Final Year B. Tech. (CSE) – I : 2021-22
4CS462 : PE2 - Data Mining Lab
Assignment No. 8

Group id: DM21G12
Group members:
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Title : Apriori algorithm

Objective/Aim :

1. Implement the Apriori algorithm for generating Association Rules
2. Experiment with different values of support, confidence, and maximum rule length.
3. Tabulate the results containing frequent item sets, total number of rules generated for different support and confidence.
4. Find the interesting rules from above obtained rules using following metrics/measures
    a. Lift
    b. Chi-Square Test χ
    c. All_confidence measure
    d. Max_confidence measure
    e. Kulczynski measure
    f. Cosine measure

Introduction:

Apriori is an algorithm for frequent item set mining and association rule learning over relational databases. It proceeds by identifying the frequent individual items in the database and extending them to larger and larger item sets as long as those item sets appear sufficiently often in the database. The frequent item sets determined by Apriori can be used to determine association rules which highlight general trends in the database: this has applications in domains such as market basket analysis.

Theory/Algorithms:

Definitions of various terms

- ***Set of items:*** $I=\{I_1,I_2,\ldots,I_m\}$
- ***Transactions:*** $D=\{t_1,t_2,\ldots,t_n\}$, $t_j \subseteq I$
- ***Itemset:*** $\{I_{i1},I_{i2},\ldots,I_{ik}\} \subseteq I$
- ***Support of an itemset:*** Percentage of transactions which contain that itemset.
- ***Large (Frequent) itemset:*** **Itemset** whose number of occurrences is above a threshold.

Apriori Algorithm

1. C_1 = Itemsets of size one in I;
2. Determine all large itemsets of size 1, L_1;
3. i = 1;
4. Repeat
5. i = i + 1;
6. C_i = Apriori-Gen(L_{i-1});
7. Count C_i to determine L_i;
8. until no more large itemsets found;

Result/Observations/Screenshots:


