Dimensionality Reduction and Feature Selection

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1. Defining the question

Problem Statement

You are a Data analyst at Carrefour Kenya and are currently undertaking a project that will inform the marketing department on the most relevant marketing strategies that will result in the highest no. of sales (total price including tax)

2. Loading and checking data

```
#Loading dataset
sales <- read.csv("C:/Users/Karimi/Downloads/Sales.csv",stringsAsFactors = T)
head(sales)
```

```
##     Invoice.ID Branch Customer.type Gender          Product.line Unit.price
## 1 750-67-8428      A        Member Female      Health and beauty      74.69
## 2 226-31-3081      C        Normal Female Electronic accessories      15.28
## 3 631-41-3108      A        Normal   Male      Home and lifestyle      46.33
## 4 123-19-1176      A        Member   Male      Health and beauty      58.22
## 5 373-73-7910      A        Normal   Male        Sports and travel      86.31
## 6 699-14-3026      C        Normal   Male Electronic accessories      85.39
##   Quantity     Tax      Date  Time     Payment   cogs gross.margin.percentage
## 1        7 26.1415 1/5/2019 13:08     Ewallet 522.83                4.761905
## 2        5  3.8200 3/8/2019 10:29        Cash  76.40                4.761905
## 3        7 16.2155 3/3/2019 13:23 Credit card 324.31                4.761905
## 4        8 23.2880 1/27/2019 20:33    Ewallet 465.76                4.761905
## 5        7 30.2085 2/8/2019 10:37     Ewallet 604.17                4.761905
## 6        7 29.8865 3/25/2019 18:30    Ewallet 597.73                4.761905
##   gross.income Rating    Total
## 1      26.1415    9.1 548.9715
## 2       3.8200    9.6  80.2200
## 3      16.2155    7.4 340.5255
## 4      23.2880    8.4 489.0480
## 5      30.2085    5.3 634.3785
## 6      29.8865    4.1 627.6165
```

```
#Checking for size of dataset
dim(sales)
```

```
## [1] 1000   16
```

```
#Checking for descriptive statistics and Null variables
#And datatypes
summary(sales)
```

```
##        Invoice.ID   Branch  Customer.type    Gender
##  101-17-6199:   1   A:340   Member:501    Female:501
##  101-81-4070:   1   B:332   Normal:499    Male  :499
##  102-06-2002:   1   C:328
##  102-77-2261:   1
##  105-10-6182:   1
##  105-31-1824:   1
##  (Other)   :994
##                      Product.line    Unit.price        Quantity          Tax
##  Electronic accessories:170   Min.   :10.08   Min.   : 1.00   Min.   : 0.5085
##  Fashion accessories   :178   1st Qu.:32.88   1st Qu.: 3.00   1st Qu.: 5.9249
##  Food and beverages    :174   Median :55.23   Median : 5.00   Median :12.0880
##  Health and beauty     :152   Mean   :55.67   Mean   : 5.51   Mean   :15.3794
##  Home and lifestyle    :160   3rd Qu.:77.94   3rd Qu.: 8.00   3rd Qu.:22.4453
##  Sports and travel     :166   Max.   :99.96   Max.   :10.00   Max.   :49.6500
##
##        Date            Time            Payment          cogs
##  2/7/2019 : 20    14:42  :  7    Cash        :344   Min.   : 10.17
##  2/15/2019: 19    19:48  :  7    Credit card:311    1st Qu.:118.50
##  1/8/2019 : 18    17:38  :  6    Ewallet     :345   Median :241.76
##  3/14/2019: 18    10:11  :  5                       Mean   :307.59
##  3/2/2019 : 18    11:40  :  5                       3rd Qu.:448.90
##  1/23/2019: 17    11:51  :  5                       Max.   :993.00
##  (Other)  :890    (Other):965
##  gross.margin.percentage   gross.income           Rating            Total
##  Min.   :4.762             Min.   : 0.5085   Min.   : 4.000   Min.   :  10.68
##  1st Qu.:4.762             1st Qu.: 5.9249   1st Qu.: 5.500   1st Qu.: 124.42
##  Median :4.762             Median :12.0880   Median : 7.000   Median : 253.85
##  Mean   :4.762             Mean   :15.3794   Mean   : 6.973   Mean   : 322.97
##  3rd Qu.:4.762             3rd Qu.:22.4453   3rd Qu.: 8.500   3rd Qu.: 471.35
##  Max.   :4.762             Max.   :49.6500   Max.   :10.000   Max.   :1042.65
##
```

From the summary, we can deduce the following from the data: 1. We have 1000 records and 16 attributes 2. Out of the 16 attributes, 8 are of data type character 3. We don't have any null values 4. Looking at the ranges around the summary statistics of our numeric variables, we see that they are measured in different units hence we will need to scale later

```
head(sales)
```

```
##    Invoice.ID Branch Customer.type Gender          Product.line Unit.price
## 1 750-67-8428      A        Member Female      Health and beauty      74.69
## 2 226-31-3081      C        Normal Female Electronic accessories      15.28
## 3 631-41-3108      A        Normal   Male      Home and lifestyle      46.33
## 4 123-19-1176      A        Member   Male      Health and beauty      58.22
## 5 373-73-7910      A        Normal   Male      Sports and travel      86.31
## 6 699-14-3026      C        Normal   Male Electronic accessories      85.39
##   Quantity     Tax      Date  Time      Payment   cogs gross.margin.percentage
## 1        7 26.1415 1/5/2019 13:08     Ewallet 522.83                4.761905
## 2        5  3.8200 3/8/2019 10:29        Cash  76.40                4.761905
## 3        7 16.2155 3/3/2019 13:23 Credit card 324.31                4.761905
## 4        8 23.2880 1/27/2019 20:33    Ewallet 465.76                4.761905
## 5        7 30.2085 2/8/2019 10:37     Ewallet 604.17                4.761905
## 6        7 29.8865 3/25/2019 18:30    Ewallet 597.73                4.761905
##   gross.income Rating    Total
## 1      26.1415    9.1 548.9715
## 2       3.8200    9.6  80.2200
## 3      16.2155    7.4 340.5255
## 4      23.2880    8.4 489.0480
## 5      30.2085    5.3 634.3785
## 6      29.8865    4.1 627.6165
```

