For_OnlineRetail.R

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2022-11-19

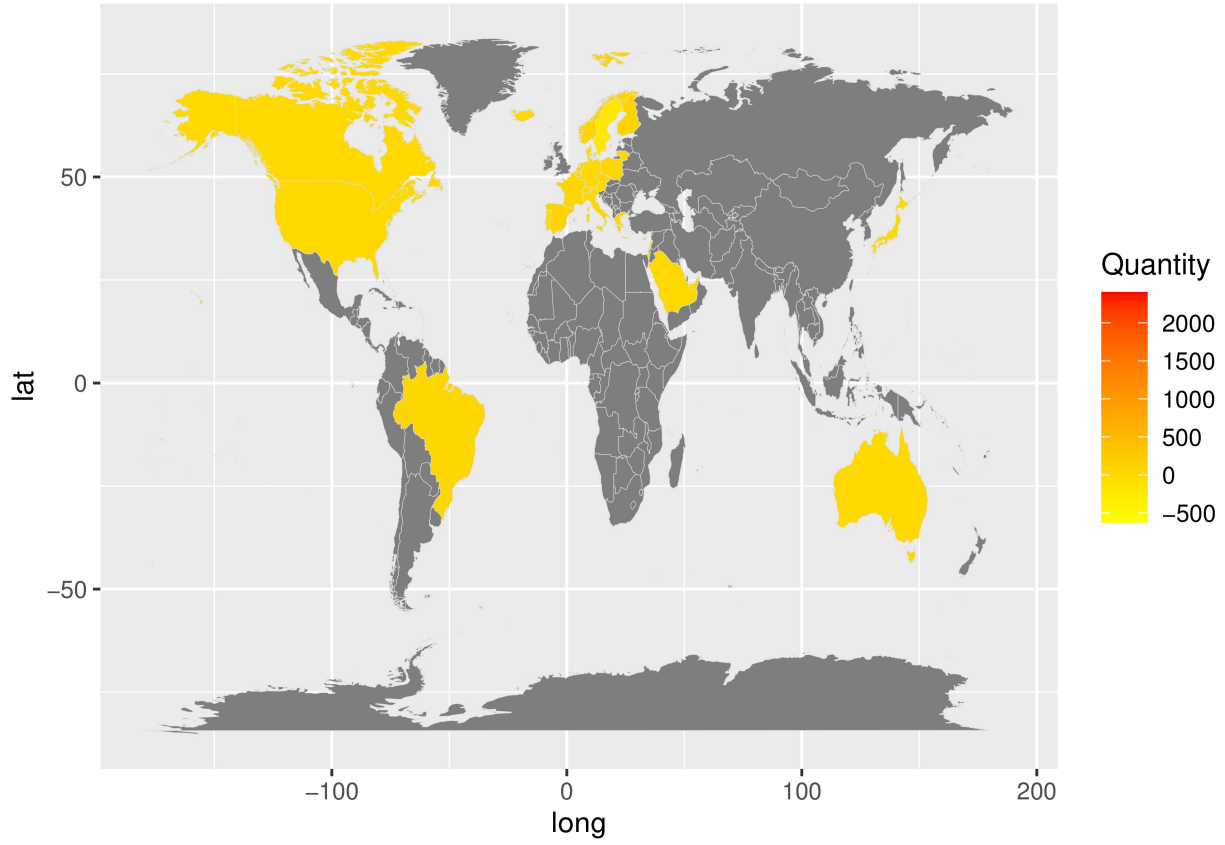
```
setwd("C:/Users/vk0589/OneDrive - UNT System/Documents/UNT/INFO_5307/Datasets")
#install.packages("tidyverse")
#read.csv("OnlineRetail.csv")
library(readxl)
data1 <- read_excel("OnlineRetail.xlsx")
data2 <- as.data.frame(data1)
# head(data2)

# Transforming Data for Plotting #####
# Renaming the Country Names
#data2$Country[data2$Country == "United Kingdom"] = "UK"
#data2$Country[data2$Country == "EIRE"] = "Ireland"
#data2$Country[data2$Country == "RSA"] = "South Africa"
#data2$Country[data2$Country == "Hong Kong"] = "China"

# Changing characters to factors
data2$InvoiceNo <- as.factor(data2$InvoiceNo)
data2$Description <- as.factor(data2$Description)
data2$CustomerID <- as.factor(data2$CustomerID)
data2$Description <- as.factor(data2$Description)
data2$Country <- as.factor(data2$Country)
data2$StockCode <- as.factor(data2$StockCode)
# summary(data2)

# World Map ####
# install.packages("tidyverse")
# install.packages("maps")
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
```

```
library(tidyr)
library(ggplot2)
library(maps)
```

```
## Warning: package 'maps' was built under R version 4.2.2
```

```
# creating variable for World Map
world <-map_data("world")

# Plotting Countries with ggplot on World Map
# Following Map indicates the data available in OnlineRetail.xlsx dataset
# Changing to factor
world %>%
  left_join(data2, by = c("region" = "Country")) %>%
  ggplot(aes(x = long, y = lat, group = group, fill = Quantity)) +
  geom_polygon(color = "#DFDFDF", size = 0.1) +
  scale_fill_gradient(low = "yellow", high = "red" )
```




```
# Findings #####
library(tidyverse)
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.2 --
```

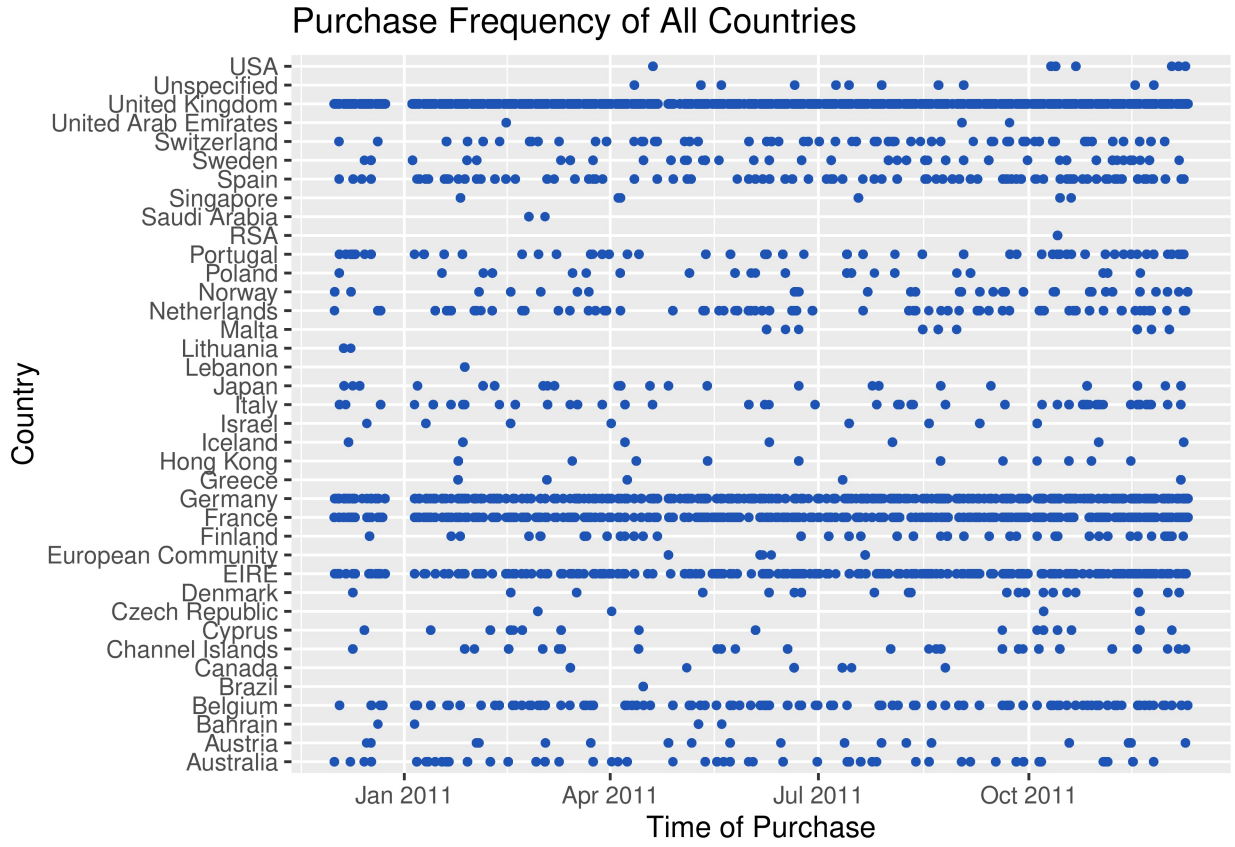
```
## v tibble  3.1.8     v stringr 1.4.1
```

```
## v readr   2.1.3     v forcats 0.5.2
## v purrr   0.3.5
## -- Conflicts ---------------------------------------- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
## x purrr::map()    masks maps::map()
```

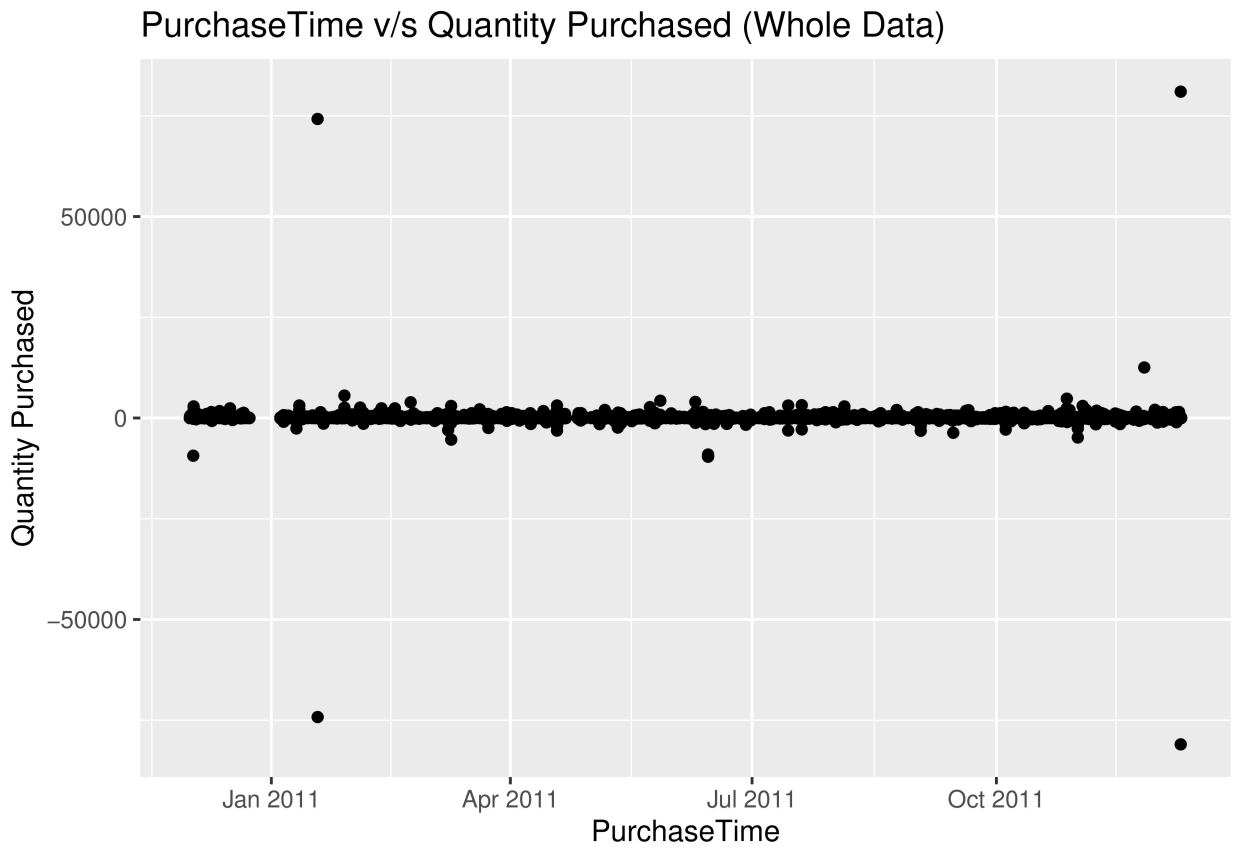
```