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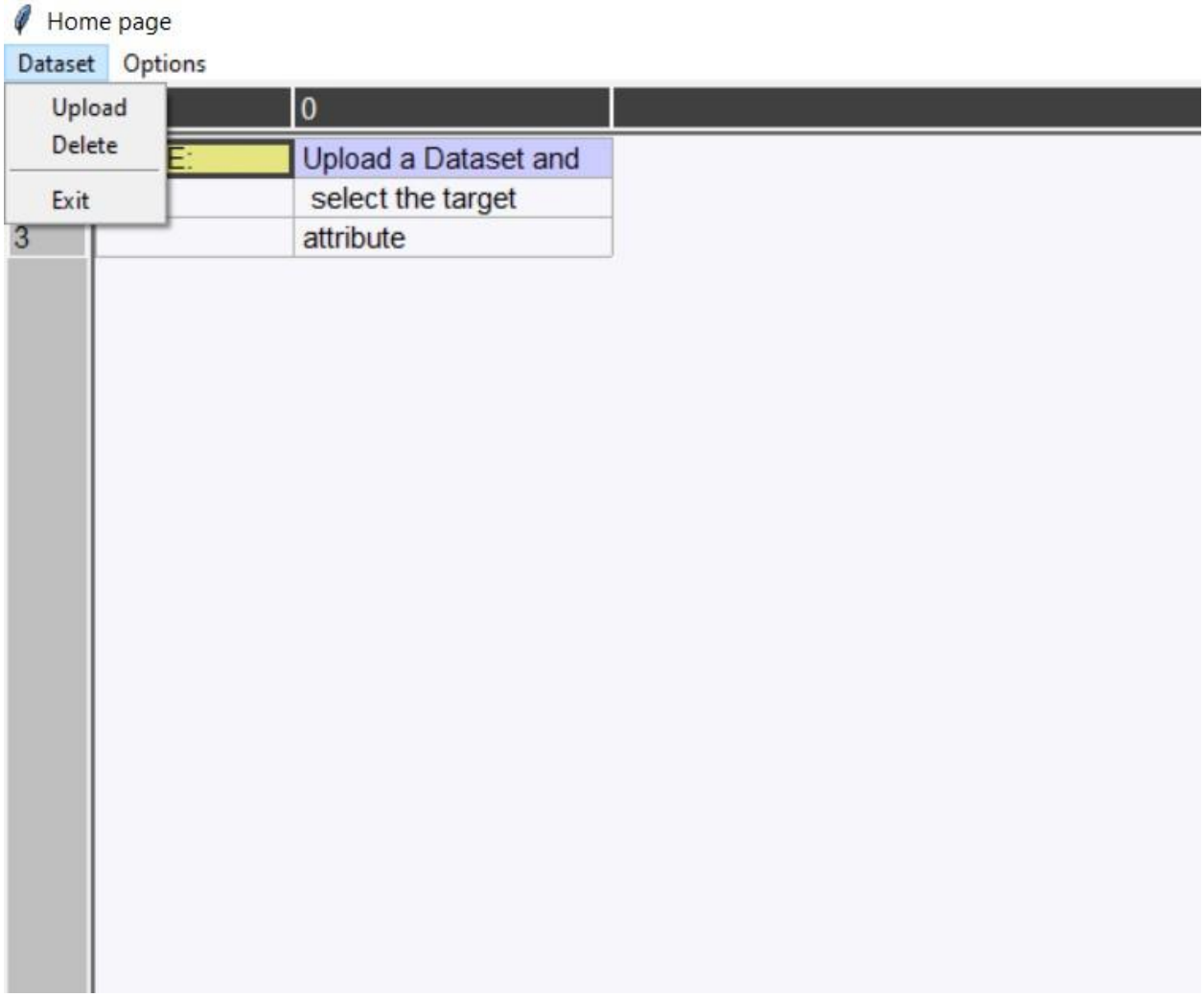
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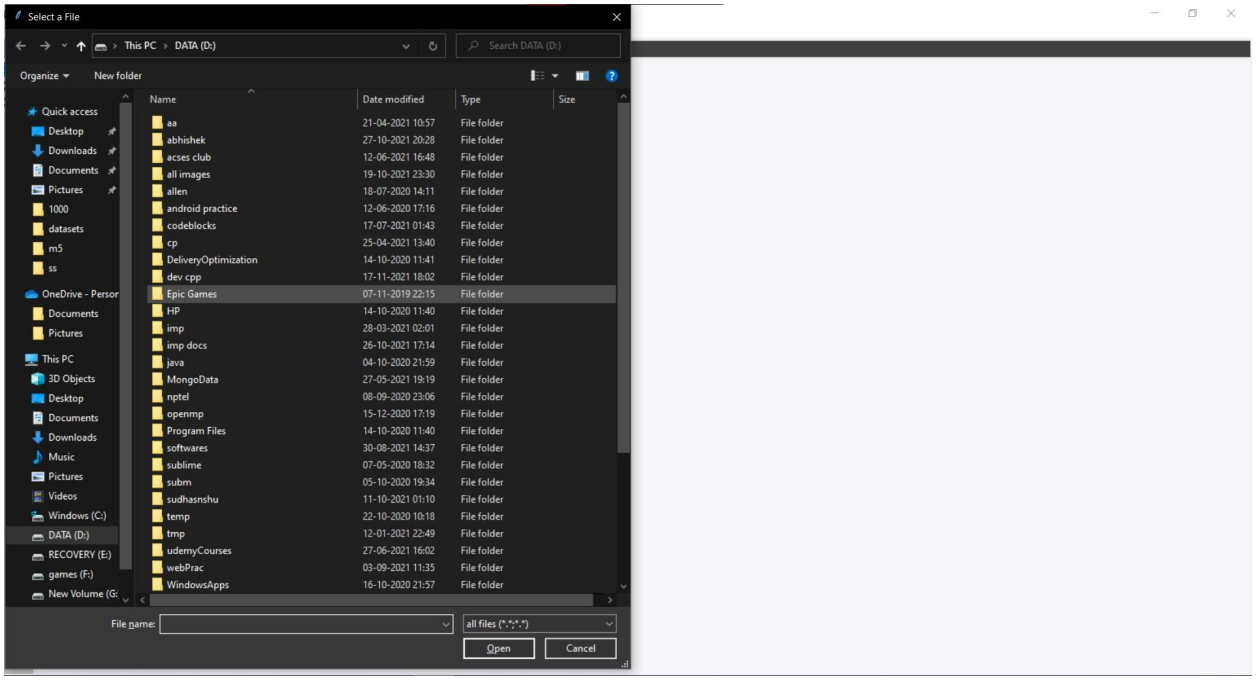
