Stats525HW7

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2.4 a. Obtain a 99 percent confidence interval for b1. Interpret your confidence interval. Does it include rero? Why might the director of admissions be interested in whether the confidence interval includes zero? CI:(0.00175,0.094787) This means that we can be 95% confident that for every increase in GPA, the ACT score will increase by between 0.00175 and 0.094787. This does not include zero. The director would be interseted in whether the confidence interval includes zero because if it did then there might not be a correlatin between ACT scores and GPA.

```r
library(tidyverse)
```

```
## ── Attaching packages ─────────────────────────────────────────────────────────── tidyverse
1.3.0 ──
```

```
## ✓ ggplot2 3.3.2     ✓ purrr   0.3.4
## ✓ tibble  3.0.3     ✓ dplyr   1.0.2
## ✓ tidyr   1.1.2     ✓ stringr 1.4.0
## ✓ readr   1.3.1     ✓ forcats 0.5.0
```

```
## ── Conflicts ──────────────────────────────────────────────────────────── tidyverse_confl
icts() ──
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```r
loadRData <- function(fileName){
  load(fileName)
  get(ls()[ls() != "fileName"])
}
gpa <- loadRData("/Users/lukegeel/Downloads/gpa_spring2021.RData")
n <- nrow(gpa)
y <- gpa$Y
x <- gpa$X
linmod <- lm(y~x)
b1 <- linmod$coef[2]
s.b1 <- summary(linmod)$coef[2, 2]
alpha <- 0.01
qt <- qt(alpha/2, n - 2)
pvalue <- pt(-abs(b1/s.b1),n-2)+(1-pt(abs(b1/s.b1),n-2))
lower <- b1+s.b1*qt(alpha/2,n-2)
upper <- b1-s.b1*qt(alpha/2,n-2)
lower
```

```
##           x
## 0.001748182
```

```r
upper
```

```
##          x
## 0.09476612
```

b. Test, using the test statistic t*, whether or not a linear association exists between student's ACT score (X) and GPA at the end of the freshman year (Y). Use a level of significance of .Ol. State the alternatives, decision rule, and conclusion. Alternative hypothesis: There is no linear association between student's ACT score and GPA at the end of the freshman year. Decision rule: If the test statistic exceeds the t-value given the alpha level, we reject the alternative hypothesis. Conclusion: The test statistci exceeds t, so we can reject the alternative hypothesis and conclude that there is a linear association between ACT scores and GPA.

```
library(tidyverse)
loadRData <- function(fileName){
  load(fileName)
  get(ls()[ls() != "fileName"])
}
gpa <- loadRData("/Users/lukegeel/Downloads/gpa_spring2021.RData")
n <- nrow(gpa)
y <- gpa$Y
x <- gpa$X
linmod <- lm(y~x)
b1 <- linmod$coef[2]
s.b1 <- summary(linmod)$coef[2, 2]
alpha <- 0.01
tquantile <- qt(1 - alpha/2, n - 2)
statistic <- b1/s.b1
tquantile
```

```
## [1] 2.618137
```

```
statistic
```

```
##        x
## 2.716548
```

c. What is the P-value of your test in part (b)? How does it support the conclusion reached in part (b)? P-value: 0.007 The P-value is less than the alpha level so it supports our conclusion that a linear association exists.

```
library(tidyverse)
loadRData <- function(fileName){
  load(fileName)
  get(ls()[ls() != "fileName"])
}
gpa <- loadRData("/Users/lukegeel/Downloads/gpa_spring2021.RData")
n <- nrow(gpa)
y <- gpa$Y
x <- gpa$X
linmod <- lm(y~x)
b1 <- linmod$coef[2]
s.b1 <- summary(linmod)$coef[2, 2]
alpha <- 0.01
tquantile <- qt(1 - alpha/2, n - 2)
pvalue <- 2*pt(-abs(b1/s.b1), n - 2)
pvalue
```

```
##           x
## 0.007589142
```

2.5. Refer to Copier maintenance Problem 1.20. a. Estimate the change in the mean service time when the number of copiers serviced increases by one. Use a 90 percent confidence interval. Interpret your confidence interval. We can be 90% confident that when the number of copiers serviced increases by one, the service time increases by between 14.0258 and 16.08582 minutes.

```
data <- loadRData("/Users/lukegeel/Downloads/copier_spring2021.RData")
n <- nrow(data)
y <- data$Y
x <- data$X
linmod <- lm(y~x)
b1 <- linmod$coef[2]
s.b1 <- summary(linmod)$coef[2, 2]
alpha <- 0.1
qt <- qt(alpha/2, n - 2)
pvalue <- pt(-abs(b1/s.b1),n-2)+(1-pt(abs(b1/s.b1),n-2))
lower <- b1+s.b1*qt(alpha/2,n-2)
upper <- b1-s.b1*qt(alpha/2,n-2)
lower
```

```
##       x
## 14.0258
```

```
upper
```

```
##        x
## 16.08582
```

b. Conduct a t test to determine whether or not there is a linear association between X and Y here; control the alpha risk at .10. State the alternatives, decision rule, and conclusion. What is the P-value of your test? Alternative hypothesis: There is not a linear association between X and Y. Decision rule: If the test statistic exceeds the t-value given the alpha level, we reject the alternative hypothesis. Conclusion: The test statistic doesn't exceed t, so we fail to reject the alternative hypothesis and say that there isn't a linear association between X and Y. P-value: 6.093652e-27

```
data <- loadRData("/Users/lukegeel/Downloads/copier_spring2021.RData")
n <- nrow(data)
y <- data$Y
x <- data$X
linmod <- lm(y~x)
b1 <- linmod$coef[2]
s.b1 <- summary(linmod)$coef[2, 2]
alpha <- 0.1
tquantile <- qt(1 - alpha/2, n - 2)
statistic <- b1/s.b1
pvalue <- 2*pt(-abs(b1/s.b1), n - 2)
pvalue
```

```
##            x
## 6.093652e-27
```

```
tquantile
```

```
## [1] 1.681071
```

```
statistic
```

```
##        x
## 24.57245
```

c. Are your results in parts (a) and (b) consistent? Explain. No, the results aren't consistent. From a, we get there the mean change is about 15 minutes for each additional copier but from b we concluded that there isn;t a linear relationship. These results contradict each other.

d. Does bo give any relevant information here about the "start-up" time on calls-Le., about the time required before service work is begun on the copiers at a customer location? No, b0 does not give any relevant information about the start-up time on calls.

1.44. Refer to the CDI data set in Appendix C.2. a. For each geographic region, regress per capita income in a CDr (Y) against the percentage of individuals in a county having at least a bachelor's degree (X). Assume that first-order regression model (1.1) is appropriate for each region. State the estimated regression functions. Region 1: 9223.8 + 522.2X Region 2: 13581.4 + 238.7X Region 3: 10529.8 + 330.6 Region 4: 8615.1 + 440.3X

```
cdi <- loadRData("/Users/lukegeel/Downloads/cdi_spring2021.RData")
region1 <- cdi%>%filter(X17 == 1)
n <- nrow(region1)
Y <- region1$X15
X <- region1$X12
linmod1 <- lm(Y~X)
linmod1
```

```
##
## Call:
## lm(formula = Y ~ X)
##
## Coefficients:
## (Intercept)            X
##      9223.8        522.2
```

```
region2 <- cdi%>%filter(X17 == 2)
n <- nrow(region2)
Y <- region2$X15
X <- region2$X12
linmod2 <- lm(Y~X)
linmod2
```

```
##
## Call:
## lm(formula = Y ~ X)
##
## Coefficients:
## (Intercept)            X
##     13581.4        238.7
```

```
region3 <- cdi%>%filter(X17 == 3)
n <- nrow(region3)
Y <- region3$X15
X <- region3$X12
linmod3 <- lm(Y~X)
linmod3
```

```
##
## Call:
## lm(formula = Y ~ X)
##
## Coefficients:
## (Intercept)            X
##     10529.8        330.6
```

```
region4 <- cdi%>%filter(X17 == 4)
n <- nrow(region4)
Y <- region4$X15
X <- region4$X12
linmod4 <- lm(Y~X)
linmod4
```

```
##
## Call:
## lm(formula = Y ~ X)
##
## Coefficients:
## (Intercept)            X
##      8615.1        440.3
```

b. Are the estimated regression functions similar for the four regions? Discuss. Yes, the estimated regression functions are relatively similar for all four regions. The intercepts are all between 8000 and 14000 and the slope of X are all between 230 and 520.

