

Econ573_ProblemSet1_PartIII

Code ▾

1. Exploring Data

prices are elevated in all regions, and we see that brownies flavor is the most sold flavor.

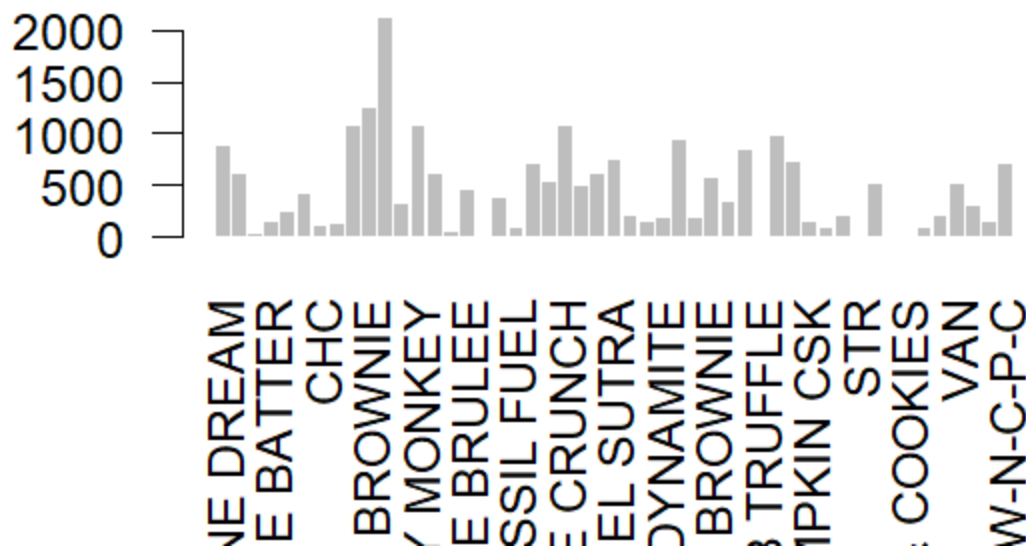
Hide

```
class(benjer$flavor_descr)
```

```
[1] "character"
```

Hide

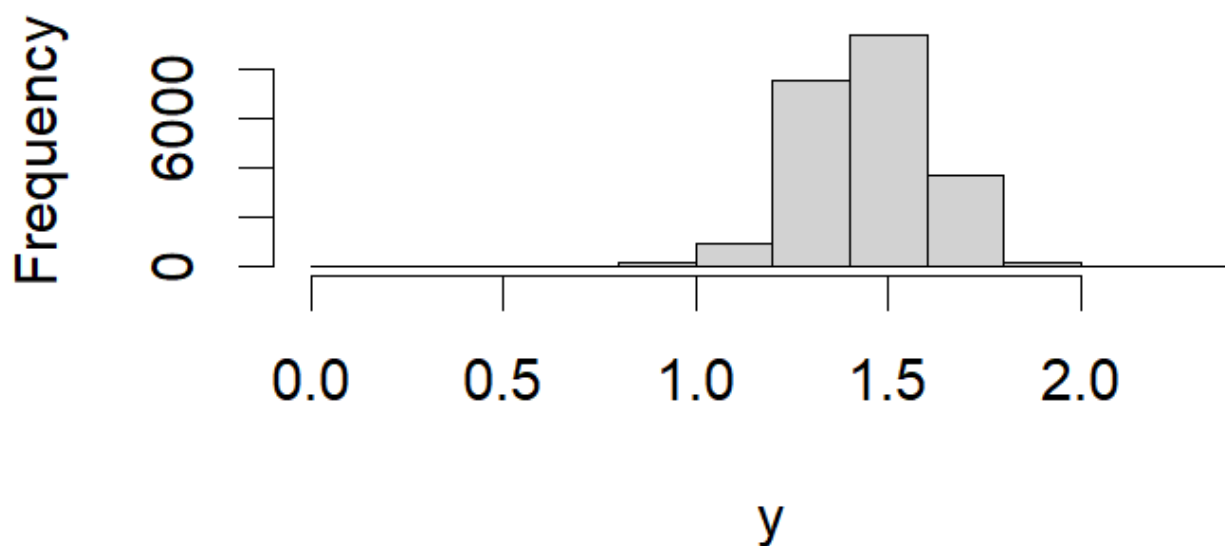
```
barplot(table(benjer$flavor_descr), border = NA, las = 2)
```



