Homework 1

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Apriori Algorithm

The Apriori algorithm works on the Apriori principle which states that if an itemset is frequent, all of its subsets must also be frequent. To generate frequent itemsets, the Apriori algorithm uses support-based pruning to control the exponential growth of candidate itemsets.
Initially, every item is considered as a candidate-1 itemset. After counting their supports, the candidate itemsets who have support value below the minimum support threshold are discarded and the resultant is called the frequent 1-itemsets. In the subsequent iterations, the candidate 2-itemsets are generated from the previous frequent-1 itemsets and the process goes on until there are no frequent itemsets of a particular length. This describes the overall flow of the Apriori algorithm for frequent itemsets generation.

Rule Generation

It uses a level-wise approach for generating association rules where each level corresponds to the number of items that belong to the rule consequent. Initially, all the high confidence rules that have only 1 item in the rule are generated. Then these rules are used to generate new candidate rules. If any node in the lattice of association rules has low confidence, the according to the Apriori principle, the entire subgraph spanned by the node can be pruned immediately. Another form of the Apriori principle is that if a rule X -> Y does not satisfy the confidence threshold, then any rule X' -> Y – X', where X' is a subset of X must not satisfy the confidence threshold as well. This is how rules are generated from the frequent itemsets.

Task 1:

Support 30%

Support is set to be 30 percentage
Number of length-1 frequent itemsets:196
Number of length-2 frequent itemsets:5340
Number of length-3 frequent itemsets:5287
Number of length-4 frequent itemsets:1518
Number of length-5 frequent itemsets:438
Number of length-6 frequent itemsets:88
Number of length-7 frequent itemsets:11
Number of length-8 frequent itemsets:1

Support 40%

Support is set to be 40 percentage
Number of length-1 frequent itemsets:167
Number of length-2 frequent itemsets:753
Number of length-3 frequent itemsets:149
Number of length-4 frequent itemsets:7
Number of length-5 frequent itemsets:1

Support 50%

Support is set to be 50 percentage
Number of length-1 frequent itemsets:109
Number of length-2 frequent itemsets:63
Number of length-3 frequent itemsets:2

Support 60%

Support is set to be 60 percentage
Number of length-1 frequent itemsets:34
Number of length-2 frequent itemsets:2

Support 70%

Support is set to be 70 percentage
Number of length-1 frequent itemsets:7

Task 2:

Template 1:

11:

cnt= 26
result11: (Mapped as L[0] -> L[1]
[[['gene82_down'], ['gene59_up', 'gene72_up']],
 [['gene6_up'], ['gene59_up']],
 [['gene59_up'], ['gene88_down']],
 [['gene59_up'], ['gene72_up']],
 [['gene88_down'], ['gene59_up']],
 [['gene59_up', 'gene72_up'], ['gene96_down']],
 [['gene87_up'], ['gene59_up']],
 [['gene32_down'], ['gene59_up']],
 [['gene96_down', 'gene72_up'], ['gene59_up']],
 [['gene82_down'], ['gene59_up']],
 [['gene72_up'], ['gene59_up']],
 [['gene59_up'], ['gene13_down']],
 [['gene59_up'], ['gene96_down']],
 [['gene38_down'], ['gene59_up']],
 [['gene59_up'], ['gene82_down']],

[['gene96_down'], ['gene59_up']],
[['gene82_down', 'gene72_up'], ['gene59_up']],
[['gene13_down'], ['gene59_up']],
[['gene82_down', 'gene59_up'], ['gene72_up']],
[['gene59_up', 'gene96_down'], ['gene72_up']],
[['gene10_down'], ['gene59_up']],
[['gene96_down'], ['gene59_up', 'gene72_up']],
[['gene72_up'], ['gene82_down', 'gene59_up']],
[['gene59_up', 'gene72_up'], ['gene82_down']],
[['gene28_down'], ['gene59_up']],
[['gene1_up'], ['gene59_up']]]