c. Calculate MSE for each region. Is the variability· around the fitted regression line approximately the same for the four regions? Discuss. Region 1 MSE: 7335008 Region 2 MSE: 4411341 Region 3 MSE: 7474349 Region 4 MSE: 8214318 I believe that the variability around the fitted regression line is approximately the same for the four regions as all the MSEs are very large, all between 4 and 8 million.

```
loadRData("/Users/lukegeel/Downloads/cdi_spring2021.RData")
```

```
##      X1                X2 X3   X4      X5   X6   X7    X8    X9    X10
## 1     1       Los_Angeles CA 4060 8863164 32.1  9.7 23734 27700 688936
## 2     2              Cook IL  946 5105067 29.2 12.4 14246 21550 436936
## 3     3            Harris TX 1729 2818199 31.3  7.1  9137 12449 253526
## 4     4         San_Diego CA 4205 2498016 33.5 10.9  5915  6179 173821
## 5     5            Orange CA  790 2410556 32.6  9.2  6874  6369 144524
## 6     6             Kings NY   71 2300664 28.3 12.4  6097  8942 680966
## 7     7          Maricopa AZ 9204 2122101 29.2 12.5  4200  6104 177593
## 8     8             Wayne MI  614 2111687 27.4 12.5  4819  9490 193978
## 9     9              Dade FL 1945 1937094 27.1 13.9  4312  8840 244725
## 10   10            Dallas TX  880 1852810 32.6  8.2  4665  6934 214258
## 11   11      Philadelphia PA  135 1585577 29.1 15.2  6043 10494 109148
## 12   12              King WA 2126 1507319 30.1 11.1  4050  4009 124959
```

```
## 13   13             Santa_Clara CA  1291 1497577 32.6  8.7  3970  3342  77009
## 14   14          San_Bernardino CA 20062 1418380 30.1  8.8  2482  3349  83110
## 15   15                Cuyahoga OH   458 1412140 26.3 15.6  4901  8132  73150
## 16   16               Middlesex MA   824 1398468 31.7 12.5  5645  4152  35825
## 17   17               Allegheny PA   730 1336449 26.2 17.4  7242  8436  50186
## 18   18                 Suffolk NY   911 1321864 27.9 10.8  2802  3904  66723
## 19   19                  Nassau NY   287 1287348 25.7 14.2  5492  5200  43203
## 20   20                 Alameda CA   738 1279182 30.8 10.6  3839  3284 107338
## 21   21                 Broward FL  1209 1255488 25.3 20.7  6216  5543 107386
## 22   22                   Bexar TX  1247 1185394 29.5  9.9  3215  4086 133098
## 23   23               Riverside CA  7208 1170413 27.9 13.2  1945  2435  95494
## 24   24                 Tarrant TX   864 1170103 32.2  8.3  2993  3672 132495
## 25   25                 Oakland MI   873 1083592 27.6 10.9  2558  3254  50964
## 26   26              Sacramento CA   966 1041219 29.7 10.6  2544  2855  84305
## 27   27                Hennepin MN   557 1032431 31.6 11.3  6381  5395  71753
## 28   28               St._Louis MO   508  993529 26.1 13.1  1110  1056  42595
## 29   29                    Erie NY  1045  968532 27.3 15.2  2968  4632  55306
## 30   30                Franklin OH   540  961437 33.5  9.6  2980  4011  82680
## 31   31               Milwaukee WI   242  959275 29.3 13.6  3360  4141  73681
## 32   32             Westchester NY   433  874866 26.3 14.4  3985  3540  37118
## 33   33                Hamilton OH   407  866228 28.0 13.3  3503  4683  57208
## 34   34              Palm_Beach FL  1974  863518 23.3 24.4  2045  3164  76142
## 35   35                Hartford CT   736  851783 28.3 14.1  2822  2940  51926
## 36   36                Pinellas FL   280  851659 22.4 26.0  1913  4458  62344
## 37   37                Honolulu HI   600  836231 30.6 11.0  1763  2174  51032
## 38   38            Hillsborough FL  1051  834054 29.4 12.2  1994  3068  89895
## 39   39               Fairfield CT   626  827645 26.7 13.3  2776  2494  44374
## 40   40                  Shelby TN   755  826330 29.4 10.4  2873  4918  67032
## 41   41                  Bergen NJ   234  825380 25.4 15.3  2641  2279  28521
## 42   42          Fairfax_County VA   396  818584 29.2  6.5  2960   135  30202
## 43   43               New_Haven CT   606  804219 28.7 14.7  2970  2486  52903
## 44   44            Contra_Costa CA   720  803732 26.5 10.9  2699  1781  51243
## 45   45                  Marion IN   396  797159 30.6 11.7  2519  4654  61004
## 46   46                  DuPage IL   334  781666 29.0  8.7  1249  1842  29708
## 47   47                   Essex NJ   126  778206 28.6 12.7  2923  4841  75595
## 48   48              Montgomery MD   495  757027 28.6 10.2  3735  1507  34754
## 49   49                   Clark NV  7911  741459 29.0 10.5  1047  2011  52786
## 50   50          Baltimore_City MD    81  736014 30.0 13.7  5759  6203  87355
## 51   51         Prince_George's MD   486  729268 33.7  6.9  1256  1322  54469
## 52   52               Salt_Lake UT   737  725956 27.8  8.5   706  2076  58610
## 53   53           San_Francisco CA    47  723959 32.2 14.5  4854  3640  71234
## 54   54                  Macomb MI   480  717400 28.2 12.3   570  1202  41048
## 55   55                  Monroe NY   659  713968 29.0 12.5  2433  3077  43780
## 56   56               Worcester MA  1513  709705 29.2 13.7  2338  2205   7099
## 57   57               Baltimore MD   599  692134 27.8 14.0  1101   641  46789
## 58   58              Montgomery PA   483  678111 26.1 15.0  2206  2425  20335
## 59   59                  Orange FL   908  677491 33.2 10.6  1894  2929  52577
## 60   60                   Duval FL   774  672971 30.7 10.7  1164  2623  68586
## 61   61               Middlesex NJ   311  671780 31.6 11.8  1866  1880  30548
## 62   62                   Essex MA   498  670080 27.3 14.1  4066  2009  34312
## 63   63                 Ventura CA  1846  669016 28.8  9.4  1159  1372  30235
## 64   64                  Fresno CA  5963  667490 28.3 10.4  1218  1681  62004
## 65   65                    Pima AZ  9187  666880 28.9 13.7  1480  2016  57051
## 66   66               Jefferson KY   385  664937 27.0 13.4  2162  3559  32419
## 67   67                 Suffolk MA    59  663906 39.2 12.1  5360  6154  68808
## 68   68               Jefferson AL  1113  651525 26.7 14.0  2416  4602  55604
## 69   69               San_Mateo CA   449  649623 28.4 12.3  2284  1642  30473
## 70   70                  Fulton GA   529  648951 31.6 10.0  3481  5757  93025
## 71   71                 Jackson MO   605  633232 28.1 13.1  1688  3762  61760
## 72   72                 Norfolk MA   400  616087 28.8 14.1  1861  1903  14830
## 73   73  District_of_Columbia DC    61  606900 33.6 12.8  3674  4262  64393
## 74   74                Oklahoma OK   709  599611 28.4 12.1  1841  3487  57045
## 75   75              Providence RI   413  596270 29.9 15.8  1474  2360  34627
## 76   76                 El_Paso TX  1013  591610 29.5  8.1   789  1650  54002
## 77   77                  Pierce WA  1676  586203 29.5 10.5   711  1226  41980
## 78   78               Multnomah OR   435  583887 28.4 13.6  2200  3009  58216
## 79   79                  Travis TX   989  576407 38.0  7.3  1011  1392  60961
## 80   80              Montgomery OH   462  573809 28.1 12.6  1223  3068  36665
## 81   81                Monmouth NJ   472  553124 25.6 12.7  1426  1904  22302
## 82   82                  Hudson NJ    47  553099 31.5 12.7   950  2443  40581
## 83   83                Delaware PA   184  547651 27.6 15.5  1317  1588  18924
## 84   84                 De_Kalb GA   268  545837 32.6  8.5  1106   922  56950
```

```
## 85   85            Kern CA  8142  543477 28.3  9.7   644  1194  36318
## 86   86           Bucks PA   608  541174 26.6 10.9  1317  1435  16894
## 87   87            Lake IL   448  516418 28.9  8.4  1094  1499  22349
## 88   88          Summit OH   413  514990 26.8 13.8  1155  2226  26228
## 89   89     Mecklenburg NC   527  511433 32.0  9.4  1381  2021  57999
## 90   90        Davidson TN   502  510784 32.1 11.6  2398  3847  45237
## 91   91         Bristol MA   556  506325 27.6 14.4  1369  1306  22023
## 92   92           Tulsa OK   570  503341 28.2 11.5  1655  2512  39496
## 93   93          Camden NJ   222  502824 27.5 12.2  1309  2041  34814
## 94   94            Kent MI   856  500631 29.6 10.8  1099  1460  31553
## 95   95         Orleans LA   181  496938 28.3 13.0  2398  4018  54238
## 96   96           Union NJ   103  493819 26.8 15.0  1332  2541  30299
## 97   97          Ramsey MN   156  485765 31.0 12.2   745  1140  30574
## 98   98     San_Joaquin CA  1399  480628 27.7 11.1   623  1051  41179
## 99   99      Bernalillo NM  1166  480577 29.2 10.5  1545  1726  41280
## 100 100            Lake IN   497  475594 25.5 12.3   766  2413  29926
## 101 101        Onondaga NY   780  468973 29.4 13.0   830  1668  23249
## 102 102          Denver CO   153  467610 30.3 13.8  3131  3652  37466
## 103 103       Snohomish WA  2090  465642 28.1  9.5   517   672  20323
## 104 104           Lucas OH   340  462361 27.8 13.0  1348  3021  38194
## 105 105         Hampden MA   619  456310 27.8 14.8   927  1665  24247
## 106 106         Passaic NJ   185  453060 28.9 12.9   945  1912  26434
## 107 107       Jefferson LA   306  448306 28.1 10.2   525  1648  41625
## 108 108            Cobb GA   340  447745 31.7  6.3  1010   983  27582
## 109 109      New_Castle DE   426  441946 30.6 11.4  1089  1488  27717
## 110 110       Jefferson CO   772  438430 26.9  8.0   485   298  23453
## 111 111        Plymouth MA   661  435276 27.1 11.6   575   813  14846
## 112 112           Ocean NJ   636  433203 22.4 23.2   591  1475  17379
## 113 113         Genesee MI   640  430459 27.2 10.2   686  1830  33136
## 114 114    Anne_Arundel MD   416  427239 29.6  8.8  1057   617  21826
## 115 115            Wake NC   834  423380 34.5  7.8  1561  1199  26006
## 116 116       Lancaster PA   949  422822 27.2 13.1   762  1241  13086
## 117 117          Morris NJ   469  421353 26.7 10.6  2123  1599  12147
## 118 118         Douglas NE   331  416444 29.0 11.4   757  2889  26006
## 119 119            Polk FL  1875  405382 23.9 18.6   520  1288  37290
## 120 120        Sedgwick KS  1000  403662 28.5 11.4  1001  1840  34071
## 121 121         Brevard FL  1019  398978 26.2 16.6   640  1085  23686
## 122 122         El_Paso CO  2127  397014 31.7  8.0   657  1026  25234
## 123 123   St._Louis_City MO    62  396685 28.7 16.6  1267  7814  64103
## 124 124      Burlington NJ   805  395066 28.8 10.7   697  1150  13034
## 125 125    VA_Beach_City VA   248  393069 35.3  5.9   689   530  23412
## 126 126        Arapahoe CO   803  391511 28.3  7.4   878   742  27587
## 127 127          Sonoma CA  1576  388222 25.8 13.4   812   798  18556
## 128 128         Hidalgo TX  1569  383545 26.4 10.1   289   860  26712
## 129 129 East_Baton_Rouge LA   456  380105 31.5  9.2   675  1876  41592
## 130 130          Mobile AL  1233  378643 26.7 11.8   965  1898  30409
## 131 131         Chester PA   756  376396 27.1 10.9  1303   920   9491
## 132 132         Volusia FL  1106  370712 24.3 22.8   612  1349  25736
## 133 133      Stanislaus CA  1495  370522 27.4 10.8   677  1306  25461
## 134 134    Westmoreland PA  1023  370321 23.3 17.1   459  1306   7445
## 135 135   Santa_Barbara CA  2739  369608 32.8 12.3  1123  1031  18313
## 136 136           Stark OH   576  367585 24.9 14.4   548  1537  17466
## 137 137            Dane WI  1202  367085 35.6  9.3  1084  1382  20344
## 138 138         Spokane WA  1764  361364 27.0 13.2   838  1346  20042
## 139 139            Will IL   837  357313 27.4  8.6   353   746  16432
## 140 140        Monterey CA  3322  355660 32.6  9.8   515   602  17870
## 141 141         Johnson KS   477  355054 27.5  9.4  1231   925  15238
## 142 142        Gwinnett GA   433  352910 32.6  4.7   347   439  17119
## 143 143         Pulaski AR   771  349660 28.5 11.5  1463  2785  42404
## 144 144        Guilford NC   650  347420 30.4 11.9   918  1188  28212
## 145 145          Solano CA   828  340421 29.7  8.2   290   503  21756
## 146 146            York PA   905  339574 26.6 13.1   460   951  11292
## 147 147           Berks PA   859  336523 26.1 15.6   476  1041  12827
## 148 148    Hillsborough NH   877  336073 30.0 10.3   755  1050  12843
## 149 149            Knox TN   509  335749 30.0 12.7  1022  2178  22422
## 150 150             Lee FL   804  335113 21.5 24.7   509  1202  18442
## 151 151         Luzerne PA   891  328149 24.1 19.7   462  1495   4982
## 152 152          Mercer NJ   226  325824 29.2 13.0  1069  1724  20153
## 153 153      Greenville SC   792  320167 28.2 11.9   785  1358  20504
## 154 154            Kane IL   521  317471 27.8  9.3   478  1263  16721
## 155 155          Tulare CA  4824  311921 26.3 10.8   401   656  19489
## 156 156      Washington OR   724  311554 27.6 10.1   328   294  12630
## 157 157          Orange NY   816  307647 28.0 10.4   549   986  10975
```

