**Module 15 Assignment Documentation**

**Sharat Manikonda, Weekend Class (2-6pm)**

**Data Science WEECO 250120**

**by: Shubhangi Gautam**

**Problem Statement 1 -> Book**

**Business Problem:** Analyze the support and confidence values and prepare rules for the Book dataset

**EDA:**

> summary(data)

ChildBks YouthBks CookBks DoItYBks

Min. :0.000 Min. :0.0000 Min. :0.000 Min. :0.000

1st Qu.:0.000 1st Qu.:0.0000 1st Qu.:0.000 1st Qu.:0.000

Median :0.000 Median :0.0000 Median :0.000 Median :0.000

Mean :0.423 Mean :0.2475 Mean :0.431 Mean :0.282

3rd Qu.:1.000 3rd Qu.:0.0000 3rd Qu.:1.000 3rd Qu.:1.000

Max. :1.000 Max. :1.0000 Max. :1.000 Max. :1.000

RefBks ArtBks GeogBks ItalCook

Min. :0.0000 Min. :0.000 Min. :0.000 Min. :0.0000

1st Qu.:0.0000 1st Qu.:0.000 1st Qu.:0.000 1st Qu.:0.0000

Median :0.0000 Median :0.000 Median :0.000 Median :0.0000

Mean :0.2145 Mean :0.241 Mean :0.276 Mean :0.1135

3rd Qu.:0.0000 3rd Qu.:0.000 3rd Qu.:1.000 3rd Qu.:0.0000

Max. :1.0000 Max. :1.000 Max. :1.000 Max. :1.0000

ItalAtlas ItalArt Florence

Min. :0.000 Min. :0.0000 Min. :0.0000

1st Qu.:0.000 1st Qu.:0.0000 1st Qu.:0.0000

Median :0.000 Median :0.0000 Median :0.0000

Mean :0.037 Mean :0.0485 Mean :0.1085

3rd Qu.:0.000 3rd Qu.:0.0000 3rd Qu.:0.0000

Max. :1.000 Max. :1.0000 Max. :1.0000

> str(data) #all data is numeric

Classes ‘spec\_tbl\_df’, ‘tbl\_df’, ‘tbl’ and 'data.frame': 2000 obs. of 11 variables:

$ ChildBks : num 0 1 0 1 0 1 0 0 1 1 ...

$ YouthBks : num 1 0 0 1 0 0 1 1 0 1 ...

$ CookBks : num 0 0 0 1 1 0 0 0 0 1 ...

$ DoItYBks : num 1 0 0 0 0 0 0 0 1 0 ...

$ RefBks : num 0 0 0 1 0 0 0 1 0 0 ...

$ ArtBks : num 0 0 0 0 0 1 0 0 0 0 ...

$ GeogBks : num 1 0 0 1 1 0 0 0 0 1 ...

$ ItalCook : num 0 0 0 0 0 0 0 0 0 0 ...

$ ItalAtlas: num 0 0 0 0 0 0 0 0 0 0 ...

$ ItalArt : num 0 0 0 0 0 0 0 0 0 0 ...

$ Florence : num 0 0 0 0 0 1 0 0 0 0 ...

- attr(\*, "spec")=

All data is numeric. So we can move on with creating the rules using the Apriori Algo

*# Building rules using apriori algorithm*

*arules <- apriori(as.matrix(data), parameter = list(support=0.02,confidence=0.6,minlen=5))*

*arules*

*#[124 rule(s)] done [0.00s].*

*arules <- apriori(as.matrix(data), parameter = list(support=0.001,confidence=0.6,minlen=3))*

*arules*

*#writing ... [6537 rule(s)] done [0.01s].*

*arules <- apriori(as.matrix(data), parameter = list(support=0.004,confidence=0.6,minlen=4))*

*arules*

*#writing ... [3070 rule(s)]*

*arules<-apriori(as.matrix(data),parameter = list(support=0.08,confidence=0.7,minlen=3))*

*arules*

*#writing ... [39 rule(s)]*

I go with the 39 rule one as It has the least number of rules. I also remove the duplicated rules.

> arules<-apriori(as.matrix(data),parameter = list(support=0.08,confidence=0.7,minlen=3))

Apriori

Parameter specification:

confidence minval smax arem aval originalSupport maxtime support minlen

0.7 0.1 1 none FALSE TRUE 5 0.08 3

maxlen target ext

10 rules TRUE

Algorithmic control:

filter tree heap memopt load sort verbose

0.1 TRUE TRUE FALSE TRUE 2 TRUE

Absolute minimum support count: 160

set item appearances ...[0 item(s)] done [0.00s].

set transactions ...[11 item(s), 2000 transaction(s)] done [0.00s].

sorting and recoding items ... [9 item(s)] done [0.00s].

creating transaction tree ... done [0.00s].

checking subsets of size 1 2 3 4 done [0.00s].

writing ... [39 rule(s)] done [0.00s].

creating S4 object ... done [0.00s].

> # Overal quality -> looks at all the parameters

> head(quality(arules))