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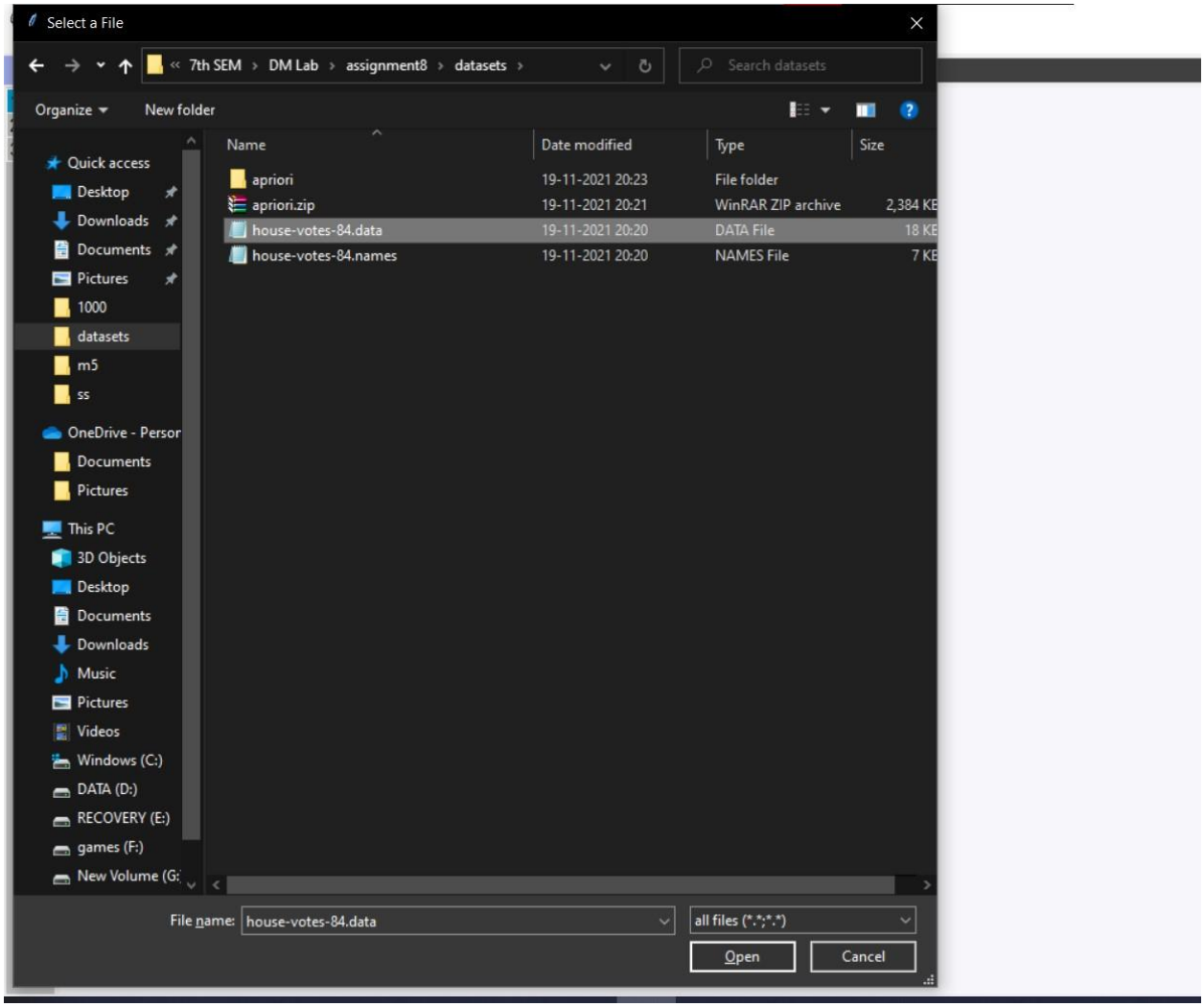
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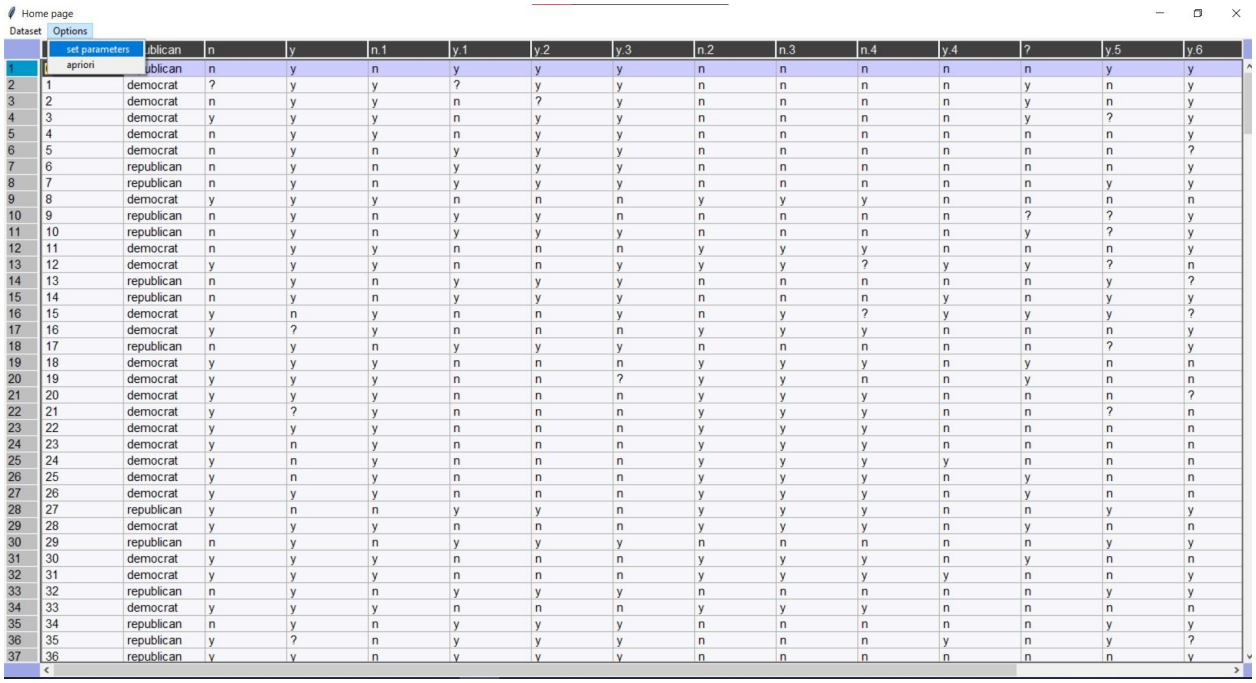