```
## 158 158                Waukesha WI   556  304715 24.4  9.8   615   677   8935
## 159 159                   Allen IN   657  300836 27.4 11.4   522  1268  19842
## 160 160              Charleston SC   917  295039 34.1 10.1   832  1956  28190
## 161 161                  Albany NY   524  292594 30.4 14.7   820  1246  15077
## 162 162                  Butler OH   467  291479 29.9 10.2   334   878  13850
## 163 163                  Nueces TX   836  291145 27.3 10.1   574  1406  28606
## 164 164                  Lehigh PA   347  291130 26.3 15.4   656  1305  12254
## 165 165                Seminole FL   308  287529 27.9 10.3   378   352  17518
## 166 166                Richland SC   757  285720 34.7  9.5   966  1207  24101
## 167 167                Hamilton TN   543  285536 26.3 13.5   723  1573  23532
## 168 168               Washtenaw MI   710  282937 39.5  7.5  4561  1730  19367
## 169 169                    Lane OR  4554  282912 27.4 13.1   497   654  16091
## 170 170                  Ingham MI   559  281912 37.4  8.7   838  1438  17337
## 171 171                   Pasco FL   745  281131 18.4 32.3   244   941  12509
## 172 172               Clackamas OR  1868  278850 23.1 11.5   379   345  12855
## 173 173                Sarasota FL   572  277776 18.2 32.1   774  1363  19801
## 174 174                    Erie PA   802  275572 27.5 13.8   587  1417   9936
## 175 175                  Dakota MN   570  275227 30.6  6.4   209   283  10953
## 176 176              Cumberland NC   653  274566 37.4  6.2   290   586  25247
## 177 177                  Denton TX   889  273525 36.9  5.0   252   458  20372
## 178 178                  Lorain OH   493  271126 26.4 11.6   292   941   9864
## 179 179                 Forsyth NC   410  265878 29.2 12.3   903  1609  21554
## 180 180                Rockland NY   174  265475 25.5 10.1  1179   745   7194
## 181 181                   Adams CO  1192  265038 29.6  7.6   449   318  19369
## 182 182                Mahoning OH   415  264806 23.5 17.1   619  1473  13181
## 183 183                  Collin TX   848  264036 29.8  5.3   389   571  17625
## 184 184                    Utah UT  1998  263590 33.9  7.0   279   544  10605
## 185 185               St._Clair IL   664  262852 26.8 12.7   434  1088  14563
## 186 186                Escambia FL   664  262798 29.2 11.9   951  1584  14380
## 187 187             Norfolk_City VA    54  261229 41.7 10.5   979  1471  25194
## 188 188                 Cameron TX   906  260120 25.9 10.6   265   825  18842
## 189 189                Dutchess NY   802  259462 29.0 11.4   536   741   9087
## 190 190              New_London CT   666  254957 31.2 11.9   364   515   7807
## 191 191                  Washoe NV  6343  254667 29.5 10.3   619   990  18831
## 192 192                   Hinds MS   869  254441 29.5 11.2  1253  2118  28841
## 193 193               Winnebago IL   514  252913 26.5 12.7   602   910  19674
## 194 194                  Oneida NY  1213  250836 27.7 15.5   429   905   9234
## 195 195                 Madison IL   725  249238 26.2 13.9   441  1120  10666
## 196 196                   Caddo LA   882  248253 25.2 13.3   701  1868  22091
## 197 197             Northampton PA   374  247105 26.9 15.0   434   933   6452
## 198 198              St._Joseph IN   457  247052 28.2 14.1   416   927  10637
## 199 199              Rockingham NH   695  245845 29.0  9.2   343   514   7295
## 200 200              Cumberland ME   836  243135 29.1 13.0   742  1104  13816
## 201 201                Somerset NJ   305  240279 28.6 10.8   600   374   8308
## 202 202               Jefferson TX   904  239397 25.8 14.0   446  1724  21677
## 203 203                 Madison AL   805  238912 31.4  8.9   697   933   6635
## 204 204                   Clark WA   628  238053 25.3 10.6   225   299  10706
## 205 205                 Dauphin PA   525  237813 26.8 14.3   816  1425  11563
## 206 206                   Marin CA   520  230096 24.7 12.3   942   488   9460
## 207 207              Gloucester NJ   325  230082 28.0 10.8   194   339   9746
## 208 208              Santa_Cruz CA   446  229734 29.9 11.3   427   390  13707
## 209 209                  Marion OR  1185  228483 25.7 14.3   368   498  14825
## 210 210                Trumbull OH   616  227813 23.9 14.4   293   925   7315
## 211 211             Spartanburg SC   811  226800 27.0 12.6   275   832  17198
## 212 212               Fort_Bend TX   875  225421 26.8  4.9   222   301   9433
## 213 213                 Fayette KY   285  225366 34.9  9.9  1187  1851  17378
## 214 214                 Boulder CO   743  225339 34.2  7.6   431   387  14124
## 215 215                Atlantic NJ   561  224327 29.0 14.5   401   990  25167
## 216 216               Kalamazoo MI   562  223411 32.4 10.6   422   793  15306
## 217 217                 Lubbock TX   900  222636 34.1  9.8   667  1562  14509
## 218 218                 Niagara NY   523  220756 25.8 15.1   214   893   9437
## 219 219              Lackawanna PA   459  219039 24.3 19.8   433  1136   4368
## 220 220               Galveston TX   399  217399 26.9 10.5   249  1592  18586
## 221 221         San_Luis_Obispo CA  3305  217162 31.4 14.1   410   522   8103
## 222 222                 Chatham GA   440  216935 28.5 12.8   618  1112  18732
## 223 223 Prince_William_County VA   338  215686 32.3  3.0   189   153   9001
## 224 224                    Lake OH   228  215499 26.4 12.0   180   359   5481
## 225 225               Lancaster NE   839  213641 33.9 10.8   387   778  16414
## 226 226              St._Charles MO   561  212907 29.0  6.9   235   613   7785
## 227 227                  Broome NY   707  212160 28.6 15.0   419   816   7435
## 228 228                 Saginaw MI   809  211946 25.5 12.0   496  1193  16190
## 229 229                 Manatee FL   741  211707 21.0 28.1   342   855  16916
## 230 230              Montgomery AL   790  209085 28.4 11.6   823  1102  17388
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## 231 231             Greene MO  675  207949 31.0 13.3  782  1785 13551
## 232 232            Kanawha WV  903  207619 23.9 15.7  569  1342 10246
## 233 233                Ada ID 1055  205775 27.6 10.4  367   557  9701
## 234 234         Washington PA  857  204584 23.7 17.5  277   687  4526
## 235 235          St._Louis MN 6226  198213 24.3 16.9  334  1391  7518
## 236 236         Cumberland PA  550  195257 28.6 13.4  372   733  5247
## 237 237             Marion FL 1579  194833 21.6 22.1  214   451 14860
## 238 238              Brown WI  529  194594 29.6 10.8  344   632  8101
## 239 239               Leon FL  667  192493 38.5  8.2  626   823 23363
## 240 240           Brazoria TX 1387  191707 28.7  7.8  153   318  8692
## 241 241               Bell TX 1059  191088 34.6  8.8  251   572 10865
## 242 242             Kitsap WA  396  189731 27.7 10.7  178   244  8996
## 243 243           Richmond GA  324  189719 31.1 10.0  336  1787 17918
## 244 244           McLennan TX 1042  189123 30.0 13.6  267   560 16486
## 245 245             Yakima WA 4296  188823 25.1 13.0  339   518 15139
## 246 246              Davis UT  305  187941 26.2  6.1  165   248  6279
## 247 247             Ottawa MI  566  187768 28.9  9.8  182   313  6140
## 248 248             Howard MD  252  187328 29.8  6.1  406   208  9057
## 249 249         Barnstable MA  396  186605 22.1 22.0  338   384  7441
## 250 250            Larimer CO 2601  186136 32.1  9.6  317   409  8921
## 251 251             Beaver PA  435  186093 23.6 16.9  240   616  4088
## 252 252            McHenry IL  604  183241 26.3  9.4  177   371  4854
## 253 253             Peoria IL  620  182827 26.0 14.2  426  1219 12483
## 254 254         Montgomery TX 1044  182201 25.5  8.6  166   340  9469
## 255 255            Harford MD  440  182132 28.8  8.3  289   333  6735
## 256 256              Butte CA 1640  182120 28.2 17.3  395   625  8939
## 257 257            Clayton GA  143  182052 32.4  5.8  148   346 15419
## 258 258             Durham NC  291  181835 33.7 10.7 1253  1496 15477
## 259 259            Alachua FL  874  181596 40.1  9.3  509  1096 18218
## 260 260           Saratoga NY  812  181276 28.4 10.3  200   221  5281
## 261 261           Muscogee GA  216  179278 30.6 10.8  652  1168 11454
## 262 262             Merced CA 1929  178403 28.2  9.2  187   337  8587
## 263 263           Sangamon IL  868  178386 25.8 13.8  527  1330 11929
## 264 264             Gaston NC  357  175093 27.3 12.1  126   368 11865
## 265 265             Racine WI  333  175034 26.0 12.0  242   532 11110
## 266 266           Buncombe NC  656  174821 24.8 16.1  513   725  9512
## 267 267          Cleveland OK  536  174253 33.9  6.7  135   319 12194
## 268 268         Litchfield CT  920  174092 25.4 14.1  415   411  3593
## 269 269          Champaign IL  997  173025 41.6  8.8  441   805 11508
## 270 270             Placer CA 1404  172796 23.5 12.0  265   322  8904
## 271 271          Jefferson MO  657  171380 28.5  8.3   50   230  3128
## 272 272    Arlington_County VA   26  170936 37.6 11.3 1289   781 12526
## 273 273   Newport_News_City VA   68  170045 33.9  9.3  439   836 11776
## 274 274          Calcasieu LA 1071  168134 26.6 10.9  244   845  6399
## 275 275          Lexington SC  701  167611 27.8  8.9  205   259  9814
## 276 276           Harrison MS  581  165365 30.0 10.8  332   764  7043
## 277 277             Ulster NY 1127  165304 27.8 13.0  257   413  4701
## 278 278        Vanderburgh IN  235  165058 27.0 15.7  386  1376  8405
## 279 279          Lafayette LA  270  164762 31.1  8.3  395  1018 10599
## 280 280               York ME  991  164587 26.4 12.6  242   404  6027
## 281 281            Cambria PA  688  163029 23.0 18.7  169   892  3187
## 282 282          Wyandotte KS  151  161993 27.4 13.0  284  1019 18902
## 283 283            Berrien MI  571  161378 25.2 13.7  352   688 12229
## 284 284           Thurston WA  727  161238 25.3 11.7  290   500  7882
## 285 285               Kent RI  170  161135 26.2 15.1  255   359  7302
## 286 286            Shawnee KS  550  160976 26.2 13.1  328   661 13845
## 287 287           Muskegon MI  509  158983 25.8 13.0  232   660 12181
## 288 288              Weber UT  576  158330 26.0 11.1  278   573  9191
## 289 289            Elkhart IN  464  156198 26.8 11.2  155   478  7573
## 290 290         Rensselaer NY  654  154429 29.8 13.2  272   616  5297
## 291 291               Clay MO  397  153411 28.3 10.4   99   693 11085
## 292 292         Schuylkill PA  779  152585 22.9 20.0  157   634  2119
## 293 293               Lake FL  953  152104 19.0 27.5  205   664  7099
## 294 294            Collier FL 2026  152099 22.4 22.8  268   431  9426
## 295 295             Butler PA  789  152013 27.0 13.5  166   261  3420
## 296 296     Chesapeake_City VA  341  151976 28.6  8.4  189   210  8427
## 297 297              Smith TX  929  151309 26.2 13.7  317   795 11712
## 298 298         Tuscaloosa AL 1325  150522 33.3 11.4  309   731 12377
## 299 299          Frederick MD  663  150208 28.7  9.4  156   241  4939
## 300 300           Clermont OH  452  150187 28.1  8.7   87   151  5114
## 301 301          St._Lucie FL  573  150171 22.9 21.0  161   425  9842
## 302 302               Bibb GA  250  149967 27.5 12.9  446  1010 12701
```

