

D212 Data Mining II - Task 3

Scott Babcock WGU - MS, Data Analytics

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Load Libraries

```
library(dplyr)
library(tidyverse)
library(tidyr)
library(arules)
```

Data Load & Initial Work

```
# load data into environment
data <- read.csv("teleco_market_basket.csv")

# view dimensions, structure & first records of dataset
dim(data)
```

```
## [1] 15002    20
```

```
str(data)
```

```
## 'data.frame':    15002 obs. of  20 variables:
## $ Item01: chr    "" "Logitech M510 Wireless mouse" "" "Apple Lightning to Digital AV Adapter" ...
## $ Item02: chr    "" "HP 63 Ink" "" "TP-Link AC1750 Smart WiFi Router" ...
## $ Item03: chr    "" "HP 65 ink" "" "Apple Pencil" ...
## $ Item04: chr    "" "nonda USB C to USB Adapter" "" "" ...
## $ Item05: chr    "" "10ft iPhone Charger Cable" "" "" ...
## $ Item06: chr    "" "HP 902XL ink" "" "" ...
## $ Item07: chr    "" "Creative Pebble 2.0 Speakers" "" "" ...
## $ Item08: chr    "" "Cleaning Gel Universal Dust Cleaner" "" "" ...
## $ Item09: chr    "" "Micro Center 32GB Memory card" "" "" ...
## $ Item10: chr    "" "YUNSONG 3pack 6ft Nylon Lightning Cable" "" "" ...
## $ Item11: chr    "" "TopMate C5 Laptop Cooler pad" "" "" ...
## $ Item12: chr    "" "Apple USB-C Charger cable" "" "" ...
## $ Item13: chr    "" "HyperX Cloud Stinger Headset" "" "" ...
## $ Item14: chr    "" "TONOR USB Gaming Microphone" "" "" ...
## $ Item15: chr    "" "Dust-Off Compressed Gas 2 pack" "" "" ...
## $ Item16: chr    "" "3A USB Type C Cable 3 pack 6FT" "" "" ...
## $ Item17: chr    "" "HOVAMP iPhone charger" "" "" ...
## $ Item18: chr    "" "SanDisk Ultra 128GB card" "" "" ...
## $ Item19: chr    "" "FEEL2NICE 5 pack 10ft Lighning cable" "" "" ...
## $ Item20: chr    "" "FEIYOLD Blue light Blocking Glasses" "" "" ...
```

```
head(data)
```

```
##                               Item01                               Item02
## 1
## 2           Logitech M510 Wireless mouse           HP 63 Ink
## 3
## 4  Apple Lightning to Digital AV Adapter TP-Link AC1750 Smart WiFi Router
## 5
## 6 UNEN Mfi Certified 5-pack Lightning Cable
##      Item03                               Item04                               Item05
## 1
```

```

## 2    HP 65 ink nonda USB C to USB Adapter 10ft iPhone Charger Cable
## 3
## 4 Apple Pencil
## 5
## 6
##      Item06                      Item07                      Item08
## 1
## 2 HP 902XL ink Creative Pebble 2.0 Speakers Cleaning Gel Universal Dust Cleaner
## 3
## 4
## 5
## 6
##      Item09                      Item10
## 1
## 2 Micro Center 32GB Memory card YUNSONG 3pack 6ft Nylon Lightning Cable
## 3
## 4
## 5
## 6
##      Item11                      Item12
## 1
## 2 TopMate C5 Laptop Cooler pad Apple USB-C Charger cable
## 3
## 4
## 5
## 6
##      Item13                      Item14
## 1
## 2 HyperX Cloud Stinger Headset TONOR USB Gaming Microphone
## 3
## 4
## 5
## 6
##      Item15                      Item16
## 1
## 2 Dust-Off Compressed Gas 2 pack 3A USB Type C Cable 3 pack 6FT
## 3
## 4
## 5
## 6
##      Item17                      Item18
## 1
## 2 HOVAMP iPhone charger SanDisk Ultra 128GB card
## 3
## 4
## 5
## 6
##      Item19                      Item20
## 1
## 2 FEEL2NICE 5 pack 10ft Lighning cable FEIYOLD Blue light Blocking Glasses
## 3
## 4
## 5
## 6