12:
cnt= 91
result12: (Mapped as L[0] -> L[1]
[[['gene67_up'], ['gene38_down']],
[['gene38_down'], ['gene32_down']],
[['gene10_down'], ['gene70_down']],
[['gene88_down'], ['gene10_down']],
[['gene32_down'], ['gene72_up']],
[['gene38_down'], ['gene52_down']],
[['gene28_down'], ['gene52_down']],
[['gene72_up'], ['gene1_up']],
[['gene87_up'], ['gene88_down']],
[['gene38_down'], ['gene28_down']],
[['gene88_down'], ['gene28_down']],
[['gene65_down'], ['gene38_down']],
[['gene70_down'], ['gene1_up']],
[['gene24_down'], ['gene54_up']],
[['gene97_down'], ['gene72_up']],
[['gene10_down'], ['gene47_up']],
[['gene10_down'], ['gene1_up']],
[['gene88_down'], ['gene54_up']],
[['gene10_down'], ['gene38_down']],
[['gene28_down'], ['gene41_down']],
[['gene94_up'], ['gene10_down']],
[['gene6_up'], ['gene28_down']],
[['gene72_up'], ['gene82_down']],
[['gene72_up'], ['gene96_down']],
[['gene67_up'], ['gene1_up']],
[['gene8_up'], ['gene88_down']],
[['gene87_up'], ['gene28_down']],
[['gene1_up'], ['gene38_down']],
[['gene96_down'], ['gene72_up']],
[['gene70_down'], ['gene38_down']],
[['gene38_down'], ['gene47_up']],
[['gene82_down'], ['gene13_down']],

[['gene2_down'], ['gene28_down']],
[['gene88_down'], ['gene41_down']],
[['gene82_down'], ['gene72_up']],
[['gene13_down'], ['gene82_down']],
[['gene38_down'], ['gene1_up']],
[['gene96_down'], ['gene82_down']],
[['gene10_down'], ['gene94_up']],
[['gene54_up'], ['gene1_up']],
[['gene24_down'], ['gene88_down']],
[['gene28_down'], ['gene38_down']],
[['gene70_down'], ['gene10_down']],
[['gene32_down'], ['gene38_down']],
[['gene94_up'], ['gene38_down']],
[['gene88_down'], ['gene87_up']],
[['gene72_up'], ['gene13_down']],
[['gene82_down'], ['gene97_down']],
[['gene88_down'], ['gene38_down']],
[['gene88_down'], ['gene24_down']],
[['gene1_up'], ['gene67_up']],
[['gene41_down'], ['gene38_down']],
[['gene88_down'], ['gene8_up']],
[['gene38_down'], ['gene70_down']],
[['gene10_down'], ['gene28_down']],
[['gene10_down'], ['gene88_down']],
[['gene97_down'], ['gene82_down']],
[['gene1_up'], ['gene70_down']],
[['gene54_up'], ['gene88_down']],
[['gene82_down'], ['gene96_down']],
[['gene28_down'], ['gene32_down']],
[['gene13_down'], ['gene72_up']],
[['gene54_up'], ['gene24_down']],
[['gene13_down'], ['gene6_up']],
[['gene32_down'], ['gene6_up']],
[['gene28_down'], ['gene88_down']],
[['gene6_up'], ['gene13_down']],
[['gene13_down'], ['gene28_down']],
[['gene6_up'], ['gene32_down']],
[['gene28_down'], ['gene2_down']],
[['gene91_up'], ['gene38_down']],
[['gene38_down'], ['gene10_down']],
[['gene52_down'], ['gene38_down']],
[['gene41_down'], ['gene28_down']],
[['gene28_down'], ['gene6_up']],
[['gene1_up'], ['gene72_up']],
[['gene6_up'], ['gene38_down']],
[['gene28_down'], ['gene10_down']],
[['gene28_down'], ['gene13_down']],

[['gene38_down'], ['gene91_up']],
[['gene47_up'], ['gene10_down']],
[['gene1_up'], ['gene54_up']],
[['gene52_down'], ['gene28_down']],
[['gene32_down'], ['gene28_down']],
[['gene47_up'], ['gene28_down']],
[['gene47_up'], ['gene38_down']],
[['gene28_down'], ['gene47_up']],
[['gene2_down'], ['gene38_down']],
[['gene28_down'], ['gene87_up']],
[['gene1_up'], ['gene10_down']],
[['gene41_down'], ['gene88_down']]]