Hide

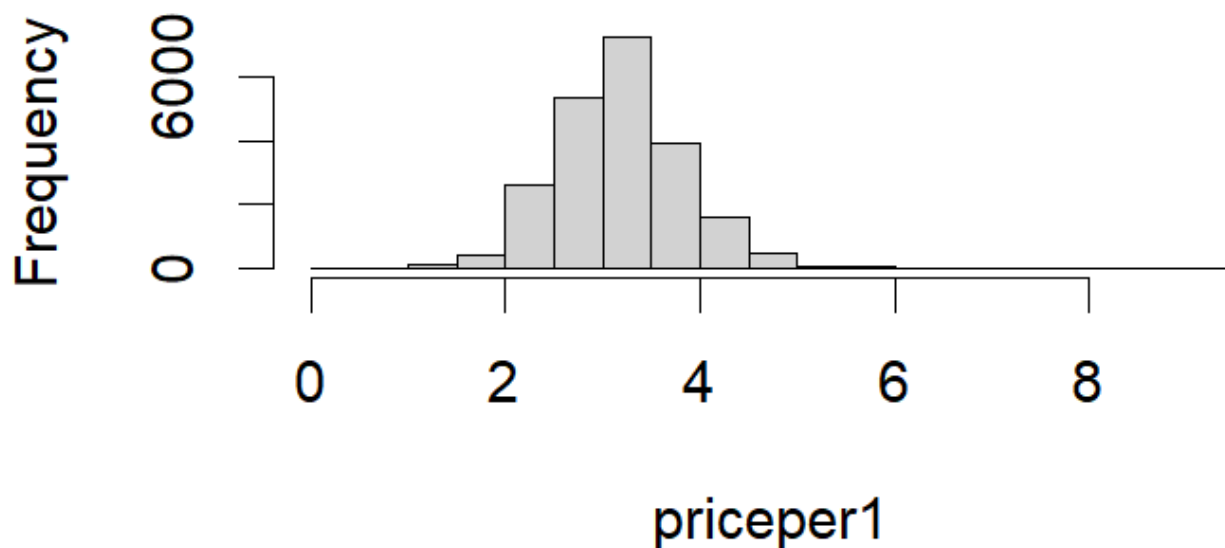
```
hist(y)
```

Histogram of y

[Hide](#)