3. Tidying the data

```
#Checking to see how many unique values are in each variable
rapply(sales,function(x)length(unique(x)))
```

```
##               Invoice.ID                  Branch            Customer.type
##                     1000                       3                        2
##                   Gender            Product.line               Unit.price
##                        2                       6                      943
##                 Quantity                     Tax                     Date
##                       10                     990                       89
##                     Time                 Payment                     cogs
##                      506                       3                      990
## gross.margin.percentage            gross.income                   Rating
##                        1                     990                       61
##                    Total
##                      990
```

```
#From output, a few columns don't seem to make sense so we go forward and check them out
```

```
#Checking list of unique values for every column
ulst <- lapply(sales, unique)
ulst
```

```
## $Invoice.ID
##    [1] 750-67-8428 226-31-3081 631-41-3108 123-19-1176 373-73-7910 699-14-3026
##    [7] 355-53-5943 315-22-5665 665-32-9167 692-92-5582 351-62-0822 529-56-3974
##   [13] 365-64-0515 252-56-2699 829-34-3910 299-46-1805 656-95-9349 765-26-6951
##   [19] 329-62-1586 319-50-3348 300-71-4605 371-85-5789 273-16-6619 636-48-8204
##   [25] 549-59-1358 227-03-5010 649-29-6775 189-17-4241 145-94-9061 848-62-7243
##   [31] 871-79-8483 149-71-6266 640-49-2076 595-11-5460 183-56-6882 232-16-2483
##   [37] 129-29-8530 272-65-1806 333-73-7901 777-82-7220 280-35-5823 554-53-8700
##   [43] 354-25-5821 228-96-1411 617-15-4209 132-32-9879 370-41-7321 727-46-3608
##   [49] 669-54-1719 574-22-5561 326-78-5178 162-48-8011 616-24-2851 778-71-5554
##   [55] 242-55-6721 399-46-5918 106-35-6779 635-40-6220 817-48-8732 120-06-4233
##   [61] 285-68-5083 803-83-5989 347-34-2234 199-75-8169 853-23-2453 877-22-3308
##   [67] 838-78-4295 109-28-2512 232-11-3025 382-03-4532 393-65-2792 796-12-2025
##   [73] 510-95-6347 841-35-6630 287-21-9091 732-94-0499 263-10-3913 381-20-0914
##   [79] 829-49-1914 756-01-7507 870-72-4431 847-38-7188 480-63-2856 787-56-0757
##   [85] 360-39-5055 730-50-9884 362-58-8315 633-44-8566 504-35-8843 318-68-5053
##   [91] 565-80-5980 225-32-0908 873-51-0671 152-08-9985 512-91-0811 594-34-4444
##   [97] 766-85-7061 871-39-9221 865-92-6136 733-01-9107 163-56-7055 189-98-2939
##  [103] 551-21-3069 212-62-1842 716-39-1409 704-48-3927 628-34-3388 630-74-5166
##  [109] 588-01-7461 861-77-0145 479-26-8945 210-67-5886 227-78-1148 645-44-1170
##  [115] 237-01-6122 225-98-1496 291-32-1427 659-65-8956 642-32-2990 378-24-2715
##  [121] 638-60-7125 659-36-1684 219-22-9386 336-78-2147 268-27-6179 668-90-8900
##  [127] 870-54-3162 189-08-9157 663-86-9076 549-84-7482 191-10-6171 802-70-5316
##  [133] 695-51-0018 590-83-4591 483-71-1164 597-78-7908 700-81-1757 354-39-5160
##  [139] 241-72-9525 575-30-8091 731-81-9469 280-17-4359 338-65-2210 488-25-4221
##  [145] 239-10-7476 458-41-1477 685-64-1609 568-90-5112 262-47-2794 238-49-0436
##  [151] 608-96-3517 584-86-7256 746-94-0204 214-17-6927 400-89-4171 782-95-9291
##  [157] 279-74-2924 307-85-2293 743-04-1105 423-57-2993 894-41-5205 275-28-0149
##  [163] 101-17-6199 423-80-0988 548-46-9322 505-02-0892 234-65-2137 687-47-8271
##  [169] 796-32-9050 105-31-1824 249-42-3782 316-55-4634 733-33-4967 608-27-6295
##  [175] 414-12-7047 827-26-2100 175-54-2529 139-52-2867 407-63-8975 342-65-4817
##  [181] 130-98-8941 434-83-9547 851-28-6367 824-88-3614 586-25-0848 895-66-0685
##  [187] 305-14-0245 732-04-5373 400-60-7251 593-65-1552 284-34-9626 437-58-8131
##  [193] 286-43-6208 641-43-2399 831-07-6050 556-86-3144 848-24-9445 856-22-8149
##  [199] 699-01-4164 420-11-4919 606-80-4905 542-41-0513 426-39-2418 875-46-5808
##  [205] 394-43-4238 749-24-1565 672-51-8681 263-87-5680 573-58-9734 817-69-8206
##  [211] 888-02-0338 677-11-0152 142-63-6033 656-16-1063 891-58-8335 802-43-8934
##  [217] 560-30-5617 319-74-2561 549-03-9315 790-29-1172 239-36-3640 468-01-2051
##  [223] 389-25-3394 279-62-1445 213-72-6612 746-68-6593 836-82-5858 583-72-1480
##  [229] 466-61-5506 721-86-6247 289-65-5721 545-46-3100 418-02-5978 269-04-5750
##  [235] 157-13-5295 645-78-8093 211-30-9270 755-12-3214 346-84-3103 478-06-7835
##  [241] 540-11-4336 448-81-5016 142-72-4741 217-58-1179 376-02-8238 530-90-9855
##  [247] 866-05-7563 604-70-6476 799-71-1548 785-13-7708 845-51-0542 662-47-5456
##  [253] 883-17-4236 290-68-2984 704-11-6354 110-48-7033 366-93-0948 729-09-9681
##  [259] 151-16-1484 380-94-4661 850-41-9669 821-07-3596 655-85-5130 447-15-7839
##  [265] 154-74-7179 253-12-6086 808-65-0703 571-94-0759 144-51-6085 731-14-2199
##  [271] 783-09-1637 687-15-1097 126-54-1082 633-91-1052 477-24-6490 566-19-5475
##  [277] 526-86-8552 376-56-3573 537-72-0426 828-61-5674 136-08-6195 523-38-0215
##  [283] 490-29-1201 667-92-0055 565-17-3836 498-41-1961 593-95-4461 226-71-3580
##  [289] 283-79-9594 430-60-3493 139-20-0155 558-80-4082 278-97-7759 316-68-6352
##  [295] 585-03-5943 211-05-0490 727-75-6477 744-02-5987 307-83-9164 779-06-0012
```

```
## [301] 446-47-6729 573-10-3877 735-06-4124 439-54-7422 396-90-2219 411-77-0180
## [307] 286-01-5402 803-17-8013 512-98-1403 848-42-2560 532-59-7201 181-94-6432
## [313] 870-76-1733 423-64-4619 227-07-4446 174-36-3675 428-83-5800 603-07-0961
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## [331] 868-81-1752 634-97-8956 566-71-1091 442-48-3607 835-16-0096 527-09-6272
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## [379] 595-86-2894 182-69-8360 289-15-7034 462-78-5240 868-52-7573 153-58-4872
## [385] 662-72-2873 525-88-7307 689-16-9784 725-56-0833 394-41-0748 596-42-3999
## [391] 541-89-9860 173-82-9529 563-36-9814 308-47-4913 885-17-6250 726-27-2396
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## [403] 236-86-3015 831-64-0259 587-03-7455 882-40-4577 732-67-5346 725-32-9708
## [409] 256-08-8343 372-26-1506 244-08-0162 569-71-4390 132-23-6451 696-90-2548
## [415] 472-15-9636 268-03-6164 750-57-9686 186-09-3669 848-07-1692 745-71-3520
## [421] 266-76-6436 740-22-2500 271-88-8734 301-81-8610 489-64-4354 198-84-7132
## [427] 269-10-8440 650-98-6268 741-73-3559 325-77-6186 286-75-7818 574-57-9721
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## [439] 549-96-4200 810-60-6344 450-28-2866 394-30-3170 138-17-5109 192-98-7397
## [445] 301-11-9629 390-80-5128 235-46-8343 453-12-7053 296-11-7041 449-27-2918
## [451] 891-01-7034 744-09-5786 727-17-0390 568-88-3448 187-83-5490 767-54-1907
## [457] 710-46-4433 533-33-5337 325-90-8763 729-46-7422 639-76-1242 234-03-4040
## [463] 326-71-2155 320-32-8842 470-32-9057 878-30-2331 440-59-5691 554-53-3790
## [469] 746-19-0921 233-34-0817 767-05-1286 340-21-9136 405-31-3305 731-59-7531
## [475] 676-39-6028 502-05-1910 485-30-8700 598-47-9715 701-69-8742 575-67-1508
## [481] 541-08-3113 246-11-3901 674-15-9296 305-18-3552 493-65-6248 438-01-4015
## [487] 709-58-4068 795-49-7276 556-72-8512 627-95-3243 686-41-0932 510-09-5628
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## [499] 401-18-8016 420-18-8989 277-63-2961 573-98-8548 620-02-2046 282-35-2475
## [505] 511-54-3087 726-29-6793 387-49-4215 862-17-9201 291-21-5991 602-80-9671
## [511] 347-72-6115 209-61-0206 595-27-4851 189-52-0236 503-07-0930 413-20-6708
## [517] 425-85-2085 521-18-7827 220-28-1851 600-38-9738 734-91-1155 451-28-5717
## [523] 609-81-8548 133-14-7229 534-01-4457 719-89-8991 286-62-6248 339-38-9982
## [529] 827-44-5872 827-77-7633 287-83-1405 435-13-4908 857-67-9057 236-27-1144
## [535] 892-05-6689 583-41-4548 339-12-4827 643-38-7867 308-81-0538 358-88-9262
## [541] 460-35-4390 343-87-0864 173-50-1108 243-47-2663 841-18-8232 701-23-5550
## [547] 647-50-1224 541-48-8554 539-21-7227 213-32-1216 747-58-7183 582-52-8065
## [553] 210-57-1719 399-69-4630 134-75-2619 356-44-8813 198-66-9832 283-26-5248
## [559] 712-39-0363 218-59-9410 174-75-0888 866-99-7614 134-54-4720 760-90-2357
## [565] 514-37-2845 698-98-5964 718-57-9773 651-88-7328 241-11-2261 408-26-9866
## [571] 834-83-1826 343-61-3544 239-48-4278 355-34-6244 550-84-8664 339-96-8318
## [577] 458-61-0011 592-34-6155 797-88-0493 207-73-1363 390-31-6381 443-82-0585
## [583] 339-18-7061 359-90-3665 375-72-3056 127-47-6963 278-86-2735 695-28-6250
## [589] 379-17-6588 227-50-3718 302-15-2162 788-07-8452 560-49-6611 880-35-0356
## [595] 585-11-6748 470-31-3286 152-68-2907 123-35-4896 258-69-7810 334-64-2006
## [601] 219-61-4139 881-41-7302 373-09-4567 642-30-6693 484-22-8230 830-58-2383
## [607] 559-98-9873 544-32-5024 318-12-0304 349-97-8902 421-95-9805 277-35-5865
## [613] 789-23-8625 284-54-4231 443-59-0061 509-29-3912 327-40-9673 840-19-2096
## [619] 828-46-6863 641-96-3695 420-97-3340 436-54-4512 670-79-6321 852-62-7105
## [625] 598-06-7312 135-13-8269 816-57-2053 628-90-8624 856-66-2701 308-39-1707
## [631] 149-61-1929 655-07-2265 589-02-8023 420-04-7590 182-88-2763 188-55-0967
## [637] 610-46-4100 318-81-2368 364-33-8584 665-63-9737 695-09-5146 155-45-3814
## [643] 794-32-2436 131-15-8856 273-84-2164 706-36-6154 778-89-7974 574-31-8277
## [649] 859-71-0933 740-11-5257 369-82-2676 563-47-4072 742-04-5161 149-15-7606
## [655] 133-77-3154 169-52-4504 250-81-7186 562-12-5430 816-72-8853 491-38-3499
## [661] 322-02-2271 842-29-4695 725-67-2480 641-51-2661 714-02-3114 518-17-2983
## [667] 779-42-2410 190-14-3147 408-66-6712 679-22-6530 588-47-8641 642-61-4706
## [673] 576-31-4774 556-41-6224 811-03-8790 242-11-3142 752-23-3760 274-05-5470
## [679] 648-94-3045 130-67-4723 528-87-5606 320-85-2052 370-96-0655 105-10-6182
## [685] 510-79-0415 241-96-5076 767-97-4650 648-83-1321 173-57-2300 305-03-2383
## [691] 394-55-6384 266-20-6657 689-05-1884 196-01-2849 372-62-5264 800-09-8606
## [697] 182-52-7000 826-58-8051 868-06-0466 751-41-9720 626-43-7888 176-64-7711
## [703] 191-29-0321 729-06-2010 640-48-5028 186-79-9562 834-45-5519 162-65-8559
## [709] 760-27-5490 445-30-9252 786-94-2700 728-88-7867 183-21-3799 268-20-3585
## [715] 735-32-9839 258-92-7466 857-16-3520 482-17-1179 788-21-5741 821-14-9046
## [721] 418-05-0656 678-79-0726 776-68-1096 592-46-1692 434-35-9162 149-14-0304
## [727] 442-44-6497 174-64-0215 210-74-9613 299-29-0180 247-11-2470 635-28-5728
## [733] 756-49-0168 438-23-1242 238-45-6950 607-65-2441 386-27-7606 137-63-5492
```

```
##   [739] 197-77-7132 805-86-0265 733-29-1227 451-73-2711 373-14-0504 546-80-2899
##   [745] 345-68-9016 390-17-5806 457-13-1708 664-14-2882 487-79-6868 314-23-4520
##   [751] 210-30-7976 585-86-8361 807-14-7833 775-72-1988 288-38-3758 652-43-6591
##   [757] 785-96-0615 406-46-7107 250-17-5703 156-95-3964 842-40-8179 525-09-8450
##   [763] 410-67-1709 587-73-4862 787-87-2010 593-14-4239 801-88-0346 388-76-2555
##   [769] 711-31-1234 886-54-6089 707-32-7409 759-98-4285 201-63-8275 471-06-8611
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## Levels: A B C
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## Levels: Member Normal
##
## $Gender
## [1] Female Male
## Levels: Female Male
##
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## [4] Sports and travel      Food and beverages     Fashion accessories
## 6 Levels: Electronic accessories Fashion accessories ... Sports and travel
##
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## [550] 26.2080  6.6630  6.7620  5.6220  7.2040 49.2600 12.4980 10.8630  9.7110
## [559] 44.6000 16.9680 22.3530  9.9250 40.6050 24.6650 29.5830 27.9510 25.8930
## [568] 20.5100 13.3350  3.5455  7.2390 21.4775 28.4585 12.0600  6.3540 12.8540
## [577]  6.9510  4.0830 15.5360  9.2980  3.6160  9.4590 10.3420  7.8510 10.7650
## [586] 29.8050  3.6550 13.9590  8.4840  2.2790 11.2800 14.5200  2.2230  7.8300
## [595] 20.9970  9.2125  7.0320  3.2495 38.7800 16.3530 18.1615  6.3500 18.7775
## [604]  9.9580  1.5305  5.7890  1.4480 44.5365 13.9830  4.0465 33.7250 17.4240
## [613] 21.7800 21.9775 29.5590 13.0380 10.7520  4.5805 33.1065 41.6250  4.5675
## [622]  7.8880  6.0870 41.2900  7.9950  0.6045 32.0950 11.7465  8.3770 14.9550
```

```
## [631] 11.9865 33.2350 10.1325  2.3100  4.4075  7.8630 14.8185 35.4200  5.5670
## [640] 29.0080  3.0125  8.7120 21.0630  1.6815  1.5490 12.3700 18.9150 16.7430
## [649] 36.3900 16.7940 12.0360  2.3535  4.9845 13.2225  6.9825  2.7725  6.4455
## [658]  5.9990 17.6250 43.5500  9.8800  9.7260  8.6610  3.5940 14.3130  4.0620
## [667] 28.0200  9.3400 11.0115 13.4560 22.7400 22.4280 14.6940 29.4750 14.5500
## [676]  1.9740  1.7405 14.7960  2.1480  6.9240  4.9100  6.4830 31.7800  7.2880
## [685] 10.0650 31.5855 19.2640 24.3150 25.6830 23.6700 21.8425  5.4080 12.4380
## [694] 31.3110 48.7500 24.1640  4.8480  9.8850 36.2115 39.7755 25.1195  8.6000
## [703]  3.4490  6.2480  3.8550 24.1860 15.1060 34.9335  6.2325  8.9200 25.0110
## [712]  1.7910  6.8070  5.2440  8.9460 40.7835  6.6180 12.8695  4.6680 11.4000
## [721]  8.3355 34.8700 19.4520 18.2630  4.4640  8.4000  0.9850 26.5580  2.6860
## [730] 40.9750 28.4200 29.3800 36.6240 42.2820 19.4635  4.2415  7.1630  3.7690
## [739] 12.6680  1.9210 32.6150  2.6325  5.5305 28.4305  6.8200  8.7100 18.3200
## [748] 12.7305 38.9160 14.2960 28.9560  9.4250 11.0780 38.6000 36.0650 25.5520
## [757]  2.6725 11.1000 38.1840 11.4090  4.1070 19.1280  3.4290 19.1080 30.0545
## [766] 23.7965  2.6210  6.5650  7.2150 22.8585  4.6690  6.3125 39.5415  8.7200
## [775] 18.9520  1.5310 17.6040  2.5400 26.1030 28.7560  2.7475  9.0705 20.6185
## [784]  2.3205 13.7100 48.6850 32.4100  4.6610  2.7180  3.0435 12.2450  4.6390
## [793] 21.6725  6.9030 12.0800 23.5865 22.0320 34.0155 15.4940  9.3180 10.0460
## [802]  0.8875 31.0900  4.3000 20.1300 16.2425  4.7575 19.4480 21.2840 15.9040
## [811] 13.5520 19.2320 11.7900 10.5780  4.7680  0.5085 10.3065 21.0280  4.4020
## [820] 32.4495  6.1920 32.4750 37.1100  4.2240 12.5140  4.7400  4.5650 14.2555
## [829]  2.6190  9.6350 13.3890 27.9350  8.7660  7.7910  3.0150  3.9470  1.4870
## [838]  1.0660 14.0670  3.6630  1.1190 32.7960 29.7300  3.7050  9.8480 18.6165
## [847] 26.3950 23.9875 16.4295  8.4480  5.6620 17.2770 21.4335  4.3135  1.2760
## [856]  5.0760 17.8745 11.9385  5.0715 36.2120  6.2820  3.6465 12.9180  8.6870
## [865]  2.8250 10.7150 26.7180  4.6580 26.1040  2.6175  1.9875 36.0080  4.8400
## [874] 16.6050  4.0720 15.9950  8.3340 15.9530  4.3950 36.7350  4.8760 38.4600
## [883] 20.9150 23.1640 23.1225  7.0950 15.1350 39.6640 21.2590 14.1810 29.9600
## [892] 15.7680 20.1780  9.1940  6.9325  4.0355  5.8320 15.6760 42.3050 20.7200
## [901]  7.9540 24.5050  4.3725 11.2260 37.2480 20.5360 14.9400 10.6470  2.1425
## [910] 18.9340 10.3455  3.9390 16.1055  4.9110  1.2730 29.0990 10.5660  2.7560
## [919]  4.4155 17.8290 39.7125  2.5310 29.9760  8.3350 37.2200 18.9450 12.8580
## [928] 27.6115 22.3700 13.8135 17.1870 13.3040 44.9190 22.8400 12.6975  3.5280
## [937] 32.8580  8.4250  2.6890  8.9525 10.5720  5.9865  3.2850  4.2080 19.7730
## [946] 14.8995 22.7205 13.8060  7.9000 44.3970  4.5990  2.0890  0.7750 14.5230
## [955]  3.3330  3.8270 14.9850 12.1515  2.3700  8.6225 42.3150 12.9185 30.4780
## [964] 12.0120  8.6130  4.9920 14.9320  7.9800  1.2725  3.3885 11.9180 11.6300
## [973] 43.8660 34.9860 33.7295 15.9275  1.4760 24.8000 41.1700 30.1480 14.1400
## [982] 38.3000  5.8030  8.7450  3.0475  2.0175 48.6900  1.5920  3.2910 30.9190
##
## $Date
##  [1] 1/5/2019   3/8/2019   3/3/2019   1/27/2019 2/8/2019   3/25/2019 2/25/2019
##  [8] 2/24/2019 1/10/2019 2/20/2019 2/6/2019   3/9/2019   2/12/2019 2/7/2019
## [15] 3/29/2019 1/15/2019 3/11/2019 1/1/2019   1/21/2019 3/5/2019   3/15/2019
## [22] 2/17/2019 3/2/2019   3/22/2019 3/10/2019 1/25/2019 1/28/2019 1/7/2019
## [29] 3/23/2019 1/17/2019 2/2/2019   3/4/2019   3/16/2019 2/27/2019 2/10/2019
## [36] 3/19/2019 2/3/2019   3/7/2019   2/28/2019 3/27/2019 1/20/2019 3/12/2019
## [43] 2/15/2019 3/6/2019   2/14/2019 3/13/2019 1/24/2019 1/6/2019   2/11/2019
## [50] 1/22/2019 1/13/2019 1/9/2019   1/12/2019 1/26/2019 1/23/2019 2/23/2019
## [57] 1/2/2019   2/9/2019   3/26/2019 3/1/2019   2/1/2019   3/28/2019 3/24/2019
## [64] 2/5/2019   1/19/2019 1/16/2019 1/8/2019   2/18/2019 1/18/2019 2/16/2019
## [71] 2/22/2019 1/29/2019 1/4/2019   3/30/2019 1/30/2019 1/3/2019   3/21/2019
## [78] 2/13/2019 1/14/2019 3/18/2019 3/20/2019 2/21/2019 1/31/2019 1/11/2019
## [85] 2/26/2019 3/17/2019 3/14/2019 2/4/2019   2/19/2019
## 89 Levels: 1/1/2019 1/10/2019 1/11/2019 1/12/2019 1/13/2019 ... 3/9/2019
##
## $Time
##   [1] 13:08 10:29 13:23 20:33 10:37 18:30 14:36 11:38 17:15 13:27 18:07 17:03
##  [13] 10:25 16:48 19:21 16:19 11:03 10:39 18:00 15:30 11:24 10:40 12:20 11:15
##  [25] 17:36 19:20 15:31 12:17 19:48 15:36 19:39 12:43 14:49 10:12 10:42 12:28
##  [37] 19:15 17:17 13:24 13:01 18:45 10:11 13:03 20:39 19:47 17:24 15:47 12:45
##  [49] 17:08 10:19 15:10 14:42 15:46 11:49 19:01 11:26 11:28 15:55 20:36 17:47
##  [61] 10:55 13:40 12:27 14:35 16:40 15:43 15:01 10:04 18:50 12:46 18:17 18:21
##  [73] 17:04 14:20 15:48 16:24 18:56 19:56 18:37 10:17 14:31 10:23 20:35 16:57
##  [85] 17:55 19:54 16:42 12:09 20:05 20:38 13:11 10:16 18:14 13:22 11:27 16:44
##  [97] 18:19 14:50 20:54 20:19 10:43 14:30 11:32 10:41 12:44 20:07 20:31 12:29
## [109] 15:26 20:48 12:02 17:26 19:52 14:57 18:44 13:26 16:17 15:57 13:18 20:34
## [121] 18:36 14:40 16:43 20:59 15:39 12:21 19:25 13:00 13:48 19:57 10:36 16:37
## [133] 17:11 15:07 16:07 11:56 18:23 13:05 19:40 13:58 14:43 19:18 16:21 19:44
## [145] 19:42 15:24 14:12 13:32 16:20 16:31 11:36 19:17 17:34 12:04 17:01 10:50
## [157] 19:16 16:47 10:00 11:51 15:00 11:19 19:46 19:00 10:53 12:50 20:50 13:41
## [169] 19:08 20:23 11:30 19:30 18:03 10:13 19:58 10:01 11:57 10:02 14:51 12:42
```

```
## [169] 19:08 20:23 11:30 19:30 16:05 10:15 19:58 10:01 11:57 10:02 14:51 12:42
## [181] 17:38 20:24 18:08 15:53 15:05 18:27 16:55 12:58 18:59 13:44 13:46 18:06
## [193] 12:38 15:56 14:29 19:14 10:52 12:55 19:28 13:52 10:54 18:31 18:24 18:09
## [205] 15:16 17:07 19:26 11:20 16:49 12:01 11:25 18:42 14:47 19:43 14:04 16:11
## [217] 19:06 15:34 11:22 11:23 10:46 13:25 14:53 19:22 11:00 19:24 17:22 20:55
## [229] 16:05 13:34 18:13 11:44 15:51 16:52 20:52 16:28 13:29 11:09 15:02 14:21
## [241] 18:01 13:30 14:38 17:37 17:20 20:29 11:46 13:42 14:44 14:16 15:54 10:21
## [253] 16:46 20:14 17:09 17:43 19:05 10:08 13:12 20:51 17:29 11:34 18:58 20:26
## [265] 15:08 13:21 12:48 19:53 19:09 16:30 13:07 18:48 17:27 15:59 11:21 15:49
## [277] 13:02 20:21 15:04 16:10 12:14 11:06 18:22 19:02 15:44 20:01 13:45 15:40
## [289] 16:58 11:12 15:12 20:37 17:44 16:23 12:12 19:33 14:28 17:54 12:25 12:52
## [301] 19:50 15:32 13:19 13:37 14:55 12:31 10:26 20:18 20:04 13:38 17:30 15:28
## [313] 19:07 18:55 19:36 10:57 17:13 13:57 13:53 16:53 16:51 15:37 20:15 19:35
## [325] 15:42 14:11 17:58 11:02 15:09 13:47 16:59 14:15 15:19 18:33 12:10 11:40
## [337] 16:54 15:25 20:47 18:20 11:48 14:14 11:17 12:40 17:53 16:36 10:48 18:05
## [349] 12:07 19:49 15:52 20:46 10:34 13:55 11:43 16:03 20:03 19:41 18:04 10:31
## [361] 13:28 17:16 18:43 10:30 20:40 12:08 17:45 10:28 10:49 12:34 18:51 19:38
## [373] 12:32 10:33 19:55 14:33 13:54 12:15 12:37 15:06 15:58 14:03 16:38 11:07
## [385] 12:23 14:13 19:11 18:53 14:22 10:06 20:08 12:56 10:18 11:45 16:08 12:24
## [397] 19:51 18:10 15:27 16:04 14:41 14:19 14:08 11:29 12:16 20:00 15:29 14:58
## [409] 11:52 17:46 14:45 11:39 13:06 20:43 16:34 13:10 17:10 10:22 19:29 14:27
## [421] 12:22 11:59 17:59 12:51 13:56 19:45 16:18 18:57 11:18 14:06 20:13 15:14
## [433] 16:06 12:47 20:42 20:10 14:24 11:42 17:49 15:33 10:38 12:39 14:26 12:41
## [445] 15:20 16:33 20:44 11:16 12:30 17:48 20:30 13:59 11:58 16:50 18:02 17:52
## [457] 20:32 16:09 11:33 15:15 20:06 16:26 18:38 16:45 18:41 17:12 14:00 16:32
## [469] 10:10 10:05 18:15 11:01 15:21 16:16 11:05 19:31 18:35 13:51 12:35 11:55
## [481] 15:11 14:48 12:36 13:35 15:45 14:25 15:18 10:03 13:14 16:35 20:57 13:50
## [493] 17:35 17:56 10:44 10:09 10:58 13:49 11:10 13:33 14:05 16:27 15:23 18:18
## [505] 15:17 19:12
## 506 Levels: 10:00 10:01 10:02 10:03 10:04 10:05 10:06 10:08 10:09 ... 20:59
##
## $Payment
## [1] Ewallet     Cash        Credit card
## Levels: Cash Credit card Ewallet
##
## $cogs
##   [1] 522.83  76.40 324.31 465.76 604.17 597.73 413.04 735.60  72.52 164.52
##  [11]  57.92 102.04 234.75 431.90 713.80 562.32 482.51 435.66 164.01  80.60
##  [21] 430.20 263.94  66.40 172.80 265.89 420.72  33.52 175.34 441.80 224.01
##  [31] 470.65 702.63 670.24 193.16 397.68  68.12 313.10 547.92 439.36 240.96
##  [41]  86.72 112.22 414.72 789.60  30.74 375.84 510.21 180.09 113.58 826.30
##  [51] 639.80 222.95  71.48  15.43  32.32 687.84  88.68 716.80 723.50 183.66
##  [61]  74.22 334.38 495.63 158.10 302.96 158.70  66.94 585.66 787.70  18.33
##  [71] 894.80 621.20 145.56 455.46 672.03 416.50 441.36 783.10 101.90 595.14
##  [81] 290.04 154.00 321.44 244.55 581.42 382.60 345.66  42.47 461.94 189.52
##  [91] 448.60 153.86 579.24  89.75  97.16 878.70  74.70 158.25 496.20  48.71
## [101] 706.95 207.63 349.56 212.45 886.70 164.28 372.78 305.82 819.70  32.98
## [111] 294.63 509.88 522.63 727.11  81.06 109.70  51.36 109.60 106.88 796.48
## [121] 399.84 899.64 511.28 451.76 655.83 161.25 285.57 548.32 812.52 277.34
## [131] 552.78 139.36 524.70 487.80 270.66 131.55 206.52 519.10 580.00 898.00
## [141] 905.00 686.00  30.41 467.70 277.56 301.40 264.56 574.88 259.68 366.16
## [151] 241.92 749.16  98.88 647.76 461.45  72.17 251.40 874.98 560.34 345.44
## [161]  63.69 320.53 152.80 399.00 340.56 955.80 989.80 307.68 486.64 350.05
## [171] 400.25 166.80 317.34 158.32 304.56 177.36 157.57 443.28 260.40 449.82
## [181] 307.76 155.00 274.48  86.38  54.24 755.92 185.88  74.07 279.24 231.12
## [191] 147.04 790.20 102.20 163.55  74.29  87.40  25.29 166.00 356.95 114.90
## [201] 229.96 429.87 259.00  88.85 207.27 599.85 285.30  91.11 897.57 236.07
## [211] 839.34 461.80 139.26  18.28 123.85 283.92 758.96 172.02 272.10 434.56
## [221]  59.05  12.54  86.50 174.32 624.33 148.24 544.20 507.36 162.74  31.77
## [231] 756.81 295.28 519.40 186.28  87.05 221.10  66.10  89.69 224.46 119.54
## [241] 186.40 250.60 750.96 380.72 244.20  89.70 310.88 511.42 418.95 351.90
## [251]  28.78  95.00 471.20 130.48  66.35 155.46 129.00 263.76 675.54  65.80
## [261] 153.20 222.40  54.45 688.80 141.88 746.00 282.96 355.40 337.15  42.24
## [271] 193.86  24.06 598.26 335.79 218.20 381.68 709.90 440.20 559.68  37.00
## [281]  15.34 598.98 190.68 333.40  74.86 213.75 339.57 664.16 403.00 194.95
## [291]  62.48  72.72 181.10 259.60 115.36 470.28 240.04  88.61 199.64  39.01
## [301]  48.61 204.76 119.68 505.40 281.61 710.32  79.44 163.82 479.58 138.66
## [311]  71.15 139.95 781.30 198.74  63.24 373.95 207.69 176.28 206.37  39.42
## [321]  91.56 308.85 129.12 390.96 498.90 377.04 204.52 145.44 198.18  98.70
## [331] 385.10  46.96  73.50 142.25 687.60 347.70 142.95 385.38 144.27 391.79
## [341] 538.30 485.15 133.95 701.37  71.95 714.00 182.14 135.00 993.00 361.83
## [351] 383.11 243.00  30.24 356.56 375.50 954.40  82.50  74.97 647.68 755.76
## [361] 199.58 439.32 164.96 326.72 461.88 143.60 193.50 183.82 121.92 420.66
```