13:

cnt= 39

result13: (Mapped as L[0] -> L[1]

[[['gene82_down'], ['gene59_up', 'gene72_up']],
[['gene10_down'], ['gene70_down']],
[['gene6_up'], ['gene59_up']],
[['gene88_down'], ['gene10_down']],
[['gene59_up'], ['gene88_down']],
[['gene59_up'], ['gene72_up']],
[['gene88_down'], ['gene59_up']],
[['gene59_up', 'gene72_up'], ['gene96_down']],
[['gene10_down'], ['gene47_up']],
[['gene10_down'], ['gene1_up']],
[['gene10_down'], ['gene38_down']],
[['gene94_up'], ['gene10_down']],
[['gene87_up'], ['gene59_up']],
[['gene32_down'], ['gene59_up']],
[['gene96_down', 'gene72_up'], ['gene59_up']],
[['gene82_down'], ['gene59_up']],
[['gene72_up'], ['gene59_up']],
[['gene59_up'], ['gene13_down']],
[['gene59_up'], ['gene96_down']],
[['gene10_down'], ['gene94_up']],
[['gene38_down'], ['gene59_up']],
[['gene70_down'], ['gene10_down']],
[['gene59_up'], ['gene82_down']],
[['gene96_down'], ['gene59_up']],
[['gene82_down', 'gene72_up'], ['gene59_up']],
[['gene10_down'], ['gene28_down']],
[['gene13_down'], ['gene59_up']],
[['gene10_down'], ['gene88_down']],
[['gene82_down', 'gene59_up'], ['gene72_up']],
[['gene59_up', 'gene96_down'], ['gene72_up']],
[['gene96_down'], ['gene59_up', 'gene72_up']],

[['gene72_up'], ['gene82_down', 'gene59_up']],
[['gene59_up', 'gene72_up'], ['gene82_down']],
[['gene28_down'], ['gene59_up']],
[['gene1_up'], ['gene59_up']],
[['gene38_down'], ['gene10_down']],
[['gene28_down'], ['gene10_down']],
[['gene47_up'], ['gene10_down']],
[['gene1_up'], ['gene10_down']]]

14:

cnt= 9

result14: (Mapped as L[0] -> L[1]

[[['gene59_up'], ['gene13_down']],
[['gene59_up'], ['gene88_down']],
[['gene82_down', 'gene59_up'], ['gene72_up']],
[['gene59_up', 'gene96_down'], ['gene72_up']],
[['gene59_up'], ['gene96_down']],
[['gene59_up'], ['gene72_up']],
[['gene59_up', 'gene72_up'], ['gene96_down']],
[['gene59_up', 'gene72_up'], ['gene82_down']],
[['gene59_up'], ['gene82_down']]]

15:

cnt= 108

result15: (Mapped as L[0] -> L[1]

[[['gene67_up'], ['gene38_down']],
[['gene82_down'], ['gene59_up', 'gene72_up']],
[['gene38_down'], ['gene32_down']],
[['gene10_down'], ['gene70_down']],
[['gene6_up'], ['gene59_up']],
[['gene88_down'], ['gene10_down']],
[['gene32_down'], ['gene72_up']],
[['gene38_down'], ['gene52_down']],
[['gene28_down'], ['gene52_down']],
[['gene72_up'], ['gene1_up']],
[['gene87_up'], ['gene88_down']],
[['gene38_down'], ['gene28_down']],
[['gene88_down'], ['gene28_down']],
[['gene88_down'], ['gene59_up']],
[['gene65_down'], ['gene38_down']],
[['gene70_down'], ['gene1_up']],
[['gene24_down'], ['gene54_up']],
[['gene97_down'], ['gene72_up']],
[['gene10_down'], ['gene47_up']],
[['gene10_down'], ['gene1_up']],
[['gene88_down'], ['gene54_up']],
[['gene10_down'], ['gene38_down']],
[['gene28_down'], ['gene41_down']],