library(ggplot2)
library(dplyr)

# Observations summary based on Country (Count)
summary(data2$Country)
```

```
##            Australia              Austria              Bahrain
##                 1259                  401                   19
##              Belgium               Brazil               Canada
##                 2069                   32                  151
##      Channel Islands               Cyprus       Czech Republic
##                  758                  622                   30
##              Denmark                 EIRE   European Community
##                  389                 8196                   61
##              Finland               France              Germany
##                  695                 8557                 9495
##               Greece            Hong Kong              Iceland
##                  146                  288                  182
##               Israel                Italy                Japan
##                  297                  803                  358
##              Lebanon            Lithuania                Malta
##                   45                   35                  127
##          Netherlands               Norway               Poland
##                 2371                 1086                  341
##             Portugal                  RSA         Saudi Arabia
##                 1519                   58                   10
##            Singapore                Spain               Sweden
##                  229                 2533                  462
##          Switzerland United Arab Emirates       United Kingdom
##                 2002                   68               495478
##          Unspecified                  USA
##                  446                  291
```

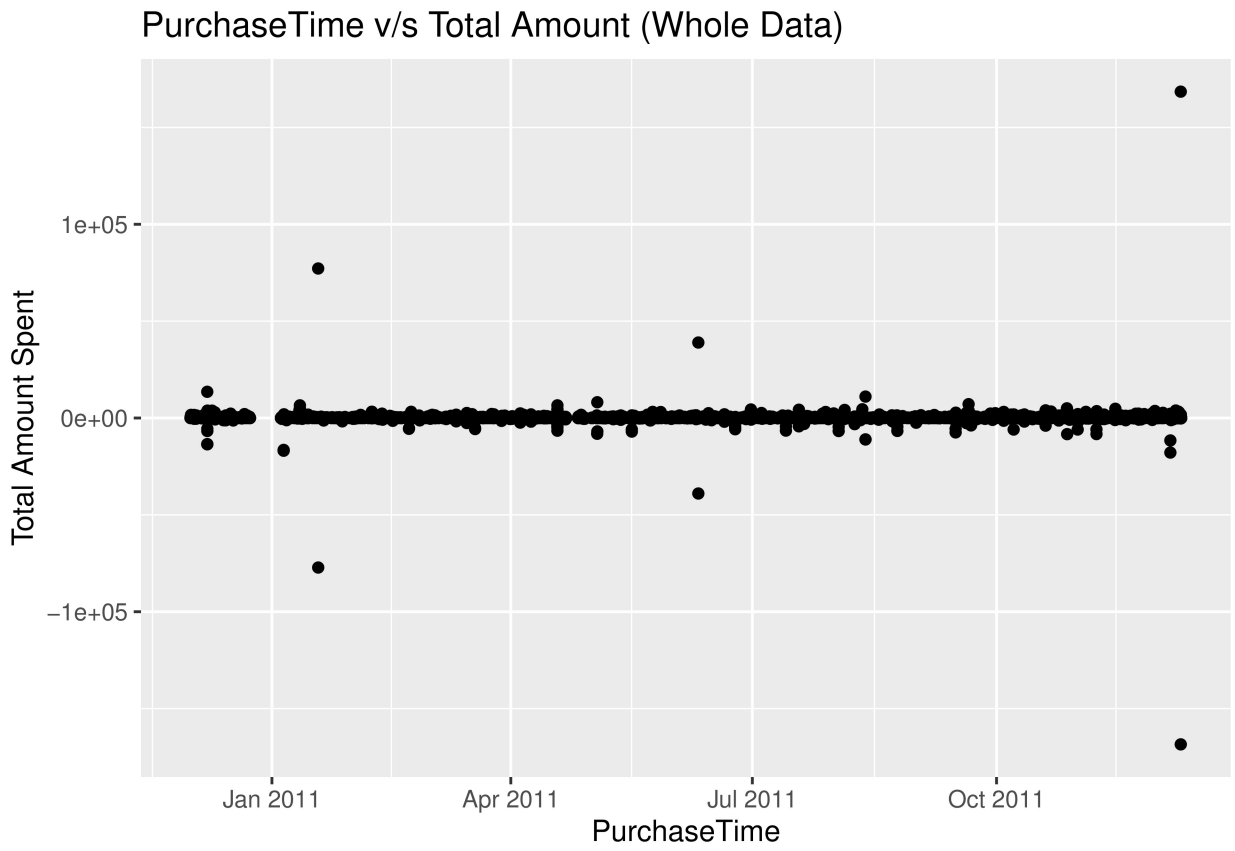
```
# Purchase Time v/s Country
data2%>%
  ggplot(aes(InvoiceDate, Country))+
  geom_point(color = "#1D55B6", size = 1) +
  labs(x = "Time of Purchase", y = "Country",
       title = "Purchase Frequency of All Countries")
```




```r
# Purchase Time v/s Quantity for whole Data:
qplot(x = InvoiceDate, y = Quantity,