Home page

Dataset Options

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2	1	democrat	?	y	y	?
3	2	democrat	n	y	y	n
4	3					y	n
5	4					y	n
6	5					n	y
7	6					n	y
8	7					n	y
9	8					y	n
10	9					n	y
11	10	republican	n	y	n	y
12	11	democrat	n	y	y	n
13	12	democrat	y	y	y	n
14	13	republican	n	y	n	y
15	14	republican	n	y	n	y
16	15	democrat	y	n	y	n

For values of paramt...

Enter Value of min_support 0.2

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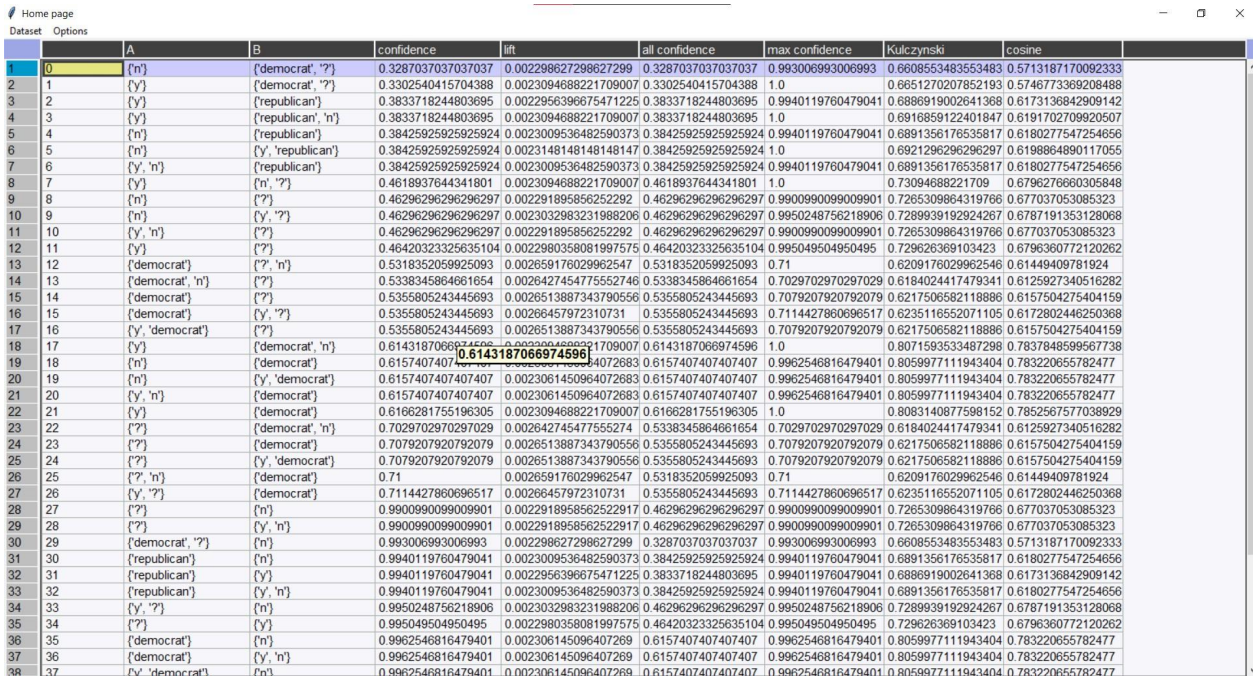
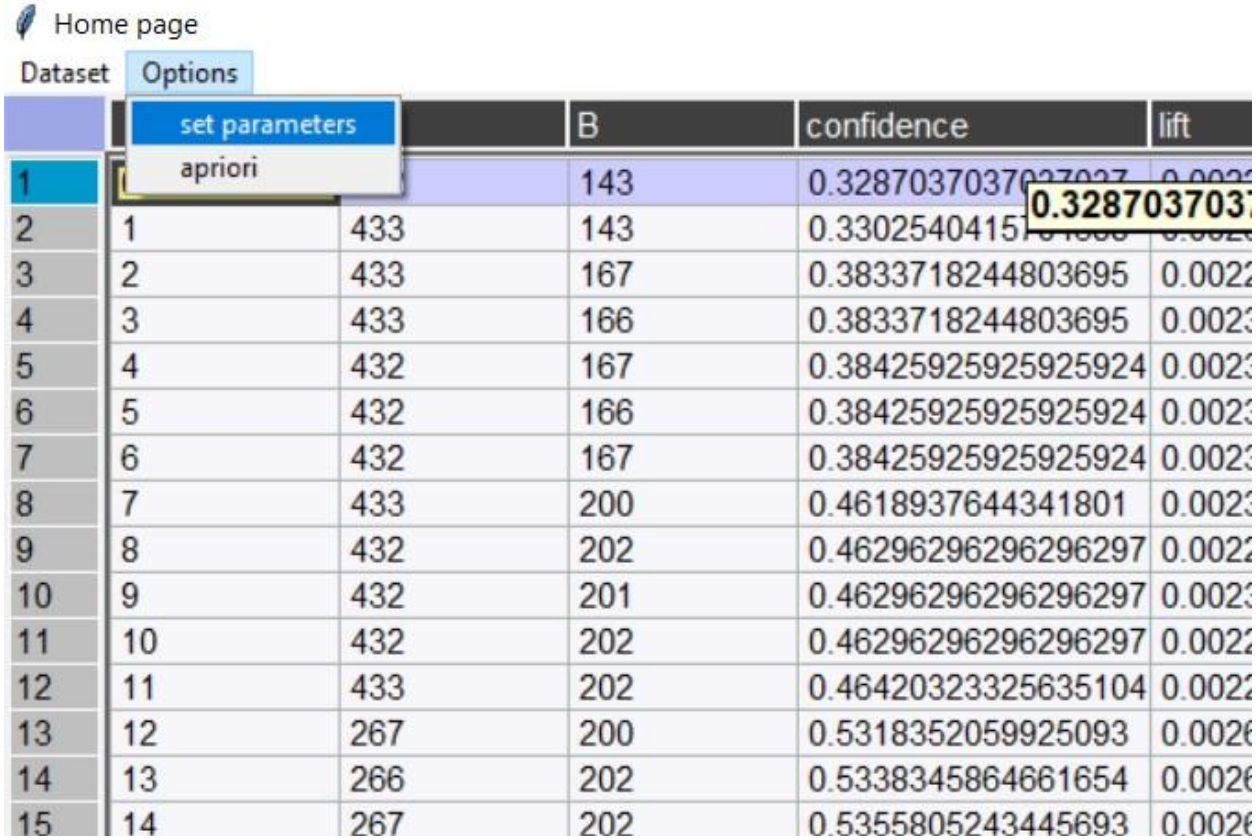