```

```
# remove blank rows from dataset [In-text citation:(Data Mining II, n.d.)]
clean_data <- data[!apply(data == "",1,all), ]

dim(clean_data)
```

```
## [1] 7501 20
```

```
head(clean_data)
```

```
##                               Item01                               Item02
## 2           Logitech M510 Wireless mouse           HP 63 Ink
## 4       Apple Lightning to Digital AV Adapter TP-Link AC1750 Smart WiFi Router
## 6 UNEN Mfi Certified 5-pack Lightning Cable
## 8           Cat8 Ethernet Cable           HP 65 ink
## 10       Dust-Off Compressed Gas 2 pack       Screen Mom Screen Cleaner kit
## 12       TopMate C5 Laptop Cooler pad
##                               Item03                               Item04
## 2           HP 65 ink nonda USB C to USB Adapter
## 4       Apple Pencil
## 6
## 8
## 10 Moread HDMI to VGA Adapter       HP 62XL Tri-Color ink
## 12
##                               Item05       Item06                               Item07
## 2 10ft iPhone Charger Cable HP 902XL ink Creative Pebble 2.0 Speakers
## 4
## 6
## 8
## 10 Apple USB-C Charger cable
## 12
##                               Item08                               Item09
## 2 Cleaning Gel Universal Dust Cleaner Micro Center 32GB Memory card
## 4
## 6
## 8
## 10
## 12
##                               Item10                               Item11
## 2 YUNSONG 3pack 6ft Nylon Lightning Cable TopMate C5 Laptop Cooler pad
## 4
## 6
## 8
## 10
## 12
##                               Item12       Item13
## 2 Apple USB-C Charger cable HyperX Cloud Stinger Headset
## 4
## 6
## 8
## 10
## 12
##                               Item14       Item15
## 2 TONOR USB Gaming Microphone Dust-Off Compressed Gas 2 pack
```

```
## 4
## 6
## 8
## 10
## 12
##
##           Item16           Item17
## 2  3A USB Type C Cable 3 pack 6FT HOVAMP iPhone charger
## 4
## 6
## 8
## 10
## 12
##
##           Item18           Item19
## 2  SanDisk Ultra 128GB card FEEL2NICE 5 pack 10ft Lightning cable
## 4
## 6
## 8
## 10
## 12
##
##           Item20
## 2  FEIYOLD Blue light Blocking Glasses
## 4
## 6
## 8
## 10
## 12
```

```
# add ID column to dataset
clean_data$id <- factor(seq.int(nrow(clean_data)))

# factorize dataset
clean_data <- as.data.frame(unclass(clean_data), stringsAsFactors = TRUE)
str(clean_data)
```

```
## 'data.frame': 7501 obs. of 21 variables:
## $ Item01: Factor w/ 115 levels "10ft iPhone Charger Cable",...: 61 9 104 22 28 101 6 2 73 105 ...
## $ Item02: Factor w/ 118 levels "", "10ft iPhone Charger Cable",...: 40 105 1 46 99 1 108 11 114 1 ...
## $ Item03: Factor w/ 116 levels "", "10ft iPhone Charger Cable",...: 44 12 1 1 68 1 1 49 14 1 ...
## $ Item04: Factor w/ 115 levels "", "10ft iPhone Charger Cable",...: 73 1 1 1 39 1 1 1 1 1 ...
## $ Item05: Factor w/ 111 levels "", "10ft iPhone Charger Cable",...: 2 1 1 1 15 1 1 1 1 1 ...
## $ Item06: Factor w/ 107 levels "", "10ft iPhone Charger Cable",...: 46 1 1 1 1 1 1 1 1 1 ...
## $ Item07: Factor w/ 103 levels "", "10ft iPhone Charger Cable",...: 20 1 1 1 1 1 1 1 1 1 ...
## $ Item08: Factor w/ 98 levels "", "10ft iPhone Charger Cable",...: 20 1 1 1 1 1 1 1 1 1 ...
## $ Item09: Factor w/ 89 levels "", "10ft iPhone Charger Cable 2 Pack",...: 54 1 1 1 1 1 1 1 1 1 ...
## $ Item10: Factor w/ 81 levels "", "10ft iPhone Charger Cable",...: 81 1 1 1 1 1 1 1 1 1 ...
## $ Item11: Factor w/ 67 levels "", "3 pack Nylon Braided Lightning Cable",...: 58 1 1 1 1 1 1 1 1 1 ...
## $ Item12: Factor w/ 51 levels "", "10ft iPhone Charger Cable",...: 6 1 1 1 1 1 1 1 1 1 ...
## $ Item13: Factor w/ 44 levels "", "Apple USB-C Charger cable",...: 17 1 1 1 1 1 1 1 1 1 ...
## $ Item14: Factor w/ 29 levels "", "3 pack Nylon Braided Lightning Cable",...: 24 1 1 1 1 1 1 1 1 1 ...
## $ Item15: Factor w/ 20 levels "", "3 pack Nylon Braided Lightning Cable",...: 9 1 1 1 1 1 1 1 1 1 ...
## $ Item16: Factor w/ 9 levels "", "3A USB Type C Cable 3 pack 6FT",...: 2 1 1 1 1 1 1 1 1 ...
## $ Item17: Factor w/ 4 levels "", "HOVAMP iPhone charger",...: 2 1 1 1 1 1 1 1 1 ...
## $ Item18: Factor w/ 4 levels "", "Brother Genuine High Yield Toner Cartridge",...: 4 1 1 1 1 1 1 1 1 ...
## $ Item19: Factor w/ 4 levels "", "FEEL2NICE 5 pack 10ft Lightning cable",...: 2 1 1 1 1 1 1 1 1 ...
```

```
## $ Item20: Factor w/ 2 levels "", "FEIYOLD Blue light Blocking Glasses": 2 1 1 1 1 1 1 1 1 1 ...
## $ id : Factor w/ 7501 levels "1","2","3","4",...: 1 2 3 4 5 6 7 8 9 10 ...
```

```
# pivot dataframe
pre_trans <- pivot_longer(clean_data, cols = 1:20, names_to = "ItemNo", values_to = "Product")

# keep relevant variables
pre_trans <- pre_trans[, c(1,3)]

# remove blank rows from product
pre_trans <- pre_trans[!(pre_trans$Product == ""),]

# create list df and split data
list_data <- as.data.frame(pre_trans)
list_data <- split(list_data$Product, list_data$id)
str(list_data)
```

```