[['gene94_up'], ['gene10_down']],
[['gene87_up'], ['gene59_up']],
[['gene32_down'], ['gene59_up']],
[['gene6_up'], ['gene28_down']],
[['gene72_up'], ['gene82_down']],
[['gene72_up'], ['gene96_down']],
[['gene96_down', 'gene72_up'], ['gene59_up']],
[['gene67_up'], ['gene1_up']],
[['gene82_down'], ['gene59_up']],
[['gene8_up'], ['gene88_down']],
[['gene87_up'], ['gene28_down']],
[['gene1_up'], ['gene38_down']],
[['gene72_up'], ['gene59_up']],
[['gene96_down'], ['gene72_up']],
[['gene70_down'], ['gene38_down']],
[['gene38_down'], ['gene47_up']],
[['gene82_down'], ['gene13_down']],
[['gene2_down'], ['gene28_down']],
[['gene88_down'], ['gene41_down']],
[['gene82_down'], ['gene72_up']],
[['gene13_down'], ['gene82_down']],
[['gene38_down'], ['gene1_up']],
[['gene96_down'], ['gene82_down']],
[['gene10_down'], ['gene94_up']],
[['gene54_up'], ['gene1_up']],
[['gene24_down'], ['gene88_down']],
[['gene28_down'], ['gene38_down']],
[['gene38_down'], ['gene59_up']],
[['gene70_down'], ['gene10_down']],
[['gene32_down'], ['gene38_down']],
[['gene94_up'], ['gene38_down']],
[['gene88_down'], ['gene87_up']],
[['gene72_up'], ['gene13_down']],
[['gene82_down'], ['gene97_down']],
[['gene88_down'], ['gene38_down']],
[['gene88_down'], ['gene24_down']],
[['gene96_down'], ['gene59_up']],
[['gene1_up'], ['gene67_up']],
[['gene41_down'], ['gene38_down']],
[['gene82_down', 'gene72_up'], ['gene59_up']],
[['gene88_down'], ['gene8_up']],
[['gene38_down'], ['gene70_down']],
[['gene10_down'], ['gene28_down']],
[['gene13_down'], ['gene59_up']],
[['gene10_down'], ['gene88_down']],
[['gene97_down'], ['gene82_down']],
[['gene1_up'], ['gene70_down']],

[['gene10_down'], ['gene59_up']],
[['gene54_up'], ['gene88_down']],
[['gene82_down'], ['gene96_down']],
[['gene28_down'], ['gene32_down']],
[['gene13_down'], ['gene72_up']],
[['gene54_up'], ['gene24_down']],
[['gene13_down'], ['gene6_up']],
[['gene96_down'], ['gene59_up', 'gene72_up']],
[['gene32_down'], ['gene6_up']],
[['gene72_up'], ['gene82_down', 'gene59_up']],
[['gene28_down'], ['gene88_down']],
[['gene6_up'], ['gene13_down']],
[['gene13_down'], ['gene28_down']],
[['gene6_up'], ['gene32_down']],
[['gene28_down'], ['gene59_up']],
[['gene28_down'], ['gene2_down']],
[['gene1_up'], ['gene59_up']],
[['gene91_up'], ['gene38_down']],
[['gene38_down'], ['gene10_down']],
[['gene52_down'], ['gene38_down']],
[['gene41_down'], ['gene28_down']],
[['gene28_down'], ['gene6_up']],
[['gene1_up'], ['gene72_up']],
[['gene6_up'], ['gene38_down']],
[['gene28_down'], ['gene10_down']],
[['gene28_down'], ['gene13_down']],
[['gene38_down'], ['gene91_up']],
[['gene47_up'], ['gene10_down']],
[['gene1_up'], ['gene54_up']],
[['gene52_down'], ['gene28_down']],
[['gene32_down'], ['gene28_down']],
[['gene47_up'], ['gene28_down']],
[['gene47_up'], ['gene38_down']],
[['gene28_down'], ['gene47_up']],
[['gene2_down'], ['gene38_down']],
[['gene28_down'], ['gene87_up']],
[['gene1_up'], ['gene10_down']],
[['gene41_down'], ['gene88_down']]]