      data = data2,
      xlab = "PurchaseTime",
      ylab = "Quantity Purchased",
      main = "PurchaseTime v/s Quantity Purchased (Whole Data)")
```




```
# Purchase Time v/s Price Spent for whole Data:
qplot(x = InvoiceDate, y = Quantity*UnitPrice,
      data = data2,
      xlab = "PurchaseTime",
      ylab = "Total Amount Spent",
      main = "PurchaseTime v/s Total Amount (Whole Data)")
```




```
# Tests based on Countries
# 1) USA
filter(data2, Country == "USA") -> us_data
summary(us_data)
```

```
##    InvoiceNo     StockCode                          Description
##  570467 :101   22027  :  4   CARD DOLLY GIRL                :  4
##  C570867:101   22712  :  4   TEA PARTY BIRTHDAY CARD        :  4
##  572215 : 24   21121  :  3   EMBROIDERED RIBBON REEL SUSIE  :  3
##  550644 : 22   21122  :  3   PINK HAPPY BIRTHDAY BUNTING    :  3
##  580553 : 21   21123  :  3   SET 2 PANTRY DESIGN TEA TOWELS :  3
##  580158 : 11   21124  :  3   SET OF 12 FAIRY CAKE BAKING CASES:  3
##  (Other): 11   (Other):271   (Other)                        :271
##     Quantity         InvoiceDate                      UnitPrice
##  Min.   :-36.000   Min.   :2011-04-19 16:19:00.00   Min.   : 0.420
##  1st Qu.:-10.000   1st Qu.:2011-10-10 16:06:00.00   1st Qu.: 0.850
##  Median :  5.000   Median :2011-10-12 16:17:00.00   Median : 1.450
##  Mean   :  3.553   Mean   :2011-10-07 08:22:58.97   Mean   : 2.216
##  3rd Qu.: 12.000   3rd Qu.:2011-10-12 16:17:00.00   3rd Qu.: 2.950
##  Max.   : 72.000   Max.   :2011-12-08 10:14:00.00   Max.   :16.950
##
##    CustomerID       Country
##  12607  :202   USA      :291
##  12646  : 45   Australia:  0
##  12558  : 22   Austria  :  0
##  12733  : 22   Bahrain  :  0
```

```
##  12346   :  0   Belgium  :  0
##  12347   :  0   Brazil   :  0
##  (Other):  0   (Other)  :  0
```

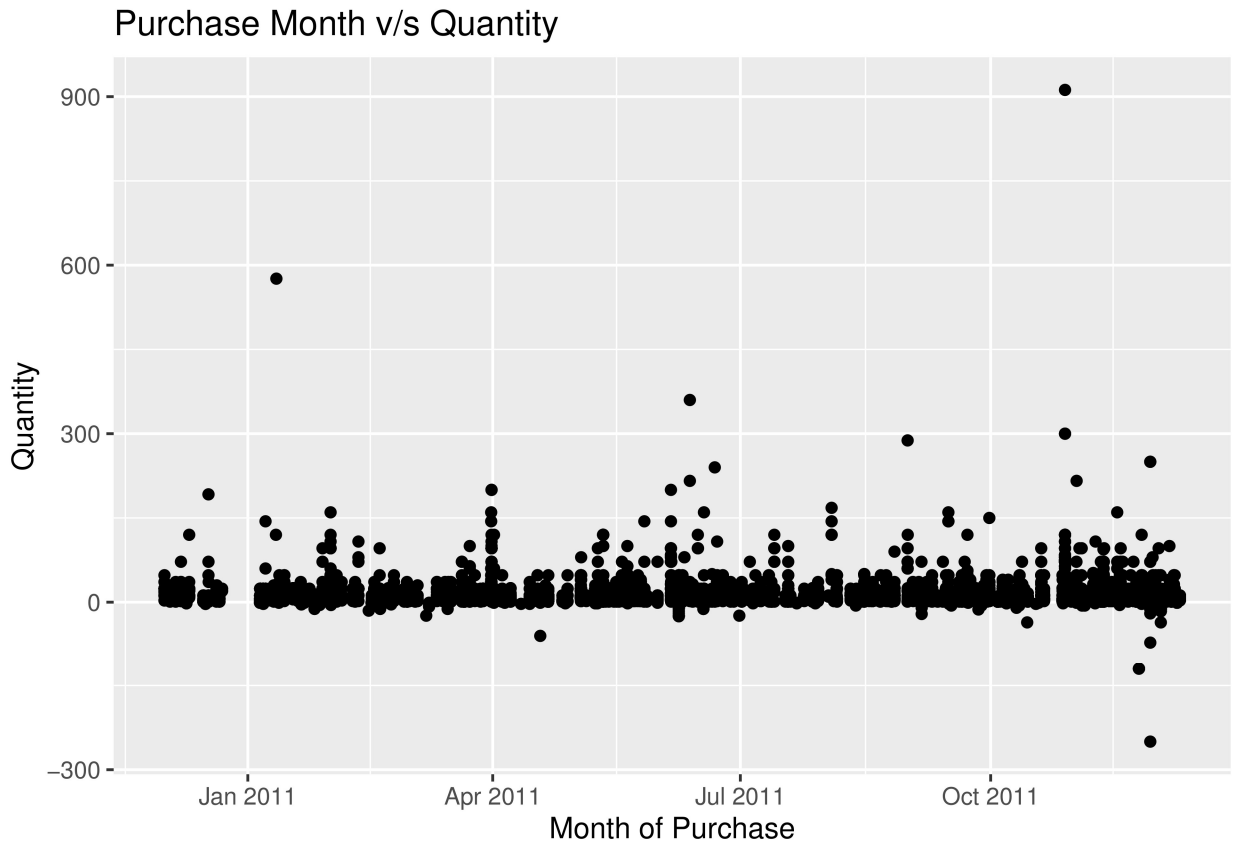
```
# qplot(x = InvoiceDate, y = Quantity, data = us_data, color = CustomerID)
# qplot(x = InvoiceDate, y = Quantity, data = us_data, color = InvoiceNo)
qplot(x = InvoiceDate, y = Quantity,
      data = us_data,
      xlab = "Month of Purchase (Per each Customers)",
      ylab = "Quantity",