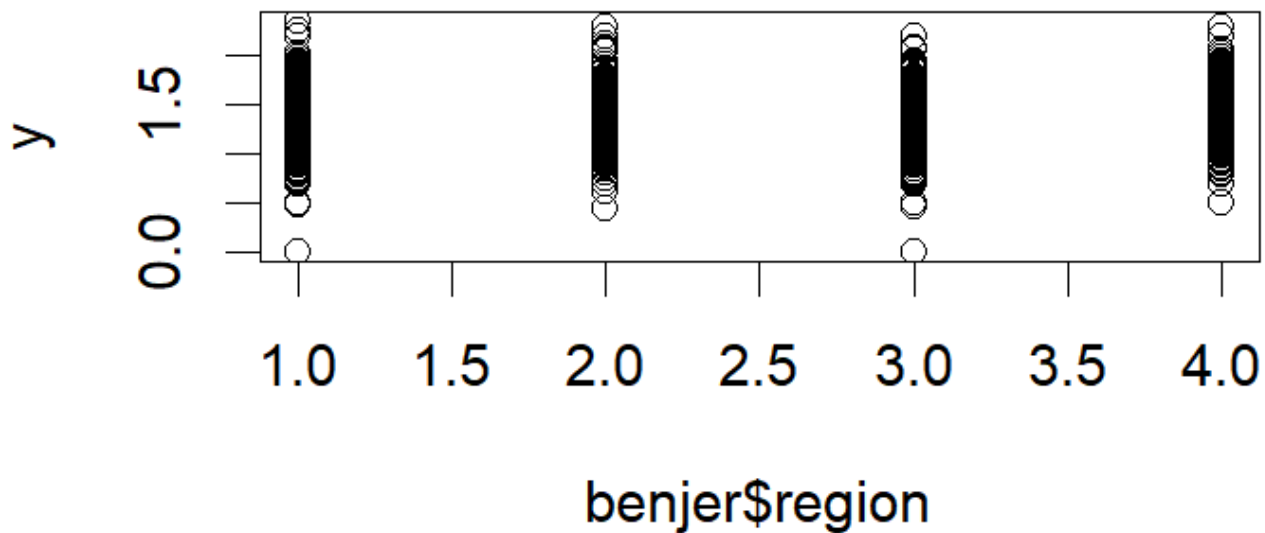
```
hist(priceper1)
```

Histogram of priceper1



Hide

```
plot(y ~ benjer$region)
```



2.

3. Regression Model

```
```r
summary(fit)
```
```

The refine the model, we can remove the `flavor_descr` variable to simplify the model. We can also remove other non-significant variables like `race`, `hispanic_origin`, and `dishwasher`.

```
```r
fit2 <- glm(y ~ . - flavor_descr, data = x)
summary(fit2)
fit3 <- glm(y ~ . - flavor_descr - race - dishwasher - hispanic_origin, data = x)
summary(fit3)
```
```

Now we compare the models using AIC/BIC to see which one best fits the data.

```
```\n n <- nrow(x)\n BIC <- c(\n   reg1 = extractAIC(fit, k = log(n))[2],\n   reg2 = extractAIC(fit2, k = log(n))[2],\n   reg3 = extractAIC(fit3, k = log(n))[2]\n )\n\n# Model probabilities\n eBIC <- exp(-0.5 * (BIC - min(BIC)))\n probs <- eBIC / sum(eBIC)\n round(probs, 5)\n\n```\n
```

The simpler model (3) is better.

3. d

```
```\n summary(fit)\n```\n
```

...

Call:

```
glm(formula = y ~ ., data = x)
```

Coefficients:

| | Estimate |
|--|------------|
| (Intercept) | 1.4669881 |
| flavor_descrBANANA SPLIT | -0.0138247 |
| flavor_descrBLACK & TAN | -0.0499627 |
| flavor_descrBROWNIE BATTER | 0.0188342 |
| flavor_descrBUTTER PECAN | 0.0139218 |
| flavor_descrCAKE BATTER | -0.0115120 |
| flavor_descrCHC | 0.0179803 |
| flavor_descrCHC ALMOND NOUGAT | 0.0063547 |
| flavor_descrCHC CHIP C-DH | 0.0034564 |
| flavor_descrCHC FUDGE BROWNIE | 0.0026161 |
| flavor_descrCHERRY GRCA | -0.0040438 |
| flavor_descrCHUBBY HUBBY | 0.0172097 |
| flavor_descrCHUNKY MONKEY | -0.0100498 |
| flavor_descrCINNAMON BUNS | -0.0161418 |
| flavor_descrCOFFEE | 0.0537233 |
| flavor_descrCREME BRULEE | -0.0206253 |
| flavor_descrDOUBLE CHC FUDGE SWR | 0.0416880 |
| flavor_descrDUBLIN MUDSLIDE | 0.0126996 |
| flavor_descrFOSSIL FUEL | -0.0225000 |
| flavor_descrHALF BAKED | -0.0067405 |
| flavor_descrHEATH CANDY EVERYTHING BUT THE | -0.0086388 |
| flavor_descrHEATH COFFEE CRUNCH | 0.0055113 |
| flavor_descrHEATH CRUNCH | 0.0243080 |
| flavor_descrIMAGINE WHIRLED PEACE | -0.0141377 |
| flavor_descrKARAMEL SUTRA | -0.0045983 |
| flavor_descrMAGIC BROWNIES | -0.0142210 |
| flavor_descrMINT CHC CHUNK | 0.0397984 |
| flavor_descrNEAPOLITAN DYNAMITE | 0.0020003 |
| flavor_descrNEW YORK SUPER FUDGE CHUNK | -0.0061045 |
| flavor_descrOATMEAL COOKIE CHUNK | 0.0039328 |
| flavor_descrONE CSK BROWNIE | -0.0282081 |
| flavor_descrOXFORD MINT CHC COOKIE | 0.0016106 |
| flavor_descrPB CUP | -0.0003787 |
| flavor_descrPB TRUFFLE | -0.0314963 |
| flavor_descrPHISH FOOD | 0.0078353 |
| flavor_descrPISTACHIO PISTACHIO | -0.0003495 |
| flavor_descrPUMPKIN CSK | -0.0695472 |
| flavor_descrRSP CHC CHUNK | 0.0274639 |
| flavor_descrSMORES | 0.0342119 |
| flavor_descrSTR | 0.0752184 |
| flavor_descrSTR CSK | -0.0155258 |
| flavor_descrSTRAWBERRIES & CREAM | 0.0076638 |
| flavor_descrSWEET CREAM & COOKIES | 0.0612916 |
| flavor_descrTRIPLE CARAMEL CHUNK | -0.0134533 |
| flavor_descrTURTLE SOUP | -0.0271302 |

| | |
|--|------------|
| flavor_descrVAN | 0.0270131 |
| flavor_descrVAN CARAMEL FUDGE | -0.0154687 |
| flavor_descrVERMONTY PYTHON | 0.0040200 |
| flavor_descrW-N-C-P-C | -0.0065707 |
| flavor_descrWHITE RUSSIAN | 0.2232747 |
| size1_descr32.0 MLOZ | 0.3108154 |
| household_income | 0.0020848 |
| household_size | -0.0040760 |
| usecoupTRUE | -0.0709608 |
| couponper1 | 0.0683420 |
| regionCentral | -0.0212732 |
| regionSouth | -0.0247856 |
| regionWest | -0.0184250 |
| marriedTRUE | -0.0113292 |
| raceblack | 0.0123061 |
| raceasian | -0.0026165 |
| raceother | 0.0154499 |
| hispanic_originTRUE | -0.0010270 |
| microwaveTRUE | -0.0350319 |
| dishwasherTRUE | -0.0017803 |
| sfhTRUE | -0.0091538 |
| internetTRUE | 0.0064933 |
| tvacableTRUE | 0.0059701 |
| Std. Error | |
| (Intercept) | 0.0099541 |
| flavor_descrBANANA SPLIT | 0.0078504 |
| flavor_descrBLACK & TAN | 0.0299396 |
| flavor_descrBROWNIE BATTER | 0.0131905 |
| flavor_descrBUTTER PECAN | 0.0107575 |
| flavor_descrCAKE BATTER | 0.0088554 |
| flavor_descrCHC | 0.0159096 |
| flavor_descrCHC ALMOND NOUGAT | 0.0144803 |
| flavor_descrCHC CHIP C-DH | 0.0068028 |
| flavor_descrCHC FUDGE BROWNIE | 0.0065659 |
| flavor_descrCHERRY GRCA | 0.0060251 |
| flavor_descrCHUBBY HUBBY | 0.0096747 |
| flavor_descrCHUNKY MONKEY | 0.0067639 |
| flavor_descrCINNAMON BUNS | 0.0077840 |
| flavor_descrCOFFEE | 0.0203468 |
| flavor_descrCREME BRULEE | 0.0085668 |
| flavor_descrDOUBLE CHC FUDGE SWR | 0.1473872 |
| flavor_descrDUBLIN MUDSLIDE | 0.0091918 |
| flavor_descrFOSSIL FUEL | 0.0168629 |
| flavor_descrHALF BAKED | 0.0074898 |
| flavor_descrHEATH CANDY EVERYTHING BUT THE | 0.0081527 |
| flavor_descrHEATH COFFEE CRUNCH | 0.0067491 |
| flavor_descrHEATH CRUNCH | 0.0083332 |
| flavor_descrIMAGINE WHIRLED PEACE | 0.0077914 |
| flavor_descrKARAMEL SUTRA | 0.0073953 |
| flavor_descrMAGIC BROWNIES | 0.0115980 |
| flavor_descrMINT CHC CHUNK | 0.0132361 |
| flavor_descrNEAPOLITAN DYNAMITE | 0.0118651 |