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## 303 303                  Onslow NC   767  149838 49.7  4.4    65   133   7505
## 304 304                 Jackson MI   707  149756 27.1 12.3    92   573   8630
## 305 305             Schenectady NY   206  149285 26.1 16.5   325   721   6364
## 306 306             Rock_Island IL   427  148723 24.9 15.0   231   769   7154
## 307 307                   Clark OH   400  147548 25.3 13.8   176   463  10131
## 308 308                  Shasta CA  3786  147036 22.8 14.1   173   468   7336
## 309 309               Penobscot ME  3396  146601 30.0 11.5   228   598   4749
## 310 310               Hampshire MA   529  146568 38.2 11.6   315   236   2547
## 311 311                 Jackson OR  2785  146389 22.1 16.2   262   522   7170
## 312 312              Washington MN   392  145896 26.5  6.6   121    92   5365
## 313 313               St._Clair MI   725  145607 25.9 12.3   140   431   6568
## 314 314                 Fayette PA   790  145351 22.9 18.0   103   409   3612
## 315 315                Anderson SC   718  145196 25.5 13.6   182   456   7525
## 316 316             St._Tammany LA   854  144508 24.2  8.9   177   512   4447
## 317 317                   Horry SC  1134  144053 28.2 12.7   247   505  12459
## 318 318                Okaloosa FL   936  143776 30.8  9.3   189   482   5153
## 319 319                Sullivan TN   413  143596 24.6 14.3   313   982   6236
## 320 320               Middlesex CT   369  143196 28.4 13.1   296   235   3409
## 321 321                 Portage OH   492  142585 33.6  9.4   116   285   2769
## 322 322                Ouachita LA   611  142191 28.3 11.2   505  1043  10605
## 323 323                  Kenton KY   163  142031 28.3 11.5   284   733   6925
## 324 324              Chautauqua NY  1062  141895 25.7 15.7   235   653   5178
## 325 325                    Yolo CA  1012  141092 36.5  9.6   215   168  10650
## 326 326               Outagamie WI   640  140510 28.2 11.1   203   511   4860
## 327 327               Winnebago WI   439  140320 30.3 12.8   262   528   6170
## 328 328              Williamson TX  1124  139551 29.1  7.6   343   185   5724
## 329 329                    Rock WI   721  139510 26.2 12.6   183   491   7643
## 330 330               Berkshire MA   931  139352 26.0 16.9   329   598   3862
## 331 331              Cumberland NJ   489  138053 26.7 13.5   107   534   9071
## 332 332                  Greene OH   415  136731 28.5  9.8   151   210   5221
## 333 333                 Calhoun MI   709  135982 25.1 13.3   183   566   9810
## 334 334                Dona_Ana NM  3807  135510 31.4  8.8   226   240   8850
## 335 335            Hampton_City VA    52  133793 33.0  9.6   256   251   8376
## 336 336                  Monroe MI   551  133600 26.1 10.4    81   182   6726
## 337 337                    Webb TX  3357  133239 28.5  7.9   107   382  12202
## 338 338                    Weld CO  3993  131821 29.6 10.2   207   281   7901
## 339 339              Chittenden VT   539  131761 35.8  8.1   696   573   4739
## 340 340                 Rapides LA  1323  131556 26.8 12.0   243   768   6101
## 341 341                    York SC   683  131497 28.7 10.6   152   276   9525
## 342 342                  Sussex NJ   521  130943 26.3  8.9   166   261   3174
## 343 343                 Madison IN   452  130669 25.5 14.0   133   655   5373
## 344 344              Tippecanoe IN   500  130598 42.3  9.5   421   635   6141
## 345 345                   Blair PA   526  130542 23.7 17.0   139   654   3196
## 346 346                  McLean IL  1184  129180 37.0 10.5   235   588   5949
## 347 347                  Porter IN   418  128932 26.4  9.8   161   379   4014
## 348 348                 Tolland CT   410  128699 33.9  9.0   229   173   1799
## 349 349                 Licking OH   687  128300 26.2 11.8    84   192   1380
## 350 350                 Kenosha WI   273  128181 27.5 12.6   141   334   6616
## 351 351                 Whatcom WA  2120  127780 28.8 12.5   149   214   7070
## 352 352                     Bay FL   764  126994 27.7 12.0   162   478   8634
## 353 353                Davidson NC   552  126677 26.9 12.0    92   221   5662
## 354 354                Richland OH   497  126137 25.0 12.9   100   463   7977
## 355 355               El_Dorado CA  1712  125995 23.0 11.8   150   163   5152
## 356 356               Minnehaha SD   809  123809 29.7 11.6   376   912   5625
## 357 357                  Centre PA  1108  123786 45.0  9.0   180   270   4136
## 358 358                Tazewell IL   649  123692 23.9 13.2    95   297   3140
## 359 359                 Carroll MD   449  123372 26.6 10.2   181   123   3430
## 360 360                  Pueblo CO  2389  123051 24.1 15.2   232   555   8640
## 361 361                 Wichita TX   628  122378 29.5 12.8   115   457  10727
## 362 362                  Medina OH   422  122354 24.5  9.7    72   226    563
## 363 363                  Brazos TX   586  121862 49.4  6.7   218   279   8203
## 364 364                  Oswego NY   953  121771 29.8 10.7    89   269   3582
## 365 365                Franklin PA   772  121082 25.5 14.4   159   296   3155
## 366 366                  Mercer PA   672  121003 24.5 17.2   146   653   2777
## 367 367                   Aiken SC  1073  120940 26.7 11.4   135   191   6835
## 368 368                  Hawaii HI  4028  120317 22.5 12.6   266   391   7226
## 369 369             New_Hanover NC   199  120284 29.0 12.5   275   554  11892
## 370 370               Merrimack NH   935  120005 27.7 12.1   201   368   3325
## 371 371                Delaware IN   393  119659 32.9 12.7   161   494   1064
## 372 372                  Taylor TX   916  119655 30.7 12.0   185   467   6785
## 373 373                Humboldt CA  3573  119118 27.5 12.3   204   311   5737
## 374 374                   Ector TX   901  118934 27.1  9.3   102   389  14643
## 375 375                 Stearns MN  1345  118791 33.6 10.5   239   661   4101
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## 376 376             Lycoming PA  1235  118710 25.4 15.1    211    668    3826
## 377 377           Rutherford TN   619  118570 33.1  8.4    120    215    6072
## 378 378              Catawba NC   400  118412 27.2 11.9    155    464    6830
## 379 379                Macon IL   581  117206 24.1 14.5    172    725    6103
## 380 380                Pinal AZ  5370  116379 24.4 13.7    144    309    6275
## 381 381              Calhoun AL   609  116034 28.8 12.4    126    486    4901
## 382 382             Kennebec ME   868  115904 26.1 13.4    236    497    4184
## 383 383           Livingston MI   568  115645 25.3  8.2     82     93    3760
## 384 384             Marathon WI  1545  115400 25.9 12.7    156    254    3655
## 385 385              Jackson MS   727  115243 25.9  9.4    110    346    4777
## 386 386             Florence SC   799  114344 26.2 11.2    202    731    8421
## 387 387              Lebanon PA   362  113744 25.3 15.0     98    196    2919
## 388 388          Yellowstone MT  2635  113419 25.6 12.4    262    554    3879
## 389 389           Washington AR   950  113409 32.0 11.2    310    651    6122
## 390 390                 Wood OH   617  113269 34.5 10.2     78    124    3759
## 391 391               Benton WA  1703  112560 25.1 10.1    186    278    6249
## 392 392                Boone MO   685  112379 40.9  8.4    213   1023    5456
## 393 393         St._Lawrence NY  2686  111974 31.2 12.1    177    378    3851
## 394 394                  Bay MI   444  111723 25.4 13.4    132    415    4849
## 395 395             Comanche OK  1069  111486 34.5  8.7    134    347    5979
## 396 396      Alexandria_City VA    15  111183 38.3 10.3    830    662    8537
## 397 397                 Kent DE   591  110993 29.7 10.3    123    193    5846
## 398 398            Charlotte FL   694  110975 16.6 33.8    140    632    3741
## 399 399            Jefferson NY  1272  110943 32.7 10.9    116    336    3064
## 400 400                 Napa CA   754  110765 24.5 16.5    554   1019    5056
## 401 401                Rowan NC   511  110605 26.0 15.2    121    244    5233
## 402 402           Washington RI   333  110006 31.0 12.3    103    241    3838
## 403 403                Allen OH   405  109755 26.2 13.4    168    560    4734
## 404 404             Imperial CA  4175  109303 25.5 10.2     85    221    8042
## 405 405               Monroe IN   394  108978 45.8  8.6    251    285    1657
## 406 406             Hamilton IN   398  108936 25.1  8.2    203    122    1699
## 407 407           Columbiana OH   533  108276 23.4 14.9     86    485     898
## 408 408             Alamance NC   431  108213 27.3 14.8     94    340    4152
## 409 409                 Pitt NC   652  107924 35.4  9.9    157    583    4603
## 410 410            Hunterdon NJ   430  107776 25.6  9.5    216    182    2068
## 411 411              Osceola FL  1322  107728 27.1 13.9    104    291    9665
## 412 412              Yavapai AZ  8124  107714 18.3 23.8    114    159    3952
## 413 413             La_Porte IN   598  107066 26.0 13.1    128    519    6021
## 414 414             La_Salle IL  1135  106913 23.8 17.2    105    504    2982
## 415 415                 Yuma AZ  5514  106895 27.4 13.8     90    197    5414
## 416 416              Midland TX   900  106611 26.8  9.0    129    333    7546
## 417 417             Randolph NC   788  106546 27.1 12.2     74    145    2940
## 418 418              Olmsted MN   653  106470 29.3 10.0   1830   1437    4310
## 419 419                 Vigo IN   403  106107 30.2 15.1    189    576    3435
## 420 420                 Clay FL   601  105986 26.3  8.5     97    277    4560
## 421 421         Androscoggin ME   470  105259 27.9 13.4    134    527    4020
## 422 422              Robeson NC   949  105179 26.7 10.7     79    281    4318
## 423 423                Gregg TX   274  104948 26.4 13.3    166    420    9181
## 424 424                Wayne NC   553  104666 29.7 10.2     98    263    4682
## 425 425            Strafford NH   369  104233 34.8 10.7    137    237    3651
## 426 426            Sheboygan WI   514  103877 25.4 14.6    193    421    4433
## 427 427            Fairfield OH   506  103461 25.2 11.3     73    195     625
## 428 428               Sumner TN   529  103281 25.5 10.2     98    259    3285
## 429 429                 Cass ND  1766  102874 34.4  9.8    343    643    3401
## 430 430               Sumter SC   666  102637 31.6  9.4     92    214    7138
## 431 431                Sarpy NE   241  102583 30.4  4.8     37    160    2689
## 432 432              Windham CT   513  102525 28.5 12.5    127    254    1397
## 433 433                Kings CA  1390  101469 33.7  7.7     82    180    4449
## 434 434                Wayne OH   555  101461 26.3 11.6     63    155    2377
## 435 435              Charles MD   461  101154 29.9  6.5    102    104    5279
## 436 436             Hernando FL   478  101115 16.4 30.7     82    290    4414
## 437 437               Martin FL   556  100900 20.4 27.5    166    277    5081
## 438 438           Montgomery TN   539  100498 35.7  7.9     75    188    6537
## 439 439                 Maui HI  1159  100374 26.2 11.3    134    182    7130
## 440 440               Morgan AL   582  100043 26.3 11.7    124    464    4693
##      X11  X12  X13  X14   X15    X16 X17
## 1   70.0 22.3 11.6  8.0 20786 184230   4
## 2   73.4 22.8 11.1  7.2 21729 110928   2
## 3   74.9 25.4 12.5  5.7 19517  55003   3
## 4   81.9 25.3  8.1  6.1 19588  48931   4
## 5   81.2 27.8  5.2  4.8 24400  58818   4
## 6   63.7 16.6 19.5  9.5 16803  38658   1
## 7   81.5 22.1  8.8  4.9 18042  38287   4
```

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## 8    70.0 13.7 16.9 10.0 17461  36872   2
## 9    65.0 18.8 14.2  8.7 17823  34525   3
## 10   77.1 26.3 10.4  6.1 21001  38911   3
## 11   64.3 15.2 16.1  8.0 16721  26512   1
## 12   88.2 32.8  5.0  4.6 23779  35843   4
## 13   82.0 32.6  5.0  5.5 25193  37728   4
## 14   75.4 14.9 10.3  8.0 16399  23260   4
## 15   74.0 20.1 11.0  5.5 21086  29776   2
## 16   84.3 35.4  4.2  7.3 25312  35398   1
## 17   79.0 22.6  8.7  5.3 20681  27639   1
## 18   82.2 23.0  3.3  7.0 24262  32071   1
## 19   84.2 30.0  2.5  5.1 31679  40782   1
## 20   81.4 28.8  8.1  5.3 22148  28331   4
## 21   76.8 18.8  7.1  7.4 22355  28066   3
## 22   72.7 19.7 16.2  6.7 15508  18383   3
## 23   74.1 14.6  8.4 10.7 17185  20114   4
## 24   79.9 24.0  8.2  6.6 18825  22027   3
## 25   84.6 30.2  4.4  7.3 26884  29131   2
## 26   82.2 23.0  9.8  6.3 18934  19714   4
## 27   88.2 31.6  6.4  4.3 23705  24474   2
## 28   82.3 29.2  4.0  5.1 24219  24062   2
## 29   76.4 20.0  9.4  6.8 18305  17729   1
## 30   81.0 26.6  9.1  4.2 19040  18306   2
## 31   76.3 19.3 12.6  4.9 18431  17680   2
## 32   81.0 35.3  4.7  5.4 33330  29159   1
## 33   75.6 23.7 10.3  4.5 20580  17827   2
## 34   78.8 22.1  6.2  8.4 26798  23141   3
## 35   77.7 25.8  6.0  6.9 24875  21188   1
## 36   78.1 18.5  6.2  6.2 21610  18404   3
## 37   81.2 24.6  5.4  2.3 21307  17818   4
## 38   75.6 20.2  9.5  6.0 16876  14075   3
## 39   81.0 34.2  4.5  5.9 32342  26768   1
## 40   75.1 20.8 14.7  5.4 18430  15229   3
## 41   81.6 31.7  2.7  5.2 32230  26602   1
## 42   91.4 49.0  2.2  3.2 28999  23738   3
## 43   77.5 24.2  6.0  7.3 22197  17851   1
## 44   86.5 31.6  5.5  5.6 25523  20514   4
## 45   76.8 21.4  9.3  5.0 19148  15264   2
## 46   88.6 36.0  1.7  4.8 26772  20927   2
## 47   70.1 24.0 11.3  7.9 24523  19084   1
## 48   90.6 49.9  2.7  3.3 30081  22772   3
## 49   77.3 13.8  7.5  5.8 18625  13810   4
## 50   60.7 15.5 17.8  9.4 17263  12706   3
## 51   83.2 25.5  3.7  5.0 19568  14270   3
## 52   85.3 23.8  7.7  4.5 15399  11179   4
## 53   78.0 35.0  9.7  5.6 28532  20656   4
## 54   76.9 13.5  4.0  9.4 20924  15011   2
## 55   80.1 26.3  7.7  4.4 21641  15451   1
## 56   77.4 22.2  6.3 10.2 19895  14120   1
## 57   78.4 25.0  3.8  5.7 23470  16244   3
## 58   83.8 32.1  2.2  5.0 28462  19300   1
## 59   78.8 21.2  7.8  6.6 17879  12113   3
## 60   76.9 18.4  9.8  6.6 17662  11886   3
## 61   79.4 26.5  3.4  5.7 24896  16725   1
## 62   80.2 25.9  7.5  9.0 22834  15301   1
## 63   79.4 23.0  5.0  7.0 21420  14330   4
## 64   66.2 16.9 16.8 12.6 16365  10923   4
## 65   80.5 23.3 12.0  3.9 15191  10131   4
## 66   74.1 19.3 10.9  6.3 19140  12727   3
## 67   75.4 27.7 14.4  8.7 23150  15369   1
## 68   73.8 19.9 12.7  5.3 18624  12134   3
## 69   84.1 31.3  4.3  4.2 28819  18721   4
## 70   77.8 31.6 15.4  5.3 22819  14808   3
## 71   79.5 20.0  9.8  6.5 18611  11785   2
## 72   88.0 34.4  3.1  7.5 26909  16578   1
## 73   73.1 33.3 13.3  7.7 23603  14325   3
## 74   79.1 22.6 11.3  6.0 17741  10638   3
## 75   67.0 18.3  8.9  9.0 17866  10653   1
## 76   63.7 15.2 22.4 10.8 11545   6830   3
## 77   83.2 17.5  8.7  6.4 16194   9493   4
## 78   82.9 23.7  8.9  5.1 19215  11219   4
## 79   83.4 34.7 10.2  4.8 18340  10571   3
```