## List of 7501
## $ 1 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 61 39 45 72 1 47 25 24 67 115 ...
## $ 2 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 9 102 12
## $ 3 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 104
## $ 4 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 22 45
## $ 5 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 28 96 68 38 14
## $ 6 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 101
## $ 7 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 6 105
## $ 8 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 2 10 50
## $ 9 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 73 111 14
## $ 10 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 105
## $ 11 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 12 56
## $ 12 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 108
## $ 13 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 22 9 28 12 74
## $ 14 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 111 107 108
## $ 15 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 28 4
## $ 16 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 28
## $ 17 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 61 35 29 51 48 74 101
## $ 18 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 22 12
## $ 19 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 22 59 8 111 28 78 4 12 29 26
## $ 20 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 102 96 51 105 20
## $ 21 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 110 61 53 58 12 35 89
## $ 22 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 90 87
## $ 23 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 111 28 69 79 98 14
## $ 24 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 9 80 61 53 45 51 21 44
## $ 25 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 12
## $ 26 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 75 111 2 45 96 83
## $ 27 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 95 111 28 96 68 78 4 92 41
## $ 28 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 87
## $ 29 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 28 12 29 35 105
## $ 30 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 73 111 25 28
## $ 31 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 84 16 10 15
## $ 32 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 28 35 45 12
## $ 33 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 22 105 36
## $ 34 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 73 77 35
## $ 35 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 108
## $ 36 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 54 111 4 41
```

```

## $ 37 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 68 105
## $ 38 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 110 95 28
## $ 39 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 28 99 24
## $ 40 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 54 107 14
## $ 41 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 111
## $ 42 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 59 73 111 28 51 38 92 41
## $ 43 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 111
## $ 44 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 2 102 63 87
## $ 45 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 41
## $ 46 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 2 45 105 63 33 79 98 14
## $ 47 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 28 29 57 23
## $ 48 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 28 46
## $ 49 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 45 65
## $ 50 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 9 78 14
## $ 51 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 111 35 33 21 14
## $ 52 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 59 28 12
## $ 53 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 111 65
## $ 54 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 111 35
## $ 55 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 105 41 107
## $ 56 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 16 112
## $ 57 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 22 59 73 8 95 111 28 35 2 96 ...
## $ 58 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 12 108
## $ 59 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 2 29 91 11 79 67 14
## $ 60 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 22 73 28 40 74 14
## $ 61 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 111
## $ 62 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 23
## $ 63 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 67
## $ 64 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 2 46 50 20 14
## $ 65 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 22 12
## $ 66 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 105
## $ 67 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 35 96
## $ 68 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 84 6 95 28 45 40 38
## $ 69 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 108
## $ 70 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 61 53
## $ 71 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 80 84 8 16 19
## $ 72 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 9 41 50
## $ 73 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 108
## $ 74 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 76
## $ 75 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 2 12
## $ 76 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 108
## $ 77 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 28 35 101
## $ 78 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 12 36
## $ 79 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 80 95 111 28 21
## $ 80 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 27
## $ 81 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 12 99 105
## $ 82 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 9 111 96 105 14
## $ 83 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 28 68 86 105
## $ 84 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 9 80 84 28 12 74
## $ 85 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 68
## $ 86 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 68 67
## $ 87 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 35 92
## $ 88 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 101
## $ 89 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 62 100
## $ 90 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 9 105 101 14