| | |
|--|-----------|
| flavor_descrNEW YORK SUPER FUDGE CHUNK | 0.0069755 |
| flavor_descrOATMEAL COOKIE CHUNK | 0.0119730 |
| flavor_descrONE CSK BROWNIE | 0.0080356 |
| flavor_descrOXFORD MINT CHC COOKIE | 0.0095891 |
| flavor_descrPB CUP | 0.0071737 |
| flavor_descrPB TRUFFLE | 0.1474045 |
| flavor_descrPHISH FOOD | 0.0069126 |
| flavor_descrPISTACHIO PISTACHIO | 0.0074424 |
| flavor_descrPUMPKIN CSK | 0.0133163 |
| flavor_descrRSP CHC CHUNK | 0.0173288 |
| flavor_descrSMORES | 0.0116086 |
| flavor_descrSTR | 0.0447278 |
| flavor_descrSTR CSK | 0.0082183 |
| flavor_descrSTRAWBERRIES & CREAM | 0.0411736 |
| flavor_descrSWEET CREAM & COOKIES | 0.0361381 |
| flavor_descrTRIPLE CARAMEL CHUNK | 0.0165856 |
| flavor_descrTURTLE SOUP | 0.0115245 |
| flavor_descrVAN | 0.0082384 |
| flavor_descrVAN CARAMEL FUDGE | 0.0100402 |
| flavor_descrVERMONTY PYTHON | 0.0136927 |
| flavor_descrW-N-C-P-C | 0.0075149 |
| flavor_descrWHITE RUSSIAN | 0.1474021 |
| size1_descr32.0 MLOZ | 0.0080789 |
| household_income | 0.0002032 |
| household_size | 0.0008837 |
| usecoupTRUE | 0.0045418 |
| couponper1 | 0.0027052 |
| regionCentral | 0.0031093 |
| regionSouth | 0.0029581 |
| regionWest | 0.0030072 |
| marriedTRUE | 0.0025633 |
| raceblack | 0.0040044 |
| raceasian | 0.0062476 |
| raceother | 0.0058016 |
| hispanic_originTRUE | 0.0053361 |
| microwaveTRUE | 0.0075637 |
| dishwasherTRUE | 0.0025721 |
| sfhTRUE | 0.0024985 |
| internetTRUE | 0.0028001 |
| tvicableTRUE | 0.0021529 |
| t value | |
| (Intercept) | 147.376 |
| flavor_descrBANANA SPLIT | -1.761 |
| flavor_descrBLACK & TAN | -1.669 |
| flavor_descrBROWNIE BATTER | 1.428 |
| flavor_descrBUTTER PECAN | 1.294 |
| flavor_descrCAKE BATTER | -1.300 |
| flavor_descrCHC | 1.130 |
| flavor_descrCHC ALMOND NOUGAT | 0.439 |
| flavor_descrCHC CHIP C-DH | 0.508 |
| flavor_descrCHC FUDGE BROWNIE | 0.398 |
| flavor_descrCHERRY GRCA | -0.671 |