support confidence coverage lift count

1 0.0850 1.0000000 0.0850 2.320186 170

3 0.0830 0.8601036 0.0965 2.033342 166

4 0.0900 0.8530806 0.1055 2.016739 180

5 0.0845 0.8009479 0.1055 1.858348 169

6 0.0940 0.8506787 0.1105 2.011061 188

7 0.0890 0.8054299 0.1105 1.868747 178

**![A close up of text on a white background

Description automatically generated](data:image/jpeg;base64,/9j/4AAQSkZJRgABAQEAqACoAAD/4RD0RXhpZgAATU0AKgAAAAgABAE7AAIAAAAOAAAISodpAAQAAAABAAAIWJydAAEAAAAcAAAQ0OocAAcAAAgMAAAAPgAAAAAc6gAAAAgAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAFJhamVzaCBHYXV0YW0AAAWQAwACAAAAFAAAEKaQBAACAAAAFAAAELqSkQACAAAAAzUwAACSkgACAAAAAzUwAADqHAAHAAAIDAAACJoAAAAAHOoAAAAIAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA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U2Nzg5OkNERUZHSElKU1RVVldYWVpjZGVmZ2hpanN0dXZ3eHl6g4SFhoeIiYqSk5SVlpeYmZqio6Slpqeoqaqys7S1tre4ubrCw8TFxsfIycrS09TV1tfY2drh4uPk5ebn6Onq8fLz9PX29/j5+v/EAB8BAAMBAQEBAQEBAQEAAAAAAAABAgMEBQYHCAkKC//EALURAAIBAgQEAwQHBQQEAAECdwABAgMRBAUhMQYSQVEHYXETIjKBCBRCkaGxwQkjM1LwFWJy0QoWJDThJfEXGBkaJicoKSo1Njc4OTpDREVGR0hJSlNUVVZXWFlaY2RlZmdoaWpzdHV2d3h5eoKDhIWGh4iJipKTlJWWl5iZmqKjpKWmp6ipqrKztLW2t7i5usLDxMXGx8jJytLT1NXW19jZ2uLj5OXm5+jp6vLz9PX29/j5+v/aAAwDAQACEQMRAD8A+kaKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAzbD/jxj/H+ZoosP+PGP8f5mimI0qKKKQwooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKAM2w/wCPGP8AH+ZoosP+PGP8f5mimI0qKKKQwooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKAM2w/48Y/x/maKLD/jxj/H+ZopiNKiiikMKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACkZlRSzsFUDJJOAKWvHf2hPHF34b8MxaXpUjRXmoHAZDg7c4I/WonLlWm7LhHmZ0/iL4y+C/C939m1PUyZM4/cJ5gH5Uvh/4yeC/E10tvpupkSN0E6eXn868c+H/wCzpD4k0GLVvFV7cRPdKJEWEgHB9c1H43/ZuutG8i68Fz3F0VdcpJy4Oeox6Vrb2ckqn4GaanrDbzPqBWDqGQhgehBzmlrjvCqa54f+HMa666TX1pbj5uecDvXjumftE+K9R1K+0210KG8vEkZLZLdCc4JHPPpSlZVHCOtgi26am9Ln0nRXlWhfEnxDY+CtR1v4gaUmmSWzbYoAhVn4zjmuJX41fEzVIX1DQPCAuNLydsxhY8D3zSl7snHsNaq/c+i6K84+FPxUj+INpNFcwfZr+3bbJGOATjJxXC+LP2gdX8LfEOTSJbC3l0+J8MUU+YRkjjmnJcs1B7vYI+9FtdNz6BqG8u4rCzlurgkRRLuYgZwK+eNR+O3j7RZI7/WPCq2mjyONs0kRBKk+ua9ah8VWfjH4Z3Oraefklg+ZSeVPoaipzRpSmug4WdSMH1LPhP4j+HfGl3dW2g3Esslq22UPEUwfx+ldVXx18KvGl94W1vXIdF0qbUtRuZm8mONdw4J616P4a+O/iKLxlb6H490aPTGuHCLhCpU+pyelbcqk4qPVfj5Gbk48zeyZ79Ve/vrfTLGW7vJBHDCpZ2PYCpo3WSNXQ5VgCD6g15D+0Lq+u2Hg9rfSbEz2c6EXMoUnYOf6Vz1ZOEbo2pxU2bNr8ePAt7qyabbX9w9w77FAtmwT9a9GVg6Bl6MMivkP4G2uoXGq2O3wdbX9j5zb9UkhJaP/AIFntXrnxD+Nv/CN6yugeGbIahqvC+WBkBvTH4it5xUVFdX/AFsZxfNKVtEj2Givny1+PPivQdSgi+IXhs6dDMwCssZUn8zXrniLxX9h8Cy6/pHlz4i3x7uVPBNZzahB1Hshx96fItzp6K+bdD/aC8a+ItPeLRvDcd9qStnbBGSgXt39a9t8B6rruteF4bzxRZJZXzswaFVI24PoavldmyeZXsdBc3MNnbtNdSpFGgyzOwAH515zffH/AMAaffvaT6lOZUbaSluzLn6itj4oeE9U8ZeE30rR7tLV5G+dnPDLjpXJeG/gd4b8P+Bp4fEthZ3t+qSM10yZK8ZGD7Vmm7Sk9l+JrZWilu/wPS/D/iXSvE+nLe6NdJPCw7HkfUdqpeLPHegeCrQXGv3ghU9EQbn/AO+RzXz5+z7dvp/xO1TTdOnZ9L8t36/KSAMGmabBH8Tvj9cRa6ftFnaSGPyX5UgFhVtc8oKH2lfXoiPgU3P7Lt957p4V+LPhHxldNb6LqBaUfwzJ5ZP0z1rtK+YvjZ4R0rwBr2ja34YgTTirgskI2qfmH+FfRHhjUW1Xwvp987bmnt0dj6kinHlnByj0dmTK8ZqL6q6NWisLxlrc/h7wreanaIjywIWVX6Hg14Vof7QXjTxFp7w6N4bS+1JWztgjJQL271mpXbit0W1ZJvqfSVFeI+Jviz4w8L/D6x1fUtLtYNRndlkgkRgFAOOma9L8CeIbnxP4F0zWb1I457uASOsf3QT6VbVlJ/yuz+65LduXzOjrj7v4o+GLLxcvhq4uZhqTP5YQQkrn6/jXHeAPi1rPir4iajoN9bWsdtayuiPGDuIBI5/KvO/E3/Jz8H/X4v8AMUoXlVpxe0rlTXLCp3j/AMD/ADPqUHIorz/4mfFKy+H+nwxqn2nUbg7YoV7HHBI9DXmy/HD4g6O0N94s8KCz0h3AM4iI69OSaItSenp5XBppJs+iaK52HxrpU/gpvEyygWSReaxJ+704P514wfjl49125nl8F+FhfWMLEGTyixA/A0npJx6rfyEmnFTWzPomivJPhh8Zn8YaxLoevWYsdUiHzIBgFs42/WvW6uUXG3mSpJ3QUUUVJQUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAZth/x4x/j/M0UWH/HjH+P8zRTEaVFFFIYUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFfOH7TdvJBrmgai4ZreIneccD5xX0fXLfEHwRZ+PPC82l3Z2MfnicDow6fhms6id1JdHc0ptap9U0ReE9ct7/4b2d3pUqO6WgIVcEqcdMV836n8dvihY3tyGcRQxysqs9gAMA8ckU268E/FT4bXMlp4auL5oHOc2ALA/XirWmeFvi74/wAWGu319DaMw8wXy7QR+VaSvUqOcOvRmS/d01CXTqesfDTxnrPjb4Yarfa/NHNOmVBSMIMYB6CvPv2cbWGbx/r0skas8ch2kjOPmavY/DPgCHwP8PbvSbB5LmWSPLEgZLYxxivNvgD4Z1vRfGOuz6tpd1ZxSyExvNGVDfM3StYuP1mbjtykSUvqyT35v8j0r4s+MLXwX4OkvZ7OG7eRgkccqBhuIODgivI9K034l+P/AA7Lc3V5b6TpDqzRi3gVOMZxhcdq9R+NXga58b+C2ttP2/aYHEqg/wAWM8V5L4c1j4rxeGz4Qg0CSBBuQX0yOpA9j0xxXLFcyqJq76LobysnBp6dSH9mqJ7fx9fwly4RXBbsTiqWo2lvfftPWsF6ivC1zhlbofvV0nwK8L+I/CnxEvbbW9OukidXJuPLPlscetcN41sNT1P4/G10KZYL95v3MjHAU5NdPMvb0Hv7r/r5bmXL+7rrbU+j/irYWU/wzvY7hIxHHGCmVHBAOMV5b8B7id/hFrkT5MSsxUk9+Kz/ABTq3xW8YWa+FLjQWtIgVD3sSvtkx6k16n4Q8At4L+FE+lRr5t5NFvlCDOXOMgflWEotUq0/5lZee5opXnSh2d2eYfs2WsMni3X5pI1aRJjtYjOOWpn7QpFv8UtBliVVfywcgdTuNbn7PnhvWdE8Q67Jq+mXNmksxMbTRlQwyelV/jz4Z1vWfiFo1zpWl3V3DHEA8kUZYL8x61vL+LQ8rGcfhrej/I970hi2i2LHqbeMn/vkVxfxr/5JhqX+4f5Gu00pGj0aySRSrLbxhgex2iuT+Lmn3ep/Du/ttPt5Lid0IWONck8GubFawlb+tTXD6Sjc4f8AZyZl+FNwyfeDzEVw/wAGIo9U+OeoXOqKHuVEpCyDd2HPNel/s+aHqOj/AA/a01mxms5WlkzHMm04JrkPG3w58TeDfiA3jDwJGZlkJZ7aMHJBxlcDscV2VJKGK53s429LowhFzw8oLfmv66s7L9oeytJvhvPPOqCaEExMVGc8d65jwjc3Fx+zRILjcQkbhWY5yMNWFrKfE34wz22naro50OzR/nDKyqw75zXrWt+EBofwfl0HR7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CNwGSKdQAUVjeJPEtp4bsUkuMy3M5KWtrH/rLh+u1R3OOa4xvCPiLXGOoan4r1TTLib5jaWMmIox2AB746+9A0mz0yivNY9J8ReDHGp2es6l4jgX/j5s7t97lB/wA8gP4/rXeaPrFlrumR3+mzLNC+QSpztYdVPuDwaAasXqKqXV/HAjBWDSDjb6U6xuvtUOWxvB5A7UCLNFFVNRuPs9v8uQzHAIoAt0VUsr1bldp4kHUetLqWo2mkabPf6jOkFtAu6SRzgKKALVFedt8V5tx8rwV4glTPyukC4YdiOeldB4X8aWviSSS3e0uNMv4xvNleALLs7PgdqB2Z0lBIHU4oJwMnpWHd3Uk91tibIU/Jt70CNyio4HZ4VLqytjBDVJQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFAGbYf8AHjH+P8zRRYf8eMf4/wAzRTEaVFFFIYUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQBHNOkCgvnnpgZrPTVS9ygCYU8EVqEZ61nXGmhG863+8DnZ2oA0ap6oxWyJUkHcOlS21ytwno4+8vpTbxDOqwhc5IYntgUAUrG7uW+UL5iqOO1aw6DPFMjijhXEShR6Cn0AFFFFAHB/EHTLmy1HT/Fekxk3Vkwhu3+9ttCcyYXueB05rorG+t9Sso7qzkEkMihlYfyPofatkgMpDDIPUV5inhjVPhvNc6ho9xd6xpNxcPPdWLAF4dxzmJR1OT37UmVFne0VzOn/EDw7e+THNfx2N5KQv2K6YJMjE8KV7GulJABJ4A60jQWqWsataaFo9zqeoyeXa2yb5HxnArCv/AIjeH7aNhp91/a90rbTaafiWX3O30Heqtr4W1XxpMuo+JLy5s9KlPGigDy7iLsJgeQ3qAe1Am7Gh4E0e8/tbVfFF9H9nbWRHsts5KIgwrZ/2gQa7amQwx28EcMKhI41CIo6AAYAp9UZBRRRQBmX1rcSXhkgBxgcg4q/b+Z5C+d9/HNSUUAeax/6R8ftYjn/exwaRbyQq/IjYuwLKD0OO4ruK5XxLo95oXi2TxlpcLXqzW6W2oW4GXWFCSGiA6tk8g9q6DTtRtdVsI7yxlWWGQcMpzz3H1FSzSOxari/ACCx8VeJfC9sSumWDxzQJn5laXLPlup5rodd1600Cx8+73O7nbDbxDMk7f3UHc+1Vvh74fu9J0mW+1xVk1i+kaSe4zl3jyTGre6qcU0KR0Z0y2JyVYn/eqWC0itiTECN3XJqaimQFIyq33lB+opaKAIJbSN2DgbXUcEcV5tp9xJ4/1u4vNTYjT9Iu3ghswcBpUO0u/ZlI/hPSvUK8s+HQNldeINPux5N4dTnuBA/DGJm+V8eh9aT2LppOR24AVQFAAAwAO1c3400e6u9JfUdBjxr1ipksXVtu6QdA395fY8V0tZ2v61beHfD95q98HNvZxGWQIMtgegqDpdral/w3rEHinw7a31vP5iEeXOQu3Mq8OP8AvrNbMcEcSqqIPl6HHNcn8LtEudB8CwW16ULzTS3K7DkbJGLr+ODXYVocYUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQBm2H/HjH+P8AM0UWH/HjH+P8zRTEaVFFFIYUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAeeeJtQn8ReMp/BlpI1jbw2yXV/PGdsk0bkgIjDlCCM5rLkjf4Vy2t5YXl5faXe3MdrcW15O00hkkbajq7fdA5yO9dT4p8LXcuoDxD4YMcetxoEeORtsd4g6Ru3YDJPFZemeF/EHiS+iuPH9vZ29tZuHh0+zmMsczg5WRiQCCpHGKWty048p6FRRRTICiiigAooooAxtT8I6FqwmN3plt50wIa4SJRKD6h8ZB965UfBbw8GB/tPxAcdjqsleh0UAZeneGdF0l0k0/TLWCZF2iZIVDke7AZrUoooAKKKKACiiigAooooACMjB5FcPqnwl8PapqMt4bnVbMynJhsr54Yl+iLwK7iigDkfDvw10Pw3qH222kv7yYD5Pt9004jP8AeUN90+4rrqKKACiiigAooooAK5vxV4UGtLHf6bKLPWLU77e5A+VjjG2QD764zwe/NdJRQB5YfFXjaI+W3w9vpivymRbqMB8dwO2av6Rour+ML6K+8W6fJpdjatmLS5HDGRx/E5HDIR/Ca9EopWRbnJqwiIsaKiKFVRgADAApaKKZAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQBm2H/HjH+P8AM0UWH/HjH+P8zRTEaVFFFIYUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFQtcolysLcFhkGpqzrnT5TOZ4Hy+7OD2oA0aKzbe+nVhHcRsecFgK5PxZ4t1r/hK4PDPha2gl8+3Zrq/83myIOOmMFsc4NA1qd0biEHBmjB/3hTkkSQExurY67TmvMf+FU+G5v3l9FcXFy/zSzfaXXzGPVsA4GT2qO50a/8Ah7Zzan4GhN1CiFrjS55iVmOPvhzk5AHCjrmldFum0j1SmTTJBGXkOAP1rL8O66uueGbTVCqpJLErSxI27ynxyp9xU8lnNeOWnfYP4VHNMzLkE6XEQdPxHpUlVrS0NqCBIWU9iKs0AFFFFABRRRQAUUUUAFFFFABRRRQAUUUySZIVJkYDAzigB9FUY9SWa7WKJcq38Rq9QAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAZth/x4x/j/M0UWH/HjH+P8zRTEaVFFFIYUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFAFPV5Hi0S+kjYq6W8jKw6ghTzXn/wALEWX4fadqcihr7UYhNd3B+/O+SNzHucCvRb23+2afcW27b50TR7vTIxn9a818K3C+DJrTwNrLRxTQQk2Excf6XEDyx/unJxtqZbGlNq521FFU9U1Sz0bTZr/UZlht4VLMzHHTsPU+1QdBznhJjZ/GbX9LtT5ViNNhuvs68J5rudz49TjrXpVcD4F0q41DxHe+NrgCGPU7SO3t4Ac5iU7lkJ7E56dq76tEcstwooopkhRRRQAUUUUAFFFFABRRRQAUUUUAFRTW8c4/eKCcYB9KlooAyksWs7pJWYGMHk+latMmkSKB5JfuIpZuM8DmvLrv4yvqTBvA+jNq9vHlZ5Lhzb7WzwFyPmHXkUm0ty4QlN8sVdnqlFcj4O+IuleL72fTbdZodUtIRJdQPEQqZOOGP3hnuK66mS007MKKKKBBRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAZth/x4x/j/ADNFFh/x4x/j/M0UxGlRRRSGFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAVz/iTwVoviiSO51C0T+0IEKWt8F/e2/OcoexzzXQUUAeanTPidbkw2zaHPDH8scs7yeY6joWx3PerFn4G1TxJLu+JH2O6tohtj022Ja3lPZ3B53A9PrXoVFKyKcmyGztLews4rSziWG3hQJHGg4VR0AqaiimSFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFAHK/Es6svw91I+H/ADvt2xdnkfexuG79M151oQsRotuNK8v7Nt+Xy/u57/rmvbJYlmheKT7rqVbHoRivLLn4NT6SwTwHrP8AZdvIS08d6hudzZ4K5PyjrxWNWm5rQ9HA4qOHk+ZaMw7E3a/FLQv7A3+e0wGreR1+y7Tt3/7O7H417lXE+FPAOleB76TVY3uJ9TvohFeXDysyNg7sqp+6M9q7VWDKCpyDVwjyxsc2JrKtVc0rXFoooqznCiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAzbD/jxj/H+ZoosP8Ajxj/AB/maKYjSooopDCiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigCOeITQPGTgMOtY9tfyWx8rG9c4APatzrUEVlDCSVXJJz83NAEyNvQNgjPY0tFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAZth/wAeMf4/zNFFh/x4x/j/ADNFMRpUUUUhhRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAZth/x4x/j/M0UWH/HjH+P8zRTEaVFFFIYUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFAGbYf8AHjH+P8zRRYf8eMf4/wAzRTEaVFFFIYUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFAGbYf8eMf4/zNFFh/x4x/j/M0UxGlRRRSGFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQBm2H/AB4x/j/M0UWH/HjH+P8AM0UxGlRRRSGFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQBm2H/HjH+P8zRRYf8eMf4/zNFMRpUUUUhhRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAZth/wAeMf4/zNFFh/x4x/j/ADNFMRpUUUUhhRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAZth/x4x/j/M0UWH/HjH+P8zRTEaVFFFIYUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFeejxNcWXj7Vor7UCljb2iOiSNhFYk//Wr0KvMoYYp/idriTRpIv2FPldQR1b1qdeb5Mb+B+q/M3fA3i6HxDbyia8ie6LEiFWyQBWzd+K9Bsbk295qtrDKOqPJgiuU8BWcA8H3kkSw28x3qJ9gyvXv1qiNT8O2+izafbwjWNSkyCxgOWb2dhx+dVN226JfkCWrv3f5noOoXYbQbq6s5c4gdkkQ99pIIrmdD8TyWXw/GrarLJcyLHuJPLMcVm+BZ5pvhzqAmLfLFKArNkrweKwrov/wrnRxz5JmAlx/d20OPvyiuvL+LBP3U30b/AATOutNJ8Q+Io/t17rV1pSycxw2bcbe2c+1LYT69oHiBNMvHn1WymOVun5dO3PbFddY4Gn2+3p5S4/KpJHijYGVkUngFiBmntLTYjeOu5DfajZ6ZbG41C4jt4h1eQ4AqDTdf0rV2ZdMv4Lor1ETZxXHXoTxD8SjYXu5razjR1jz8rFh3HfpSeOtPi0W60vU9KjW1kW4SJlhGxWUnnIHWpi7qLez/AOGLad3FdP8Ahzur7ULTTbZri/uI7eFeryHAFVtO8QaTq7lNM1CC6ZeoifOK4u6lHiX4gw6df7jbW0CTeWDhWLAg5HfpUvjvTINHGnarpUa2ksVxHERCNisrNzkDr0prZOXV/wDAFa7aXb9Llu71a/T4pQ6el1ILRoEYwg/KSSea6ifWNOtr1LS4vIo7iT7sTN8xry/xNrc9h8RLW6t7dri4ltE2Ivc810XgHTba+jk1q9lF3fysdxYf6vtgA9KcE3FX6Xv97Cbs7rra33Hd0UUUgCiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAzbD/AI8Y/wAf5miiw/48Y/x/maKYjSooopDCiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigArz+0068/wCFk6xObeQQyWaKkhX5WOW4zXoFFK2t/Jr7wesben4HmHh+K9/4RzU9AksrmG5ZXKSGMiNuD/F+NTaRrNxZ+HBotvol0upKnlrI8BERb1L16TRT3Vn1ST+Q76382/vPNvBNvqFp4W1bTb+zmjuBHJg7DtckHoe9XtE8Nvqnw5XTL1ZLaVo8AlcMhx15ru6KHre/VJfcJabd7nDaf4p1DQIzp2vaVdzSQDaktnCZVZe2T64qstrqXjbxFDe3NtJZ6VZyBo45QUeQjuVNehUU768z3FbTlWxw2vWF3oHiaPX9OtGuYGRUuI4wS4AGBgDrVTVJLzx1qNjBZ2NxaWVtIssz3UZjYkHoAeoxXolFKOlr9NhvW7XU4XX9MutB8RQ+INNtWuowixXEaAltqjjAHXk1V1a4vfHV3ZWllYXNpaQyrNPJdRmM5U5wM9a9Eoojpa/TX+vmD8vQ4GfSp1+KNtKlvI1qlsiebt+Xv3p0VteeF/HRNtayS6ZqAy3lKT5bAYH05Nd5RQtLeV/ncHqmvT8AooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigDNsP+PGP8f5miiw/48Y/x/maKYjSooopDCiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAzbD/jxj/H+ZoosP8Ajxj/AB/maKYjSooopDCiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAzbD/jxj/H+ZoosP+PGP8f5mimI//9k=)**