```

```
## $ 91 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 101
## $ 92 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 9 84 61 53 111 28 102 31 68 37 ...
## $ 93 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 107 101
## $ 94 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 107
## $ 95 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 9 39 12 105 108 14
## $ 96 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 69 2 41 79
## $ 97 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 22 69 73 58 48 26 117 15
## $ 98 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 65 12 108
## $ 99 : Factor w/ 120 levels "10ft iPhone Charger Cable",...: 108
## [list output truncated]
```

```
# transform into transactional dataset & convert to matrix
data_trx <- as(list_data, "transactions")
data_trx <- as(data_trx, "matrix")
```

A1, Research Question

Can products frequently purchased in tandem be identified using Market Basket Analysis to assist marketing efforts and help drive revenue?

A2, Goal of Analysis

The analysis aims to mine company transaction records and uncover patterns of customer purchasing behavior using the Market Basket Analysis technique. By identifying products that are frequently purchased together, recommendations can be made to the executive team regarding items of interest to incentivize.

B1, Market Basket Explanation

Market Basket Analysis is a data mining technique that analyzes and uncovers patterns in purchasing behavior. The technique is concerned with which combinations of products are purchased together and not by quantities. The technique uses three key metrics to determine these combinations: support, confidence, and lift. Support is the popularity of an item set, or the fraction of transactions that contain a given combination. Confidence pertains to how often the rule is true. Lift indicates how strong the association is for the itemset. A lift greater than one means the items are likely to be purchased together.

The expected outcome of the analysis is a list of association rules that will display the product combinations that are most likely to be purchased together or have the strongest associations. These combinations of products can be reported to the executive and marketing teams for strategic decision-making.

B2, Transaction Example

Below is an example of items purchased together in a single transaction. The first image is how the data initially looked after removing blank rows. The second image is the same transaction after pivoting the data, which is a more user-friendly way to look at it. The final image shows the transaction after getting into transactional format and turning it into a matrix. In this example, 20 items were purchased together.

```
clean_data %>% filter(id == 1)
```



```

##          Item01      Item02      Item03          Item04
## 1 Logitech M510 Wireless mouse HP 63 Ink HP 65 ink nonda USB C to USB Adapter
##          Item05      Item06          Item07
## 1 10ft iPhone Charger Cable HP 902XL ink Creative Pebble 2.0 Speakers
##          Item08          Item09
## 1 Cleaning Gel Universal Dust Cleaner Micro Center 32GB Memory card
##          Item10          Item11
## 1 YUNSONG 3pack 6ft Nylon Lightning Cable TopMate C5 Laptop Cooler pad
##          Item12          Item13
## 1 Apple USB-C Charger cable HyperX Cloud Stinger Headset
##          Item14          Item15
## 1 TONOR USB Gaming Microphone Dust-Off Compressed Gas 2 pack
##          Item16          Item17          Item18
## 1 3A USB Type C Cable 3 pack 6FT HOVAMP iPhone charger SanDisk Ultra 128GB card
##          Item19          Item20 id
## 1 FEEL2NICE 5 pack 10ft Lighning cable FEIYOLD Blue light Blocking Glasses 1

```

```

pre_trans %>%
  filter(id == 1)

```

```

## # A tibble: 20 x 2
##   id   Product
##   <fct> <fct>
## 1 1   Logitech M510 Wireless mouse
## 2 1   HP 63 Ink
## 3 1   HP 65 ink
## 4 1   nonda USB C to USB Adapter
## 5 1   10ft iPhone Charger Cable
## 6 1   HP 902XL ink
## 7 1   Creative Pebble 2.0 Speakers
## 8 1   Cleaning Gel Universal Dust Cleaner
## 9 1   Micro Center 32GB Memory card
## 10 1  YUNSONG 3pack 6ft Nylon Lightning Cable
## 11 1  TopMate C5 Laptop Cooler pad
## 12 1  Apple USB-C Charger cable
## 13 1  HyperX Cloud Stinger Headset
## 14 1  TONOR USB Gaming Microphone
## 15 1  Dust-Off Compressed Gas 2 pack
## 16 1  3A USB Type C Cable 3 pack 6FT
## 17 1  HOVAMP iPhone charger
## 18 1  SanDisk Ultra 128GB card
## 19 1  FEEL2NICE 5 pack 10ft Lighning cable
## 20 1  FEIYOLD Blue light Blocking Glasses

```

```

head(data_trx, 1)