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## [371] 252.48 335.45 483.50 318.42 668.43 387.92  94.60 329.32  53.22 498.45
## [381] 299.56 204.70  75.82 280.62 323.20 486.63 127.54 241.44 379.50  76.82
## [391] 522.60  79.74 387.50 271.35 122.31 246.36 173.16 236.58 184.88  13.98
## [401] 198.75 684.53 269.04  68.95 274.84 226.12 119.10 342.10  43.74 104.85
## [411]  77.52 407.44  96.11 181.52  81.51 114.44 176.54 115.80 252.15 972.10
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## [431] 668.78  47.44 893.16 331.72 203.94  68.16 326.88  87.20 707.44 802.89
## [441]  12.78 133.70  19.15 276.60 137.22  27.07  39.12 448.26 132.06 318.05
## [451]  25.00  83.08 147.80 696.60 793.90 465.70  35.89 202.60 730.50 295.80
## [461]  22.62 256.70 545.50 260.05 222.12  21.58  98.84 502.62 160.20 431.30
## [471] 580.56 322.20 195.54 166.30 336.28 343.70  38.60 527.76 328.00 185.70
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## [491] 121.20 199.78 607.36 126.44 541.44  98.13 412.16  73.97  31.90 138.80
## [501] 186.62  88.45 193.44 145.50 504.30 306.45  95.70 635.18 214.55 379.96
## [511] 696.85 408.73  51.47 274.30 196.95  69.46 359.60 137.13 499.02 224.64
## [521] 125.74 490.26 457.05 156.84 119.72 543.60 882.81 152.58 693.44 229.50
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## [551] 133.26 135.24 112.44 144.08 985.20 249.96 217.26 194.22 892.00 339.36
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## [621]  91.35 157.76 121.74 825.80 159.90  12.09 641.90 234.93 167.54 299.10
## [631] 239.73 664.70 202.65  46.20  88.15 157.26 296.37 708.40 111.34 580.16
## [641]  60.25 174.24 421.26  33.63  30.98 247.40 378.30 334.86 727.80 335.88
## [651] 240.72  47.07  99.69 264.45 139.65  55.45 128.91 119.98 352.50 871.00
## [661] 197.60 194.52 173.22  71.88 286.26  81.24 560.40 186.80 220.23 269.12
## [671] 454.80 448.56 293.88 589.50 291.00  39.48  34.81 295.92  42.96 138.48
## [681]  98.20 129.66 635.60 145.76 201.30 631.71 385.28 486.30 513.66 473.40
## [691] 436.85 108.16 248.76 626.22 975.00 483.28  96.96 197.70 724.23 795.51
## [701] 502.39 172.00  68.98 124.96  77.10 483.72 302.12 698.67 124.65 178.40
## [711] 500.22  35.82 136.14 104.88 178.92 815.67 132.36 257.39  93.36 228.00
## [721] 166.71 697.40 389.04 365.26  89.28 168.00  19.70 531.16  53.72 819.50
## [731] 568.40 587.60 732.48 845.64 389.27  84.83 143.26  75.38 253.36  38.42
## [741] 652.30  52.65 110.61 568.61 136.40 174.20 366.40 254.61 778.32 285.92
## [751] 579.12 188.50 221.56 772.00 721.30 511.04  53.45 222.00 763.68 228.18
## [761]  82.14 382.56  68.58 382.16 601.09 475.93  52.42 131.30 144.30 457.17
## [771]  93.38 126.25 790.83 174.40 379.04  30.62 352.08  50.80 522.06 575.12
## [781]  54.95 181.41 412.37  46.41 274.20 973.70 648.20  93.22  54.36  60.87
## [791] 244.90  92.78 433.45 138.06 241.60 471.73 440.64 680.31 309.88 186.36
## [801] 200.92  17.75 621.80  86.00 402.60 324.85  95.15 388.96 425.68 318.08
## [811] 271.04 384.64 235.80 211.56  95.36  10.17 206.13 420.56  88.04 648.99
## [821] 123.84 649.50 742.20  84.48 250.28  94.80  91.30 285.11  52.38 192.70
## [831] 267.78 558.70 175.32 155.82  60.30  78.94  29.74  21.32 281.34  73.26
## [841]  22.38 655.92 594.60  74.10 196.96 372.33 527.90 479.75 328.59 168.96
## [851] 113.24 345.54 428.67  86.27  25.52 101.52 357.49 238.77 101.43 724.24
## [861] 125.64  72.93 258.36 173.74  56.50 214.30 534.36  93.16 522.08  52.35
## [871]  39.75 720.16  96.80 332.10  81.44 319.90 166.68 319.06  87.90 734.70
## [881]  97.52 769.20 418.30 463.28 462.45 141.90 302.70 793.28 425.18 283.62
## [891] 599.20 315.36 403.56 183.88 138.65  80.71 116.64 313.52 846.10 414.40
## [901] 159.08 490.10  87.45 224.52 744.96 410.72 298.80 212.94  42.85 378.68
## [911] 206.91  78.78 322.11  98.22  25.46 581.98 211.32  55.12  88.31 356.58
## [921] 794.25  50.62 599.52 166.70 744.40 378.90 257.16 552.23 447.40 276.27
## [931] 343.74 266.08 898.38 456.80 253.95  70.56 657.16 168.50  53.78 179.05
## [941] 211.44 119.73  65.70  84.16 395.46 297.99 454.41 276.12 158.00 887.94
## [951]  91.98  41.78  15.50 290.46  66.66  76.54 299.70 243.03  47.40 172.45
## [961] 846.30 258.37 609.56 240.24 172.26  99.84 298.64 159.60  25.45  67.77
## [971] 238.36 232.60 877.32 699.72 674.59 318.55  29.52 496.00 823.40 602.96
## [981] 282.80 766.00 116.06 174.90  60.95  40.35 973.80  31.84  65.82 618.38
##
## $gross.margin.percentage
## [1] 4.761905
##
## $gross.income
##   [1] 26.1415  3.8200 16.2155 23.2880 30.2085 29.8865 20.6520 36.7800  3.6260
##  [10]  8.2260  2.8960  5.1020 11.7375 21.5950 35.6900 28.1160 24.1255 21.7830
##  [19]  8.2005  4.0300 21.5100 13.1970  3.3200  8.6400 13.2945 21.0360  1.6760
##  [28]  8.7670 22.0900 11.2005 23.5325 35.1315 33.5120  9.6580 19.8840  3.4060
##  [37] 15.6550 27.3960 21.9680 12.0480  4.3360  5.6110 20.7360 39.4800  1.5370
##  [46] 18.7920 25.5105  9.0045  5.6790 41.3150 31.9900 11.1475  3.5740  0.7715
```

