for their accuracy,
#especially in Iowa.,
#https://projects.fivethirtyeight.com/pollster-ratings/selzer-co/
#https://www.desmoinesregister.com/story/news/politics/2020/11/04/
#iowa-poll-closely-matches-election-results-how-did-ann-selzer-do-it/6159615002/
```

```
##part(C)
#Some potential sources of bias include:
#Nonresponse Bias: People who are less likely to respond to surveys may also be
#more likely to vote for a particular candidate.
#Late Deciders: Some people may only decide who they will vote for at the last
#minute, after the polls have closed.
#Sampling Error: The sample drawn for the poll may not accurately represent
#the population.
```

```
##part(d)
#Better Sampling: Ensuring that the sample is representative of the voting
#population is crucial. This could mean taking into account factors like age,
#race, education level, and geographic location.

#Weighting: If the sample isn't perfectly representative, statisticians can
#assign weights to responses from underrepresented groups to ensure they have
#the correct influence on the final results.

#Tracking Late Changes: Conducting polls close to the election day can help
#capture late changes in public opinion.
```