```

```

##   10ft iPhone Charger Cable 10ft iPhone Charger Cable 2 Pack
## 1                               TRUE                               FALSE
##   3 pack Nylon Braided Lightning Cable 3A USB Type C Cable 3 pack 6FT
## 1                               FALSE                               TRUE
##   5pack Nylon Braided USB C cables Anker 2-in-1 USB Card Reader
## 1                               FALSE                               FALSE
##   Anker 4-port USB hub Anker USB C to HDMI Adapter

```

```

## 1          FALSE          FALSE
## Apple Lightning to Digital AV Adapter Apple Lightning to USB cable
## 1          FALSE          FALSE
## Apple Magic Mouse 2 Apple Pencil Apple Pencil 2nd Gen
## 1          FALSE          FALSE          FALSE
## Apple USB-C Charger cable ARRIS SURFboard SB8200 Cable Modem
## 1          TRUE          FALSE
## AutoFocus 1080p Webcam BENG00 G90000 headset Blue Light Blocking Glasses
## 1          FALSE          FALSE          FALSE
## Blue Light Blocking Glasses 2pack Brother Genuine High Yield Toner Cartridge
## 1          FALSE          FALSE
## Cat 6 Ethernet Cable 50ft Cat8 Ethernet Cable
## 1          FALSE          FALSE
## CicTsing MM057 2.4G Wireless Mouse Cleaning Gel Universal Dust Cleaner
## 1          FALSE          TRUE
## Creative Pebble 2.0 Speakers DisplayPort ot HDMI adapter
## 1          TRUE          FALSE
## Dust-Off Compressed Gas Dust-Off Compressed Gas 2 pack
## 1          FALSE          TRUE
## Falcon Dust Off Compressed Gas FEEL2NICE 5 pack 10ft Lighning cable
## 1          FALSE          TRUE
## FEIYOLD Blue light Blocking Glasses HOVAMP iPhone charger
## 1          TRUE          TRUE
## HOVAMP Mfi 6pack Lightning Cable HP 61 2 pack ink HP 61 ink
## 1          FALSE          FALSE          FALSE
## HP 61 Tri-color ink HP 62XL ink HP 62XL Tri-Color ink HP 63 Ink
## 1          FALSE          FALSE          FALSE          TRUE
## HP 63 Tri-color ink HP 63XL Ink HP 63XL Tri-color ink HP 64 ink
## 1          FALSE          FALSE          FALSE          FALSE
## HP 64 Tri-Color ink HP 65 ink hP 65 Tri-color ink HP 902XL ink HP 952 ink
## 1          FALSE          TRUE          FALSE          TRUE          FALSE
## HP ENVY 5055 printer HP952XL ink HyperX Cloud Stinger Headset
## 1          FALSE          FALSE          TRUE
## iFixit Pro Tech Toolkit iPhone 11 case iPhone 12 case iPhone 12 Charger cable
## 1          FALSE          FALSE          FALSE          FALSE
## iPhone 12 Pro case iPhone Charger Cable Anker 6ft iPhone SE case
## 1          FALSE          FALSE          FALSE
## Jelly Comb 2.4G Slim Wireless mouse Leader Desk Pad Protector
## 1          FALSE          FALSE
## Logitech M510 Wireless mouse Logitech MK270 Wireless Keyboard/Mouse
## 1          TRUE          FALSE
## Logitech MK345 Wireless combo Logitech USB H390 headset M.2 Screw kit
## 1          FALSE          FALSE          FALSE
## Mfi-Certified Lightning to USB A Cable Micro Center 32GB Memory card
## 1          FALSE          TRUE
## Moread HDMI to VGA Adapter Mpow HC6 USB Headset NETGEAR CM500 Cable Modem
## 1          FALSE          FALSE          FALSE
## NETGEAR Nighthawk WiFi Router nonda USB C to USB Adapter
## 1          FALSE          TRUE
## Nylon Braided Lightning to USB cable Premium Nylon USB Cable PS4 Headset
## 1          FALSE          FALSE          FALSE
## RUNMUS Gaming Headset Sabrent 4-port USB 3.0 hub SAMSUNG 128GB card
## 1          FALSE          FALSE          FALSE
## SAMSUNG 256 GB card SAMSUNG EVO 32GB card SAMSUNG EVO 64GB card