```
##  [55]  1.6160 34.3920  4.4340 35.8400 36.1750  9.1830  3.7110 16.7190 24.7815
##  [64]  7.9050 15.1480  7.9350  3.3470 29.2830 39.3850  0.9165 44.7400 31.0600
##  [73]  7.2780 22.7730 33.6015 20.8250 22.0680 39.1550  5.0950 29.7570 14.5020
##  [82]  7.7000 16.0720 12.2275 29.0710 19.1300 17.2830  2.1235 23.0970  9.4760
##  [91] 22.4300  7.6930 28.9620  4.4875  4.8580 43.9350  3.7350  7.9125 24.8100
## [100]  2.4355 35.3475 10.3815 17.4780 10.6225 44.3350  8.2140 18.6390 15.2910
## [109] 40.9850  1.6490 14.7315 25.4940 26.1315 36.3555  4.0530  5.4850  2.5680
## [118]  5.4800  5.3440 39.8240 19.9920 44.9820 25.5640 22.5880 32.7915  8.0625
## [127] 14.2785 27.4160 40.6260 13.8670 27.6390  6.9680 26.2350 24.3900 13.5330
## [136]  6.5775 10.3260 25.9550 29.0000 44.9000 45.2500 34.3000  1.5205 23.3850
## [145] 13.8780 15.0700 13.2280 28.7440 12.9840 18.3080 12.0960 37.4580  4.9440
## [154] 32.3880 23.0725  3.6085 12.5700 43.7490 28.0170 17.2720  3.1845 16.0265
## [163]  7.6400 19.9500 17.0280 47.7900 49.4900 15.3840 24.3320 17.5025 20.0125
## [172]  8.3400 15.8670  7.9160 15.2280  8.8680  7.8785 22.1640 13.0200 22.4910
## [181] 15.3880  7.7500 13.7240  4.3190  2.7120 37.7960  9.2940  3.7035 13.9620
## [190] 11.5560  7.3520 39.5100  5.1100  8.1775  3.7145  4.3700  1.2645  8.3000
## [199] 17.8475  5.7450 11.4980 21.4935 12.9500  4.4425 10.3635 29.9925 14.2650
## [208]  4.5555 44.8785 11.8035 41.9670 23.0900  6.9630  0.9140  6.1925 14.1960
## [217] 37.9480  8.6010 13.6050 21.7280  2.9525  0.6270  4.3250  8.7160 31.2165
## [226]  7.4120 27.2100 25.3680  8.1370  1.5885 37.8405 14.7640 25.9700  9.3140
## [235]  4.3525 11.0550  3.3050  4.4845 11.2230  5.9770  9.3200 12.5300 37.5480
## [244] 19.0360 12.2100  4.4850 15.5440 25.5710 20.9475 17.5950  1.4390  4.7500
## [253] 23.5600  6.5240  3.3175  7.7730  6.4500 13.1880 33.7770  3.2900  7.6600
## [262] 11.1200  2.7225 34.4400  7.0940 37.3000 14.1480 17.7700 16.8575  2.1120
## [271]  9.6930  1.2030 29.9130 16.7895 10.9100 19.0840 35.4950 22.0100 27.9840
## [280]  1.8500  0.7670 29.9490  9.5340 16.6700  3.7430 10.6875 16.9785 33.2080
## [289] 20.1500  9.7475  3.1240  3.6360  9.0550 12.9800  5.7680 23.5140 12.0020
## [298]  4.4305  9.9820  1.9505  2.4305 10.2380  5.9840 25.2700 14.0805 35.5160
## [307]  3.9720  8.1910 23.9790  6.9330  3.5575  6.9975 39.0650  9.9370  3.1620
## [316] 18.6975 10.3845  8.8140 10.3185  1.9710  4.5780 15.4425  6.4560 19.5480
## [325] 24.9450 18.8520 10.2260  7.2720  9.9090  4.9350 19.2550  2.3480  3.6750
## [334]  7.1125 34.3800 17.3850  7.1475 19.2690  7.2135 19.5895 26.9150 24.2575
## [343]  6.6975 35.0685  3.5975 35.7000  9.1070  6.7500 49.6500 18.0915 19.1555
## [352] 12.1500  1.5120 17.8280 18.7750 47.7200  4.1250  3.7485 32.3840 37.7880
## [361]  9.9790 21.9660  8.2480 16.3360 23.0940  7.1800  9.6750  9.1910  6.0960
## [370] 21.0330 12.6240 16.7725 24.1750 15.9210 33.4215 19.3960  4.7300 16.4660
## [379]  2.6610 24.9225 14.9780 10.2350  3.7910 14.0310 16.1600 24.3315  6.3770
## [388] 12.0720 18.9750  3.8410 26.1300  3.9870 19.3750 13.5675  6.1155 12.3180
## [397]  8.6580 11.8290  9.2440  0.6990  9.9375 34.2265 13.4520  3.4475 13.7420
## [406] 11.3060  5.9550 17.1050  2.1870  5.2425  3.8760 20.3720  4.8055  9.0760
## [415]  4.0755  5.7220  8.8270  5.7900 12.6075 48.6050 10.1680  0.8140 18.2745
## [424] 18.6095  3.1305 16.8175 45.3250  6.9080  4.3270  7.0380 33.4390  2.3720
## [433] 44.6580 16.5860 10.1970  3.4080 16.3440  4.3600 35.3720 40.1445  0.6390
## [442]  6.6850  0.9575 13.8300  6.8610  1.3535  1.9560 22.4130  6.6030 15.9025
## [451]  1.2500  4.1540  7.3900 34.8300 39.6950 23.2850  1.7945 10.1300 36.5250
## [460] 14.7900  1.1310 12.8350 27.2750 13.0025 11.1060  1.0790  4.9420 25.1310
## [469]  8.0100 21.5650 29.0280 16.1100  9.7770  8.3150 16.8140 17.1850  1.9300
## [478] 26.3880 16.4000  9.2850 30.1900 18.4900  9.8980 20.5450  7.4300  1.1480
## [487] 34.9560  3.4700  9.8300 10.1280  6.0600  9.9890 30.3680  6.3220 27.0720
## [496]  4.9065 20.6080  3.6985  1.5950  6.9400  9.3310  4.4225  9.6720  7.2750
## [505] 25.2150 15.3225  4.7850 31.7590 10.7275 18.9980 34.8425 20.4365  2.5735
## [514] 13.7150  9.8475  3.4730 17.9800  6.8565 24.9510 11.2320  6.2870 24.5130
## [523] 22.8525  7.8420  5.9860 27.1800 44.1405  7.6290 34.6720 11.4750  7.3395
## [532]  7.0800  5.8345  3.6980  4.8970 14.6100 26.2440  4.6020  3.7940  4.0360
## [541]  5.6310  3.5600  7.7620 14.7100 27.4275 12.8850 19.8180  8.5905 24.4395
## [550] 26.2080  6.6630  6.7620  5.6220  7.2040 49.2600 12.4980 10.8630  9.7110
## [559] 44.6000 16.9680 22.3530  9.9250 40.6050 24.6650 29.5830 27.9510 25.8930
## [568] 20.5100 13.3350  3.5455  7.2390 21.4775 28.4585 12.0600  6.3540 12.8540
## [577]  6.9510  4.0830 15.5360  9.2980  3.6160  9.4590 10.3420  7.8510 10.7650
## [586] 29.8050  3.6550 13.9590  8.4840  2.2790 11.2800 14.5200  2.2230  7.8300
## [595] 20.9970  9.2125  7.0320  3.2495 38.7800 16.3530 18.1615  6.3500 18.7775
## [604]  9.9580  1.5305  5.7890  1.4480 44.5365 13.9830  4.0465 33.7250 17.4240
## [613] 21.7800 21.9775 29.5590 13.0380 10.7520  4.5805 33.1065 41.6250  4.5675
## [622]  7.8880  6.0870 41.2900  7.9950  0.6045 32.0950 11.7465  8.3770 14.9550
## [631] 11.9865 33.2350 10.1325  2.3100  4.4075  7.8630 14.8185 35.4200  5.5670
## [640] 29.0080  3.0125  8.7120 21.0630  1.6815  1.5490 12.3700 18.9150 16.7430
## [649] 36.3900 16.7940 12.0360  2.3535  4.9845 13.2225  6.9825  2.7725  6.4455
## [658]  5.9990 17.6250 43.5500  9.8800  9.7260  8.6610  3.5940 14.3130  4.0620
## [667] 28.0200  9.3400 11.0115 13.4560 22.7400 22.4280 14.6940 29.4750 14.5500
## [676]  1.9740  1.7405 14.7960  2.1480  6.9240  4.9100  6.4830 31.7800  7.2880
## [685] 10.0650 31.5855 19.2640 24.3150 25.6830 23.6700 21.8425  5.4080 12.4380
## [694] 31.3110 48.7500 24.1640  4.8480  9.8850 36.2115 39.7755 25.1195  8.6000
## [703]  3.4490  6.2480  3.8550 24.1860 15.1060 34.9335  6.2325  8.9300 25.0110
```