**Problem Statement 1 -> Groceries**

**Business Problem:** Analyze the support and confidence values and prepare rules for the Groceries dataset

**EDA:**

> summary(Groceries)

transactions as itemMatrix in sparse format with

9835 rows (elements/itemsets/transactions) and

169 columns (items) and a density of 0.02609146

most frequent items:

whole milk other vegetables rolls/buns soda

2513 1903 1809 1715

yogurt (Other)

1372 34055

element (itemset/transaction) length distribution:

sizes

1 2 3 4 5 6 7 8 9 10 11 12 13 14

2159 1643 1299 1005 855 645 545 438 350 246 182 117 78 77

15 16 17 18 19 20 21 22 23 24 26 27 28 29

55 46 29 14 14 9 11 4 6 1 1 1 1 3

32

1

Min. 1st Qu. Median Mean 3rd Qu. Max.

1.000 2.000 3.000 4.409 6.000 32.000

includes extended item information - examples:

labels level2 level1

1 frankfurter sausage meat and sausage

2 sausage sausage meat and sausage

3 liver loaf sausage meat and sausage

> str(data) #all data is numeric

Classes ‘spec\_tbl\_df’, ‘tbl\_df’, ‘tbl’ and 'data.frame': 2000 obs. of 11 variables:

$ ChildBks : num 0 1 0 1 0 1 0 0 1 1 ...

$ YouthBks : num 1 0 0 1 0 0 1 1 0 1 ...

$ CookBks : num 0 0 0 1 1 0 0 0 0 1 ...

$ DoItYBks : num 1 0 0 0 0 0 0 0 1 0 ...

$ RefBks : num 0 0 0 1 0 0 0 1 0 0 ...

$ ArtBks : num 0 0 0 0 0 1 0 0 0 0 ...

$ GeogBks : num 1 0 0 1 1 0 0 0 0 1 ...

$ ItalCook : num 0 0 0 0 0 0 0 0 0 0 ...

$ ItalAtlas: num 0 0 0 0 0 0 0 0 0 0 ...

$ ItalArt : num 0 0 0 0 0 0 0 0 0 0 ...

$ Florence : num 0 0 0 0 0 1 0 0 0 0 ...

All data is numeric. So we can move on with creating the rules using the Apriori Algo

*# Building rules using apriori algorithm*

*arules <- apriori(Groceries, parameter = list(support=0.02,confidence=0.6,minlen=5))*

*arules*

*#writing ... [0 rule(s)] done [0.00s].*

*arules <- apriori(Groceries, parameter = list(support=0.001,confidence=0.6,minlen=3))*

*arules*

*#writing ... [2915 rule(s)] done [0.01s].*

*arules <- apriori(Groceries, parameter = list(support=0.004,confidence=0.4,minlen=2))*

*arules*

*#writing ... [432 rule(s)] done [0.00s].*

*arules<-apriori(Groceries,parameter = list(support=0.008,confidence=0.7,minlen=3))*

*arules*

*#writing ... [0 rule(s)] done [0.00s].*

I go with the 432 rule one as It has the least number of rules. I also remove the duplicated rules.

> arules <- apriori(Groceries, parameter = list(support=0.004,confidence=0.4,minlen=2))

Apriori

Parameter specification:

confidence minval smax arem aval originalSupport maxtime support minlen

0.4 0.1 1 none FALSE TRUE 5 0.004 2

maxlen target ext

10 rules TRUE

Algorithmic control:

filter tree heap memopt load sort verbose

0.1 TRUE TRUE FALSE TRUE 2 TRUE

Absolute minimum support count: 39

set item appearances ...[0 item(s)] done [0.01s].

set transactions ...[169 item(s), 9835 transaction(s)] done [0.12s].

sorting and recoding items ... [126 item(s)] done [0.00s].

creating transaction tree ... done [0.03s].

checking subsets of size 1 2 3 4 5 done [0.02s].

writing ... [432 rule(s)] done [0.01s].

creating S4 object ... done [0.15s].

> # Overal quality -> looks at all the parameters

> head(quality(arules))