      main = "Purchase Month v/s Quantity",
      color = InvoiceNo, # Coloring Points based on 'InvoiceNo'
      facets = ~ CustomerID) # Separated Graphs for CustomerID
```


```
# 2) France
filter(data2, Country == "France") -> frc_data
summary(frc_data)
```

```
##    InvoiceNo      StockCode                          Description
##  570672 : 259   POST   : 311   POSTAGE                       : 311
##  578541 : 126   23084  :  75   RABBIT NIGHT LIGHT            :  75
##  569568 :  89   21731  :  72   RED TOADSTOOL LED NIGHT LIGHT :  72
##  576927 :  81   22554  :  68   PLASTERS IN TIN CIRCUS PARADE :  68
##  569332 :  77   22556  :  68   PLASTERS IN TIN WOODLAND ANIMALS  :  68
##  552826 :  75   22326  :  65   ROUND SNACK BOXES SET OF4 WOODLAND:  65
```

```
##  (Other):7850   (Other):7898   (Other)                         :7898
##     Quantity         InvoiceDate                      UnitPrice
##  Min.   :-250.00   Min.   :2010-12-01 08:45:00.00   Min.   :   0.000
##  1st Qu.:   5.00   1st Qu.:2011-04-07 13:07:00.00   1st Qu.:   1.250
##  Median :  10.00   Median :2011-08-17 08:50:00.00   Median :   1.790
##  Mean   :  12.91   Mean   :2011-07-13 01:19:17.42   Mean   :   5.029
##  3rd Qu.:  12.00   3rd Qu.:2011-10-19 13:49:00.00   3rd Qu.:   3.750
##  Max.   : 912.00   Max.   :2011-12-09 12:50:00.00   Max.   :4161.060
##
##    CustomerID        Country
##  12681  : 646   France   :8557
##  12682  : 525   Australia:   0
##  12567  : 463   Austria  :   0
##  12637  : 394   Bahrain  :   0
##  12683  : 362   Belgium  :   0
##  (Other):6101   Brazil   :   0
##  NA's   :  66   (Other)  :   0
```

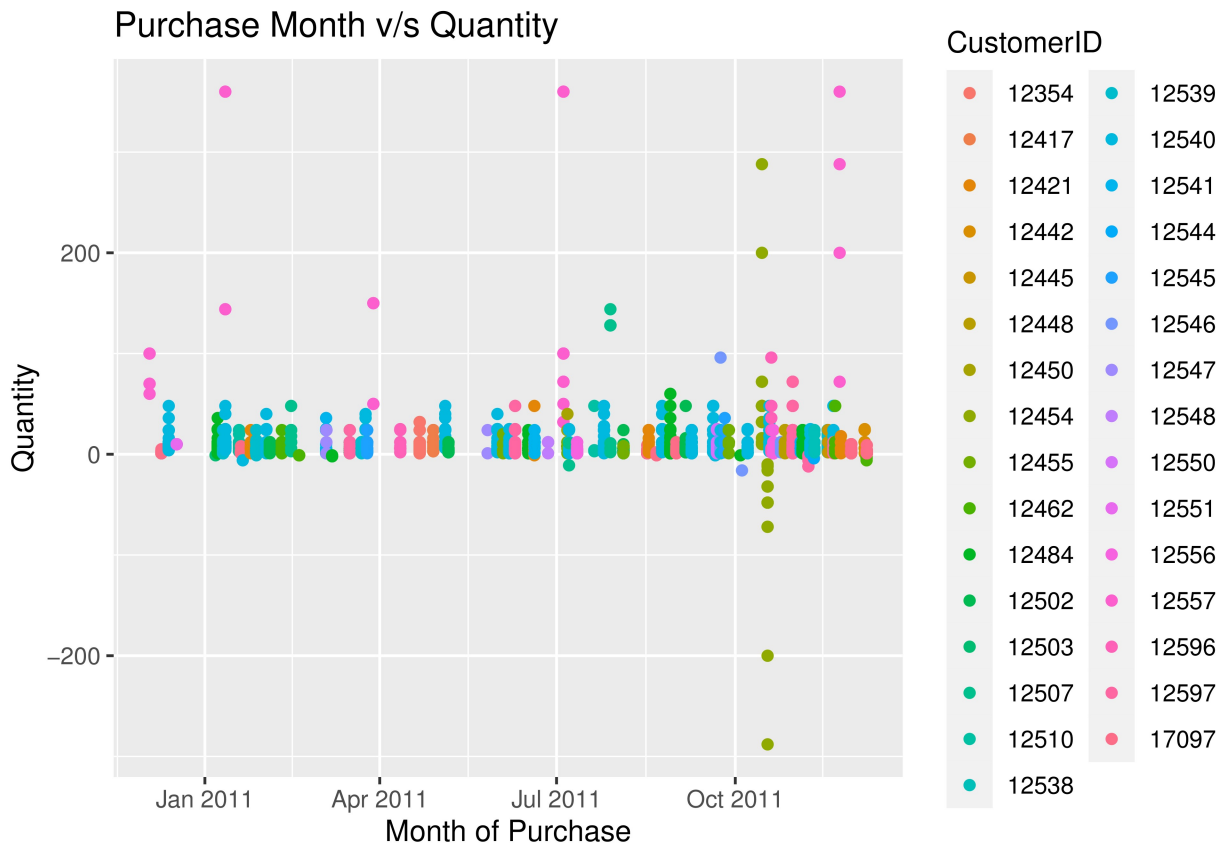
```
qplot(x = InvoiceDate, y = Quantity,
      xlab = "Month of Purchase",
      ylab = "Quantity",
      main = "Purchase Month v/s Quantity",
      data = frc_data)
```



```r
#color = CustomerID - FAILURE - Lot of Customers - Inappropriate Graph

# 3) Spain
filter(data2, Country == "Spain") -> spn_data
summary(spn_data)
```

```