```
## [703]   3.4490   6.2480   3.8550 24.1860 15.1080 34.9555   6.2525   8.9200 25.0110
## [712]   1.7910   6.8070   5.2440   8.9460 40.7835   6.6180 12.8695   4.6680 11.4000
## [721]   8.3355 34.8700 19.4520 18.2630   4.4640   8.4000   0.9850 26.5580   2.6860
## [730] 40.9750 28.4200 29.3800 36.6240 42.2820 19.4635   4.2415   7.1630   3.7690
## [739] 12.6680   1.9210 32.6150   2.6325   5.5305 28.4305   6.8200   8.7100 18.3200
## [748] 12.7305 38.9160 14.2960 28.9560   9.4250 11.0780 38.6000 36.0650 25.5520
## [757]   2.6725 11.1000 38.1840 11.4090   4.1070 19.1280   3.4290 19.1080 30.0545
## [766] 23.7965   2.6210   6.5650   7.2150 22.8585   4.6690   6.3125 39.5415   8.7200
## [775] 18.9520   1.5310 17.6040   2.5400 26.1030 28.7560   2.7475   9.0705 20.6185
## [784]   2.3205 13.7100 48.6850 32.4100   4.6610   2.7180   3.0435 12.2450   4.6390
## [793] 21.6725   6.9030 12.0800 23.5865 22.0320 34.0155 15.4940   9.3180 10.0460
## [802]   0.8875 31.0900   4.3000 20.1300 16.2425   4.7575 19.4480 21.2840 15.9040
## [811] 13.5520 19.2320 11.7900 10.5780   4.7680   0.5085 10.3065 21.0280   4.4020
## [820] 32.4495   6.1920 32.4750 37.1100   4.2240 12.5140   4.7400   4.5650 14.2555
## [829]   2.6190   9.6350 13.3890 27.9350   8.7660   7.7910   3.0150   3.9470   1.4870
## [838]   1.0660 14.0670   3.6630   1.1190 32.7960 29.7300   3.7050   9.8480 18.6165
## [847] 26.3950 23.9875 16.4295   8.4480   5.6620 17.2770 21.4335   4.3135   1.2760
## [856]   5.0760 17.8745 11.9385   5.0715 36.2120   6.2820   3.6465 12.9180   8.6870
## [865]   2.8250 10.7150 26.7180   4.6580 26.1040   2.6175   1.9875 36.0080   4.8400
## [874] 16.6050   4.0720 15.9950   8.3340 15.9530   4.3950 36.7350   4.8760 38.4600
## [883] 20.9150 23.1640 23.1225   7.0950 15.1350 39.6640 21.2590 14.1810 29.9600
## [892] 15.7680 20.1780   9.1940   6.9325   4.0355   5.8320 15.6760 42.3050 20.7200
## [901]   7.9540 24.5050   4.3725 11.2260 37.2480 20.5360 14.9400 10.6470   2.1425
## [910] 18.9340 10.3455   3.9390 16.1055   4.9110   1.2730 29.0990 10.5660   2.7560
## [919]   4.4155 17.8290 39.7125   2.5310 29.9760   8.3350 37.2200 18.9450 12.8580
## [928] 27.6115 22.3700 13.8135 17.1870 13.3040 44.9190 22.8400 12.6975   3.5280
## [937] 32.8580   8.4250   2.6890   8.9525 10.5720   5.9865   3.2850   4.2080 19.7730
## [946] 14.8995 22.7205 13.8060   7.9000 44.3970   4.5990   2.0890   0.7750 14.5230
## [955]   3.3330   3.8270 14.9850 12.1515   2.3700   8.6225 42.3150 12.9185 30.4780
## [964] 12.0120   8.6130   4.9920 14.9320   7.9800   1.2725   3.3885 11.9180 11.6300
## [973] 43.8660 34.9860 33.7295 15.9275   1.4760 24.8000 41.1700 30.1480 14.1400
## [982] 38.3000   5.8030   8.7450   3.0475   2.0175 48.6900   1.5920   3.2910 30.9190
##
## $Rating
##  [1]  9.1  9.6  7.4  8.4  5.3  4.1  5.8  8.0  7.2  5.9  4.5  6.8  7.1  8.2  5.7
## [16]  4.6  6.9  8.6  4.4  4.8  5.1  9.9  6.0  8.5  6.7  7.7  7.5  7.0  4.7  7.6
## [31]  7.9  6.3  5.6  9.5  8.1  6.5  6.1  6.6  5.4  9.3 10.0  6.4  4.3  4.0  8.7
## [46]  9.4  5.5  8.3  7.3  4.9  4.2  9.2  7.8  5.2  9.0  8.8  6.2  9.8  9.7  5.0
## [61]  8.9
##
## $Total
##    [1]   548.9715    80.2200   340.5255   489.0480   634.3785   627.6165   433.6920
##    [8]   772.3800    76.1460   172.7460    60.8160   107.1420   246.4875   453.4950
##   [15]   749.4900   590.4360   506.6355   457.4430   172.2105    84.6300   451.7100
##   [22]   277.1370    69.7200   181.4400   279.1845   441.7560    35.1960   184.1070
##   [29]   463.8900   235.2105   494.1825   737.7615   703.7520   202.8180   417.5640
##   [36]    71.5260   328.7550   575.3160   461.3280   253.0080    91.0560   117.8310
##   [43]   435.4560   829.0800    32.2770   394.6320   535.7205   189.0945   119.2590
##   [50]   867.6150   671.7900   234.0975    75.0540    16.2015    33.9360   722.2320
##   [57]    93.1140   752.6400   759.6750   192.8430    77.9310   351.0990   520.4115
##   [64]   166.0050   318.1080   166.6350    70.2870   614.9430   827.0850    19.2465
##   [71]   939.5400   652.2600   152.8380   478.2330   705.6315   437.3250   463.4280
##   [78]   822.2550   106.9950   624.8970   304.5420   161.7000   337.5120   256.7775
##   [85]   610.4910   401.7300   362.9430    44.5935   485.0370   198.9960   471.0300
##   [92]   161.5530   608.2020    94.2375   102.0180   922.6350    78.4350   166.1625
##   [99]   521.0100    51.1455   742.2975   218.0115   367.0380   223.0725   931.0350
##  [106]   172.4940   391.4190   321.1110   860.6850    34.6290   309.3615   535.3740
##  [113]   548.7615   763.4655    85.1130   115.1850    53.9280   115.0800   112.2240
##  [120]   836.3040   419.8320   944.6220   536.8440   474.3480   688.6215   169.3125
##  [127]   299.8485   575.7360   853.1460   291.2070   580.4190   146.3280   550.9350
##  [134]   512.1900   284.1930   138.1275   216.8460   545.0550   609.0000   942.9000
##  [141]   950.2500   720.3000    31.9305   491.0850   291.4380   316.4700   277.7880
##  [148]   603.6240   272.6640   384.4680   254.0160   786.6180   103.8240   680.1480
##  [155]   484.5225    75.7785   263.9700   918.7290   588.3570   362.7120    66.8745
##  [162]   336.5565   160.4400   418.9500   357.5880  1003.5900  1039.2900   323.0640
##  [169]   510.9720   367.5525   420.2625   175.1400   333.2070   166.2360   319.7880
##  [176]   186.2280   165.4485   465.4440   273.4200   472.3110   323.1480   162.7500
##  [183]   288.2040    90.6990    56.9520   793.7160   195.1740    77.7735   293.2020
##  [190]   242.6760   154.3920   829.7100   107.3100   171.7275    78.0045    91.7700
##  [197]    26.5545   174.3000   374.7975   120.6450   241.4580   451.3635   271.9500
##  [204]    93.2925   217.6335   629.8425   299.5650    95.6655   942.4485   247.8735
##  [211]   881.3070   484.8900   146.2230    19.1940   130.0425   298.1160   796.9080
##  [218]   180.6210   285.7050   456.2880    62.0025    13.1670    90.8250   183.0360
```

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## [225]   655.5465   155.6520   571.4100   532.7280   170.8770    33.3585   794.6505
## [232]   310.0440   545.3700   195.5940    91.4025   232.1550    69.4050    94.1745
## [239]   235.6830   125.5170   195.7200   263.1300   788.5080   399.7560   256.4100
## [246]    94.1850   326.4240   536.9910   439.8975   369.4950    30.2190    99.7500
## [253]   494.7600   137.0040    69.6675   163.2330   135.4500   276.9480   709.3170
## [260]    69.0900   160.8600   233.5200    57.1725   723.2400   148.9740   783.3000
## [267]   297.1080   373.1700   354.0075    44.3520   203.5530    25.2630   628.1730
## [274]   352.5795   229.1100   400.7640   745.3950   462.2100   587.6640    38.8500
## [281]    16.1070   628.9290   200.2140   350.0700    78.6030   224.4375   356.5485
## [288]   697.3680   423.1500   204.6975    65.6040    76.3560   190.1550   272.5800
## [295]   121.1280   493.7940   252.0420    93.0405   209.6220    40.9605    51.0405
## [302]   214.9980   125.6640   530.6700   295.6905   745.8360    83.4120   172.0110
## [309]   503.5590   145.5930    74.7075   146.9475   820.3650   208.6770    66.4020
## [316]   392.6475   218.0745   185.0940   216.6885    41.3910    96.1380   324.2925
## [323]   135.5760   410.5080   523.8450   395.8920   214.7460   152.7120   208.0890
## [330]   103.6350   404.3550    49.3080    77.1750   149.3625   721.9800   365.0850
## [337]   150.0975   404.6490   151.4835   411.3795   565.2150   509.4075   140.6475
## [344]   736.4385    75.5475   749.7000   191.2470   141.7500  1042.6500   379.9215
## [351]   402.2655   255.1500    31.7520   374.3880   394.2750  1002.1200    86.6250
## [358]    78.7185   680.0640   793.5480   209.5590   461.2860   173.2080   343.0560
## [365]   484.9740   150.7800   203.1750   193.0110   128.0160   441.6930   265.1040
## [372]   352.2225   507.6750   334.3410   701.8515   407.3160    99.3300   345.7860
## [379]    55.8810   523.3725   314.5380   214.9350    79.6110   294.6510   339.3600
## [386]   510.9615   133.9170   253.5120   398.4750    80.6610   548.7300    83.7270
## [393]   406.8750   284.9175   128.4255   258.6780   181.8180   248.4090   194.1240
## [400]    14.6790   208.6875   718.7565   282.4920    72.3975   288.5820   237.4260
## [407]   125.0550   359.2050    45.9270   110.0925    81.3960   427.8120   100.9155
## [414]   190.5960    85.5855   120.1620   185.3670   121.5900   264.7575  1020.7050
## [421]   213.5280    17.0940   383.7645   390.7995    65.7405   353.1675   951.8250
## [428]   145.0680    90.8670   147.7980   702.2190    49.8120   937.8180   348.3060
## [435]   214.1370    71.5680   343.2240    91.5600   742.8120   843.0345    13.4190
## [442]   140.3850    20.1075   290.4300   144.0810    28.4235    41.0760   470.6730
## [449]   138.6630   333.9525    26.2500    87.2340   155.1900   731.4300   833.5950
## [456]   488.9850    37.6845   212.7300   767.0250   310.5900    23.7510   269.5350
## [463]   572.7750   273.0525   233.2260    22.6590   103.7820   527.7510   168.2100
## [470]   452.8650   609.5880   338.3100   205.3170   174.6150   353.0940   360.8850
## [477]    40.5300   554.1480   344.4000   194.9850   633.9900   388.2900   207.8580
## [484]   431.4450   156.0300    24.1080   734.0760    72.8700   206.4300   212.6880
## [491]   127.2600   209.7690   637.7280   132.7620   568.5120   103.0365   432.7680
## [498]    77.6685    33.4950   145.7400   195.9510    92.8725   203.1120   152.7750
## [505]   529.5150   321.7725   100.4850   666.9390   225.2775   398.9580   731.6925
## [512]   429.1665    54.0435   288.0150   206.7975    72.9330   377.5800   143.9865
## [519]   523.9710   235.8720   132.0270   514.7730   479.9025   164.6820   125.7060
## [526]   570.7800   926.9505   160.2090   728.1120   240.9750   154.1295   148.6800
## [533]   122.5245    77.6580   102.8370   306.8100   551.1240    96.6420    79.6740
## [540]    84.7560   118.2510    74.7600   163.0020   308.9100   575.9775   270.5850
## [547]   416.1780   180.4005   513.2295   550.3680   139.9230   142.0020   118.0620
## [554]   151.2840  1034.4600   262.4580   228.1230   203.9310   936.6000   356.3280
## [561]   469.4130   208.4250   852.7050   517.9650   621.2430   586.9710   543.7530
## [568]   430.7100   280.0350    74.4555   152.0190   451.0275   597.6285   253.2600
## [575]   133.4340   269.9340   145.9710    85.7430   326.2560   195.2580    75.9360
## [582]   198.6390   217.1820   164.8710   226.0650   625.9050    76.7550   293.1390
## [589]   178.1640    47.8590   236.8800   304.9200    46.6830   164.4300   440.9370
## [596]   193.4625   147.6720    68.2395   814.3800   343.4130   381.3915   133.3500
## [603]   394.3275   209.1180    32.1405   121.5690    30.4080   935.2665   293.6430
## [610]    84.9765   708.2250   365.9040   457.3800   461.5275   620.7390   273.7980
## [617]   225.7920    96.1905   695.2365   874.1250    95.9175   165.6480   127.8270
## [624]   867.0900   167.8950    12.6945   673.9950   246.6765   175.9170   314.0550
## [631]   251.7165   697.9350   212.7825    48.5100    92.5575   165.1230   311.1885
## [638]   743.8200   116.9070   609.1680    63.2625   182.9520   442.3230    35.3115
## [645]    32.5290   259.7700   397.2150   351.6030   764.1900   352.6740   252.7560
## [652]    49.4235   104.6745   277.6725   146.6325    58.2225   135.3555   125.9790
## [659]   370.1250   914.5500   207.4800   204.2460   181.8810    75.4740   300.5730
## [666]    85.3020   588.4200   196.1400   231.2415   282.5760   477.5400   470.9880
## [673]   308.5740   618.9750   305.5500    41.4540    36.5505   310.7160    45.1080
## [680]   145.4040   103.1100   136.1430   667.3800   153.0480   211.3650   663.2955
## [687]   404.5440   510.6150   539.3430   497.0700   458.6925   113.5680   261.1980
## [694]   657.5310  1023.7500   507.4440   101.8080   207.5850   760.4415   835.2855
## [701]   527.5095   180.6000    72.4290   131.2080    80.9550   507.9060   317.2260
## [708]   733.6035   130.8825   187.3200   525.2310    37.6110   142.9470   110.1240
## [715]   187.8660   856.4535   138.9780   270.2595    98.0280   239.4000   175.0455
## [722]   732.2700   408.4920   383.5230    93.7440   176.4000    20.6850   557.7180
## [729]    56.4060   860.4750   596.8200   616.9800   769.1040   887.9220   408.7335
```

```
## [736]    89.0715   150.4230    79.1490   266.0280    40.3410   684.9150    55.2825
## [743]   116.1405   597.0405   143.2200   182.9100   384.7200   267.3405   817.2360
## [750]   300.2160   608.0760   197.9250   232.6380   810.6000   757.3650   536.5920
## [757]    56.1225   233.1000   801.8640   239.5890    86.2470   401.6880    72.0090
## [764]   401.2680   631.1445   499.7265    55.0410   137.8650   151.5150   480.0285
## [771]    98.0490   132.5625   830.3715   183.1200   397.9920    32.1510   369.6840
## [778]    53.3400   548.1630   603.8760    57.6975   190.4805   432.9885    48.7305
## [785]   287.9100  1022.3850   680.6100    97.8810    57.0780    63.9135   257.1450
## [792]    97.4190   455.1225   144.9630   253.6800   495.3165   462.6720   714.3255
## [799]   325.3740   195.6780   210.9660    18.6375   652.8900    90.3000   422.7300
## [806]   341.0925    99.9075   408.4080   446.9640   333.9840   284.5920   403.8720
## [813]   247.5900   222.1380   100.1280    10.6785   216.4365   441.5880    92.4420
## [820]   681.4395   130.0320   681.9750   779.3100    88.7040   262.7940    99.5400
## [827]    95.8650   299.3655    54.9990   202.3350   281.1690   586.6350   184.0860
## [834]   163.6110    63.3150    82.8870    31.2270    22.3860   295.4070    76.9230
## [841]    23.4990   688.7160   624.3300    77.8050   206.8080   390.9465   554.2950
## [848]   503.7375   345.0195   177.4080   118.9020   362.8170   450.1035    90.5835
## [855]    26.7960   106.5960   375.3645   250.7085   106.5015   760.4520   131.9220
## [862]    76.5765   271.2780   182.4270    59.3250   225.0150   561.0780    97.8180
## [869]   548.1840    54.9675    41.7375   756.1680   101.6400   348.7050    85.5120
## [876]   335.8950   175.0140   335.0130    92.2950   771.4350   102.3960   807.6600
## [883]   439.2150   486.4440   485.5725   148.9950   317.8350   832.9440   446.4390
## [890]   297.8010   629.1600   331.1280   423.7380   193.0740   145.5825    84.7455
## [897]   122.4720   329.1960   888.4050   435.1200   167.0340   514.6050    91.8225
## [904]   235.7460   782.2080   431.2560   313.7400   223.5870    44.9925   397.6140
## [911]   217.2555    82.7190   338.2155   103.1310    26.7330   611.0790   221.8860
## [918]    57.8760    92.7255   374.4090   833.9625    53.1510   629.4960   175.0350
## [925]   781.6200   397.8450   270.0180   579.8415   469.7700   290.0835   360.9270
## [932]   279.3840   943.2990   479.6400   266.6475    74.0880   690.0180   176.9250
## [939]    56.4690   188.0025   222.0120   125.7165    68.9850    88.3680   415.2330
## [946]   312.8895   477.1305   289.9260   165.9000   932.3370    96.5790    43.8690
## [953]    16.2750   304.9830    69.9930    80.3670   314.6850   255.1815    49.7700
## [960]   181.0725   888.6150   271.2885   640.0380   252.2520   180.8730   104.8320
## [967]   313.5720   167.5800    26.7225    71.1585   250.2780   244.2300   921.1860
## [974]   734.7060   708.3195   334.4775    30.9960   520.8000   864.5700   633.1080
## [981]   296.9400   804.3000   121.8630   183.6450    63.9975    42.3675  1022.4900
## [988]    33.4320    69.1110   649.2990
```