support confidence coverage lift count

1 0.004677173 0.4220183 0.011082867 5.240594 46

2 0.004270463 0.5000000 0.008540925 2.584078 42

3 0.004677173 0.6133333 0.007625826 2.400371 46

4 0.004677173 0.4339623 0.010777834 2.242784 46

5 0.004778851 0.4653465 0.010269446 2.404983 47

6 0.004677173 0.4554455 0.010269446 1.782454 46

**![A close up of text on a white background

Description automatically generated](data:image/jpeg;base64,/9j/4AAQSkZJRgABAQEAqACoAAD/4RD0RXhpZgAATU0AKgAAAAgABAE7AAIAAAAOAAAISodpAAQAAAABAAAIWJydAAEAAAAcAAAQ0OocAAcAAAgMAAAAPgAAAAAc6gAAAAgAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAFJhamVzaCBHYXV0YW0AAAWQAwACAAAAFAAAEKaQBAACAAAAFAAAELqSkQACAAAAAzI4AACSkgACAAAAAzI4AADqHAAHAAAIDAAACJoAAAAAHOoAAAAIAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA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3/AMILc3nhrX7aWw0bTZPK0/VLgbY50xu5bpuyT09KXXNWHj7ULHw7olrNeaJeS4vNWt13RxhfmAVumcgA/WlzPnUrap3L5Y+z5b9LF+7iHhTxHPqNxpovNP1AB/N8rzGjOAAMYJpIddj1fWY4tJ0MSxgAyTPb+V5Y9Rkc16dFGIYUjXkIoUZ9qfQtEk+hD1bfc80tmuPBXiCfUbmCSTT7/BkaNCzRkDAGBzWfr+vTeJPFuivp9lObGK6X988TKd2D2I6V63RRHRxb6BLVSt1Gx/6pP90V5h8SLG/ttajuNJjc/wBoRfZZNik4yc5r1Gik1eSY07Jo4/VvCYvfAMWm26ASoiPj1YYJ/lWRZeLdEsdLFvqejFNQhXa0S2JYFv8AeC16PRVXd35iVrJdjh77T7rxP4JmC6XFp8rHfDGmPmGQQT6Zqvb+PEg0EWNzaXI1RU8vyhC23PQfNjHpXZ6vaXN7pskNldSWsxHyyRnBBrmFt/Hb232SZtO8thsaYM3mY9frUvXmS2f9f8ONaWb6HM+FNGn8QeC9ct54xHPNcP8ALnOGyDitLTPE+jaXpv2PWtHMd7ACu1LIuGx0+YLXZeHdCi0DTjBGxkd2LyO3VmPU1rVcrXdttPwJWq17v8Thb2S61v4e6o0Wjx2PnQHyUQAFx2JGOKxrm6k1n4eLbWMU4mtJE86No2XIDDOM9eBXqdFRbe3W34FJtW8r/ieWaxrdlq3hObT/AAzpT/a3hKyBrYx7V/3iOaZfzS3nwkWOG3m8+FwhjMZBypA/pXq1FOWt/O34BH3eXyPOrLx2tv4bjsJrO5/tQR+WIhCxUt2+bGKiu9BuNN+F9+ssTG6upPOZF+YjcwOK9Koon7131Yoe649keZapo8tquj6+tn9pW2hMc0LrnhiCTj2Aq7J4w0a5aCDRNB+1XkzbRHJZmNR/wIrivQKKbd35XuK1kvSxzGs6++jx2/8AaOkBrB1/etGvmeW3YbQOa5e/m0/xL4i0t/C9nLFNbzB5pPIMICfkM816fRSW6b6aj6WXYbGCI1DdQBmnUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQBn2v3rj/ru1FFr964/67tRTEaFFFFIYUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAVDc3At49xBJ7Ad6moIB60AYxu576bykGEJyQOuPrWvHGsUYRBgCoIrGOG6MyEjI+72qzQAUUUUAVr1vKiEwJBQ1JBcR3AJjbOOtR6grPZOqAk8cCqVlYThhIXMQI7daANaikUYUAnOB19aWgAooooAKKKKACiiigCC7sbTUIfKv7WG5jznZNGHXPrg0tpZWthB5NjbQ20Wc+XDGEXPrgVNRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFAGfa/euP+u7UUWv3rj/ru1FMRoUUUUhhRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABVbUdRtdJ0+a9v5RDbwqXdz2Aqw7rGjO5CqoySegFea29zJ498UX8l9kaNpFyI7OOM5ivDgMJt3fBJXAyKBpXdie4+KF1qJLeDvDd3rVkw2rqEciogfuCrc8VT+z/Fd/mXxNoKA8hTprEr7fertI4o4U2QxrGvXCrgU+pubqmjkrf4ia3pO2PxV4ZuYrS3O261dJF8oAf8tAgy2Ce3vXbaJruneItMj1DSLhbi2k+6wBH6HkVUdFkQpIodT1VhkGuN8RC48FXieI9AiaRJ7iOG9sVH7uRWIUykj7uwc8cetCZEoW1R6bRUdvcQ3dvHcWsqTQyLuSRDlWHqDUlUZBRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQBn2v3rj/ru1FFr964/67tRTEaFFFFIYUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUVDPdR2wBl3YPcDNAE1MmmjtoHmncJHGpZmboAKrf2ra/3m/75rmPiNZXniTwLdWuiBjOskcpyduVVgzAHvwDxQBnv8WD9uLweGdRm0TdxrSunkGPvJjO7H4ZrvrW6gvrWO5tJVlhlUOjr0YHkGuBh8XeH/wDhH1ufPjSMRbjZMoE3+75P3s+2Kv8Awr0nUNI8HOmqKVe5vZrqFS2SsUjbkBHY47dqSdzScVG1mdpRRRTMwooooAKKKKAOb8f67H4d8GXl5LE0ocC3CqRkGQ7AfwzWZ4J0KXwz4K0zR7iZJpLSHY0iAhW5J4z9am+KmkXeteALq2sFVpUlimIZsfKjhm/QGp9A1i08QaBaapprM1rcx7oy67SRnHT8Klm1M0aKKKRqFVNVtG1DR72zRgjXFu8QY9AWUjP61bqG7uo7KynupyRFBG0jkDJCqMn+VAGP8KL4SeDxo5U+ZoUh0+STtIyDlh7c967euB+E1rKujapqhA+y6vfve2pzy0TAYJHY+1d9VnK9wooooEFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAZ9r964/wCu7UUWv3rj/ru1FMRoUUUUhhRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUVzPjHxBcaPb20FntSe8lEKTP92Mnuc1R+x+NLMRXMeqwampILW6wiPIP+1mha6jeh2lFee+JPE3iC28V2elaYqKbmAllIB8ts4znvUlzqPibwveW0+t3sd/YytiUrEE8r/Hk0LW3noJ6fmd9RXJeKPE9xaTWem6MA17eAMjdQi5wT+Gaz76+8T+ExFf6xfx6jZZxMEiEZjHr70LX8g9PU72iuS8TeK5bVLKz0cB7y/AMZPRF6E/hmo4rTxpp91ayy6hDqcLPiaERCMqPXNC1/IHt+J0sd9LJqctqbKdI0AIuGA2N9KuVyun65fXHjq+02ZlFvDGjKmOQSuTzUN1fa7resXNro9yNMhtGKPNLFuDkemaSfup9xtav5HYVgweLbKW+1K3dXi/s5iJZHxtOBnIrH8J+JL+fXrzRNWuI7ua3AYXEQADZzxgVyuowXk1/4w+xXS2+2Ri+U3bl2jIqW7arZpsqKTun0a/M9W07UItTs1ubf/VsflPr71ary7TJ/EOh+A4tRj1COeFAv7oQ4IBI711Wv+JTZ+H7W6snHnXToiHGfvHGa1nZN272M43djp6KgsjKbGE3Dbpdg3nGMmuS1bXdV1PxM2heHZVtnhGZrl13Be+Me4qX8XKNax5js2bapJ7CsTS9atvE9hO1vHJGI3ZCGxkkEj+lUtNi8UWOpPDqs8eo2bR/69VEew/TvXG+DYvEV7Hfx6PeR2EMU8h3vGH8w7j+VJfE/S/4jt7t/P8ARnpFppY2q9xndnO3/GtFI1jXbGoUegridB8ZXEem6oNdw0+lsVkkAxvwOuPxqGxm8X6/ZvqlpqEVjASfLtmhDlgPf3p+a23F6+hvyeBfDE2uHWJdEtG1Eyeabkp8+/1z61v1yeh+MRcaJfS6mgiutN+W5TPVgM8Vm2E/i7xFavqdjqMVhbknyoGhDlgOhz70PRh0O+orjtL8ZSvoOoPfw/6fpuVmjB+8cZqnpw8W67po1Ox163hSUb0txAG2j0JzQ9Lgd7RXLXXiO+0PwqbzXbZY7vcIlVXB3seAeKylHjZ9KGrJqMJyvmCx8kZx/d3UOyv2XUFdpeZ31FZPhrXI9f0dLtBtbJR1z0YHB/Wtam007MSd0RXVut3ZzW8hIWaNo2I6gEYrzbwQX8OX154MvF8iLT2xpXm8SXVuBlpPfDEivTqw/FHhmDxFYqA/2e9gbfbXKjmNx0z6r7dDUsuMrO4+iuLkm8e+HAbabTIvEUafO+oJKsHB6rs56frWB4o+MOkppXkaeL+O6lYRsXspBtzwcZHNQ7o6Iyi+p6nXKeO9VuIrCLRdHjW61PUnWL7KBlzbsdssgH+ypJrz+PQPFV/p63WnaNcWokXeupy35OBj7xiP8verOkaO2n/DBtSe4km1W4vI1kuWckj58YX+6PYU+/lb8Sea9l3PYtKsrfwpoFjpFuJZLe0hWKN2xkgetaIvrYgHzlH41ydj4a/s7w7NqFkZZ9Unt8nzZzsLewPAriNc0LTLDT5Lq+1GaTUfv/6POWAPXG1T2q5+62uxzx95J9z2pXV1DIcqehFLXmtvq11ffBl7mWRhMtt99Tg0zw/4JOteHE1DV766e8aP92ySsoUAfLkA802mnJdv1BapPv8Aoem0V59ofiqbT/DWrQXsnnXOkExh8ffO3P8AWqOkaFp3iDTW1TXdXIvJyWQJebAg6gbQaT6223+/YFtrvsen0V5zoXiG/TR9a02Odbq504EQyrzvG0nNUtA0Xw/4i0k3l9qdxHqDH97vumi2v3+UnpmjzW2/3h697HqdFZegWNzp+mJBdXy3u37sgXHFalNqzEndBRRRSGFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQBn2v3rj/AK7tRRa/euP+u7UUxGhRRRSGFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFAGH4nstF1SxWw1x4lEzbYfMPIb2965HXtO1fwdZQX9j4ivLq3jdUNtOwClSQABiu71bRrPW7Nra+jJU9GQ7WX3B6g1iWXw70Syu47gPfTmPkJcXbyJ/3yeKSWvbUbenc53UNUt4/iXpM96RGZ7bC5/vFq0/ibcxS6LDp8bBri6cCJB1OCDWd4m0iLU/iTZ29xC5ga1KlkBG35ux7Gun0rwLo+kXn2qAXM8o+6bqdpdv03dKcbShHtd/ncG3GTtvZfkcV4k0meHxhozzahNpsbWxj+0QnBDFhhefWtjWvCEf9nbdd8aah9kk4InddrV2Wq6PZa1Zm2v4tydivDL9D2rCtPhzodpeRXG6+uDEcqlzdNIn4qeKFqrPv/wAEW2q7fkc9rMMGj+LPD84cSWSwtEszdMkjFehXWpWdjEkl3cxwo5wrOcAmo9S0ax1awNpeQgxdtvBX6HtWLYfD7RdPvI7hGvZ2jOVS5umlUf8AATxTTurPu394n0a7WMzS3B+KGqunzDyUIx3+SqlkuqeL9c1RG1y706C0mMKw27D5h6kGu0g0Gxt9Ym1OJGFzMoVzu+XAGBxWXqXgHRtUv2vJTdwSv977NctEG+oWpirKKfRWLbvdry/BI47wZFp1r8TNRt9LKGNY0BZf4mwdx+uac/8Ax/8AjX6v/wCgiu1h8FaNbalDfwRSRzwjAZJCN3GPm9fxqxH4X0yO4v51jcvfkmfL5ByMcDtSa91LsmgTSk33af3WMvw3bx3/AMPY4GwytER+OK47wzJJrOr6do0ysy6arGUt2cNuH6V3Npo2jeCbO5uoXulhYfMryNIBz2XtVbwbp0Zu9R1hIti30oeLIwduMf0rW6dRy6b/AD6fmZtWp8vn+HU63HGBXAaHKth8TtVgusI9zh4if4gF5xXf1j654W03xAq/blkR06SQSGNx/wACHNQrqXN6r7y94uP9aFy51KzhnFpLcxrcSD5IifmauT+Gn/IMvf8Ar4k/9CNbWj+DdK0SZ5rYXE0jDG+5mMpH0LdKu6RoVlokMkVgrqsjl23Nu5JyaErNvurfiK9428/0Z5le2c17H4xit13P5j4A6ngVreGPD1zqXh+Ka28Y6miIu10jZcIR1H4V21loFhp97d3VvG3mXbl5dzZBP0rHu/h1od3dPOWvoDJ95Le6aNP++RxSjpHl8l+BU2pO5zcnhmwi8O68dJ1h9Wu5VYzFyCwbb0471J4U8PXOo+HoZLbxhqcQRdrxRsuIyByPwrutJ0Sw0WwW0sYQsajBLfMzf7x7/jWLefDvRL27e4LXsDSfeW3umjU/gOKe110J31KPh/RdB0x9Tnk1z+0zKSLtp2Bx8uMHHtUB8GC202e68K+IrqytnzLHDAwEWTXWab4d03StM+wWtuDCRhjJ8zP9SetYknw10OSVn83UUDNuMaXrqg9goOMUpa6LsNefc47XLrUPEvw5t7mdj5kF2gklQ5IAflvwxmuis/Ddxc6NHeL421T7MyBiwddoFdlDpdnb6f8AYo4EFvt27No5rm5fhloMzOTJqCI5yY0vXVB7BRxiqdrtdH/Wwl0b6FvwXpWm6VpLR6TqJ1CNnJaUkHJzz0966SoLKxt9PtUt7SJY40GAFGKnok7sSCiiikMK4/4iabNdaTb3lrEZXs7hJSqjJ2qcmuwrK8QjVTphOiGMzqwJjkQN5i9159amWmqKjuc/f+PdHl8NP5Fyk17JFgWiHMm70xXHQ7j8I7d2Uruv4zg/9da6Z21m9tzbxeDYrC5lGPtp8o+Wf72AM11Gg+H4NI0GHTpVScIdx3rkbs5zg+9Va6k+9vwdyU7ctuhl+JmvV+HM507f5/2b5dnX8K5S3fwdZ+HGm0q2trjWWhZWWIZm3EfNx9a9V2IU2FV2YxtxxVaPStOik8yKwtUf+8sKg/niiXvOXmOOiiux5do90j/Bq8t8gTwQ7ZE7qcdK2/DPjvSoPCMUeoTpa3Uce1YJDhm4wMD3rofFWjfavC1/a6VaRieeMgLGoXcaTw74ft7fQ7aPUtOt2uUUBjJErEYA74p3cue/l+QtlH5nJaN4cu9V8N69dyxtDJqjGSKNhg/dx/Sqmg2fgGDTBb+IdPsbW/gysi3Iwz47/jXrCqqKFRQqjoAMAVVm0rTriQyT2FrK56s8Kk/mRS2em2i+4N1rve/3nL+Grnw/bWN3e+HdCkt4U53xRYE3HVeeaydTf4d6xaT3F2ljBfSDnzMCVW+nrXosUEUEQihiSOMcBEUAD8KrNo2lu5d9NtGYnJYwKST+VKSUtBp2MH4eC+HhmNdQ8zgny/M67cnH6V1dIqqihUUKo6ADGKWrlLmdyYqyCiiipGFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQBn2v3rj/AK7tRRa/euP+u7UUxGhRRRSGFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAm1d2cDPriloooAKKKKACiiigAooooAKKKKAEKhhhgCPcUoAAwBge1FFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFAGfa/euP8Aru1FFr964/67tRTEaFFFFIYUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFAGfa/euP+u7UUUUxH//Z)**