| | |
|--|---------|
| flavor_descrCHUBBY HUBBY | 1.779 |
| flavor_descrCHUNKY MONKEY | -1.486 |
| flavor_descrCINNAMON BUNS | -2.074 |
| flavor_descrCOFFEE | 2.640 |
| flavor_descrCREME BRULEE | -2.408 |
| flavor_descrDOUBLE CHC FUDGE SWR | 0.283 |
| flavor_descrDUBLIN MUDSLIDE | 1.382 |
| flavor_descrFOSSIL FUEL | -1.334 |
| flavor_descrHALF BAKED | -0.900 |
| flavor_descrHEATH CANDY EVERYTHING BUT THE | -1.060 |
| flavor_descrHEATH COFFEE CRUNCH | 0.817 |
| flavor_descrHEATH CRUNCH | 2.917 |
| flavor_descrIMAGINE WHIRLED PEACE | -1.815 |
| flavor_descrKARAMEL SUTRA | -0.622 |
| flavor_descrMAGIC BROWNIES | -1.226 |
| flavor_descrMINT CHC CHUNK | 3.007 |
| flavor_descrNEAPOLITAN DYNAMITE | 0.169 |
| flavor_descrNEW YORK SUPER FUDGE CHUNK | -0.875 |
| flavor_descrOATMEAL COOKIE CHUNK | 0.328 |
| flavor_descrONE CSK BROWNIE | -3.510 |
| flavor_descroXFORD MINT CHC COOKIE | 0.168 |
| flavor_descrPB CUP | -0.053 |
| flavor_descrPB TRUFFLE | -0.214 |
| flavor_descrPHISH FOOD | 1.133 |
| flavor_descrPISTACHIO PISTACHIO | -0.047 |
| flavor_descrpPUMPKIN CSK | -5.223 |
| flavor_descrrSP CHC CHUNK | 1.585 |
| flavor_descrsMORES | 2.947 |
| flavor_descrsTR | 1.682 |
| flavor_descrsTR CSK | -1.889 |
| flavor_descrsTRAWBERRIES & CREAM | 0.186 |
| flavor_descrsWEET CREAM & COOKIES | 1.696 |
| flavor_descrsTRIPLE CARAMEL CHUNK | -0.811 |
| flavor_descrsTURTLE SOUP | -2.354 |
| flavor_descrsVAN | 3.279 |
| flavor_descrsVAN CARAMEL FUDGE | -1.541 |
| flavor_descrsVERMONTY PYTHON | 0.294 |
| flavor_descrsW-N-C-P-C | -0.874 |
| flavor_descrsWHITE RUSSIAN | 1.515 |
| size1_descr32.0 MLOZ | 38.472 |
| household_income | 10.262 |
| household_size | -4.612 |
| usecoupTRUE | -15.624 |
| couponper1 | 25.263 |
| regionCentral | -6.842 |
| regionSouth | -8.379 |
| regionWest | -6.127 |
| marriedTRUE | -4.420 |
| raceblack | 3.073 |
| raceasian | -0.419 |
| raceother | 2.663 |
| hispanic_originTRUE | -0.192 |