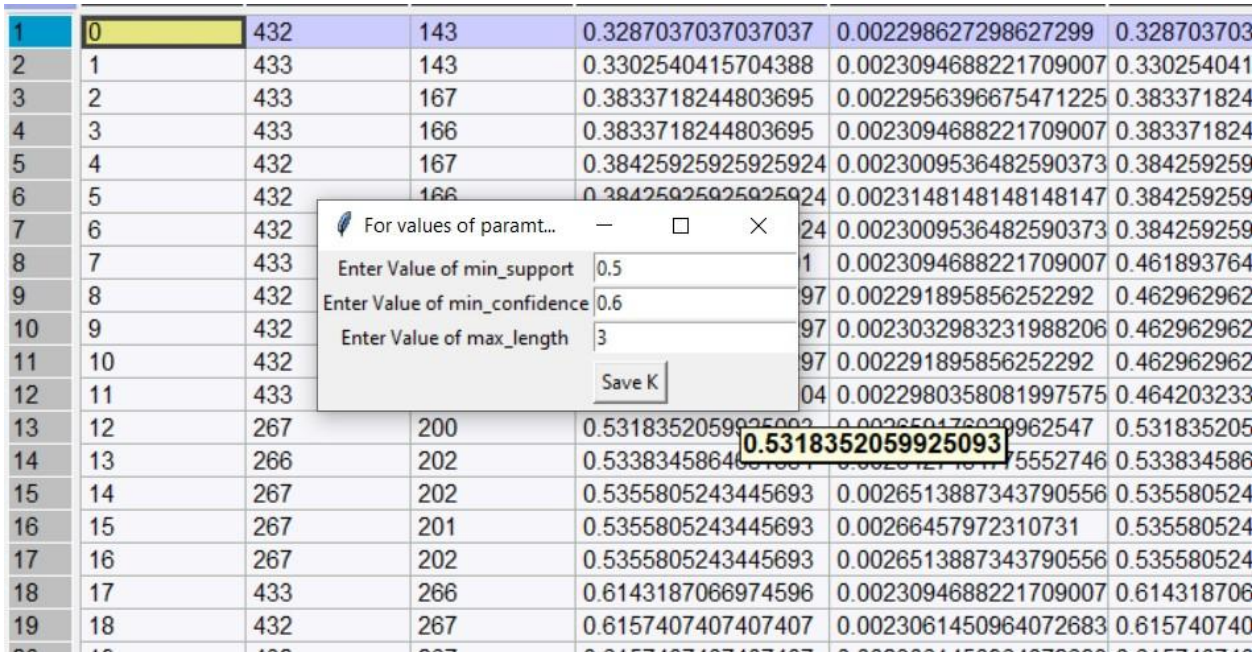
1		ublican	n	y	n	y
2	1	democrat	?	y	y	?
3	2	democrat	n	y	y	n
4	3	democrat	y	y	y	n
5	4	democrat	n	y	y	n
6	5	democrat	n	y	n	y
7	6	republican	n	y	n	y
8	7	republican	n	y	n	y
9	8	democrat	y	y	y	n
10	9	republican	n	y	n	y
11	10	republican	n	y	n	y
12	11	democrat	n	y	y	n
13	12	democrat	y	y	y	n
14	13	republican	n	y	n	y
15	14	republican	n	y	n	y
16	15	democrat	y	n	y	n
17	16	democrat	y	?	y	n
18	17	republican	n	y	n	y
19	18	democrat	y	y	y	n
20	19	democrat	y	y	y	n
21	20	democrat	y	y	y	n
22	21	democrat	y	?	y	n
23	22	democrat	y	y	y	n