**Problem Statement 3 -> Movie**

**Business Problem:** Analyze the support and confidence values and prepare rules for the Movie dataset

**EDA:**

> summary(data)

V1 V2 V3

Length:10 Length:10 Length:10

Class :character Class :character Class :character

Mode :character Mode :character Mode :character

V4 V5 Sixth Sense Gladiator

Length:10 Length:10 Min. :0.0 Min. :0.00

Class :character Class :character 1st Qu.:0.0 1st Qu.:0.25

Mode :character Mode :character Median :1.0 Median :1.00

Mean :0.6 Mean :0.70

3rd Qu.:1.0 3rd Qu.:1.00

Max. :1.0 Max. :1.00

LOTR1 Harry Potter1 Patriot LOTR2 Harry Potter2

Min. :0.0 Min. :0.0 Min. :0.0 Min. :0.0 Min. :0.0

1st Qu.:0.0 1st Qu.:0.0 1st Qu.:0.0 1st Qu.:0.0 1st Qu.:0.0

Median :0.0 Median :0.0 Median :1.0 Median :0.0 Median :0.0

Mean :0.2 Mean :0.2 Mean :0.6 Mean :0.2 Mean :0.1

3rd Qu.:0.0 3rd Qu.:0.0 3rd Qu.:1.0 3rd Qu.:0.0 3rd Qu.:0.0

Max. :1.0 Max. :1.0 Max. :1.0 Max. :1.0 Max. :1.0

LOTR Braveheart Green Mile

Min. :0.0 Min. :0.0 Min. :0.0

1st Qu.:0.0 1st Qu.:0.0 1st Qu.:0.0

Median :0.0 Median :0.0 Median :0.0

Mean :0.1 Mean :0.1 Mean :0.2

3rd Qu.:0.0 3rd Qu.:0.0 3rd Qu.:0.0

Max. :1.0 Max. :1.0 Max. :1.0

> str(data) #not all data numeric

Classes ‘spec\_tbl\_df’, ‘tbl\_df’, ‘tbl’ and 'data.frame': 10 obs. of 15 variables:

$ V1 : chr "Sixth Sense" "Gladiator" "LOTR1" "Gladiator" ...

$ V2 : chr "LOTR1" "Patriot" "LOTR2" "Patriot" ...

$ V3 : chr "Harry Potter1" "Braveheart" NA "Sixth Sense" ...

$ V4 : chr "Green Mile" NA NA NA ...

$ V5 : chr "LOTR2" NA NA NA ...

$ Sixth Sense : num 1 0 0 1 1 1 0 0 1 1

$ Gladiator : num 0 1 0 1 1 1 0 1 1 1

$ LOTR1 : num 1 0 1 0 0 0 0 0 0 0

$ Harry Potter1: num 1 0 0 0 0 0 1 0 0 0

$ Patriot : num 0 1 0 1 1 1 0 1 1 0

$ LOTR2 : num 1 0 1 0 0 0 0 0 0 0

$ Harry Potter2: num 0 0 0 0 0 0 1 0 0 0

$ LOTR : num 0 0 0 0 0 0 0 0 0 1

$ Braveheart : num 0 1 0 0 0 0 0 0 0 0

$ Green Mile : num 1 0 0 0 0 0 0 0 0 1

Not all data is numeric. So we need to specify which columns we want when creating the rules using the Apriori Algo

*# Building rules using apriori algorithm*

*arules <- apriori(as.matrix(data[,6:15]), parameter = list(support=0.02,confidence=0.6,minlen=2))*

*arules*

*#writing ... [81 rule(s)]*

*arules <- apriori(as.matrix(data[,6:15]), parameter = list(support=0.001,confidence=0.6,minlen=3))*

*arules*

*#writing ... [66 rule(s)]*

*arules <- apriori(as.matrix(data[,6:15]), parameter = list(support=0.004,confidence=0.6,minlen=4))*

*arules*

*#writing ... [29 rule(s)]*

*arules<-apriori(as.matrix(data[,6:15]),parameter = list(support=0.08,confidence=0.7,minlen=3))*

*arules*

*#writing ... [65 rule(s)]*

I go with the 29 rule one as It has the least number of rules. I also remove the duplicated rules.

> arules <- apriori(as.matrix(data[,6:15]), parameter = list(support=0.004,confidence=0.6,minlen=4))

Apriori

Parameter specification:

confidence minval smax arem aval originalSupport maxtime support minlen

0.6 0.1 1 none FALSE TRUE 5 0.004 4

maxlen target ext

10 rules TRUE

Algorithmic control:

filter tree heap memopt load sort verbose

0.1 TRUE TRUE FALSE TRUE 2 TRUE

Absolute minimum support count: 0

set item appearances ...[0 item(s)] done [0.00s].

set transactions ...[10 item(s), 10 transaction(s)] done [0.00s].

sorting and recoding items ... [10 item(s)] done [0.00s].

creating transaction tree ... done [0.00s].

checking subsets of size 1 2 3 4 5 done [0.00s].

writing ... [29 rule(s)] done [0.00s].

creating S4 object ... done [0.00s].

> # Overal quality -> looks at all the parameters

> head(quality(arules))

support confidence coverage lift count

1 0.1 1 0.1 1.666667 1

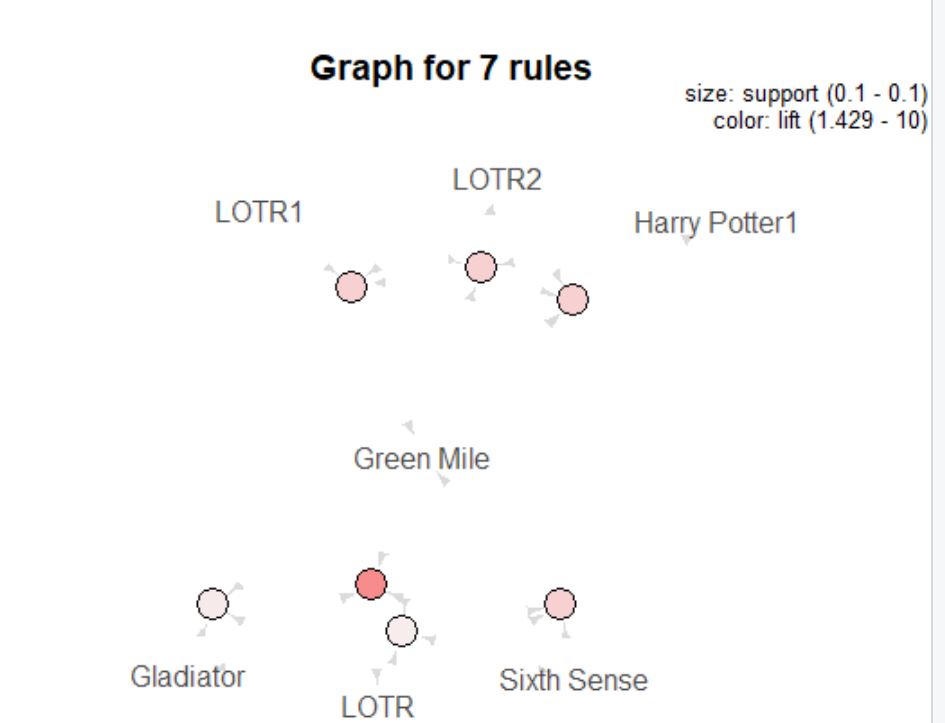
2 0.1 1 0.1 1.428571 1

3 0.1 1 0.1 5.000000 1

4 0.1 1 0.1 10.000000 1

5 0.1 1 0.1 5.000000 1

6 0.1 1 0.1 5.000000 1

****

**Problem Statement 4 -> Phone**

**Business Problem:** Analyze the support and confidence values and prepare rules for the Phone dataset

**EDA:**

> summary(data)

> summary(data)

V1 V2 V3

Length:11 Length:11 Length:11

Class :character Class :character Class :character

Mode :character Mode :character Mode :character

red white green yellow

Min. :0.0000 Min. :0.0000 Min. :0.0000 Min. :0.00000

1st Qu.:0.0000 1st Qu.:0.0000 1st Qu.:0.0000 1st Qu.:0.00000

Median :1.0000 Median :1.0000 Median :0.0000 Median :0.00000

Mean :0.5455 Mean :0.6364 Mean :0.1818 Mean :0.09091

3rd Qu.:1.0000 3rd Qu.:1.0000 3rd Qu.:0.0000 3rd Qu.:0.00000

Max. :1.0000 Max. :1.0000 Max. :1.0000 Max. :1.00000

orange blue

Min. :0.0000 Min. :0.0000

1st Qu.:0.0000 1st Qu.:0.0000

Median :0.0000 Median :1.0000

Mean :0.1818 Mean :0.5455

3rd Qu.:0.0000 3rd Qu.:1.0000

Max. :1.0000 Max. :1.0000

> str(data) #not all data numeric

Classes ‘spec\_tbl\_df’, ‘tbl\_df’, ‘tbl’ and 'data.frame': 11 obs. of 9 variables:

$ V1 : chr "red" "white" "white" "red" ...