We don't have any abnormal entries. So we go ahead to drop the column for InvoiceID since it is only a unique ID for every transaction and will not be necessary for this analysis and the gross margin percentage since it is constant at 4.76 for all transactions.

```
#Dropping columns
sales <- subset(sales, select = -c(Invoice.ID,gross.margin.percentage))
```

```
head(sales)
```

```
##   Branch Customer.type Gender             Product.line Unit.price Quantity
## 1      A       Member Female       Health and beauty      74.69        7
## 2      C       Normal Female Electronic accessories      15.28        5
## 3      A       Normal   Male       Home and lifestyle      46.33        7
## 4      A       Member   Male       Health and beauty      58.22        8
## 5      A       Normal   Male         Sports and travel      86.31        7
## 6      C       Normal   Male Electronic accessories      85.39        7
##        Tax      Date  Time      Payment   cogs gross.income Rating    Total
## 1  26.1415  1/5/2019 13:08      Ewallet 522.83      26.1415    9.1 548.9715
## 2   3.8200  3/8/2019 10:29         Cash  76.40       3.8200    9.6  80.2200
## 3  16.2155  3/3/2019 13:23 Credit card 324.31      16.2155    7.4 340.5255
## 4  23.2880 1/27/2019 20:33      Ewallet 465.76      23.2880    8.4 489.0480
## 5  30.2085  2/8/2019 10:37      Ewallet 604.17      30.2085    5.3 634.3785
## 6  29.8865 3/25/2019 18:30      Ewallet 597.73      29.8865    4.1 627.6165
```

4. Exploratory Data Analysis

```
nums <- subset(sales, select = -c(Branch, Customer.type,Gender,Product.line,Date, Time, Payment))
head(nums)
```

```
##   Unit.price Quantity     Tax    cogs gross.income Rating    Total
## 1      74.69        7 26.1415 522.83      26.1415    9.1 548.9715
## 2      15.28        5  3.8200  76.40       3.8200    9.6  80.2200
## 3      46.33        7 16.2155 324.31      16.2155    7.4 340.5255
## 4      58.22        8 23.2880 465.76      23.2880    8.4 489.0480
## 5      86.31        7 30.2085 604.17      30.2085    5.3 634.3785
## 6      85.39        7 29.8865 597.73      29.8865    4.1 627.6165
```

```r
library(tidyr)
library(ggplot2)
library(magrittr)
```

```
##
## Attaching package: 'magrittr'
```

```
## The following object is masked from 'package:tidyr':
##
##     extract
```

```r
library(dplyr)
```

```
##
## Attaching package: 'dplyr'
```

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

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

```r
library(psych)
```

```
##
## Attaching package: 'psych'
```

```
## The following objects are masked from 'package:ggplot2':
##
##     %+%, alpha
```

```r
#Central tendecy values for numerical variables
describe(nums)
```

```
##              vars    n   mean     sd median trimmed    mad   min     max
## Unit.price      1 1000  55.67  26.49  55.23   55.62  33.37 10.08   99.96
## Quantity        2 1000   5.51   2.92   5.00    5.51   2.97  1.00   10.00
## Tax             3 1000  15.38  11.71  12.09   14.00  11.13  0.51   49.65
## cogs            4 1000 307.59 234.18 241.76  279.91 222.65 10.17  993.00
## gross.income    5 1000  15.38  11.71  12.09   14.00  11.13  0.51   49.65
## Rating          6 1000   6.97   1.72   7.00    6.97   2.22  4.00   10.00
## Total           7 1000 322.97 245.89 253.85  293.91 233.78 10.68 1042.65
##                range skew kurtosis   se
## Unit.price     89.88 0.01    -1.22 0.84
## Quantity        9.00 0.01    -1.22 0.09
## Tax            49.14 0.89    -0.09 0.37
## cogs          982.83 0.89    -0.09 7.41
## gross.income   49.14 0.89    -0.09 0.37
## Rating          6.00 0.01    -1.16 0.05
## Total        1031.97 0.89    -0.09 7.78
```

```
#Distributions of different variables
par( mfrow= c ( 2 , 4 ))
for(i in 1 : length(nums)) {
hist(nums[,i], main= names(nums[i]), xlab = names(nums[i]))
}
```
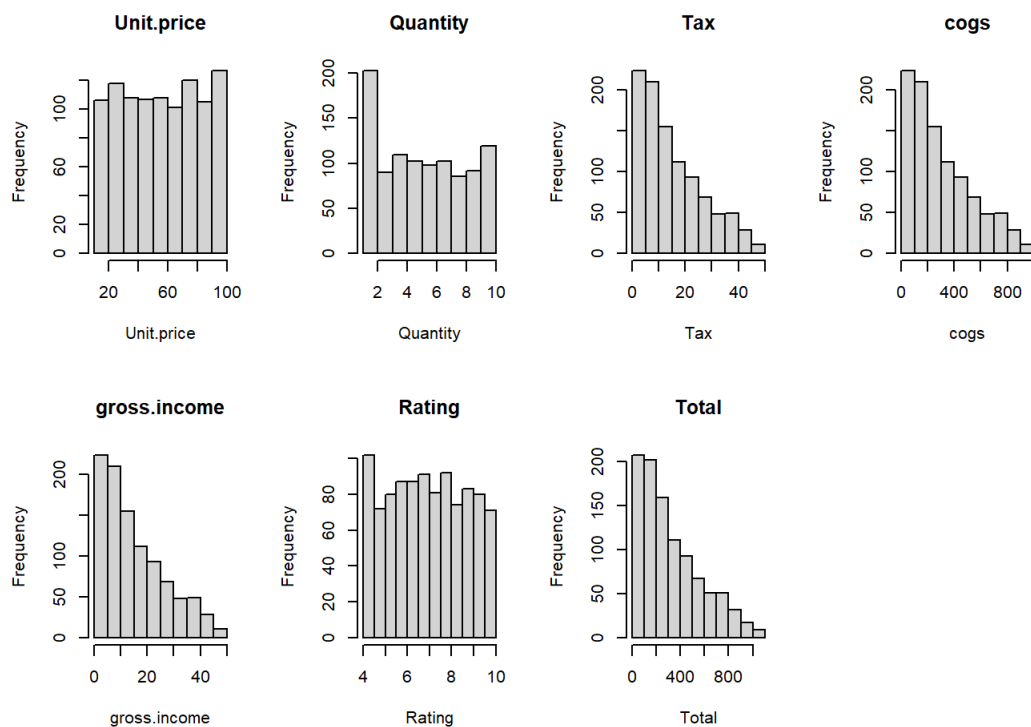

Our numerical variables don't

follow a normal distribution. * Amount purchased per unit price seems to vary at all prices though a unit price of 90 to 100 has the highest number of customer entries * Amount purchased seems to decrease with increase in Total and gross income, tax and cogs, with highest frequency levels being where variable values are least.

Checking how different factors affect our target variable "Total"

```
#Distribution of income per Gender
ggplot(sales,
       aes(x = Total,
           fill = Gender)) +
  geom_density(alpha = 0.4) +
  labs(title = "Distribution of total income per Gender")
```

Distribution of total income per Gender
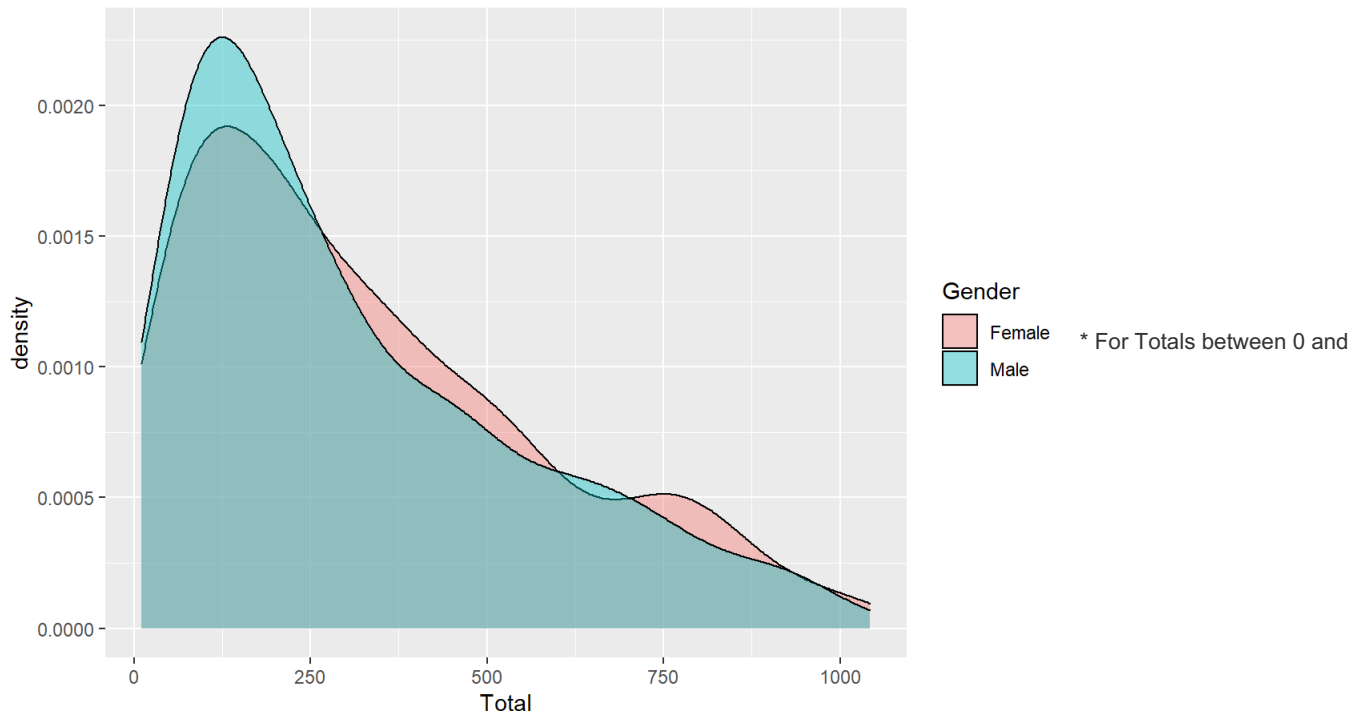

280 there seem to be more male than female though the frequency of females for totals exceeding 280 seems to surpass male

```
#Salary distribution by rank
ggplot(sales,
       aes(x = Total,
           fill = Customer.type)) +
  geom_density(alpha = 0.4) +
  labs(title = "Salary distribution by rank")
```