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## 80   77.8 20.0  9.8  5.7 18410  10564   2
## 81   82.8 28.4  3.4  5.8 27391  15151   1
## 82   64.1 19.7 12.4  9.0 18463  10212   1
## 83   81.4 24.8  5.0  5.3 23658  12956   1
## 84   83.9 32.7  7.2  4.4 21005  11465   3
## 85   67.6 13.3 13.7 11.8 15881   8631   4
## 86   82.9 24.8  2.9  6.7 22548  12202   1
## 87   84.7 32.0  3.7  4.6 27378  14138   2
## 88   78.3 19.7  9.5  6.0 18583   9570   2
## 89   81.6 28.3  7.2  4.8 20942  10710   3
## 90   75.9 24.4 10.0  4.6 19505   9963   3
## 91   65.0 15.9  7.4 12.3 18521   9378   1
## 92   81.7 23.7 10.0  6.1 19295   9712   3
## 93   75.5 21.0  8.0  6.9 19930  10021   1
## 94   80.3 20.7  6.9  7.5 18674   9349   2
## 95   68.1 22.4 27.3  6.1 16578   8238   3
## 96   75.2 25.0  5.3  6.9 26248  12962   1
## 97   85.0 28.8  8.1  4.3 20303   9862   2
## 98   68.6 13.2 12.0 12.0 15453   7427   4
## 99   82.1 26.7 10.9  5.2 17518   8419   4
## 100 73.5 12.8 11.7  7.1 16327   7765   2
## 101 80.7 24.4  7.1  5.6 19401   9099   1
## 102 79.2 29.0 13.1  5.4 22156  10360   4
## 103 85.7 19.3  4.9  5.6 18545   8635   4
## 104 76.2 17.0 12.0  8.8 17815   8237   2
## 105 73.6 17.6 10.9  9.6 19073   8703   1
## 106 68.8 18.7  7.6  8.1 21973   9955   1
## 107 76.0 18.8 11.4  5.6 17101   7666   3
## 108 85.8 33.0  3.8  4.1 21933   9820   3
## 109 80.6 25.2  5.0  6.2 22284   9848   1
## 110 89.8 30.7  4.1  4.1 20997   9206   4
## 111 83.8 22.2  5.3 10.4 21500   9358   1
## 112 74.9 15.3  4.3  7.4 20974   9086   1
## 113 76.8 12.8 14.0 12.6 16829   7244   2
## 114 81.1 24.6  3.0  5.0 22797   9740   3
## 115 85.4 35.3  5.5  3.5 20658   8746   3
## 116 70.5 16.7  5.3  5.3 18878   7982   1
## 117 87.0 36.7  1.8  5.1 31520  13281   1
## 118 84.5 24.9  8.1  2.9 19629   8174   2
## 119 68.0 12.9  9.4 10.1 14835   6014   3
## 120 82.4 22.2  8.3  4.5 19276   7781   2
## 121 82.3 20.4  6.3  7.1 17668   7049   3
## 122 88.3 25.8  8.1  6.1 16807   6673   4
## 123 62.8 15.3 20.6  9.0 18113   7185   2
## 124 81.9 23.6  3.1  5.6 23008   9090   1
## 125 88.0 25.5  4.3  5.4 17697   6956   3
## 126 91.5 35.2  4.4  3.9 22507   8812   4
## 127 84.4 24.5  5.2  5.7 22055   8562   4
## 128 46.6 11.5 36.3 17.6  8899   3413   3
## 129 80.5 27.5 15.1  5.4 17881   6797   3
## 130 70.1 15.5 17.5  7.2 14389   5448   3
## 131 84.9 34.7  3.0  4.6 24732   9309   1
## 132 75.4 14.8  7.9  6.9 15648   5801   3
## 133 68.4 13.0 11.4 14.3 15238   5646   4
## 134 77.7 15.4  8.6  6.9 17069   6321   1
## 135 80.0 26.6  7.4  6.0 21902   8095   4
## 136 76.0 14.3  8.9  6.9 16898   6211   2
## 137 88.9 34.2  4.8  3.1 20087   7374   2
## 138 84.4 20.6  9.8  6.2 16365   5914   4
## 139 80.4 18.0  4.5  7.4 18787   6713   2
## 140 72.9 21.5  8.5 10.9 19465   6923   4
## 141 92.9 40.5  2.5  3.3 26156   9287   2
## 142 86.7 29.6  2.9  4.0 19861   7009   3
## 143 79.0 23.5 10.5  5.8 18225   6373   3
## 144 76.1 24.8  7.3  5.4 20349   7070   3
## 145 82.7 18.7  6.0  7.0 17268   5878   4
## 146 72.8 13.9  4.3  6.2 19502   6622   1
## 147 70.0 15.1  5.2  6.7 19655   6614   1
## 148 82.2 26.4  4.0  7.5 22581   7589   1
## 149 74.6 23.9 10.2  4.6 17382   5836   3
## 150 76.9 16.4  6.1  6.4 18877   6326   3
## 151 72.0 13.1  8.3  8.8 16405   5383   1
## 152 77.1 29.5  5.3  5.5 26026   8480   1
```

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## 153 71.6 21.0  7.8  4.9 17874   5723   3
## 154 77.7 21.4  5.0  7.5 21684   6884   2
## 155 60.2 11.8 18.0 17.1 14710   4588   4
## 156 88.2 29.8  4.8  4.4 19932   6210   4
## 157 77.2 19.5  6.4  6.7 19788   6088   1
## 158 88.0 27.1  2.2  4.1 23004   7010   2
## 159 81.2 19.0  5.6  5.9 19123   5753   2
## 160 75.5 22.4 13.8  4.9 16015   4725   3
## 161 80.9 28.3  6.0  4.5 21003   6145   1
## 162 76.0 18.7  7.6  6.6 16750   4882   2
## 163 68.9 17.0 17.2  7.7 15124   4403   3
## 164 74.6 19.6  4.9  6.6 19785   5760   1
## 165 84.6 26.3  5.3  6.1 17885   5142   3
## 166 79.4 28.0 10.1  4.6 17137   4896   3
## 167 72.5 19.7 10.2  5.9 18242   5209   3
## 168 87.2 41.9  6.4  6.0 22782   6446   2
## 169 83.0 22.2  9.4  6.5 15701   4442   4
## 170 83.9 29.2 11.0  6.9 17458   4922   2
## 171 66.9  9.1  7.9  8.3 13944   3920   3
## 172 85.7 23.6  4.7  4.2 19942   5561   4
## 173 81.3 21.9  4.6  5.1 24948   6930   3
## 174 77.5 16.2  9.5  7.1 16331   4500   1
## 175 90.7 27.6  3.3  4.7 21123   5814   2
## 176 80.3 16.6 12.1  6.4 12923   3548   3
## 177 86.8 32.3  4.5  5.6 17801   4869   3
## 178 75.3 12.3  9.1  9.5 16006   4340   2
## 179 77.6 24.1  7.8  4.4 20645   5489   3
## 180 83.3 33.0  4.1  5.3 26757   7103   1
## 181 78.8 13.0  8.8  5.0 16116   4271   4
## 182 74.6 14.0 12.8  6.7 16256   4305   2
## 183 88.3 39.1  3.9  5.9 22303   5889   3
## 184 87.9 26.2 10.6  4.3 11467   3023   4
## 185 72.6 14.7 13.9  8.4 16190   4256   2
## 186 76.2 18.2 13.3  5.8 15392   4045   3
## 187 72.7 16.8 15.1  6.4 16412   4287   3
## 188 50.0 12.0 33.7 12.5  9728   2530   3
## 189 79.8 24.8  3.6  5.1 22173   5753   1
## 190 80.9 21.8  4.7  6.8 20259   5165   1
## 191 82.5 20.7  6.3  5.0 21327   5431   4
## 192 75.2 26.4 16.7  6.3 16215   4126   3
## 193 76.3 16.7  7.7  7.9 18376   4648   2
## 194 75.1 16.7  8.8  6.7 16477   4133   1
## 195 75.8 14.4  8.5  7.9 17980   4481   2
## 196 73.4 18.2 19.1  7.1 16337   4056   3
## 197 73.1 16.7  4.9  6.8 18336   4531   1
## 198 76.1 19.2  7.1  5.7 17211   4252   2
## 199 86.2 25.9  3.2  8.0 21770   5352   1
## 200 85.0 27.6  5.7  5.7 21362   5194   1
## 201 86.3 38.3  1.4  4.1 33180   7972   1
## 202 74.4 15.5 15.5  6.7 17418   4170   3
## 203 80.2 30.1  8.4  5.2 18990   4537   3
## 204 83.9 16.8  7.0  6.6 16790   3997   4
## 205 77.6 18.6  7.2  5.5 18348   4363   1
## 206 91.9 44.0  3.0  4.0 37541   8638   4
## 207 77.5 18.1  4.7  7.1 18523   4262   1
## 208 81.9 29.7  6.2  8.0 22025   5060   4
## 209 78.7 17.5  9.4  5.7 16022   3661   4
## 210 75.2 11.4  9.4  7.9 16144   3678   2
## 211 63.0 14.3  8.8  5.5 15776   3578   3
## 212 80.9 30.2  6.9  3.8 18301   4125   3
## 213 80.2 30.6 10.2  3.8 19320   4354   3
## 214 91.3 42.1  5.6  3.5 21421   4827   4
## 215 72.9 16.4  6.4  8.3 24035   5392   1
## 216 83.4 27.1  8.9  5.9 18288   4086   2
## 217 74.2 23.4 13.2  5.6 15443   3438   3
## 218 75.8 13.6  8.6  8.3 16647   3675   1
## 219 73.3 14.8  7.8  7.9 16963   3716   1
## 220 75.8 19.3 12.5  7.0 17744   3858   3
## 221 83.3 22.9  6.8  5.8 17221   3740   4
## 222 73.7 18.6 13.6  4.3 17776   3856   3
## 223 87.8 27.6  2.3  4.3 20543   4431   3
## 224 81.1 17.5  3.6  5.7 19692   4244   2
## 225 88.1 27.6  6.0  2.2 17816   3806   2
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## 226 83.3 21.2  3.5  6.4 18753   3993   2
## 227 78.9 20.7  6.5  5.9 18058   3831   1
## 228 74.8 13.0 14.7  8.8 16904   3583   2
## 229 75.6 15.5  6.8  5.8 17997   3810   3
## 230 75.3 24.2 14.1  5.9 17469   3653   3
## 231 78.9 20.7  9.2  4.8 16630   3458   2
## 232 72.4 17.6 12.3  7.5 17192   3569   3
## 233 87.2 24.9  6.2  4.1 18786   3866   4
## 234 73.2 13.6  9.7  7.0 16625   3401   1
## 235 80.3 17.3  9.7  6.5 15419   3056   2
## 236 81.0 22.9  2.8  4.6 19254   3759   1
## 237 69.6 11.5 10.8  8.6 13802   2689   3
## 238 82.6 17.7  6.7  4.6 18490   3598   2
## 239 84.9 37.1  9.4  3.9 16422   3161   3
## 240 75.5 15.1  7.7  5.6 17951   3441   3
## 241 79.1 17.2 12.2  6.7 13536   2587   3
## 242 86.6 19.8  7.5  5.2 17009   3227   4
## 243 70.9 17.3 14.8  4.9 15941   3024   3
## 244 71.6 16.6 13.9  6.4 14925   2823   3
## 245 66.1 13.7 15.6 11.6 15374   2903   4
## 246 89.9 23.5  5.5  4.5 13394   2517   4
## 247 79.8 18.7  3.8  6.5 18360   3447   2
## 248 91.1 46.9  2.2  4.1 27546   5160   3
## 249 88.4 28.1  5.8 11.1 23267   4342   1
## 250 88.6 32.3  6.6  4.1 17140   3190   4
## 251 74.9 11.9 10.8  9.7 15162   2822   1
## 252 84.5 21.0  2.5  7.1 21855   4005   2
## 253 77.9 19.5 11.3  7.2 18342   3353   2
## 254 75.5 19.4  9.4  5.5 17084   3113   3
## 255 81.6 21.5  4.1  6.7 20941   3814   3
## 256 77.6 19.5 12.2  9.4 15051   2741   4
## 257 77.2 14.7  7.3  5.8 16171   2944   3
## 258 78.9 33.4  8.7  3.6 19238   3498   3
## 259 82.7 34.6 14.4  4.2 16058   2916   3
## 260 83.0 25.2  4.4  5.9 18857   3418   1
## 261 71.5 16.6 14.9  4.6 15505   2780   3
## 262 63.1 12.0 15.4 14.6 13961   2491   4
## 263 81.8 22.4  7.2  4.8 19601   3497   2
## 264 60.9 10.8  8.2  6.2 16319   2857   3
## 265 76.4 16.5  7.9  6.5 18426   3225   2
## 266 74.5 19.1  8.2  4.9 16934   2960   3
## 267 83.9 25.9  7.0  4.8 14443   2517   3
## 268 80.9 25.0  2.4  7.0 25161   4380   1
## 269 87.5 34.1  8.0  4.5 16957   2934   2
## 270 85.1 22.7  5.3  6.8 20168   3485   4
## 271 71.6  9.0  6.0  8.7 15896   2724   2
## 272 87.5 52.3  4.3  3.6 30242   5169   3
## 273 79.3 18.4 12.2  6.5 15327   2606   3
## 274 70.3 14.7 15.5  7.8 14968   2517   3
## 275 77.3 21.0  6.3  4.1 18126   3038   3
## 276 74.7 16.3 15.4  6.7 13691   2264   3
## 277 76.6 21.6  5.6  5.9 18824   3112   1
## 278 75.2 16.0  9.1  5.7 18093   2986   2
## 279 73.3 22.5 16.2  5.0 16868   2779   3
## 280 79.5 19.0  4.7  6.9 17908   2947   1
## 281 71.2 10.8 11.2  9.2 14473   2360   1
## 282 69.9 10.3 13.9  7.4 14134   2290   2
## 283 74.7 16.7 11.6  9.1 16232   2619   2
## 284 86.5 24.7  7.1  5.9 17312   2791   4
## 285 76.8 20.5  3.7  8.6 20086   3237   1
## 286 84.4 22.3  7.4  4.7 19558   3148   2
## 287 74.2 11.1 12.4 12.0 14767   2348   2
## 288 82.5 18.0  7.8  5.7 15301   2423   4
## 289 72.8 14.2  5.3  6.4 16770   2619   2
## 290 77.7 19.5  6.6  6.3 17774   2745   1
## 291 84.7 20.0  4.2  5.7 18395   2822   2
## 292 68.4  8.1  7.7  9.7 15853   2419   1
## 293 70.6 12.7  7.9  8.9 17496   2661   3
## 294 79.0 22.3  6.4  7.5 25589   3892   3
## 295 78.6 15.6  7.1  6.8 17251   2622   1
## 296 77.1 16.9  7.0  6.1 16924   2572   3
## 297 75.7 19.8 12.6  6.6 17511   2650   3
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## 298 69.6 20.0 13.5  5.4 15113   2275   3
## 299 80.4 22.0  3.5  6.0 19954   2997   3
## 300 72.8 14.5  7.4  6.0 16231   2438   2
## 301 71.7 13.1  8.5 13.8 14137   2123   3
## 302 68.2 17.0 15.9  4.1 17548   2632   3
## 303 83.0 13.4  9.8  5.6 10190   1527   3
## 304 77.7 12.9  9.4  9.9 15750   2359   2
## 305 80.7 23.0  5.7  5.6 20679   3087   1
## 306 77.4 15.0 10.2  7.5 17818   2650   2
## 307 73.4 12.2 10.4  6.5 16676   2461   2
## 308 78.4 13.7 11.0 10.3 16277   2393   4
## 309 79.1 17.7  9.5  8.0 15521   2275   1
## 310 83.0 31.9  5.7  7.7 17853   2617   1
## 311 80.1 17.6  9.7  7.6 15582   2281   4
## 312 90.0 26.2  3.6  4.6 20682   3017   2
## 313 74.8 10.7  9.2 11.8 17480   2545   2
## 314 67.8  9.3 17.6  9.4 14051   2042   1
## 315 64.0 12.9  8.6  6.6 14205   2063   3
## 316 76.9 23.1 11.1  6.2 17129   2475   3
## 317 74.3 16.0 11.6  7.7 14693   2117   3
## 318 83.8 21.0  7.8  6.7 15803   2272   3
## 319 66.8 15.6 10.4  4.4 15747   2261   3
## 320 82.6 28.2  2.6  5.8 24132   3456   1
## 321 79.3 17.6  7.6  6.0 16031   2286   2
## 322 71.6 18.9 19.6  6.4 13869   1972   3
## 323 74.4 17.0  8.2  5.4 16935   2405   3
## 324 74.4 14.2  9.9  7.7 15197   2156   1
## 325 79.1 30.3  9.8  7.2 19727   2783   4
## 326 81.5 16.7  4.6  4.9 17182   2414   2
## 327 80.6 18.2  5.3  4.8 17645   2476   2
## 328 81.4 24.6  7.6  3.8 14934   2084   3
## 329 78.2 13.3  7.8  9.7 16742   2336   2
## 330 77.9 20.9  6.3 10.1 20068   2797   1
## 331 63.4 10.8 10.2 10.7 16819   2322   1
## 332 82.4 26.0  7.1  5.2 18161   2483   2
## 333 76.8 13.8 11.0  8.5 15944   2168   2
## 334 70.4 21.9 20.7  7.4 11379   1542   4
## 335 79.7 19.1  8.8  6.8 14743   1973   3
## 336 74.1 10.5  6.9 11.1 17278   2308   2
## 337 47.8 11.1 33.1  9.8  8973   1196   3
## 338 74.9 18.4 10.6  4.5 15874   2093   4
## 339 86.7 34.0  5.0  4.4 19940   2627   1
## 340 69.0 14.6 18.6  7.1 14615   1923   3
## 341 67.5 16.9  7.6  5.5 16713   2198   3
## 342 85.1 24.9  2.5  6.8 24405   3196   1
## 343 73.5 11.7 10.3  7.5 16018   2093   2
## 344 85.2 30.7  6.8  3.2 15847   2070   2
## 345 75.0 10.5 11.0  9.0 14779   1929   1
## 346 84.7 29.0  5.9  4.6 18961   2449   2
## 347 82.4 18.5  4.6  4.5 17566   2265   2
## 348 84.7 29.2  2.7  5.9 21944   2824   1
## 349 76.4 13.0  8.3  6.3 16412   2106   2
## 350 75.1 12.7  7.6  6.4 17338   2222   2
## 351 83.2 22.0  7.4  6.3 16002   2045   4
## 352 74.7 15.7 11.2  8.0 14814   1881   3
## 353 64.2 10.0  7.3  5.9 15079   1910   3
## 354 73.5 11.6  8.4  9.4 16191   2042   2
## 355 85.9 20.8  5.8  6.1 19250   2425   4
## 356 83.1 21.3  5.4  2.5 18526   2294   2
## 357 83.6 32.3  6.2  6.1 15476   1916   1
## 358 78.6 13.6  7.1  7.4 18008   2227   2
## 359 78.5 19.6  2.5  5.7 22002   2714   3
## 360 73.9 14.0 16.7  7.0 14197   1747   4
## 361 75.1 16.5 12.5  6.8 17119   2095   3
## 362 82.4 18.0  4.1  5.8 18892   2312   2
## 363 79.8 35.8 14.9  3.6 12641   1540   3
## 364 74.7 12.9  8.1 10.0 14834   1806   1
## 365 69.4 12.4  5.7  6.7 16281   1971   1
## 366 75.1 13.6 10.1  7.2 15177   1836   1
## 367 70.7 17.2 11.0  4.9 17898   2165   3
## 368 77.7 18.5 10.9  4.0 16728   2013   4
## 369 78.1 21.2  9.9  5.9 17119   2059   3
## 370 83.2 25.4  3.6  7.1 20600   2472   1
```

```
## 371 74.5 16.5 10.3  6.1 15697   1878   2
## 372 75.4 20.7 11.2  5.9 16021   1917   3
## 373 80.5 20.0 12.8  8.8 16138   1922   4
## 374 66.9 11.4 16.6  6.6 14766   1756   3
## 375 78.3 17.5  7.3  5.4 14757   1753   2
## 376 74.5 12.3  8.4  8.0 15778   1873   1
## 377 73.9 18.7  7.6  5.4 15501   1838   3
## 378 66.7 14.2  4.8  6.4 17396   2060   3
## 379 76.2 14.8  9.8  8.9 18021   2112   2
## 380 65.5  8.2 18.7  7.9 11396   1326   4
## 381 67.4 14.2 11.7  7.3 13776   1598   3
## 382 78.9 18.1  7.3  6.8 17131   1986   1
## 383 85.6 19.6  3.0  8.1 21153   2446   2
## 384 75.9 13.5  5.5  5.9 16305   1882   2
## 385 74.4 14.4 14.0  7.1 13475   1553   3
## 386 64.3 14.8 15.9  5.9 14961   1711   3
## 387 70.0 11.8  5.2  5.9 16500   1877   1
## 388 83.7 21.5  9.0  5.3 17272   1959   4
## 389 73.2 20.0  9.8  3.7 14736   1671   3
## 390 83.8 21.9  5.0  6.6 17522   1985   2
## 391 83.9 23.3  8.9  6.8 17332   1951   4
## 392 84.8 36.5  9.3  3.2 17175   1930   2
## 393 73.1 15.1 12.8  9.8 12704   1423   1
## 394 74.0 11.0 10.2  9.2 16499   1843   2
## 395 81.1 18.4 13.3  6.6 13228   1475   3
## 396 86.9 48.5  4.7  4.6 31699   3524   3
## 397 73.1 15.0  8.7  7.6 14946   1659   1
## 398 75.7 13.4  5.2  7.2 16362   1816   3
## 399 76.4 13.6  9.5 11.0 15205   1687   1
## 400 80.7 22.3  4.6  5.9 22668   2511   4
## 401 66.0 11.7  6.8  5.4 15691   1736   3
## 402 82.8 29.1  3.7  6.7 19449   2140   1
## 403 76.1 11.4 10.4  7.3 16542   1816   2
## 404 53.2  9.7 20.8 21.3 14523   1587   4
## 405 82.1 32.9  9.5  3.7 14266   1555   2
## 406 88.7 36.2  2.6  2.8 25681   2798   2
## 407 71.8  8.5 13.0  6.7 12597   1364   2
## 408 67.9 14.6  6.0  4.5 17306   1873   3
## 409 71.0 21.9 15.5  5.5 15852   1711   3
## 410 85.9 34.6  1.8  4.1 30255   3261   1
## 411 73.7 11.2  6.9  6.7 16451   1772   3
## 412 78.9 17.7  9.8  5.4 13681   1474   4
## 413 73.9 11.7  7.8  5.8 16655   1783   2
## 414 73.1 10.5  8.7  9.6 16119   1723   2
## 415 64.9 12.7 15.4 17.8 11490   1228   4
## 416 76.8 26.4 11.5  5.4 19345   2062   3
## 417 62.0  9.1  6.5  4.8 14721   1568   3
## 418 88.0 29.5  4.5  3.3 20515   2184   2
## 419 76.0 18.1 10.7  5.0 15036   1595   2
## 420 81.2 17.9  5.4  5.9 16029   1699   3
## 421 71.8 12.6  8.7  9.7 16154   1700   1
## 422 57.0 11.0 20.7  8.9 10849   1141   3
## 423 75.8 17.7 13.4  8.2 16775   1761   3
## 424 71.2 12.7 11.9  7.3 13350   1397   3
## 425 79.8 21.7  5.1  6.5 17182   1791   1
## 426 77.4 13.8  4.5  5.6 18061   1876   2
## 427 78.8 15.5  6.8  6.3 16342   1691   2
## 428 70.6 14.4  7.0  6.8 16514   1706   3
## 429 87.1 26.5  7.3  2.5 16275   1674   2
## 430 69.8 15.0 16.9  9.4 11803   1211   3
## 431 91.0 25.4  3.5  2.6 16137   1655   2
## 432 71.1 16.8  6.0  9.2 18070   1853   1
## 433 65.6  9.0 15.0 12.8 13907   1411   4
## 434 73.6 13.9  8.4  5.9 16464   1670   2
## 435 81.0 16.2  3.7  4.9 19317   1954   3
## 436 70.5  9.7  7.9  8.2 13919   1407   3
## 437 79.7 20.3  5.0  9.8 27125   2737   3
## 438 77.9 16.5 10.8  8.0 13169   1323   3
## 439 77.0 17.8  5.7  3.2 18504   1857   4
## 440 69.4 15.5  9.4  7.1 16458   1647   3
```

```
s1 <- summary(linmod1)$s
s1^2
```

```
## [1] 7335008
```

```
s2 <- summary(linmod2)$s
s2^2
```

```
## [1] 4411341
```

```
s3 <- summary(linmod3)$s
s3^2
```

```
## [1] 7474349
```

```
s4 <- summary(linmod4)$s
s4^2
```

```
## [1] 8214318
```