```

```

## 1          FALSE          FALSE          FALSE
## SanDisk 128GB card SanDisk 128GB microSDXC card
## 1          FALSE          FALSE
## SanDisk 128GB Ultra microSDXC card SanDisk 32GB card
## 1          FALSE          FALSE
## SanDisk 32GB Ultra SDHC card SanDisk Extreme 128GB card
## 1          FALSE          FALSE
## SanDisk Extreme 256GB card SanDisk Extreme 32GB 2pack card
## 1          FALSE          FALSE
## SanDisk Extreme Pro 128GB card SanDisk Extreme Pro 64GB card
## 1          FALSE          FALSE
## SanDisk Ultra 128GB card SanDisk Ultra 256GB card SanDisk Ultra 400GB card
## 1          TRUE          FALSE          FALSE
## SanDisk Ultra 64GB card Screen Mom Screen Cleaner kit seenda Wireless mouse
## 1          FALSE          FALSE          FALSE
## Stylus Pen for iPad Syntech USB C to USB Adapter TONOR USB Gaming Microphone
## 1          FALSE          FALSE          TRUE
## TopMate C5 Laptop Cooler pad TP-Link AC1750 Smart WiFi Router
## 1          TRUE          FALSE
## TP-Link AC4000 WiFi router UNEN Mfi Certified 5-pack Lightning Cable
## 1          FALSE          FALSE
## USB 2.0 Printer cable USB C to USB Male Adapter USB Type C Cable
## 1          FALSE          FALSE          FALSE
## USB Type C to USB-A Charger cable VicTsing Mouse Pad VicTsing Wireless mouse
## 1          FALSE          FALSE          FALSE
## VIVO Dual LCD Monitor Desk mount Vsco 70 pack stickers Webcam with Microphone
## 1          FALSE          FALSE          FALSE
## XPOWER A-2 Air Pump blower YUNSONG 3pack 6ft Nylon Lightning Cable
## 1          FALSE          TRUE
## HooToo USB C Hub Microsot Surface Dock 2 NETGEAR Orbi Home Mesh WiFi System
## 1          FALSE          FALSE          FALSE
## Apple Power Adapter Extension Cable
## 1          FALSE

```

B3, Market Basket Assumption

Market basket analysis assumes that there is transactional independence. Each transaction is viewed individually, and one transaction does not influence another. The technique can identify patterns among item combinations by focusing on individual transactions. The combinations of items that appear more frequently together are assumed to have a stronger association.

C1, Transformed Dataset

The following steps were performed to transform the dataset and prepare it for market basket analysis. First, the initial rows of the provided CSV file were looked at to get a sense of the structure. There were many blank rows in the data, so these needed to be removed. Next, an ID column was added to distinguish between the transactions. All items purchased in each transaction were included in one row in the initial dataset. After that, the text needed to be converted to a factor format. Then, the data was pivoted to get it into a long format. Only the transaction ID and product names were kept. Additional blank rows were removed after the pivoting. The data was then converted to a data frame and split by the product and ID fields. The data was then ready to get into transactional format. The transformed dataset used in the analysis was exported to CSV and included in the submission.

```
# save transformed dataset to csv
write.csv(data_trx,
          "d212_task3_babcock_transactional_dataset.csv",
          row.names = FALSE)
```

C2, Code Execution

The following code was executed to generate association rules. The algorithm was run with a support threshold of 0.005 and a confidence threshold of 0.5. Twenty association rules were generated.

```
# run apriori to identify association rules
arules <- apriori( data_trx,
                  control = list(verbose = F),
                  parameter = list(
                    supp = .005,
                    conf = .5))

# remove redundant rules
rules_redundant <- is.redundant(arules)
rules_refined <- arules[!rules_redundant]
```

C3, Association Rules

Twenty rules that met the criteria threshold were identified. Below are the support, confidence, and lift values for these rules.

```
inspect(rules_refined)
```