| | |
|--|----------|
| microwaveTRUE | -4.632 |
| dishwasherTRUE | -0.692 |
| sfhTRUE | -3.664 |
| internetTRUE | 2.319 |
| tv cableTRUE | 2.773 |
| Pr(> t) | |
| (Intercept) | < 2e-16 |
| flavor_descrBANANA SPLIT | 0.078248 |
| flavor_descrBLACK & TAN | 0.095174 |
| flavor_descrBROWNIE BATTER | 0.153347 |
| flavor_descrBUTTER PECAN | 0.195625 |
| flavor_descrCAKE BATTER | 0.193615 |
| flavor_descrCHC | 0.258423 |
| flavor_descrCHC ALMOND NOUGAT | 0.660773 |
| flavor_descrCHC CHIP C-DH | 0.611397 |
| flavor_descrCHC FUDGE BROWNIE | 0.690312 |
| flavor_descrCHERRY GRCA | 0.502119 |
| flavor_descrCHUBBY HUBBY | 0.075281 |
| flavor_descrCHUNKY MONKEY | 0.137345 |
| flavor_descrCINNAMON BUNS | 0.038118 |
| flavor_descrCOFFEE | 0.008287 |
| flavor_descrCREME BRULEE | 0.016067 |
| flavor_descrDOUBLE CHC FUDGE SWR | 0.777297 |
| flavor_descrDUBLIN MUDSLIDE | 0.167101 |
| flavor_descrFOSSIL FUEL | 0.182125 |
| flavor_descrHALF BAKED | 0.368153 |
| flavor_descrHEATH CANDY EVERYTHING BUT THE | 0.289328 |
| flavor_descrHEATH COFFEE CRUNCH | 0.414167 |
| flavor_descrHEATH CRUNCH | 0.003538 |
| flavor_descrIMAGINE WHIRLED PEACE | 0.069611 |
| flavor_descrKARAMEL SUTRA | 0.534083 |
| flavor_descrMAGIC BROWNIES | 0.220155 |
| flavor_descrMINT CHC CHUNK | 0.002643 |
| flavor_descrNEAPOLITAN DYNAMITE | 0.866125 |
| flavor_descrNEW YORK SUPER FUDGE CHUNK | 0.381509 |
| flavor_descrOATMEAL COOKIE CHUNK | 0.742555 |
| flavor_descrONE CSK BROWNIE | 0.000448 |
| flavor_descrOXFORD MINT CHC COOKIE | 0.866618 |
| flavor_descrPB CUP | 0.957900 |
| flavor_descrPB TRUFFLE | 0.830804 |
| flavor_descrPHISH FOOD | 0.257026 |
| flavor_descrPISTACHIO PISTACHIO | 0.962544 |
| flavor_descrPUMPKIN CSK | 1.78e-07 |
| flavor_descrRSP CHC CHUNK | 0.113011 |
| flavor_descrSMORES | 0.003211 |
| flavor_descrSTR | 0.092643 |
| flavor_descrSTR CSK | 0.058880 |
| flavor_descrSTRAWBERRIES & CREAM | 0.852341 |
| flavor_descrSWEET CREAM & COOKIES | 0.089893 |
| flavor_descrTRIPLE CARAMEL CHUNK | 0.417292 |
| flavor_descrTURTLE SOUP | 0.018575 |
| flavor_descrVAN | 0.001044 |

| | |
|-----------------------------|----------|
| flavor_descrVAN CAMEL FUDGE | 0.123412 |
| flavor_descrVERMONT PYTHON | 0.769077 |
| flavor_descrW-N-C-P-C | 0.381935 |
| flavor_descrWHITE RUSSIAN | 0.129855 |
| size1_descr32.0 MLOZ | < 2e-16 |
| household_income | < 2e-16 |
| household_size | 4.01e-06 |
| usecoupTRUE | < 2e-16 |
| couponper1 | < 2e-16 |
| regionCentral | 8.02e-12 |
| regionSouth | < 2e-16 |
| regionWest | 9.11e-10 |
| marriedTRUE | 9.93e-06 |
| raceblack | 0.002121 |
| raceasian | 0.675362 |
| raceother | 0.007749 |
| hispanic_originTRUE | 0.847390 |
| microwaveTRUE | 3.65e-06 |
| dishwasherTRUE | 0.488849 |
| sfhTRUE | 0.000249 |
| internetTRUE | 0.020406 |
| tvacableTRUE | 0.005559 |