2.63 Refer to the CDI data set in Appendix C.2 and Project I.44. Obtain a separate interval estimate of b1, for each region. Use a 90 percent confidence coefficient in each case. Do the regression lines for the different regions appear to have similar slopes? Region 1 b1 CI: (460.5177,583.8) Region 2 b1 CI: (193.4858,283.853) Region 3 b1 CI: (285.7076,375.5158) Region 4 b1 CI: (364.7585,515.8729) Yes, the regression lines for the different regions appear to have similar slopes.

```
n <- nrow(region1)
Y <- region1$X15
X <- region1$X12
linmod1 <- lm(Y~X)
b1 <- linmod1$coef[2]
s.b1 <- summary(linmod1)$coef[2, 2]
alpha <- 0.1
qt <- qt(alpha/2, n - 2)
pvalue <- pt(-abs(b1/s.b1),n-2)+(1-pt(abs(b1/s.b1),n-2))
lower <- b1+s.b1*qt(alpha/2,n-2)
upper <- b1-s.b1*qt(alpha/2,n-2)
lower
```

```
##        X
## 460.5177
```

```
upper
```

```
##     X
## 583.8
```

```
n <- nrow(region2)
Y <- region2$X15
X <- region2$X12
linmod2 <- lm(Y~X)
b1 <- linmod2$coef[2]
s.b1 <- summary(linmod2)$coef[2, 2]
alpha <- 0.1
qt <- qt(alpha/2, n - 2)
pvalue <- pt(-abs(b1/s.b1),n-2)+(1-pt(abs(b1/s.b1),n-2))
lower <- b1+s.b1*qt(alpha/2,n-2)
upper <- b1-s.b1*qt(alpha/2,n-2)
lower
```

```
##        X
## 193.4858
```

```
upper
```

```
##        X
## 283.853
```

```
n <- nrow(region3)
Y <- region3$X15
X <- region3$X12
linmod3 <- lm(Y~X)
b1 <- linmod3$coef[2]
s.b1 <- summary(linmod3)$coef[2, 2]
alpha <- 0.1
qt <- qt(alpha/2, n - 2)
pvalue <- pt(-abs(b1/s.b1),n-2)+(1-pt(abs(b1/s.b1),n-2))
lower <- b1+s.b1*qt(alpha/2,n-2)
upper <- b1-s.b1*qt(alpha/2,n-2)
lower
```

```
##         X
## 285.7076
```

```
upper
```

```
##         X
## 375.5158
```

```
n <- nrow(region4)
Y <- region4$X15
X <- region4$X12
linmod4 <- lm(Y~X)
b1 <- linmod4$coef[2]
s.b1 <- summary(linmod4)$coef[2, 2]
alpha <- 0.1
qt <- qt(alpha/2, n - 2)
pvalue <- pt(-abs(b1/s.b1),n-2)+(1-pt(abs(b1/s.b1),n-2))
lower <- b1+s.b1*qt(alpha/2,n-2)
upper <- b1-s.b1*qt(alpha/2,n-2)
lower
```

```
##         X
## 364.7585
```

```
upper
```

```
##         X
## 515.8729
```