Salary distribution by rank
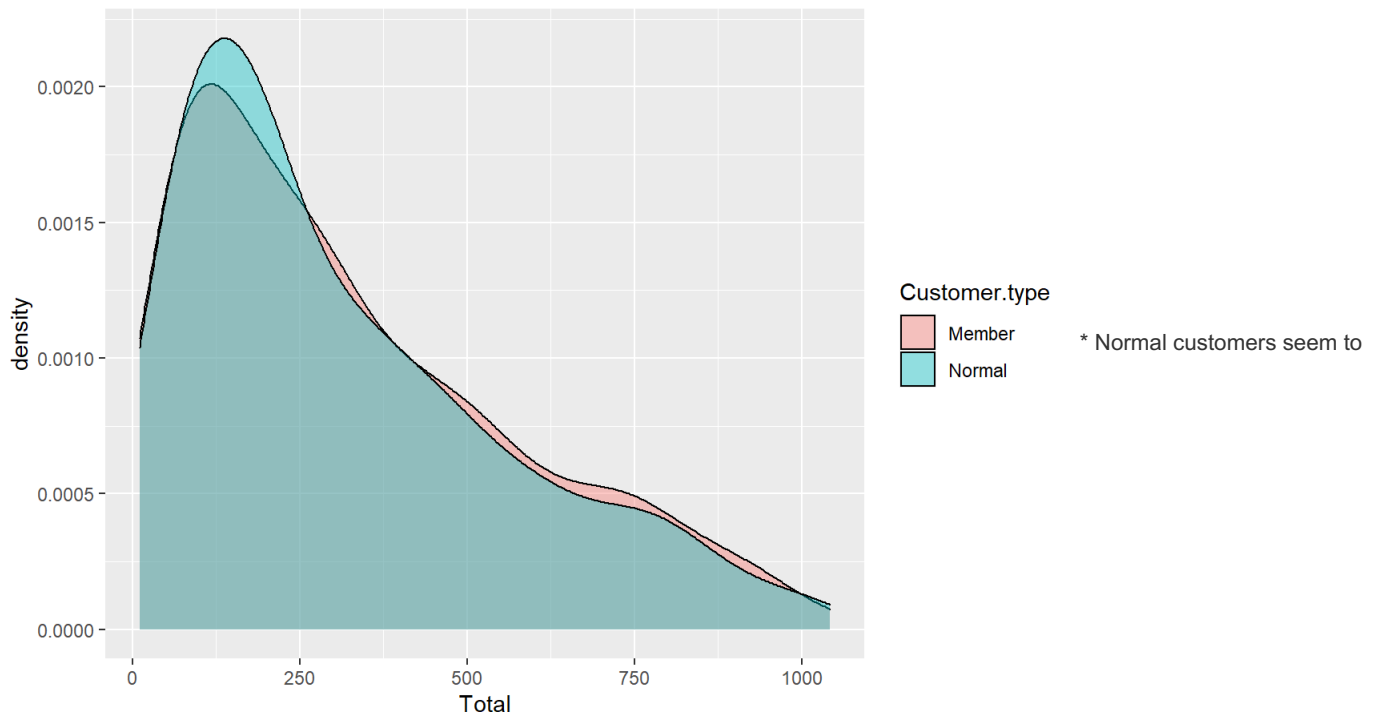
have a greater influence on total than members.

```
#Distribution of Total income per Branch
ggplot(sales,
       aes(x = Total,
           fill = Branch)) +
  geom_density(alpha = 0.4) +
  labs(title = "Distribution of Total income per Branch")
```

Distribution of Total income per Branch

Branch
- A
- B
- C

* Branch A contributes more to
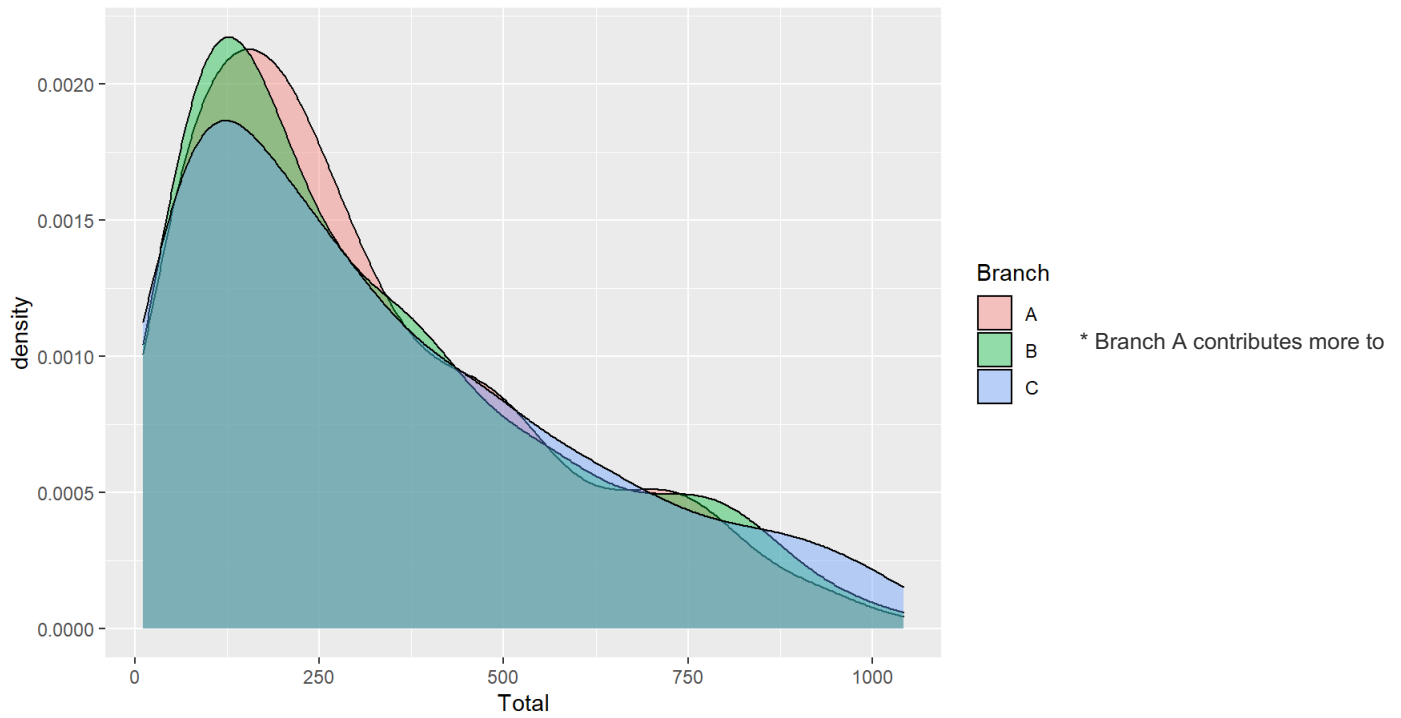
Total and Branch C contributes the least

```
#Distribution of Total per Payment method
ggplot(sales,
        aes(x = Total,
            fill = Payment)) +
  geom_density(alpha = 0.4) +
  labs(title = "Distribution of Total income per Payment method")
```

Distribution of Total income per Payment method

Payment
- Cash
- Credit card
- Ewallet
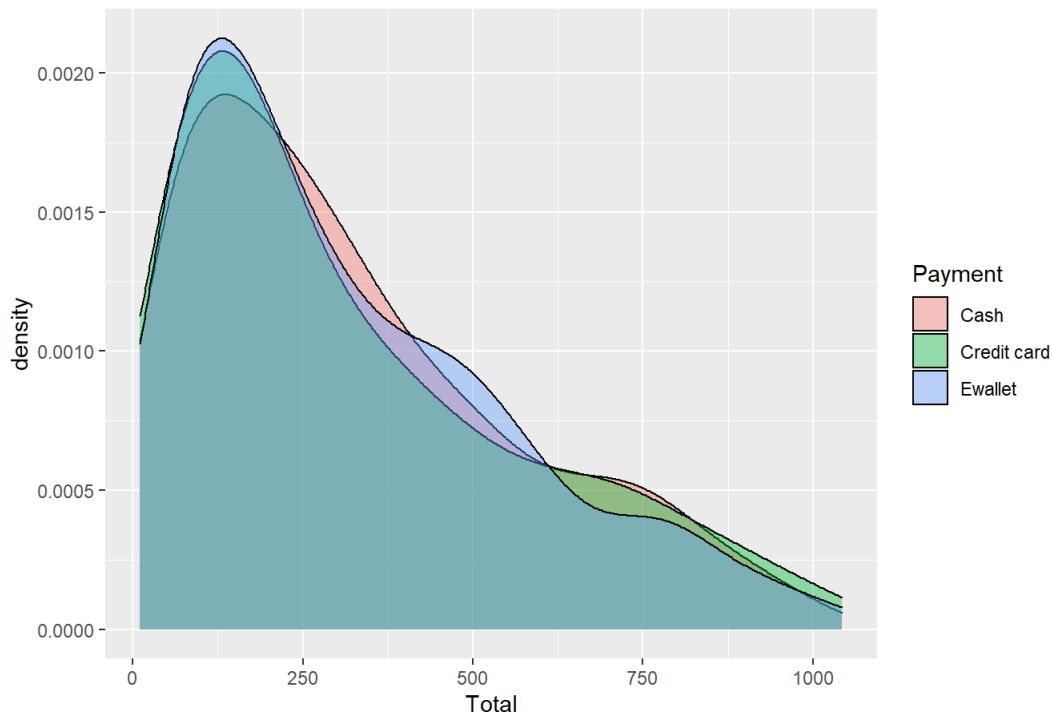
```
#What quantity was mostly purchased in the store
ggplot(sales, aes(x = Quantity)) +
  geom_bar()
```

* Most people purchased
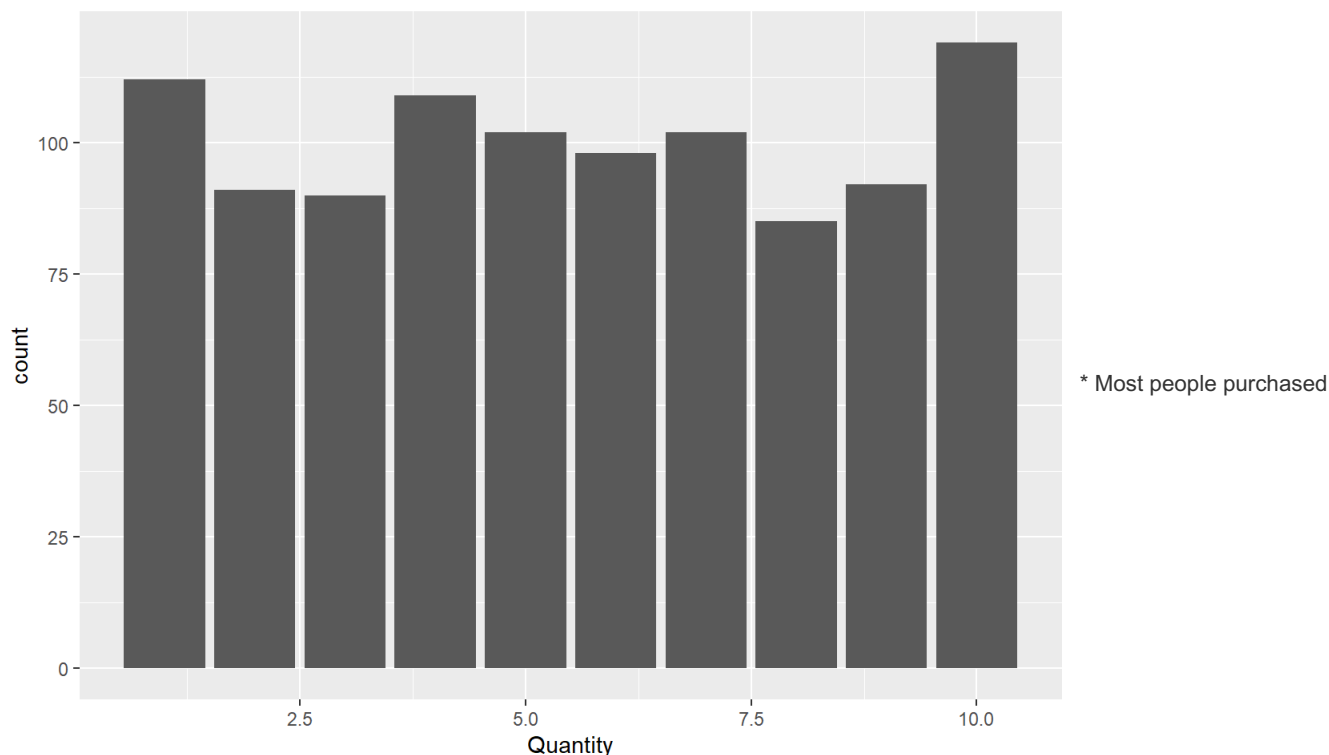
10items, followed by those who purchased 1 item

```
library(corrplot)
```

```
## corrplot 0.84 loaded
```

```
#Get the correlation matrix
res = cor(nums)
#Plotting a correlation plot

corrplot(res, method="color",addCoef.col = "black",
         tl.col="black", tl.srt=45)
```


There is perfect correlation
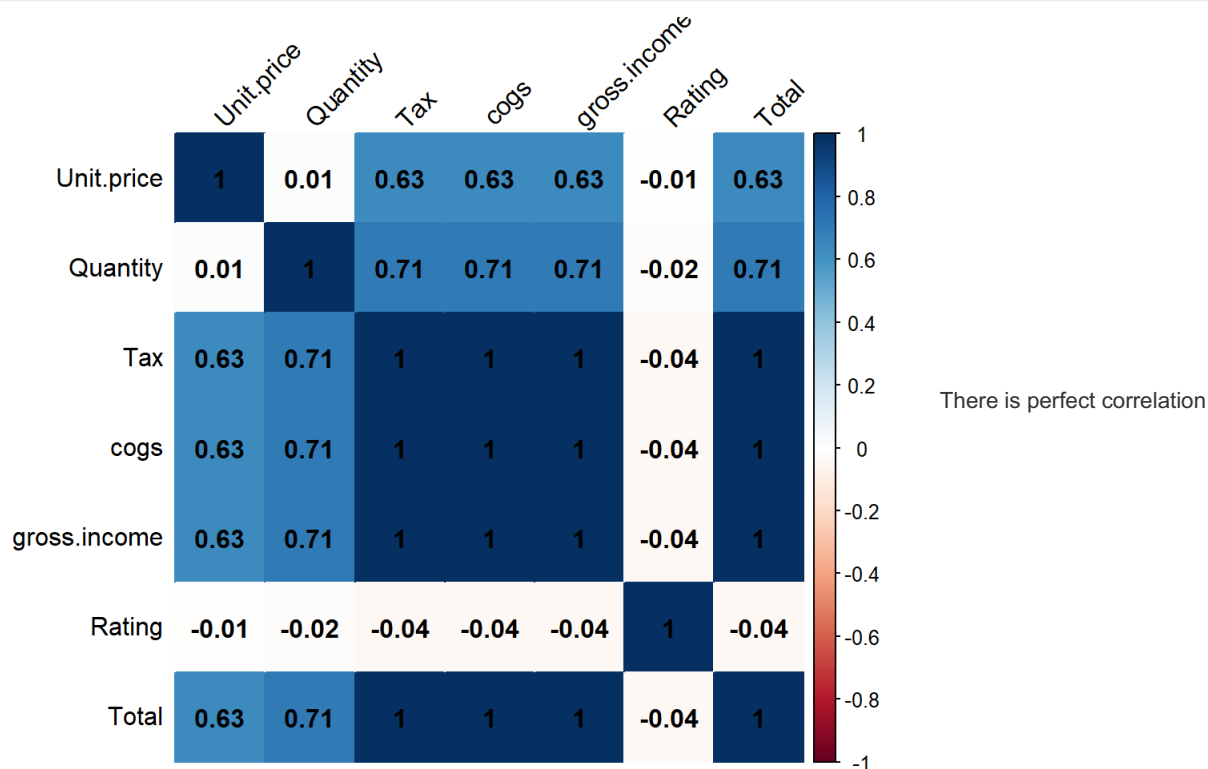
between Tax, Cogs and gross income. There is also high correlation between Unit Price and Tax,cogs and gross.income and Total.