$ V2 : chr "white" "orange" "blue" "white" ...

$ V3 : chr "green" NA NA "orange" ...

$ red : num 1 0 0 1 1 0 1 1 0 1 ...

$ white : num 1 1 1 1 0 1 0 1 0 1 ...

$ green : num 1 0 0 0 0 0 0 0 1 0 ...

$ yellow: num 0 0 0 0 0 0 0 0 0 0 ...

$ orange: num 0 1 0 1 0 0 0 0 0 0 ...

$ blue : num 0 0 1 0 1 1 1 1 0 1 ...

Not all data is numeric. So we need to specify which columns we want when creating the rules using the Apriori Algo

*# Building rules using apriori algorithm*

*arules <- apriori(as.matrix(data[,4:9]), parameter = list(support=0.02,confidence=0.6,minlen=2))*

*arules*

*#writing ... [8 rule(s)] done [0.00s].*

*arules <- apriori(as.matrix(data[,4:9]), parameter = list(support=0.001,confidence=0.6,minlen=3))*

*arules*

*#writing ... [3 rule(s)] done [0.00s].*

*arules <- apriori(as.matrix(data[,4:9]), parameter = list(support=0.004,confidence=0.5,minlen=2))*

*arules*

*#writing ... [17 rule(s)] done [0.00s].*

*arules<-apriori(as.matrix(data[,4:9]),parameter = list(support=0.08,confidence=0.7,minlen=3))*

*arules*

*#writing ... [3 rule(s)] done [0.00s].*

I use the 17 rule one.

> arules <- apriori(as.matrix(data[,4:9]), parameter = list(support=0.004,confidence=0.5,minlen=2))

Apriori

Parameter specification:

confidence minval smax arem aval originalSupport maxtime support minlen

0.5 0.1 1 none FALSE TRUE 5 0.004 2

maxlen target ext

10 rules TRUE

Algorithmic control:

filter tree heap memopt load sort verbose

0.1 TRUE TRUE FALSE TRUE 2 TRUE

Absolute minimum support count: 0

set item appearances ...[0 item(s)] done [0.00s].

set transactions ...[6 item(s), 11 transaction(s)] done [0.00s].

sorting and recoding items ... [6 item(s)] done [0.00s].

creating transaction tree ... done [0.00s].

checking subsets of size 1 2 3 done [0.00s].

writing ... [17 rule(s)] done [0.00s].

creating S4 object ... done [0.00s].

> # Overal quality -> looks at all the parameters

> head(quality(arules))