##    InvoiceNo      StockCode                          Description
##  564734 : 122   POST   :  62   POSTAGE                       :  62
##  573362 : 116   22423  :  25   REGENCY CAKESTAND 3 TIER      :  25
##  540469 :  98   22960  :  16   JAM MAKING SET WITH JARS      :  16
##  540550 :  93   22077  :  15   6 RIBBONS RUSTIC CHARM        :  15
##  542303 :  93   22553  :  13   PLASTERS IN TIN SKULLS        :  13
##  559665 :  67   22326  :  12   ASSORTED COLOUR BIRD ORNAMENT:  12
##  (Other):1944   (Other):2390   (Other)                       :2390
##     Quantity         InvoiceDate                      UnitPrice
##  Min.   :-288.00   Min.   :2010-12-03 12:20:00.00   Min.   :   0.000
##  1st Qu.:   3.00   1st Qu.:2011-03-16 14:00:00.00   1st Qu.:   1.250
##  Median :   6.00   Median :2011-07-11 13:35:00.00   Median :   2.080
##  Mean   :  10.59   Mean   :2011-06-29 16:39:39.26   Mean   :   4.987
##  3rd Qu.:  12.00   3rd Qu.:2011-10-18 12:59:00.00   3rd Qu.:   4.250
##  Max.   : 360.00   Max.   :2011-12-07 17:05:00.00   Max.   :1715.850
##
##    CustomerID       Country
##  12540  :481   Spain    :2533
##  12484  :350   Australia:   0
##  12539  :274   Austria  :   0
##  12597  :214   Bahrain  :   0
##  17097  :213   Belgium  :   0
##  12502  :147   Brazil   :   0
##  (Other):854   (Other)  :   0
```

```r
qplot(x = InvoiceDate, y = Quantity,
      data = spn_data,
      xlab = "Month of Purchase",
      ylab = "Quantity",
      main = "Purchase Month v/s Quantity",
      color = CustomerID) #color = CustomerID - MANAGABLE - 31 Customers
```

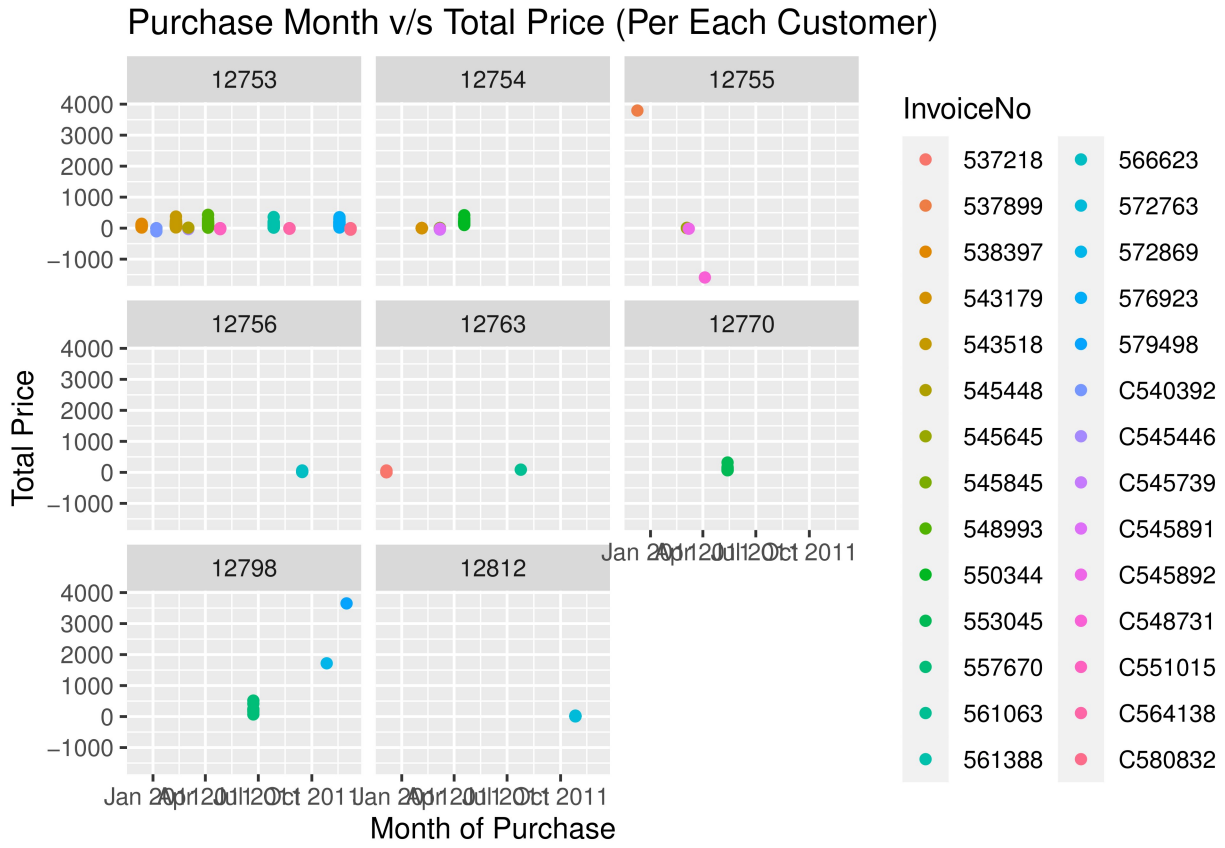



```
# 4) Japan
filter(data2, Country == "Japan") -> jpn_data
summary(jpn_data)
```

```
##    InvoiceNo     StockCode                          Description
##  538397 : 48   21218  :  7   RED SPOTTY BISCUIT TIN         :  7
##  543518 : 48   22661  :  6   CHARLOTTE BAG DOLLY GIRL DESIGN:  6
##  543179 : 37   22489  :  5   LUNCH BAG DOLLY GIRL DESIGN    :  5
##  561388 : 37   22662  :  5   PACK OF 12 TRADITIONAL CRAYONS :  5
##  548993 : 32   23084  :  5   RABBIT NIGHT LIGHT             :  5
##  576923 : 31   21210  :  4   BASKET OF TOADSTOOLS           :  4
##  (Other):125   (Other):326   (Other)                        :326
##     Quantity         InvoiceDate                      UnitPrice
##  Min.   :-624.00   Min.   :2010-12-05 15:46:00.00   Min.   : 0.210
##  1st Qu.:   4.00   1st Qu.:2011-02-04 10:32:00.00   1st Qu.: 0.850
##  Median :  36.00   Median :2011-04-05 00:04:00.00   Median : 1.650
##  Mean   :  70.44   Mean   :2011-04-23 10:54:33.51   Mean   : 2.276
##  3rd Qu.:  72.00   3rd Qu.:2011-07-27 09:32:00.00   3rd Qu.: 2.550
##  Max.   :2040.00   Max.   :2011-12-06 11:40:00.00   Max.   :45.570
##
##    CustomerID       Country
##  12753  :230   Japan    :358
##  12754  : 65   Australia:  0
##  12763  : 18   Austria  :  0
##  12812  : 15   Bahrain  :  0
```

```
##  12770   : 12   Belgium  :  0
##  12798   :  8   Brazil   :  0
##  (Other): 10   (Other)  :  0
```

```
# qplot(x = InvoiceDate, y = Quantity*UnitPrice, data = jpn_data, color = CustomerID)
# 8 Customers
qplot(x = InvoiceDate, y = Quantity*UnitPrice,
      data = jpn_data,
      xlab = "Month of Purchase",
      ylab = "Total Price",
      main = "Purchase Month v/s Total Price (Per Each Customer)",
      color = InvoiceNo,
      facets = ~ CustomerID)
```

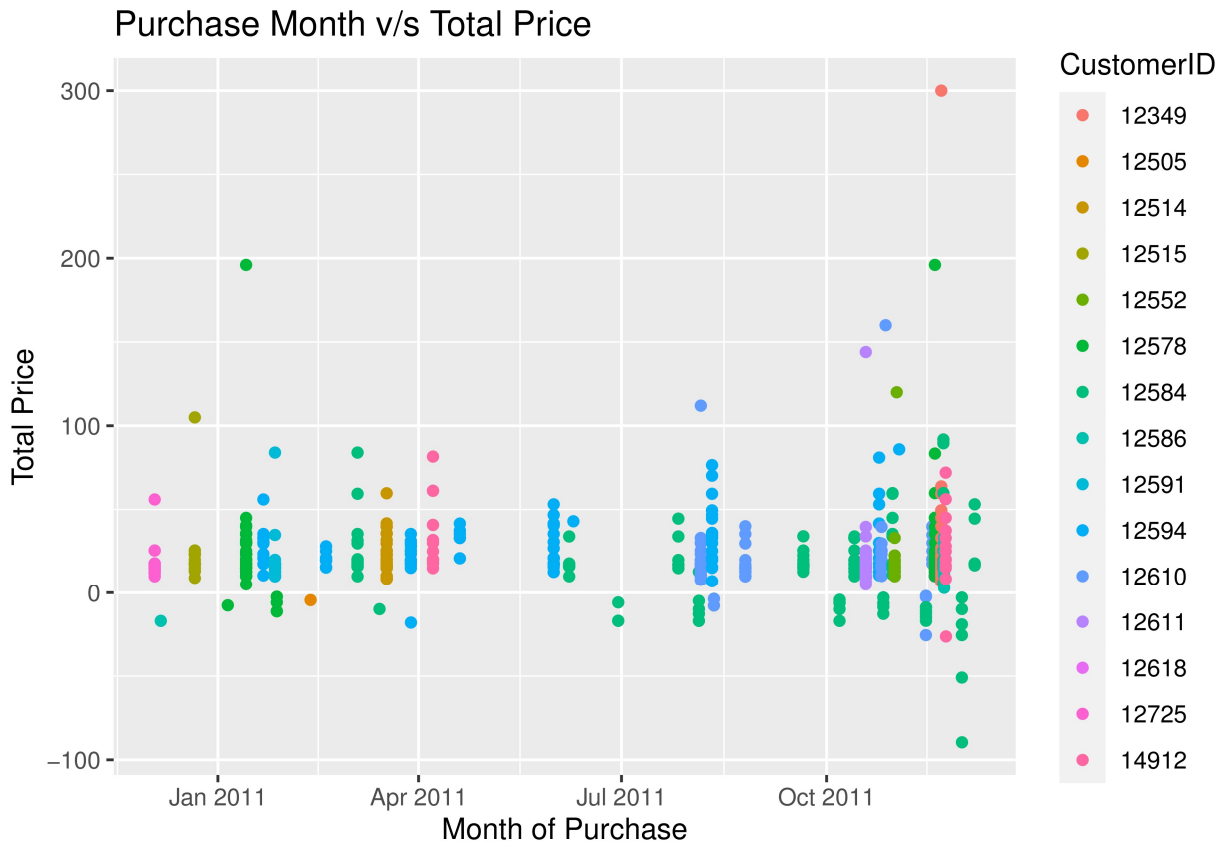



```
# TotalPrice (UnitPrice x Quantity)

# 5) Italy
filter(data2, Country == "Italy") -> ity_data
summary(ity_data)
```

```
##    InvoiceNo     StockCode                          Description
##  577609 : 73   POST    : 18   POSTAGE                       : 18
##  541115 : 70   22720   : 13   SET OF 3 CAKE TINS PANTRY DESIGN : 13
##  571670 : 65   22960   : 11   JAM MAKING SET WITH JARS      : 11
##  562528 : 54   22847   :  8   BREAD BIN DINER STYLE IVORY   :  8
```

```
##  546875 : 51   23243  :  8   SET OF TEA COFFEE SUGAR TINS PANTRY:  8
##  577316 : 44   22139  :  7   RETROSPOT TEA SET CERAMIC 11 PC    :  7
##  (Other):446   (Other):738   (Other)                            :738
##     Quantity         InvoiceDate                      UnitPrice
##  Min.   :-12.000   Min.   :2010-12-03 15:45:00.00   Min.   :  0.120
##  1st Qu.:  4.000   1st Qu.:2011-03-17 16:38:00.00   1st Qu.:  1.570
##  Median :  6.000   Median :2011-08-25 12:57:00.00   Median :  2.550
##  Mean   :  9.961   Mean   :2011-07-16 16:29:56.25   Mean   :  4.831
##  3rd Qu.: 12.000   3rd Qu.:2011-10-31 12:11:00.00   3rd Qu.:  4.950
##  Max.   :200.000   Max.   :2011-12-06 09:35:00.00   Max.   :300.000
##
##    CustomerID       Country
##  12584  :126   Italy    :803
##  12578  :120   Australia:  0
##  12594  :119   Austria  :  0
##  12610  :111   Bahrain  :  0
##  12349  : 73   Belgium  :  0
##  12611  : 65   Brazil   :  0
##  (Other):189   (Other)  :  0
```

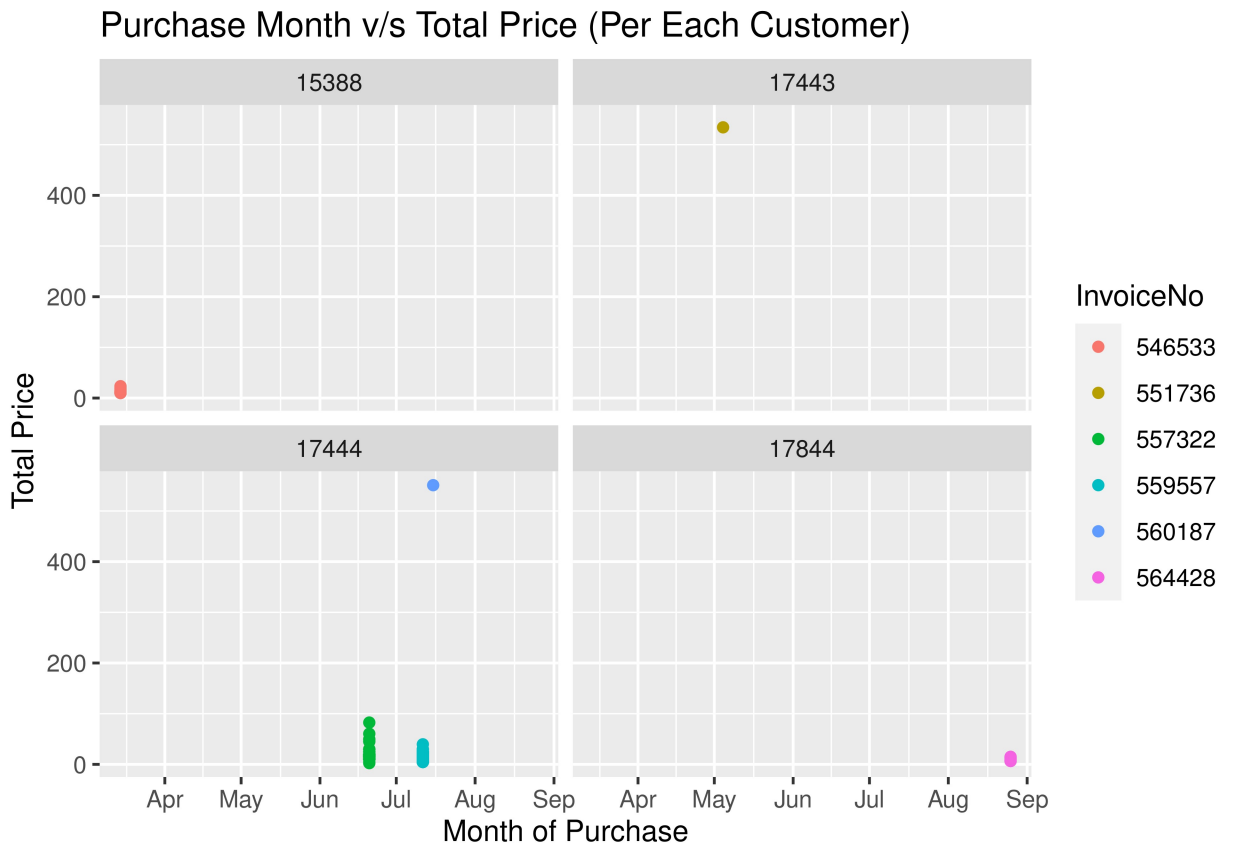
```
qplot(x = InvoiceDate, y = Quantity*UnitPrice,
      data = ity_data,
      xlab = "Month of Purchase",
      ylab = "Total Price",
      main = "Purchase Month v/s Total Price",
      color = CustomerID)
```



```r
# 6) Canada
filter(data2, Country == "Canada") -> cnd_data
summary(cnd_data)
```

```
##    InvoiceNo    StockCode                                Description
##  559557 :77   10133  :  2   COLOURING PENCILS BROWN TUBE       :  3
##  557322 :57   23190  :  2   BUNDLE OF 3 ALPHABET EXERCISE BOOKS:  2
##  546533 :10   23192  :  2   BUNDLE OF 3 SCHOOL EXERCISE BOOKS  :  2
##  564428 : 5   79030D :  2   10 COLOUR SPACEBOY PEN              :  1
##  551736 : 1   10135  :  1   12 PENCILS TALL TUBE POSY           :  1
##  560187 : 1   15044A :  1   4 TRADITIONAL SPINNING TOPS         :  1
##  (Other): 0   (Other):141   (Other)                            :141
##     Quantity       InvoiceDate                      UnitPrice
##  Min.   :  1.0   Min.   :2011-03-14 13:53:00.00   Min.   :  0.10
##  1st Qu.:  6.0   1st Qu.:2011-06-20 09:04:00.00   1st Qu.:  0.83
##  Median : 12.0   Median :2011-07-11 10:33:00.00   Median :  1.65
##  Mean   : 18.3   Mean   :2011-06-26 16:27:03.57   Mean   :  6.03
##  3rd Qu.: 20.0   3rd Qu.:2011-07-11 10:33:00.00   3rd Qu.:  2.95
##  Max.   :504.0   Max.   :2011-08-25 11:27:00.00   Max.   :550.94
##
##    CustomerID       Country
##  17444  :135   Canada   :151
##  15388  : 10   Australia:  0
##  17844  :  5   Austria  :  0
##  17443  :  1   Bahrain  :  0
##  12346  :  0   Belgium  :  0
##  12347  :  0   Brazil   :  0
##  (Other):  0   (Other)  :  0
```

```r
# qplot(x = InvoiceDate, y = Quantity*UnitPrice, data = cnd_data, color = CustomerID)
qplot(x = InvoiceDate, y = Quantity*UnitPrice,