5. Dimensionality Reduction

PCA

Feature Engineering

All variables to be used for dimensionality reduction should be numerical variables, hence we will convert our factor categories to numerics. We will also drop the date and time columns.

```
#First we will make a copy of our sales dataset for future use
data <- sales
#Dropping columns for date and time
data <- subset(data, select = -c(Date, Time))
head(data)
```

```
##   Branch Customer.type Gender           Product.line Unit.price Quantity
## 1      A        Member Female      Health and beauty      74.69        7
## 2      C        Normal Female Electronic accessories      15.28        5
## 3      A        Normal   Male      Home and lifestyle      46.33        7
## 4      A        Member   Male      Health and beauty      58.22        8
## 5      A        Normal   Male        Sports and travel      86.31        7
## 6      C        Normal   Male Electronic accessories      85.39        7
##        Tax     Payment   cogs gross.income Rating    Total
## 1  26.1415     Ewallet 522.83      26.1415    9.1 548.9715
## 2   3.8200        Cash  76.40       3.8200    9.6  80.2200
## 3  16.2155 Credit card 324.31      16.2155    7.4 340.5255
## 4  23.2880     Ewallet 465.76      23.2880    8.4 489.0480
## 5  30.2085     Ewallet 604.17      30.2085    5.3 634.3785
## 6  29.8865     Ewallet 597.73      29.8865    4.1 627.6165
```

```
#Converting factor columns to numeric
data$Branch <- as.numeric(data$Branch)
data$Customer.type <-  as.numeric(data$Customer.type)
data$Gender <- as.numeric(data$Gender)
data$Product.line <- as.numeric(data$Product.line)
data$Payment <- as.numeric(data$Payment)
data$Quantity <- as.numeric(data$Quantity)
head(data)
```

```
##   Branch Customer.type Gender Product.line Unit.price Quantity     Tax Payment
## 1      1             1      1            4      74.69        7 26.1415       3
## 2      3             2      1            1      15.28        5  3.8200       1
## 3      1             2      2            5      46.33        7 16.2155       2
## 4      1             1      2            4      58.22        8 23.2880       3
## 5      1             2      2            6      86.31        7 30.2085       3
## 6      3             2      2            1      85.39        7 29.8865       3
##     cogs gross.income Rating    Total
## 1 522.83      26.1415    9.1 548.9715
## 2  76.40       3.8200    9.6  80.2200
## 3 324.31      16.2155    7.4 340.5255
## 4 465.76      23.2880    8.4 489.0480
## 5 604.17      30.2085    5.3 634.3785
## 6 597.73      29.8865    4.1 627.6165
```

```
library(factoextra)
```

```
## Welcome! Want to learn more? See two factoextra-related books at https://goo.gl/ve3WBa
```

```
#Performing pca
data.pca <- prcomp(data[,c(1:11)], center = TRUE, scale. = TRUE)
summary(data.pca)
```

```
## Importance of components:
##                           PC1    PC2     PC3     PC4     PC5     PC6     PC7
## Standard deviation     1.9836 1.0631 1.03159 1.00991 0.99289 0.9771 0.96270
## Proportion of Variance 0.3577 0.1027 0.09674 0.09272 0.08962 0.0868 0.08425
## Cumulative Proportion  0.3577 0.4604 0.55719 0.64991 0.73953 0.8263 0.91058
##                            PC8     PC9      PC10      PC11
## Standard deviation     0.94823 0.29062 1.744e-16 2.868e-17
## Proportion of Variance 0.08174 0.00768 0.000e+00 0.000e+00
## Cumulative Proportion  0.99232 1.00000 1.000e+00 1.000e+00
```

```
str(data.pca)
```

```
## List of 5
##  $ sdev    : num [1:11] 1.984 1.063 1.032 1.01 0.993 ...
##  $ rotation: num [1:11, 1:11] 0.0267 -0.0155 -0.0338 0.0206 0.3273 ...
##   ..- attr(*, "dimnames")=List of 2
##   .. ..$ : chr [1:11] "Branch" "Customer.type" "Gender" "Product.line" ...
##   .. ..$ : chr [1:11] "PC1" "PC2" "PC3" "PC4" ...
##  $ center  : Named num [1:11] 1.99 1.5 1.5 3.45 55.67 ...
##   ..- attr(*, "names")= chr [1:11] "Branch" "Customer.type" "Gender" "Product.line" ...
##  $ scale   : Named num [1:11] 0.818 0.5 0.5 1.715 26.495 ...
##   ..- attr(*, "names")= chr [1:11] "Branch" "Customer.type" "Gender" "Product.line" ...
##  $ x       : num [1:1000, 1:11] 1.79 -2.05 0.11 1.29 2.43 ...
##   ..- attr(*, "dimnames")=List of 2
##   .. ..$ : chr [1:1000] "1" "2" "3" "4" ...
##   .. ..$ : chr [1:11] "PC1" "PC2" "PC3" "PC4" ...
##  - attr(*, "class")= chr "prcomp"
```

We have obtained 11 principal components. Our first PC, PC1 explains 35.7% Variation, our second, PC2 explains 10.3%. The first 8 PCs gives us a variability proportion of upto 99%.

```
#Graph of variables
fviz_pca_var(data.pca,
             col.var = "contrib", # Color by contributions to the PC
             gradient.cols = c("#00AFBB", "#E7B800", "#FC4E07"),
             repel = TRUE     # Avoid text overlapping
             )
```


Gross income, Tax and cogs
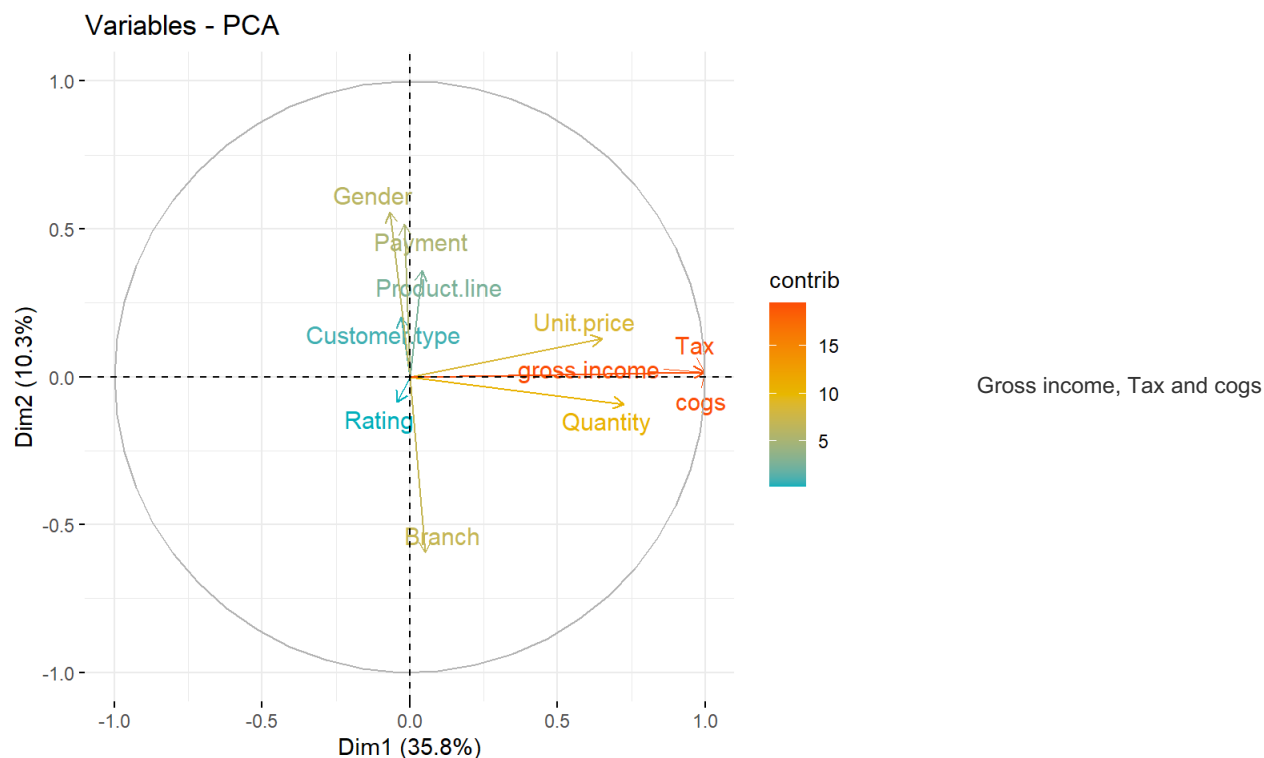
contribute highly to the first PC whereas Gender, Payment mostly contribute to the second PC.

```
# Eigenvalues
eig.val <- get_eigenvalue(data.pca)
eig.val
```

```
##          eigenvalue variance.percent cumulative.variance.percent
## Dim.1  3.934732e+00     3.577029e+01                    35.77029
## Dim.2  1.130132e+00     1.027393e+01                    46.04423
## Dim.3  1.064187e+00     9.674426e+00                    55.71865
## Dim.4  1.019927e+00     9.272061e+00                    64.99071
## Dim.5  9.858334e-01     8.962122e+00                    73.95283
## Dim.6  9.548085e-01     8.680077e+00                    82.63291
## Dim.7  9.267825e-01     8.425296e+00                    91.05821
## Dim.8  8.991345e-01     8.173950e+00                    99.23216
## Dim.9  8.446266e-02     7.678424e-01                   100.00000
## Dim.10 3.040817e-32     2.764379e-31                   100.00000
## Dim.11 8.227863e-34     7.479875e-33                   100.00000
```

Since the first 8 Principal Components contribute upto 99.23% of the variance proportion, they can be used for analysis.

6. Feature Selection

Using Filter Method Using the filter method, we will check for correlation between variables. We will then remove variables that are highly correlated as that is a sign of redundancy.

```
library(caret)
```

```
## Loading required package: lattice
```

```
#Separating target variable with independent variables
df <- data[-12]

# Calculating the correlation matrix
correlationMatrix <- cor(df)

# Find attributes that are highly correlated
highlyCorrelated <- findCorrelation(correlationMatrix, cutoff= 0.75)

# Highly correlated attributes

highlyCorrelated
```
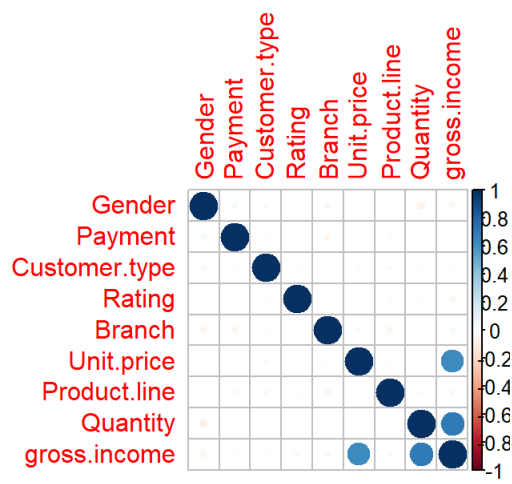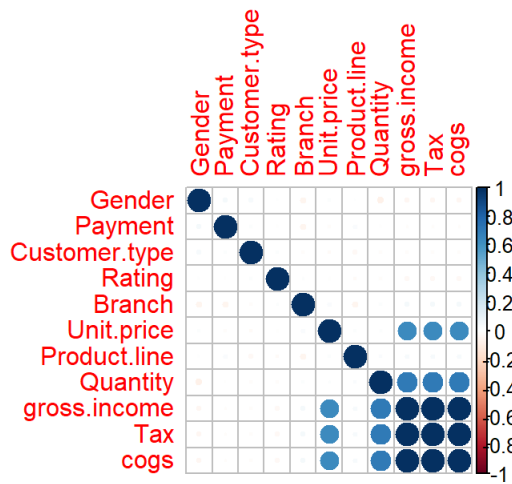
```
## [1] 7 9
```

```
names(df[,highlyCorrelated])
```

```
## [1] "Tax"  "cogs"
```

```
# Removing the highly correlated features
df.feat<-df[-highlyCorrelated]

# Performing a graphical comparison
par(mfrow = c(1, 2))
corrplot(correlationMatrix, order = "hclust")
corrplot(cor(df.feat), order = "hclust")
```

We can therefore conclude that the following features will be used for analysis: * Gender * Payment * Customer type * Rating * Branch * Unit price * Product line * Quantity and * Gross Income