6.29. Refer to the CDI data set in Appendix C.2. a. For each geographic region, regress the number of serious crimes in a CDI (Y) against population density (X" total population divided by land area), per capita personal income (X2), and percent high school graduates (X3). Use first-order regression model (6.5) with three predictor variables. State the estimated regression functions. Region 1: Y = -64466.231 + 17.383X1 - 1.406X2 + 1182.577X3 Region 2: Y = -4163.2673 + 33.6193X1 + 0.1024X2 - 2.7616X3 Region 3: Y = 38862.667 + 5.537 + 1.957X2 - 670.884X3 Region 4: Y = 129323.415 + 5.717X1 + 4.342X2 - 2159.920X3

```
region1 <- cdi%>%filter(X17 == 1)
n <- nrow(region1)
Y <- region1$X10
X1 <- region1$X5/region1$X4
X2 <- region1$X15
X3 <- region1$X11
linmod1 <- lm(Y~X1+X2+X3)
linmod1
```

```
##
## Call:
## lm(formula = Y ~ X1 + X2 + X3)
##
## Coefficients:
## (Intercept)           X1           X2           X3
##  -64466.231       17.383       -1.406     1182.577
```

```
region2 <- cdi%>%filter(X17 == 2)
n <- nrow(region2)
Y <- region2$X10
X1 <- region2$X5/region2$X4
X2 <- region2$X15
X3 <- region2$X11
linmod2 <- lm(Y~X1+X2+X3)
linmod2
```

```
##
## Call:
## lm(formula = Y ~ X1 + X2 + X3)
##
## Coefficients:
## (Intercept)           X1           X2           X3
##  -4163.2673      33.6193       0.1024      -2.7616
```

```
region3 <- cdi%>%filter(X17 == 3)
n <- nrow(region3)
Y <- region3$X10
X1 <- region3$X5/region3$X4
X2 <- region3$X15
X3 <- region3$X11
linmod3 <- lm(Y~X1+X2+X3)
linmod3
```

```
##
## Call:
## lm(formula = Y ~ X1 + X2 + X3)
##
## Coefficients:
## (Intercept)           X1           X2           X3
##   38862.667        5.537        1.957     -670.884
```

```
region4 <- cdi%>%filter(X17 == 4)
n <- nrow(region4)
Y <- region4$X10
X1 <- region4$X5/region4$X4
X2 <- region4$X15
X3 <- region4$X11
linmod4 <- lm(Y~X1+X2+X3)
linmod4
```

```
##
## Call:
## lm(formula = Y ~ X1 + X2 + X3)
##
## Coefficients:
## (Intercept)           X1           X2           X3
##  129323.415        5.717        4.342    -2159.920
```