| | |
|-------------|-----|
| (Intercept) | *** |
|-------------|-----|

| | |
|--|----|
| flavor_descrBANANA SPLIT | . |
| flavor_descrBLACK & TAN | . |
| flavor_descrBROWNIE BATTER | |
| flavor_descrBUTTER PECAN | |
| flavor_descrCAKE BATTER | |
| flavor_descrCHC | |
| flavor_descrCHC ALMOND NOUGAT | |
| flavor_descrCHC CHIP C-DH | |
| flavor_descrCHC FUDGE BROWNIE | |
| flavor_descrCHERRY GRCA | |
| flavor_descrCHUBBY HUBBY | . |
| flavor_descrCHUNKY MONKEY | |
| flavor_descr CINNAMON BUNS | * |
| flavor_descrCOFFEE | ** |
| flavor_descrCREME BRULEE | * |
| flavor_descrDOUBLE CHC FUDGE SWR | |
| flavor_descrDUBLIN MUDSLIDE | |
| flavor_descrFOSSIL FUEL | |
| flavor_descrHALF BAKED | |
| flavor_descrHEATH CANDY EVERYTHING BUT THE | |
| flavor_descrHEATH COFFEE CRUNCH | |
| flavor_descrHEATH CRUNCH | ** |
| flavor_descrIMAGINE WHIRLED PEACE | . |
| flavor_descrKARAMEL SUTRA | |
| flavor_descrMAGIC BROWNIES | |
| flavor_descrMINT CHC CHUNK | ** |
| flavor_descrNEAPOLITAN DYNAMITE | |
| flavor_descrNEW YORK SUPER FUDGE CHUNK | |

```

flavor_descrOATMEAL COOKIE CHUNK
flavor_descrONE CSK BROWNIE ***
flavor_descrOXFORD MINT CHC COOKIE
flavor_descrPB CUP
flavor_descrPB TRUFFLE
flavor_descrPHISH FOOD
flavor_descrPISTACHIO PISTACHIO
flavor_descrPUMPKIN CSK ***
flavor_descrRSP CHC CHUNK
flavor_descrSMORES **
flavor_descrSTR .
flavor_descrSTR CSK .
flavor_descrSTRAWBERRIES & CREAM
flavor_descrSWEET CREAM & COOKIES .
flavor_descrTRIPLE CARAMEL CHUNK
flavor_descrTURTLE SOUP *
flavor_descrVAN **
flavor_descrVAN CARAMEL FUDGE
flavor_descrVERMONT PYTHON
flavor_descrW-N-C-P-C
flavor_descrWHITE RUSSIAN
size1_descr32.0 MLOZ ***
household_income ***
household_size ***
usecoupTRUE ***
couponper1 ***
regionCentral ***
regionSouth ***
regionWest ***
marriedTRUE ***
raceblack **
raceasian
raceother **
hispanic_originTRUE
microwaveTRUE ***
dishwasherTRUE
sfhTRUE ***
internetTRUE *
tvcableTRUE **

```

```
---
```

Signif. codes:

```

0 '***' 0.001 '**' 0.01 '*' 0.05 '.'
0.1 ' ' 1

```

(Dispersion parameter for gaussian family taken to be 0.0216865)

```

Null deviance: 537.46 on 21939 degrees of freedom
Residual deviance: 474.33 on 21872 degrees of freedom
(34 observations deleted due to missingness)
AIC: -21721

```

```
Number of Fisher Scoring iterations: 2
```

```
...
```

Significant variables include: (Intercept), flavor_descrCINNAMON BUNS, flavor_descrCOFFEE, flavor_descrCREME BRULEE, flavor_descrHEATH CRUNCH, flavor_descrMINT CHC CHUNK, flavor_descrONE CSK BROWNIE, flavor_descrPUMPKIN CSK, flavor_descrSMORES, flavor_descrTURTLE SOUP, flavor_descrVAN, size1_descr32.0 MLOZ, household_income, household_size, usecoupTRUE, couponper1, regionCentral, regionSouth, regionWest, marriedTRUE, raceblack, raceother, microwaveTRUE, sfhTRUE, internetTRUE, tvcableTRUE