##	lhs	rhs	support	confi
## [1]	{3A USB Type C Cable 3 pack 6FT, VIVO Dual LCD Monitor Desk mount}	=> {Dust-Off Compressed Gas 2 pack}	0.006799093	0.50
## [2]	{10ft iPhone Charger Cable 2 Pack, FEIYOLD Blue light Blocking Glasses}	=> {Dust-Off Compressed Gas 2 pack}	0.005199307	0.58
## [3]	{10ft iPhone Charger Cable 2 Pack, Nylon Braided Lightning to USB cable}	=> {Dust-Off Compressed Gas 2 pack}	0.005065991	0.63
## [4]	{10ft iPhone Charger Cable 2 Pack, SanDisk Ultra 64GB card}	=> {Dust-Off Compressed Gas 2 pack}	0.005065991	0.52
## [5]	{10ft iPhone Charger Cable 2 Pack, Screen Mom Screen Cleaner kit}	=> {Dust-Off Compressed Gas 2 pack}	0.008532196	0.56
## [6]	{10ft iPhone Charger Cable 2 Pack, HP 61 ink}	=> {Dust-Off Compressed Gas 2 pack}	0.005599253	0.55
## [7]	{10ft iPhone Charger Cable 2 Pack, VIVO Dual LCD Monitor Desk mount}	=> {Dust-Off Compressed Gas 2 pack}	0.007465671	0.52
## [8]	{Apple Pencil, Premium Nylon USB Cable}	=> {Dust-Off Compressed Gas 2 pack}	0.006399147	0.54
## [9]	{Cat8 Ethernet Cable, Screen Mom Screen Cleaner kit}	=> {Dust-Off Compressed Gas 2 pack}	0.006132516	0.54
## [10]	{Falcon Dust Off Compressed Gas, HP 61 ink}	=> {Dust-Off Compressed Gas 2 pack}	0.007598987	0.51
## [11]	{FEIYOLD Blue light Blocking Glasses,			

```
##      Nylon Braided Lightning to USB cable} => {VIVO Dual LCD Monitor Desk mount} 0.005732569 0.50
## [12] {FEIYOLD Blue light Blocking Glasses,
##      Nylon Braided Lightning to USB cable} => {Dust-Off Compressed Gas 2 pack} 0.006532462 0.57
## [13] {FEIYOLD Blue light Blocking Glasses,
##      Screen Mom Screen Cleaner kit}      => {Dust-Off Compressed Gas 2 pack} 0.008532196 0.50
## [14] {FEIYOLD Blue light Blocking Glasses,
##      HP 61 ink}                          => {Dust-Off Compressed Gas 2 pack} 0.008265565 0.50
## [15] {Logitech M510 Wireless mouse,
##      SanDisk Ultra 64GB card}            => {VIVO Dual LCD Monitor Desk mount} 0.005999200 0.52
## [16] {SanDisk Ultra 64GB card,
##      Stylus Pen for iPad}                => {Dust-Off Compressed Gas 2 pack} 0.007465671 0.51
## [17] {Nylon Braided Lightning to USB cable,
##      SanDisk Ultra 64GB card}            => {VIVO Dual LCD Monitor Desk mount} 0.008665511 0.51
## [18] {Nylon Braided Lightning to USB cable,
##      SanDisk Ultra 64GB card}            => {Dust-Off Compressed Gas 2 pack} 0.009198773 0.54
## [19] {SanDisk Ultra 64GB card,
##      Screen Mom Screen Cleaner kit}      => {Dust-Off Compressed Gas 2 pack} 0.011065191 0.50
## [20] {Apple Pencil,
##      SanDisk Ultra 64GB card}            => {Dust-Off Compressed Gas 2 pack} 0.010131982 0.50
```

C4, Top 3 Rules

Below are the top 3 rules by confidence, support, and lift. Sorting by each of these metrics can give different results, but there can be commonalities in the top three for each metric. The confidence metric represents the likelihood that if a customer buys the first item or items, known as the antecedent, they will also buy the second item, known as the consequent. The support metric is the frequency at which these item pairs show up together in the dataset. The lift metric indicates the strength of the association. A lift over one means the consequent will likely be bought with the antecedent.

The top confidence rule determines that if a customer purchases the 10ft iPhone charger cable two pack and nylon braided lighting to USB cable, there is a 63.3% likelihood that they will purchase the Dust-Off gas two pack. The support rules give a slightly different result. The highest support, or frequency of the item pairs, occurs with the SanDisk Ultra 64GB card and screen cleaner kit leading to the Dust-off Gas two-pack. This item pair occurs 1.1% of the time. The top rule, according to lift, produces a 3.0 lift, indicating that if the Logitech wireless mouse and SanDisk 64 GB card are purchased together, it is highly likely that the VIVO dual LCD monitor will also be purchased. These items had a strong association.

```
# view top 3 rules by confidence, support and lift
top3rules_conf <- head(sort(rules_refined, by = "confidence"),3)
top3rules_supp <- head(sort(rules_refined, by = "support"),3)
top3rules_lift <- head(sort(rules_refined, by = "lift"),3)

inspect(top3rules_conf)
```

```
##      lhs                                                    rhs                                support confidence
## [1] {10ft iPhone Charger Cable 2 Pack,
##      Nylon Braided Lightning to USB cable} => {Dust-Off Compressed Gas 2 pack} 0.005065991 0.633333
## [2] {10ft iPhone Charger Cable 2 Pack,
##      FEIYOLD Blue light Blocking Glasses} => {Dust-Off Compressed Gas 2 pack} 0.005199307 0.582089
## [3] {FEIYOLD Blue light Blocking Glasses,
##      Nylon Braided Lightning to USB cable} => {Dust-Off Compressed Gas 2 pack} 0.006532462 0.576470
```

```
inspect(top3rules_supp)
```