		A	B	confidence	lift	all confidence	max confidence	Kulczynski	cosine
1	0	{'n'}	{'democrat', '?'}	0.3287037037037037	0.002298627298627299	0.3287037037037037	0.993006993006993	0.6608553483553483	0.5713187170092333
2	1	{'y'}	{'democrat', '?'}	0.3302540415704388	0.0023094688221709007	0.3302540415704388	1.0	0.6651270207852193	0.5746773369208488
3	2	{'y'}	{'republican'}	0.3833718244803695	0.0022956396675471225	0.3833718244803695	0.9940119760479041	0.6886919002641368	0.6173136842909142
4	3	{'y'}	{'republican', 'n'}	0.3833718244803695	0.0023094688221709007	0.3833718244803695	1.0	0.6916859122401847	0.6191702709920507
5	4	{'n'}	{'republican'}	0.38425925925925924	0.0023009536482590373	0.38425925925925924	0.9940119760479041	0.6891356176535817	0.6180277547254656
6	5	{'n'}	{'y', 'republican'}	0.38425925925925924	0.0023148148148148147	0.38425925925925924	1.0	0.6921296296296297	0.6198864890117055
7	6	{'y', 'n'}	{'republican'}	0.38425925925925924	0.0023009536482590373	0.38425925925925924	0.9940119760479041	0.6891356176535817	0.6180277547254656
8	7	{'y'}	{'n', '?'}	0.4618937644341801	0.0023094688221709007	0.4618937644341801	1.0	0.73094688221709	0.6796276660305848
9	8	{'n'}	{'?'}	0.46296296296296297	0.002291895856252292	0.46296296296296297	0.9900990099009901	0.7265309864319766	0.677037053085323
10	9	{'n'}	{'y', '?'}	0.46296296296296297	0.0023032983231988206	0.46296296296296297	0.995024875621890	0.7289939192924267	0.6787191353128068
11	10	{'y', 'n'}	{'?'}	0.46296296296296297	0.002291895856252292	0.46296296296296297	0.9900990099009901	0.7265309864319766	0.677037053085323
12	11	{'y'}	{'?'}	0.46420323325635104	0.0022980358081997575	0.46420323325635104	0.995049504950495	0.729626369103423	0.6796360721202262
13	12	{'democrat'}	{'?', 'n'}	0.5318352059925093	0.002659176029962547	0.5318352059925093	0.71	0.6209176029962546	0.61449409781924
14	13	{'democrat', 'n'}	{'?'}	0.5338345864661654	0.0026427454775552746	0.5338345864661654	0.7029702970297029	0.6184024417479341	0.6125927340516282
15	14	{'democrat'}	{'?'}	0.5355805243445693	0.0026513887343790556	0.5355805243445693	0.7079207920792079	0.6217506582118886	0.6157504275404159
16	15	{'democrat'}	{'y', '?'}	0.5355805243445693	0.0026645797231073 1	0.5355805243445693	0.7114427860696517	0.6235116552071105	0.6172802446250368
17	16	{'y', 'democrat'}	{'?'}	0.5355805243445693	0.0026513887343790556	0.5355805243445693	0.7079207920792079	0.6217506582118886	0.6157504275404159
18	17	{'y'}	{'democrat', 'n'}	0.6143187066974596	[illegible]	0.6143187066974596	1.0	0.8071593533487298	0.7837848599567738
19	18	{'n'}	{'democrat'}	0.6157407407407407	[illegible]	0.615740740740 7407	0.9962546816479401	0.8059977111943404	0.783220655782477
20	19	{'n'}	{'y', 'democrat'}	0.6157407407407407	0.0023061450964072683	0.6157407407407407	0.9962546816479401	0.8059977111943404	0.783220655782477
21	20	{'y', 'n'}	{'democrat'}	0.6157407407407407	0.0023061450964072683	0.6157407407407407	0.9962546816479401	0.8059977111943404	0.783220655782477
22	21	{'y'}	{'democrat'}	0.6166281755196305	0.0023094688221709007	0.6166281755196305	1.0	0.8083140877598152	0.7852567577038929
23	22	{'?'}	{'democrat', 'n'}	0.7029702970297029	0.002642745775555274	0.5338345864661654	0.7029702970297029	0.6184024417479341	0.6125927340516282
24	23	{'?'}	{'democrat'}	0.7079207920792079	0.0026513887343790556	0.5355805243445693	0.7079207920792079	0.6217506582118886	0.6157504275404159
25	24	{'?'}	{'y', 'democrat'}	0.7079207920792079	0.0026513887343790556	0.5355805243445693	0.7079207920792079	0.6217506582118886	0.6157504275404159
26	25	{'?', 'n'}	{'democrat'}	0.71	0.002659176029962547	0.5318352059925093	0.71	0.6209176029962546	0.61449409781924
27	26	{'y', '?'}	{'democrat'}	0.7114427860696517	0.0026645797231073 1	0.5355805243445693	0.7114427860696517	0.6235116552071105	0.6172802446250368
28	27	{'?'}	{'n'}	0.9900990099009901	0.002291895856252291 7	0.4629629629629297	0.9900990099009901	0.7265309864319766	0.677037053085323
29	28	{'?'}	{'y', 'n'}	0.9900990099009901	0.002291895856252291 7	0.4629629629629297	0.9900990099009901	0.7265309864319766	0.677037053085323
30	29	{'democrat', '?'}	{'n'}	0.99306993006993	0.002298627298627299	0.3287037037037037	0.993006993006993	0.6608553483553483	0.5713187170092333
31	30	{'republican'}	{'n'}	0.9940119760479041	0.0023009536482590373	0.38425925925925924	0.9940119760479041	0.6891356176535817	0.6180277547254656
32	31	{'republican'}	{'y'}	0.9940119760479041	0.0022956396675471225	0.3833718244803695	0.9940119760479041	0.6886919002641368	0.6173136842909142
33	32	{'republican'}	{'y', 'n'}	0.9940119760479041	0.0023009536482590373	0.38425925925925924	0.9940119760479041	0.6891356176535817	0.6180277547254656
34	33	{'y', '?'}	{'n'}	0.995024875621890	0.0023032983231988206	0.4629629629629297	0.995024875621890	0.7289939192924267	0.6787191353128068
35	34	{'?'}	{'y'}	0.995049504950495	0.0022980358081997575	0.46420323325635104	0.995049504950495	0.729626369103423	0.6796360721202262
36	35	{'democrat'}	{'n'}	0.9962546816479401	0.002306145096407269	0.6157407407407407	0.9962546816479401	0.8059977111943404	0.783220655782477
37	36	{'democrat'}	{'y', 'n'}	0.9962546816479401	0.002306145096407269	0.6157407407407407	0.9962546816479401	0.8059977111943404	0.783220655782477
38	37	{'y', 'democrat'}	{'n'}	0.9962546816479401	0.002306145096407269	0.6157407407407407	0.9962546816479401	0.8059977111943404	0.783220655782477