      data = cnd_data,
      xlab = "Month of Purchase",
      ylab = "Total Price",
      main = "Purchase Month v/s Total Price (Per Each Customer)",
      color = InvoiceNo,
      facets = ~ CustomerID)
```

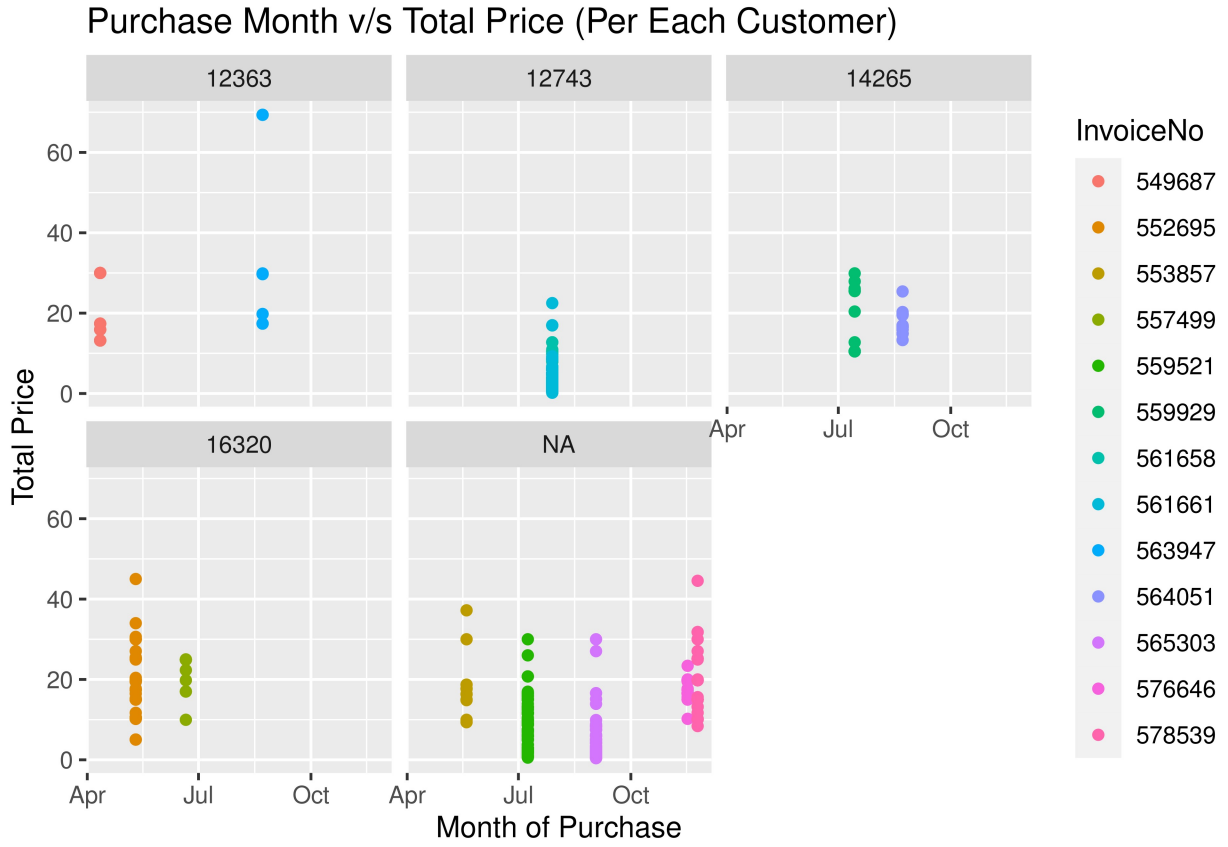



```
# 7) Unspecified
filter(data2, Country == "Unspecified") -> unsp_data
summary(unsp_data)
```

```
##    InvoiceNo    StockCode                                Description
##  561658 :83   22150  :  4   3 STRIPEY MICE FELTCRAFT          :  4
##  559521 :72   20983  :  3   12 PENCILS TALL TUBE RED RETROSPOT:  3
##  565303 :66   21124  :  3   4 TRADITIONAL SPINNING TOPS       :  3
##  561661 :51   21591  :  3   ASSORTED COLOUR BIRD ORNAMENT     :  3
##  552695 :47   21888  :  3   BINGO SET                         :  3
##  578539 :34   21889  :  3   CHILDRENS CUTLERY DOLLY GIRL      :  3
##  (Other):93   (Other):427   (Other)                           :427
##     Quantity       InvoiceDate                      UnitPrice
##  Min.   : 1.000   Min.   :2011-04-11 13:29:00.00   Min.   : 0.19
##  1st Qu.: 1.000   1st Qu.:2011-07-08 16:26:00.00   1st Qu.: 0.85
##  Median : 3.000   Median :2011-07-28 16:06:00.00   Median : 1.65
##  Mean   : 7.399   Mean   :2011-07-30 15:13:21.66   Mean   : 2.70
##  3rd Qu.:12.000   3rd Qu.:2011-09-02 12:17:00.00   3rd Qu.: 3.35
##  Max.   :48.000   Max.   :2011-11-24 14:55:00.00   Max.   :16.95
##
##    CustomerID         Country
##  12743  :134   Unspecified:446
##  16320  : 56   Australia  :  0
##  14265  : 31   Austria    :  0
##  12363  : 23   Bahrain    :  0
```

```
##  12346   :  0   Belgium    :  0
##  (Other):  0   Brazil     :  0
##  NA's    :202   (Other)    :  0
```

```
# qplot(x = InvoiceDate, y = Quantity*UnitPrice, data = unsp_data, color = CustomerID)
qplot(x = InvoiceDate, y = Quantity*UnitPrice,
      data = unsp_data,
      xlab = "Month of Purchase",
      ylab = "Total Price",
      main = "Purchase Month v/s Total Price (Per Each Customer)",
      color = InvoiceNo,
      facets = ~ CustomerID)
```




```
# Last graph consists of the data of the Invoices where Country name was not mentioned
```