b. Are the estimated regression functions similar for the four regions? Discuss. No, the estimated regression functions are not similar for the four regions. The intercepts are a wide range, some positive some negative. Also, the coefficients aren’t always all positive and negative, they are different for each region.

c. Calculate MSE and R2 for each region. Are these measures similar for the four regions? Discuss. Region 1: MSE: 787397480 R2: 0.8352049 Region 2: MSE: 1087623839 R2: 0.5285125 Region 3: MSE: 1367108167 R2: 0.09250839 Region 4: MSE: 6694591439 R2: 0.08665358 These measurements are not all similar for the four regions. The R2 values range form 0.83 to 0.08 so some are good fits some aren’t.

```r
region1 <- cdi%>%filter(X17 == 1)
n <- nrow(region1)
Y <- region1$X10
X1 <- region1$X5/region1$X4
X2 <- region1$X15
X3 <- region1$X11
linmod1 <- lm(Y~X1+X2+X3)
#linmod1
region2 <- cdi%>%filter(X17 == 2)
n <- nrow(region2)
Y <- region2$X10
X1 <- region2$X5/region2$X4
X2 <- region2$X15
X3 <- region2$X11
linmod2 <- lm(Y~X1+X2+X3)
#linmod2
region3 <- cdi%>%filter(X17 == 3)
n <- nrow(region3)
Y <- region3$X10
X1 <- region3$X5/region3$X4
X2 <- region3$X15
X3 <- region3$X11
linmod3 <- lm(Y~X1+X2+X3)
#linmod3
region4 <- cdi%>%filter(X17 == 4)
n <- nrow(region4)
Y <- region4$X10
X1 <- region4$X5/region4$X4
X2 <- region4$X15
X3 <- region4$X11
linmod4 <- lm(Y~X1+X2+X3)
#linmod4
s1 <- summary(linmod1)$s
r.sq1 <- summary(linmod1)$r.sq
s1^2
```

```
## [1] 787397480
```

```r
r.sq1
```

```
## [1] 0.8352049
```

```r
s2 <- summary(linmod2)$s
r.sq2 <- summary(linmod2)$r.sq
s2^2
```

```
## [1] 1087623839
```

```r
r.sq2
```

```
## [1] 0.5285125
```

```r
s3 <- summary(linmod3)$s
r.sq3 <- summary(linmod3)$r.sq
s3^2
```

```
## [1] 1367108167
```

```r
r.sq3
```

```
## [1] 0.09250839
```

```
s4 <- summary(linmod4)$s
r.sq4 <- summary(linmod4)$r.sq
r.sq4
```

```
## [1] 0.08665358
```

```
s4^2
```

```
## [1] 6694591439
```

628. Refer to the CDI data set in Appendix C.2. You have been asked to evaluate two alternative models for predicting the number of acti ve physicians (Y) in a CD!. Proposed model I includes as predictor variables total population (X I), land area (X2), and total personal income (X}). Proposed model II includes as predictor vcu-iables population density (X I, total population divided by land area), percent of population greatef'lhan 64 years old (X2), and total personal income (X}). (a)Obtain a point estimate and 90% confidence interval for β1 under a normal errors linear regression model that uses the number of active physicians in a CDI (Y) as a response and total population (X1) as a predictor. CI: (0.002762953, 0.002928969)

```
n <- nrow(cdi)
Y <- cdi$X8
X <- cdi$X5
linmod <- lm(Y~X)
b1 <- linmod$coef[2]
s.b1 <- summary(linmod)$coef[2, 2]
alpha <- 0.1
qt <- qt(alpha/2, n - 2)
pvalue <- pt(-abs(b1/s.b1),n-2)+(1-pt(abs(b1/s.b1),n-2))
lower <- b1+s.b1*qt(alpha/2,n-2)
upper <- b1-s.b1*qt(alpha/2,n-2)
lower
```

```
##           X
## 0.002762953
```

```
upper
```

```
##           X
## 0.002928969
```

b. Obtain a point estimate and 90% confidence interval for β1 under a normal errors linear regression model that uses the number of active physicians in a CDI (Y) as a response and total population (X1), land area (X2), and total personal income (X3) as predictors. CI: (0.0004919585, 0.001485982)

```
n <- nrow(cdi)
Y <- cdi$X8
X1 <- cdi$X5
X2 <- cdi$X4
X3 <- cdi$X16
linmod <- lm(Y~X1+X2+X3)
b1 <- linmod$coef[2]
s.b1 <- summary(linmod)$coef[2, 2]
alpha <- 0.1
qt <- qt(alpha/2, n - 2)
pvalue <- pt(-abs(b1/s.b1),n-2)+(1-pt(abs(b1/s.b1),n-2))
lower <- b1+s.b1*qt(alpha/2,n-2)
upper <- b1-s.b1*qt(alpha/2,n-2)
lower
```

```
##           X1
## 0.0004919585
```

```
upper
```

```
##          X1
## 0.001485982
```

c. Compare the interpretations of b1 in (a) and (c). Do they differ? If so, how? In part a, its predicting the number of physicians based soley on total population where as in part b they number of physicians is predicted by total population, land area, and total personal income.

d. Compare the point estimates and 90% confidence intervals for β_1 obtained in (a) and (b). Are they identical? They are not identical. The CI for part a is much smaller than part b. That means that when predicting the number of physicians using just the total population will produce more accurate results than using total population, land area, and total personal income.

e. Explain how what you observe in (d) makes sense given what you concluded in (c). Because we used more predictors in part b, the range of the CI would be larger as there are more variables in the prediction.