support confidence coverage lift count

1 0.09090909 0.5000000 0.1818182 0.9166667 1

2 0.09090909 0.5000000 0.1818182 0.7857143 1

3 0.09090909 0.5000000 0.1818182 0.9166667 1

4 0.18181818 1.0000000 0.1818182 1.5714286 2

5 0.36363636 0.6666667 0.5454545 1.2222222 4

6 0.36363636 0.6666667 0.5454545 1.2222222 4

**![A close up of text on a white background

Description automatically generated](data:image/jpeg;base64,/9j/4AAQSkZJRgABAQEAqACoAAD/4RD0RXhpZgAATU0AKgAAAAgABAE7AAIAAAAOAAAISodpAAQAAAABAAAIWJydAAEAAAAcAAAQ0OocAAcAAAgMAAAAPgAAAAAc6gAAAAgAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAFJhamVzaCBHYXV0YW0AAAWQAwACAAAAFAAAEKaQBAACAAAAFAAAELqSkQACAAAAAzkwAACSkgACAAAAAzkwAADqHAAHAAAIDAAACJoAAAAAHOoAAAAIAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAyMDIwOjA1OjIwIDA5OjUzOjQ0ADIwMjA6MDU6MjAgMDk6NTM6NDQAAABSAGEAagBlAHMAaAAgAEcAYQB1AHQAYQBtAAAA/+ELIGh0dHA6Ly9ucy5hZG9iZS5jb20veGFwLzEuMC8APD94cGFja2V0IGJlZ2luPSfvu78nIGlkPSdXNU0wTXBDZWhpSHpyZVN6TlRjemtjOWQnPz4NCjx4OnhtcG1ldGEgeG1sbnM6eD0iYWRvYmU6bnM6bWV0YS8iPjxyZGY6UkRGIHhtbG5zOnJkZj0iaHR0cDovL3d3dy53My5vcmcvMTk5OS8wMi8yMi1yZGYtc3ludGF4LW5zIyI+PHJkZjpEZXNjcmlwdGlvbiByZGY6YWJvdXQ9InV1aWQ6ZmFmNWJkZDUtYmEzZC0xMWRhLWFkMzEtZDMzZDc1MTgyZjFiIiB4bWxuczpkYz0iaHR0cDovL3B1cmwub3JnL2RjL2VsZW1lbnRzLzEuMS8iLz48cmRmOkRlc2NyaXB0aW9uIHJkZjphYm91dD0idXVpZDpmYWY1YmRkNS1iYTNkLTExZGEtYWQzMS1kMzNkNzUxODJmMWIiIHhtbG5zOnhtcD0iaHR0cDovL25zLmFkb2JlLmNvbS94YXAvMS4wLyI+PHhtcDpDcmVhdGVEYXRlPjIwMjAtMDUtMjBUMDk6NTM6NDQuOTA0PC94bXA6Q3JlYXRlRGF0ZT48L3JkZjpEZXNjcmlwdGlvbj48cmRmOkRlc2NyaXB0aW9uIHJkZjphYm91dD0idXVpZDpmYWY1YmRkNS1iYTNkLTExZGEtYWQzMS1kMzNkNzUxODJmMWIiIHhtbG5zOmRjPSJodHRwOi8vcHVybC5vcmcvZGMvZWxlbWVudHMvMS4xLyI+PGRjOmNyZWF0b3I+PHJkZjpTZXEgeG1sbnM6cmRmPSJodHRwOi8vd3d3LnczLm9yZy8xOTk5LzAyLzIyLXJkZi1zeW50YXgtbnMjIj48cmRmOmxpPlJhamVzaCBHYXV0YW08L3JkZjpsaT48L3JkZjpTZXE+DQoJCQk8L2RjOmNyZWF0b3I+PC9yZGY6RGVzY3JpcHRpb24+PC9yZGY6UkRGPjwveDp4bXBtZXRhPg0KICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICA8P3hwYWNrZXQgZW5kPSd3Jz8+/9sAQwAHBQUGBQQHBgUGCAcHCAoRCwoJCQoVDxAMERgVGhkYFRgXGx4nIRsdJR0XGCIuIiUoKSssKxogLzMvKjInKisq/9sAQwEHCAgKCQoUCwsUKhwYHCoqKioqKioqKioqKioqKioqKioqKioqKioqKioqKioqKioqKioqKioqKioqKioqKioq/8AAEQgCzwObAwEiAAIRAQMRAf/EAB8AAAEFAQEBAQEBAAAAAAAAAAABAgMEBQYHCAkKC//EALUQAAIBAwMCBAMFBQQEAAABfQECAwAEEQUSITFBBhNRYQcicRQygZGhCCNCscEVUtHwJDNicoIJChYXGBkaJSYnKCkqNDU2Nzg5OkNERUZHSElKU1RVVldYWVpjZGVmZ2hpanN0dXZ3eHl6g4SFhoeIiYqSk5SVlpeYmZqio6Slpqeoqaqys7S1tre4ubrCw8TFxsfIycrS09TV1tfY2drh4uPk5ebn6Onq8fLz9PX29/j5+v/EAB8BAAMBAQEBAQEBAQEAAAAAAAABAgMEBQYHCAkKC//EALURAAIBAgQEAwQHBQQEAAECdwABAgMRBAUhMQYSQVEHYXETIjKBCBRCkaGxwQkjM1LwFWJy0QoWJDThJfEXGBkaJicoKSo1Njc4OTpDREVGR0hJSlNUVVZXWFlaY2RlZmdoaWpzdHV2d3h5eoKDhIWGh4iJipKTlJWWl5iZmqKjpKWmp6ipqrKztLW2t7i5usLDxMXGx8jJytLT1NXW19jZ2uLj5OXm5+jp6vLz9PX29/j5+v/aAAwDAQACEQMRAD8A+kaKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAqjL/wAhYf8AXD/2ar1UZf8AkLD/AK4f+zUCZLRRRTAs0UUUhhRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAVRl/5Cw/64f8As1Xqoy/8hYf9cP8A2agTJaKKKYFmiiikMKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACqMv8AyFh/1w/9mq9VGX/kLD/rh/7NQJktFFFMCzRRRSGFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABXFeNvir4b8DBo9TulkuwM/ZY2+c/nW74s1n/hH/AApqGqYybWEyAeuK+Xfhn4Ak+LPiu/1jxDO72cchbaWPzgsePbFTHmnNxj0V2ynywhzy6uyPR7b9qfwxPOI5NIv4VP8AG7pgV6x4Y8XaP4v0xb3RLuO4jP3gpyVPoa4HVv2dfBFzpcsOm2LWt0Vwk3ms2D9Cap/B34T634A1S8nvb/8A0eVtohBDBlBOD7ZrWHK7xl95lLmSUl9x7LRXz18Y/in4r8IeP7Sw0O7Atn5aDywd/I4zWz4Sv/i3q3iKy1HVzFbaFM25ogVLbcZ6dain+8XMtFrr6Fz9x8r3PbKK8B8SePviP4h8WXGk+BLN7KK3/wCW9zHsV8deXGKzNC+LPjfwv46tND8ezW12LlgC0MiMIx65X6UU/wB40l128wn7iflv5H0jRXkfxy8da34S8MWV94duhbPPgklA2Qcev1rhNG8d/F/xv4ejvPDMccS2y7Z55No85uuQCP5Uovm5rfZ3G1a3mfS9eeeJPjDpfhrxtaeGrnTrqW4un2LKhXaOcc55rlfg98XtT8RazN4c8Vpt1KJiFkI27yM5GPwrzz4330mm/GjT7yCHz5IX3rH/AHiGHFN+7Vpp7S/yYotSpzfVH1dG4kiVwMBgDTq+afEXjH4w6JpsfiKZIrTRtqkQqVchffjPcV7R8NfGa+OPB1tqbJsnKgTJ6NzV8t02um66ojmtZPr1Ou6V5T4z+P8A4e8Ha7JpUtlc308X3/s7L8v516Nrwv20G8GjkC98s+STjGfxr4vsrPxnd/Fm5hsxby6/li3m7ChH48dMVjG8qygu1/6/U2do03Nn2B4L8XW/jTw/Hq1pazWschwEmxu/SugryfxF4+vPhl8N7N9fihbW5EC+TCAFL4z/AA8VwUHin42X2lHxJbLGulcuIWCh9o9sZrSTjeVtl16GcVLlV9306n0rRXmvwj+KS+PtPkgvo/s+pW/EkZ6sPWvMfFvxe8a6R8VJdH0ucXFvgLHbeWOSR1zilK6qKn1ewRacHPtufTFFeUfDwfFKXxI0vjaWFNNeMtHGhQkHjHTn1r1WUkQuV6hTiqkuVJsE7uyKOua5Y+HtJm1DU51ighUkljjPtXJfD/4s6V8Q9QvLXSrO4h+yruMkpBDjOOMV5D4p8H+NfH2u61careS2+jWIZo/4d2FyBjv3qX9mCEW/iLW4QchItuf+BilQXO3zfy3S+7cKz5Irl72Z9Da3rlh4e0qXUdVuEt7eIcs5xk9hXkaftP8Ahd9TFq2mXqQ79v2ksuzHr9Kxv2mNWlNzouipIyw3TAyAHGcOP8a7C+8D6Gfge1t9hhytjuEgQbs46561kpNU5Vnsna35mriueNPrJX/Q9H0fWLLXdLi1DTJ1nt5RlXU8Verwf9mbVpJtL1XS3kZo7OXCA9gSa94roqRUXps7P7znpybVnutAor5o8X/F7xro/wAVptH0qcXFvgLHbeWOSc98V2Hhm6+K0El/f+Lp4YrEWryQImxiG7dKxjLmp+16Wv8A8D1NZLln7Pqez0V4d8EPiH4k8X+LdcstevRcQWqgxKIwu35iO1WPjZ4/8Q+EfFGgWmhXgt4bzPnKUDbvnA7+1VL3XBP7VrfMIq7kv5b/AIanfeP/AB/ZfD7R49R1C0muo5HKBYSARxnvWj4T8S2/i3w5baxaQyQRXAJVJCNw59q8j/aBuJLr4VaTPOd0kh3MfUla6H4e+IrTwt8CbPVb5sRwxNgf3mycD8TSi1GFWU/stL8BSu3TUPtJnqtFfNll41+MHj4zat4MSK101WKrHIVH5bhzXcfCX4rXXia6n0LxNGINWtiVJPHmYznj8KtRb0ej3t1sKbUdem1z1uivA/iF8WvEcvjt/CfgUxx3cT+U0khABfPvxWX/AMJz8XfBWsWq+L7M6jb3DABbaMOAPUlB71NP37PZPa/Uc/dbXVH0hRVbTrxdQ02C7RWQSoG2upBH4GrNNpp2Yk01dBRRRSGFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFUZf+QsP+uH/s1Xqoy/8AIWH/AFw/9moEyWiiimBZooopDCiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigDl/iRpsuq/DvWLS3UvLJbMEUdzXin7N/izT9KuL/w/qU6W9zvIjDnG87jkV9JMoZSGGQeoNeAfEX9nuW81OfWvBty1vcOd32dSQSx6kNniphJ06jdrqSsypJVKajezTuhfjU/xLXxTA/gk6sLDySXNn9zOf8K5H4ReNvGl78ULTS/EWtahKm8rJb3D57HqKzbX4NfFea6WK5mvYYScGT7eTgfTdXtfwy+Ctl4KuF1TUbmS+1U/N5rEjb7Y79a0oJU3du619dTKs3P3VvoeW/GpQ3xx0MMMgzL/AOhivphJ0stDWY8LHDn9K8T+J3w28T+IfirpWsaVYCayt5A0knmAYG4Hp+Fe4La+bpYtph96Paw/Cs4XWE5VveX56GlSzxF3tZfofNOn6545+L/jS9ttI1t9M0+3co8cUhVSB+fpXKePfBQ8IfE3SrJL2a+uJgskjyNkljmuzn+FXxE8DeNbi/8Ah/snhuC2XfbgBuvyk1S134OfEK91my8Q3RGpX7SBpogwTy/oc1dGynSktLNXvv8A8MTV1jVi9bp27HSftGjHw+0YN2jjz+lei/Bj7P8A8Kq0b7Ntz9nXft9eetedftHJKnw/0iO4TZKqIrrnOCMA1z/hDwz8TtF8BWVx4DvUu7XUohLJDIi5izxgFj7dqVJ2jW/xfoh1Ff2Xp/mV7XH/AA1FH/ZfTnP1wc1L8WFD/H7RQ4yDOMj/AIEK734RfCC98NaxP4h8USGXU5SWVSc+WTnPP41m/ED4b+Jtb+MGl63ptiJbCCYNJJ5gGBuz0pwiqcqEG78u7+TCUvae2n3Wh23xgAX4L6mBwBbpj8xXNfszSM/gO7VmJCzKFHpwa7b4kaDqGv8AwzvtJ0uHzbyWJVRNwGSCO9YXwM8Iaz4O8J3Nnr9sLeeSVWVQ4bIwfSnS0lWv1t+aJnrTpJdG/wAj02T/AFbfQ18t+E/+Tn7v/df+Qr6lcZRgO4rwXw98NfE9j8drjxFc2AXTXVgsvmDnIHalR0xMZPaz/QdXXDyS30/U579pTf8A8JtpX2v/AI8ti5+vNfQmn+T/AMIbBt/1X2EflsrnPin8N7b4heH/ALOXEN3CS0MuOhxivJoPC3xrsdLPhu2eNtJ5QTMVL7T75zWcLqjKlbW7a87lzs6kanRKz+RT+EWf+GgNc/s//j3y3/fORVdUV/2o4g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bPcpGiD+Lk+nFXaKAPLraJPDHirWI5ZgDdRM0Q7ZCH+tVNAl/4RnUJb64wq3dgspI43OW5roPHvhLU9b1fTrzSAv7ltswLAZUsM/pUXjnwVf6zaadBpIULCwWUlsYTFSk+VLr8Py1/4H3FStzeW/z0/wCD95jXmnvD8LZJLofvLm8DNnupfj9DXS61p1tD8KpoI41VI7UlQB0q34k8PXV74Nh0zT0VpUaIkFsfdIzVzVtKurvwRPpsKg3L25RVLYGfrTqawml3VvuCn8UG/O/zscRKSU8J5OcFh/46K29c/wCSnaP/ANejf+h0x/CuqFdAAiT/AEIsZvnHGQB+PSrfifRtYk8Tadq+j2yXJt4vLeN5AnVs9a0uudP+8yF8Nv7v6s5vU9UuB8VpmOlXWq/ZoI2iit8fITkZ5qfxFdaxr11Yy2fhLUrS5gnQ/aJAvCZyRwa3dY0LVU1eHxBo0KfbiirPbFwA4A4G76k06ObxnqeowJNaQ6RbJzI6yiUv7Y96iC92K6r+rlSfvN9Gv02Osty7W8ZmGHKjcPQ1JSKCFAY5OOT60tN7krRBRRRSGFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFUZf+QsP+uH/s1Xqoy/8hYf9cP/AGagTJaKKKYFmiiikMKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACuQ8beBF8V3Fhf29/PYX+nFngkhONxI6N7cV19FA07Hli+NZNDn+xeNbOTTDCNr6k422sr+iN1Of6V0ek6zp2u2IvdHvIry2LFRLE2VJHUV1N1Y2l9GI721huUByFmjDjP0Ncfq/wk8L6zqDXc0d5bMwA8uzu3gj4/wBlcDNRym8azW5HrXizQfDs0UWuarbWMkqlo1mfBYDjIrGjvtZ8dM1joVtd6VYZzLqcg2+bGehhI6nvz2rqtB+G/hvw+ki29o135jZJv3NwV9gXzgV08UUcEaxwxrGijCqi4AH0pqIpVm9jG8L+FrXwxYvHFJJdXUxDXF5NzJOR0LHvgcVuUUVRgFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABSM21ScE47DvS0UANjkWVNy/j7U6sGRprW9OMg5yBWxazNPFveMp6Z70ATUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABVGX/kLD/rh/7NV6qMv/IWH/XD/wBmoEyWiiimBZooopDCiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACmTzxW0LzTuscaAszMcAAd6x/F/iWLwl4XvdYlha4NtGXS3VsNKf7o964JNM1H4gCHVfFP2vTbdcNa6dBMY2Ud/MK8OD6Gk3YuMHJnSaj8VPDdrGv9lzvrcpPMOmATOo9SB2qpa/F3SpbhUv9K1XS4D966vrfy4k+rZ4q9ZaLpenSmXT9PtbaQjBaGFVJHpkCrF1aW97btBeQRzxN1jkUMp/A1PMb+wXc2NI8QaRr8TyaLqNvfJGdrNA4YKfStGvM9S8C2Ul1Hf6JJJpV9brmAWzmOEv1BeNcB/xrR8NePb2XVotG8Waa+m3cx8u1nZgVvXX7xVR93gZ59aadzKdNxO7oooJx1qjIKKAc9KKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAYYIzKJCgLj+Kn0UUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAVRl/5Cw/64f8As1Xqoy/8hYf9cP8A2agTJaKKKYFmiiikMKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAoorO8Q3kuneGdSvbfHm29rJKmRkZVSRQB599ofxl8RLu4l/faPozeRFDJxsu1PzMB3G049K64DAwOlcp8OLZD4Rh1Yljc6x/ptzzx5jDnA7CusrJ7nfCNohRRRSLCsTxLosWpW0d4krW1/p+6W1ukGWiOOcZ45AxW3TJY1mheJ/uupU49DTBq6sJ4L8VnxF4I0/Wb1EimuEO+OM5wQxH9KvXN7PdIVijITPUDrXH/CjbBN4i8PqitZaJerb2u4ZbaybzuPfk16OqKi4RQo9BWp5zVnYqaZKHtQgzuTg5q7TUjSPOxQueuBTqBBRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFUZf+QsP+uH/ALNV6qMv/IWH/XD/ANmoEyWiiimBZooopDCiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKp6xYf2rol7p5coLqB4dwH3dykZ/WrlFAHlvw6uGTRLnRWQY0O4bT1kzzKEH3j6V19cr4gs28FeMJfEGCug3ybbpY+Ft5c5ad/Y8DjmunjkSaJJImDI6hlYdwehrJqzO+nK8R9FFFIsKiuZfItZZQMmNC2PXAzUtc34p1me2u9N0KwVRe607wQyyjMceBliw69M0xNpK7JfhFam50fUPFDna/iG4Fy0A5EW0FMA9+ma9CrJ8MaBb+F/Ddpo9o7vFbKQGc5JyST+prWrU89u7uFFFFAgooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACqMv8AyFh/1w/9mq9VGX/kLD/rh/7NQJktFFFMCzRRRSGFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAUNc0Wy8RaJdaTqsZltLpPLlUHBI+vavPrjQdd8AxiPw3aHVtFHzGKWbD2qj7xBOS+fT2r1Cik1cqMnF6HmekfETQdYumgje6tGVd26+t2t1PsGfAJ9qvan4v0TS7B7qS+juFTH7u0YTSH6KuSa6nXvC+ieKLVLfxBpsGoQo25UmXIB9azNK+Gng3Q9Rjv9J8O2NpdR52TRR4ZanlNvbs5GDxPrPi2QQ+DdLlW1b93NfXiGFrdj3EbD58Dmus8LeANL8MTyXiGW6v5wDLPPIXG7qSoP3cknpXVUVSVjKU3LcKKKKZAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFc18QfEFz4Y8EX2q2KK08IUKH6fMwXP60AbL6xpkV19mk1G0S4zt8pp1D59MZzVyvMIvht4fvLdL6/tlutZkUSHVZVzP5h5D56ZHGPpW/8NtfvNe8P3X9ov5kthey2QlJ+aUR4AZvc0k7lyi4nYUUUUyAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACqMv8AyFh/1w/9mq9VGX/kLD/rh/7NQJktFFFMCzRRRSGFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAVDd2kF/aSW13EssMgwyOoIP51NRQB5y/w/8SwSHT9N8TRxaBnYLaSAvOIz94ebnOeTg9q7fRtNsdI02Ox02PZFCNvP3mPqx7n3NX6y7u7a01BmVQ25AOaB3bNSioYLqK4UbGG4j7vepqBBRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFUZf8AkLD/AK4f+zVeqjL/AMhYf9cP/ZqBMlooopgWaKKKQwooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAqlc6f9puhIzYTGCO9XaKAIobaKBQI16dz1qWiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACqMv/IWH/XD/ANmq9VGX/kLD/rh/7NQJktFFFMCzRRRSGFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUEhVJY4A5JPagAory/xd421DV9Qk0fwdd/ZUt2/wBJ1NVDbX6hEB4cEdSOmK5sSeO1Of8AhNp2xzg2yc/pWcqkYuzZ2U8FXqx54x0PdKK5HwT41TxDG9hqSC11e2AEsJPDj+8hP3uOTjpXXVadzllFxdnuFFFFMkKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACqMv/ACFh/wBcP/ZqvVRl/wCQsP8Arh/7NQJktFFFMCzRRRSGFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAVxfxcvrrTvhhqtzYzvBMoQCRDggFwD+hrtK5/xx4cPizwffaOk3ktcKMPjPIIOP0oGtzzfTbaG006GG2jWKMICFUYHPJqzWfp13Mssmm6nB9k1C1wksBOc8cFT/EMdxWhXmSTT1PuKcozgpQ2MHXL6Tw5rmkeJLIK15DcpZKr8rsmcKxx646V77XiWkaQfGvjS1tXiNxodgfNu2B2jz1+aLa3fkc4r22u2imoany2YyhLEPlCiiitjzwooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKoy/8hYf9cP/AGar1UZf+QsP+uH/ALNQJktFFFMCzRRRSGFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAVVvbwW67V5kboPSmakkzQ5hbCjkgdao6bEZ7rc5zs5IbnNAGf4n8C2niy1t5Lm4mstSgG2PULbHmohOWQE9jxn6VzQ+CzZG7xrrrDuC6c/pXqFFJxT3NI1JxVotoo6No1joOlRafpcCQW8Q4RBjJ7n6mr1FFMzCiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKoy/8AIWH/AFw/9mq9VGX/AJCw/wCuH/s1AmS0UUUwLNFFFIYUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABUccEcTM0aBS3UjvUlFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAVRl/5Cw/64f8As1Xqoy/8hYf9cP8A2agTJaKKKYFmiiikMKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACqMv8AyFh/1w/9mq9VGX/kLD/rh/7NQJktFFFMCzRRRSGFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABVGX/kLD/rh/7NV6qMv/ACFh/wBcP/ZqBMlooopgWaKKKQwooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKAAnAJNefTQt428WXdlcXEsdhYOUMcTFGZh3yPY16CRlSPWvPbS6g8H+NNRbVm8i1v5DLHcPwgJ4xn8KSt7RX8/vG/gdvL7g2S+CvF1lZWc0smm32R5crl2UgZzuPvVGx0g+IvH2uW1/cXH2KOfIjjlZSG2jHI7Vd1C7XxZ4203+x2+0WdllpLhOU5HTNT+Exjx/4iH/Tx/7IKqne6v2l93QJWSly/wB377ljWdJa61OLT7+6FtosEa7SbnY8hxyM5z6VzekX9ro3xGi0zQLq4ms5Y2MqzMzjcMAYY9evarOtrpc3xEmXxn5Z08QJ9mFz/q9/Of0xWdcX+mQfEHSG0uBYNKhjaKKVBiNizDG00qXxQff+tQqK0ZLsv6sa2v2d1qvxQGnpdyRWslunnorEZX29Dmg2beDfHFlb6fPM1pdRO0iTSF+R7mrzMG+LxKnINrHg/jSeME8zx5oqH+KGQUqd0qdut/1HOzcr9v0K1jYP4616/n1OeZbC1laGOKGQocjvkfWsmTS7rw78S9OtI7yZ7Aq5jR5CSOOc881r+HdTt/COuanp+tutnFNO08U0hwrA9s1m3+swa/8AFDS/sAaS3VJAsw+6/HODVQ+KHJ/WnX5kz+GfN8v69C5JLB4w8WX1vql/9m0+xkMaxrP5TMw75z71JZXEPhPxda2Gn6h9q069yNhm8xoyBnrk9azjovh3SvGGpDxfYwPFdSmWC5uF+XHTGa2dKTwMfEEcPh7RoLiZBk3NqmVj+pzxRT+y/v8A1CpvL8P0O/ByM0UDpRSAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACqMv/IWH/XD/wBmq9VGX/kLD/rh/wCzUCZLRRRTAs0UUUhhRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFQ3FnbXihbu2hnA6CWMNj86mooAht7O2tFK2lvFAp6iNAo/SnJbwxyNJHDGjucsyqAW+p71JRQBXuLCzvCDd2kE5HTzYw2PzpP7NsdiJ9jt9qcovlLhfpxxVmigCP7NAJvOEMfm4xv2Ddj60klvDLIJHijaRRhXZASv41LRQBxV/Lr8GqTJd+HoddticwuFjXYOwO7rRo3h+7vvEUWs6hYppiW4KwWagfLkYJJXg12tFEfdCWt/MguLK1vABd20M4HTzYw2PzpLaws7Mk2lrBAW6+VGFz+VWKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKoy/8hYf9cP/AGar1UZf+QsP+uH/ALNQJktFFFMD/9k=)**