##	lhs	rhs	support	confidence
## [1]	{SanDisk Ultra 64GB card, Screen Mom Screen Cleaner kit}	=> {Dust-Off Compressed Gas 2 pack}	0.011065191	0.50303
## [2]	{Apple Pencil, SanDisk Ultra 64GB card}	=> {Dust-Off Compressed Gas 2 pack}	0.010131982	0.50666
## [3]	{Nylon Braided Lightning to USB cable, SanDisk Ultra 64GB card}	=> {Dust-Off Compressed Gas 2 pack}	0.009198773	0.54330

```
inspect(top3rules_lift)
```

##	lhs	rhs	support	confidence
## [1]	{Logitech M510 Wireless mouse, SanDisk Ultra 64GB card}	=> {VIVO Dual LCD Monitor Desk mount}	0.005999200	0.523
## [2]	{Nylon Braided Lightning to USB cable, SanDisk Ultra 64GB card}	=> {VIVO Dual LCD Monitor Desk mount}	0.008665511	0.511
## [3]	{FEIYOLD Blue light Blocking Glasses, Nylon Braided Lightning to USB cable}	=> {VIVO Dual LCD Monitor Desk mount}	0.005732569	0.505

D1, Significance of Metrics

Support is the frequency at which the item pairs show up together in the dataset. Said differently, support is the proportion of all transactions that contain the association. If the support had a value of one, it would mean the item set appeared in every transaction (Sivek, 2020). In the analysis, the top rules sorted by support had relatively low values, with the highest support level at 1.1%.

Confidence is the likelihood that if a customer purchases an item set, known as the antecedent, they will also purchase the other item, known as the consequent. Again, said differently, confidence represents the proportion of all transactions that contain the items in the itemset over the proportion of items that contain one of the items (Sivek, 2020). While the analysis had low support levels, it produced higher confidence levels. The antecedent of the iPhone charger cable two pack and nylon braided lighting to USB cable and consequent of the Dust-Off gas two pack resulted in a confidence level of 63.3%, which is a strong likelihood these items would be purchased together.

Lift represents the strength of the association. The lift calculation takes the proportion of transactions with the antecedent and consequent and divides by the proportion of transactions with the antecedent multiplied by the proportion of transactions with the consequent. If the resulting value is greater than one, the antecedent increases the likelihood of the consequent appearing in the transaction. If the value is less than one, the opposite occurs. The antecedent would decrease the likelihood of the consequent appearing in the transaction (Sivek, 2020). There were some high lift values in the analysis. If the antecedent of the Logitech wireless mouse and SanDisk 64GB card appeared, it was highly likely that the VIVO dual LCD monitor mount appeared as well, with a lift value of 3.0.

D2, Practical Significance

Market Basket Analysis is very valuable to a retail-oriented business in helping to identify which items are purchased together and the strength of those associations. When viewing all the association rules generated in the analysis, it is obvious that the Dust-Off gas two-pack is a very common consequent. Only two items appeared as the consequent in the association rules, the other being the VIVO dual LCD monitor mount. These items could be impulse buys, given the variety of antecedents.

D3, Course of Action

The research question and goal of the analysis were to identify items frequently purchased together to assist marketing efforts and help drive revenue. After analyzing the transactions using the Market Basket Analysis technique, some initial courses of action are recommended. First, the marketing team should consider placing the itemsets that show up in the top association rules nearby in a brick-and-mortar setting. For web-based business, these items could show up as recommended items. These strategies could increase the likelihood of the customers purchasing the items together. Given that only two items showed up in the consequents, they may be considered impulse purchases. Again, in a brick-and-mortar setting, the marketing team should consider placing the Dust-Off gas cans and VIVO dual LCD monitor mount near check-out stands, as customers may be more likely to add the items. Utilizing a “customers also purchased” recommendation online could have a similar effect.

E, Panopto Video

A Panopto video recording was created that covered the execution of the code. The video link can be found in the submission.

F, Sources for Code

WGU College of Information Technology (n.d.). Data Mining II – D212 [Panopto Video]. Western Governors University. (<https://wgu.hosted.panopto.com/Panopto/Pages/Viewer.aspx?id=5674b196-a9f1-4e85-a322-af0000021f3f>)

G, Sources for Content

Sivek, S. C., PhD. (November 16, 2020). Market Basket Analysis 101: Key Concepts. Medium. Retrieved April 14, 2025, from (<https://towardsdatascience.com/market-basket-analysis-101-key-concepts-1ddc6876cd00>)