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3	2	433	167	0.3833718244803695	0.0022956396675471225	0.383371824
4	3	433	166	0.3833718244803695	0.0023094688221709007	0.383371824
5	4	432	167	0.38425925925925924	0.0023009536482590373	0.384259259
6	5	432	166	0.38425925925925924	0.0023148148148148147	0.384259259
7	6	432	167	0.38425925925925924	0.0023009536482590373	0.384259259
8	7	433	200	0.4618937644341801	0.0023094688221709007	0.461893764
9	8	432	202	0.4629629629629629	0.002291895856252292	0.462962962
10	9	432	201	0.4629629629629629	0.0023032983231988206	0.462962962
11	10	432	202	0.4629629629629629	0.002291895856252292	0.462962962
12	11	433	202	0.46420323325635104	0.0022980358081997575	0.464203233
13	12	267	200	0.5318352059925093	0.002659176029962547	0.531835205
14	13	266	202	0.5338345864661654	0.0026427454775552746	0.533834586
15	14	267	202	0.5355805243445693	0.0026513887343790556	0.535580524
16	15	267	201	0.5355805243445693	0.00266457972310731	0.535580524
17	16	267	202	0.5355805243445693	0.0026513887343790556	0.535580524
18	17	433	266	0.6143187066974596	0.0023094688221709007	0.614318706
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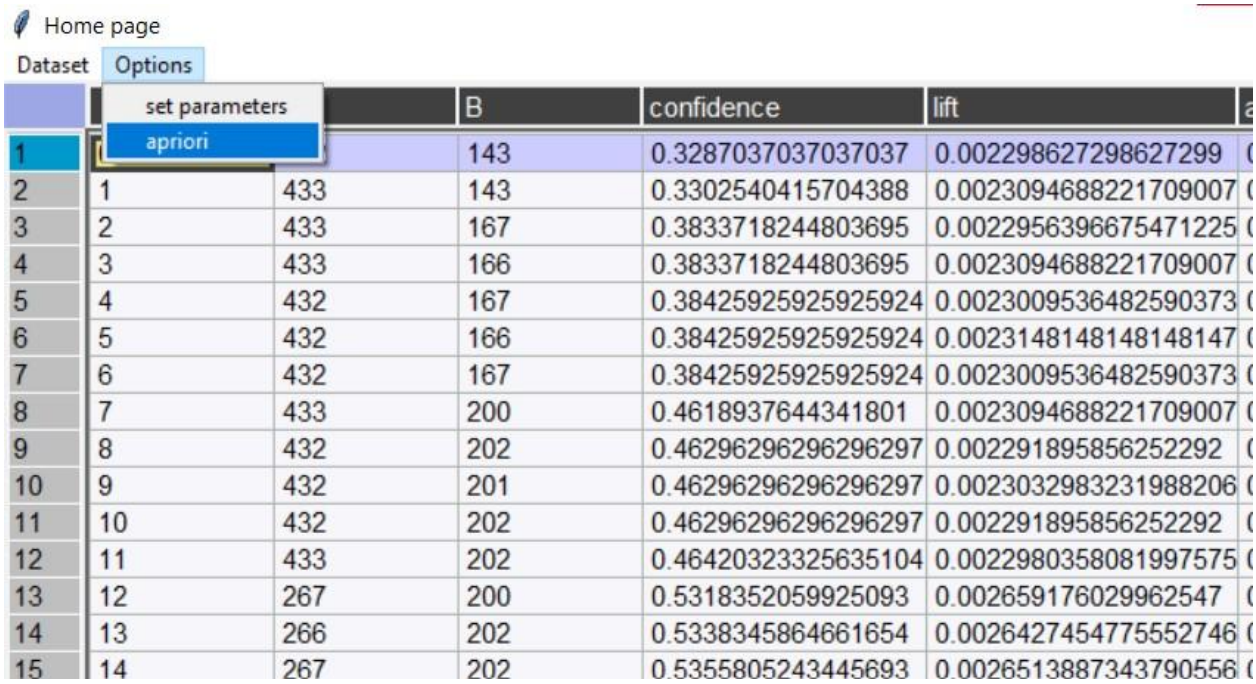
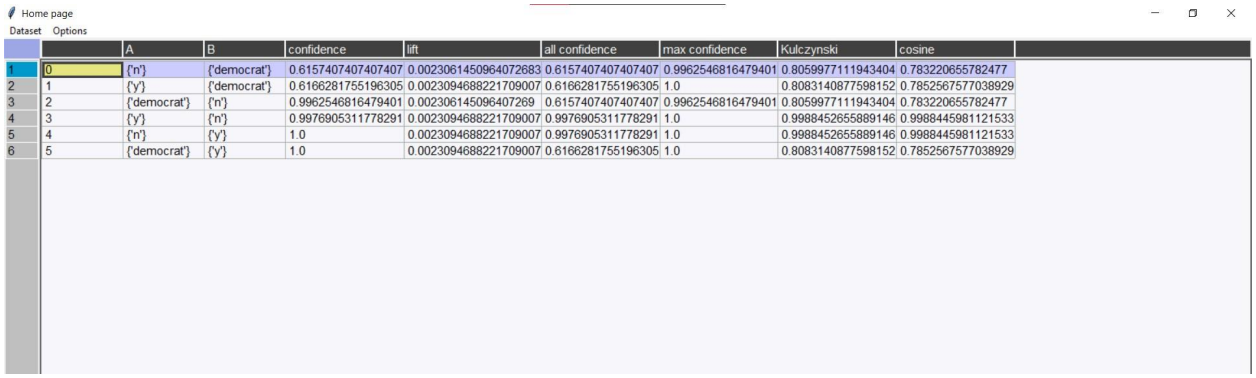


