**C3T3 Market Basket Analysis**

For this project we were asked to do a market basket analysis of Electronidex startup company. Blackwell Electronics is trying to decide if Electonidex will be an optimal acquisition in the nearest future.  We were doing a market analysis in order to identify if strong rules in the transaction data exist in the dataset given. By doing our analysis we had to answer the following questions.

* Are there any interesting patterns or item relationships within Electronidex's transactions?
* Would Blackwell benefit from selling any of Electronidex's items?
* In your opinion, should Blackwell acquire Electronidex?
* If Blackwell does acquire Electronidex, do you have any recommendations for Blackwell? (Ex: cross-selling items, sale promotions, should they remove items, etc.)

While working with the data we found that the data was clean and we did not have to check for duplicates. We had to transfer data in our dataset from the "basket" format to the sparse matrix format.

Our dataset had 9835 transactions and we found out that Electronidex is selling 125 different items. The density of the matrix was 0.035, which is the percentage of non-empty cells in the sparse matrix or the total number of items purchased divided by the total number of items in that matrix. We looked at the top 20, most frequently purchased items  and we got the information listed in the table below:

Chart, bar chart

Description automatically generated

Looking at the size of the transactions we see that 2,163 transactions were done with one item, 1,647 transactions were done by purchasing two items, and the maximum number of items purchased was 30. Please see the table below for more information:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **# of items purchased** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** |
| **# of transactions** | 2163 | 1647 | 1294 | 1021 | 856 | 646 | 540 | 439 | 353 | 247 | 171 | 119 | 77 | 72 | 56 |
| **# of items purchased** | **16** | **17** | **18** | **19** | **20** | **21** | **22** | **23** | **25** | **26** | **27** | **29** | **30** |  |  |
| **# of transactions** | 41 | 26 | 20 | 10 | 10 | 10 | 5 | 3 | 1 | 1 | 3 | 1 | 1 |  |  |

We were running different algorithms to see what combinations of items happened the most. Running algorithms by confidence level helped us determine how frequently items in Y appear in transactions that contain X, and acquire the top 10 results.  The following top 10 transactions are listed by confidence level equal to 1, and support a level of only .00112, which is very low. However, from these transactions we see that iMac (the most frequently purchased item) is the main item. The first and second numbers in the information below represent the lift level and the number of transactions accordingly.

|  |
| --- |
|  |

[1]  {Brother Printer,Halter Acrylic Monitor Stand}  => {iMac}   3.904327   11

[2]  {ASUS Monitor,Mackie CR Speakers,ViewSonic Monitor}  => {iMac}   3.904327   10

[3]  {Apple Magic Keyboard,Rii LED Gaming Keyboard & Mouse Combo,ViewSonic Monitor} => {iMac}        3.904327    17

[4]  {ASUS Monitor,Koss Home Headphones,Microsoft Office Home and Student 2016}     => {iMac}      3.904327    10

[5]  {Acer Aspire,Koss Home Headphones,ViewSonic Monitor}   => {HP Laptop  5.151912   12

[6]  {Dell Desktop,Koss Home Headphones,ViewSonic Monitor}  => {HP Laptop} 5.151912  11

[7]  {ASUS 2 Monitor,Dell Desktop,Logitech Keyboard}   => {iMac}    3.904327    10

[8]  {Alienware Laptop,ASUS Desktop,Lenovo Desktop Computer} => {iMac}  3.904327 10

[9]  {Brother Printer,Dell Desktop,Epson Printer}  => {iMac}  3.904327                 11

[10] {Apple Magic Keyboard, Brother Printer, ViewSonic Monitor} => {iMac}  3.904327     10

If we run our algorithm by lift level, our transaction combination picture changes a little bit. For the following transaction combination listed below, the lift level ranges from 7 to 10 (which is really good) and the confidence level ranges from .83 to 1. We also see that View Sonic Monitor (while it is appears in the top 10 most frequently bought items) replaced iMac in this algorithm.

{Apple MacBook Pro,HP Black & Tri-color Ink,HP Laptop,iMac}  => {Acer Aspire}

[2]  {Dell Desktop,iMac,Lenovo Desktop Computer,Mackie CR Speakers}  => {ViewSonic Monitor}

[3]  {Dell Desktop,HP Laptop,iMac,Lenovo Desktop Computer,Mackie CR Speakers} => {ViewSonic Monitor}

[4]  {Dell Desktop,Lenovo Desktop Computer,Mackie CR Speakers} => {ViewSonic Monitor}

[5]  {Dell Desktop,HP Laptop,Lenovo Desktop Computer,Mackie CR Speakers}  => {ViewSonic Monitor}

[6]  {Dell Desktop,Etekcity Power Extension Cord Cable,HP Laptop,iMac,Lenovo Desktop Computer} => {ViewSonic Monitor

[7]  {Acer Aspire,Apple Earpods,HP Laptop,HP Monitor}   => {ViewSonic Monitor}

[8]  {HP Laptop,iMac,Lenovo Desktop Computer,Mackie CR Speakers}  => {ViewSonic Monitor}

[9]  {Acer Aspire,Dell Desktop,Epson Printer,HP Laptop}  => {ViewSonic Monitor} 0

[10] {Acer Aspire,ASUS Chromebook,Dell Desktop,HP Laptop}  => {ViewSonic Monitor}

We ran different models, changing support and confidence levels and we did not see an absolutely clear consistent outcome that will tell us what combination of items in the consumer market basket customers will buy for sure. But looking at different transaction combinations, we can definitely pass it on to the marketing department and they can promote some cross selling to the customers of Electronidex.  We think that Blackwell Electronics should analyze the financial statements of Electronidex before making any acquisition decisions.