**Problem Statement 5 -> Transaction**

**Business Problem:** Analyze the support and confidence values and prepare rules for the Transaction dataset

**EDA:**

> summary(data)

'HANGING' 'HEART' 'HOLDER'

Length:557040 Length:557040 Length:557040

Class :character Class :character Class :character

Mode :character Mode :character Mode :character

'T-LIGHT' 'WHITE' X6

Length:557040 Length:557040 Length:557040

Class :character Class :character Class :character

Mode :character Mode :character Mode :character

> str(data) #not all data is numeric

Classes ‘spec\_tbl\_df’, ‘tbl\_df’, ‘tbl’ and 'data.frame': 557040 obs. of 6 variables:

$ 'HANGING': chr "'LANTERN'" "'COAT'" "'BOTTLE'" "'HEART.'" ...

$ 'HEART' : chr "'METAL'" "'CREAM'" "'FLAG'" "'HOTTIE'" ...

$ 'HOLDER' : chr "'WHITE'" "'CUPID'" "'HOT'" "'RED'" ...

$ 'T-LIGHT': chr NA "'HANGER'" "'KNITTED'" "'WHITE'" ...

$ 'WHITE' : chr NA "'HEARTS'" "'UNION'" "'WOOLLY'" ...

$ X6 : chr NA NA "'WATER'" NA ...

Not all data is numeric. So we need to use the as function for transforming it to a list

retail<-as(data,"transactions")

*# Building rules using apriori algorithm*

*arules<-apriori(retail,parameter = list(support=0.002,confidence=0.5,minlen=3))*

*arules*

*#writing ... [1110 rule(s)] done [0.00s].*

*arules<-apriori(retail,parameter = list(support=0.01,confidence=0.5,minlen=2))*

*arules*

*#writing ... [16 rule(s)] done [0.00s].*

*arules<-apriori(retail,parameter = list(support=0.008,confidence=0.6,minlen=4))*

*arules*

*#writing ... [0 rule(s)] done [0.00s].*

I use the 16 rule one.

> arules<-apriori(retail,parameter = list(support=0.01,confidence=0.5,minlen=2))

Apriori

Parameter specification:

confidence minval smax arem aval originalSupport maxtime support minlen

0.5 0.1 1 none FALSE TRUE 5 0.01 2

maxlen target ext

10 rules TRUE

Algorithmic control:

filter tree heap memopt load sort verbose

0.1 TRUE TRUE FALSE TRUE 2 TRUE

Absolute minimum support count: 5570

set item appearances ...[0 item(s)] done [0.00s].

set transactions ...[4754 item(s), 557040 transaction(s)] done [2.61s].

sorting and recoding items ... [64 item(s)] done [0.02s].

creating transaction tree ... done [0.40s].

checking subsets of size 1 2 3 done [0.00s].

writing ... [16 rule(s)] done [0.00s].

creating S4 object ... done [0.10s].

> # Overal quality -> looks at all the parameters

> head(quality(arules))

support confidence coverage lift count

1 0.01067966 0.9993281 0.01068684 54.09248 5949

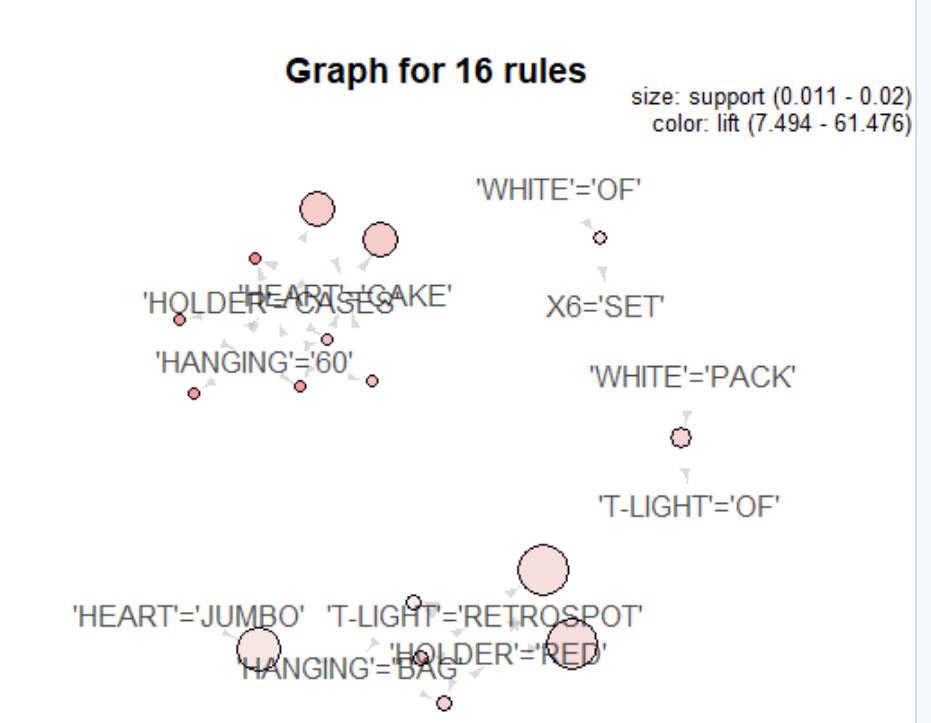
2 0.01067966 0.5780779 0.01847444 54.09248 5949

3 0.01067966 0.9993281 0.01068684 37.98210 5949

4 0.01269568 0.9908925 0.01281237 26.68698 7072

5 0.01847264 0.9140979 0.02020860 12.18301 10290

6 0.01090227 0.6255021 0.01742963 21.51597 6073

****