			B	confidence	lift	a
1	0	432	143	0.3287037037037037	0.002298627298627299	0
2	1	433	143	0.3302540415704388	0.0023094688221709007	0
3	2	433	167	0.3833718244803695	0.0022956396675471225	0
4	3	433	166	0.3833718244803695	0.0023094688221709007	0
5	4	432	167	0.38425925925925924	0.0023009536482590373	0
6	5	432	166	0.38425925925925924	0.0023148148148148147	0
7	6	432	167	0.38425925925925924	0.0023009536482590373	0
8	7	433	200	0.4618937644341801	0.0023094688221709007	0
9	8	432	202	0.4629629629629629	0.002291895856252292	0
10	9	432	201	0.4629629629629629	0.0023032983231988206	0
11	10	432	202	0.4629629629629629	0.002291895856252292	0
12	11	433	202	0.46420323325635104	0.0022980358081997575	0
13	12	267	200	0.5318352059925093	0.002659176029962547	0
14	13	266	202	0.5338345864661654	0.0026427454775552746	0
15	14	267	202	0.5355805243445693	0.0026513887343790556	0



		A	B	confidence	lift	all confidence	max confidence	Kulczynski	cosine
1	0	{'n'}	{'democrat'}	0.6157407407407407	0.00230614509640726 83	0.6157407407407407	0.9962546816479401	0.8059977111943404	0.783220655782477
2	1	{'y'}	{'democrat'}	0.6166281755196305	0.00230946882217090 07	0.6166281755196305	1.0	0.8083140877598152	0.7852567577038929
3	2	{'democrat'}	{'n'}	0.9962546816479401	0.00230614509640726 9	0.6157407407407407	0.9962546816479401	0.8059977111943404	0.783220655782477
4	3	{'y'}	{'n'}	0.9976905311778291	0.00230946882217090 07	0.9976905311778291	1.0	0.9988452655889146	0.9988445981121533
5	4	{'n'}	{'y'}	1.0	0.00230946882217090 07	0.9976905311778291	1.0	0.9988452655889146	0.9988445981121533
6	5	{'democrat'}	{'y'}	1.0	0.00230946882217090 07	0.6166281755196305	1.0	0.8083140877598152	0.7852567577038929

Conclusion:

1. Implemented the Apriori algorithm for generating Association Rules
2. Experimented with different values of support, confidence, and maximum rule length.
3. Tabulated the results containing frequent item sets, total number of rules generated for different support and confidence.
4. Found the interesting rules from above obtained rules using following metrics/measures
    a. Lift
    b. Chi-Square Test χ
    c. All_confidence measure
    d. Max_confidence measure
    e. Kulczynski measure
    f. Cosine measure