16:
cnt= 17
result16: (Mapped as L[0] -> L[1]
[[['gene10_down'], ['gene70_down']],
[['gene59_up'], ['gene88_down']],
[['gene10_down'], ['gene28_down']],
[['gene10_down'], ['gene88_down']],
[['gene82_down', 'gene59_up'], ['gene72_up']],

[['gene59_up', 'gene96_down'], ['gene72_up']],
[['gene59_up'], ['gene72_up']],
[['gene10_down'], ['gene59_up']],
[['gene59_up', 'gene72_up'], ['gene96_down']],
[['gene10_down'], ['gene47_up']],
[['gene10_down'], ['gene1_up']],
[['gene10_down'], ['gene38_down']],
[['gene59_up', 'gene72_up'], ['gene82_down']],
[['gene59_up'], ['gene13_down']],
[['gene59_up'], ['gene96_down']],
[['gene10_down'], ['gene94_up']],
[['gene59_up'], ['gene82_down']]]

17:

cnt= 17

result17: (Mapped as L[0] -> L[1]

[[['gene96_down', 'gene72_up'], ['gene59_up']],
[['gene82_down'], ['gene59_up', 'gene72_up']],
[['gene82_down'], ['gene59_up']],
[['gene96_down'], ['gene59_up']],
[['gene6_up'], ['gene59_up']],
[['gene82_down', 'gene72_up'], ['gene59_up']],
[['gene72_up'], ['gene59_up']],
[['gene13_down'], ['gene59_up']],
[['gene10_down'], ['gene59_up']],
[['gene88_down'], ['gene59_up']],
[['gene96_down'], ['gene59_up', 'gene72_up']],
[['gene72_up'], ['gene82_down', 'gene59_up']],
[['gene38_down'], ['gene59_up']],
[['gene87_up'], ['gene59_up']],
[['gene32_down'], ['gene59_up']],
[['gene28_down'], ['gene59_up']],
[['gene1_up'], ['gene59_up']]]

18:

cnt= 100

result18: (Mapped as L[0] -> L[1]

[[['gene67_up'], ['gene38_down']],
[['gene38_down'], ['gene32_down']],
[['gene10_down'], ['gene70_down']],
[['gene88_down'], ['gene10_down']],
[['gene32_down'], ['gene72_up']],
[['gene59_up'], ['gene88_down']],
[['gene38_down'], ['gene52_down']],
[['gene28_down'], ['gene52_down']],
[['gene72_up'], ['gene1_up']],
[['gene87_up'], ['gene88_down']],

[['gene38_down'], ['gene28_down']],
[['gene88_down'], ['gene28_down']],
[['gene59_up'], ['gene72_up']],
[['gene65_down'], ['gene38_down']],
[['gene70_down'], ['gene1_up']],
[['gene59_up', 'gene72_up'], ['gene96_down']],
[['gene24_down'], ['gene54_up']],
[['gene97_down'], ['gene72_up']],
[['gene10_down'], ['gene47_up']],
[['gene10_down'], ['gene1_up']],
[['gene88_down'], ['gene54_up']],
[['gene10_down'], ['gene38_down']],
[['gene28_down'], ['gene41_down']],
[['gene94_up'], ['gene10_down']],
[['gene6_up'], ['gene28_down']],
[['gene72_up'], ['gene82_down']],
[['gene72_up'], ['gene96_down']],
[['gene67_up'], ['gene1_up']],
[['gene8_up'], ['gene88_down']],
[['gene87_up'], ['gene28_down']],
[['gene1_up'], ['gene38_down']],
[['gene59_up'], ['gene13_down']],
[['gene96_down'], ['gene72_up']],
[['gene70_down'], ['gene38_down']],
[['gene38_down'], ['gene47_up']],
[['gene82_down'], ['gene13_down']],
[['gene2_down'], ['gene28_down']],
[['gene88_down'], ['gene41_down']],
[['gene59_up'], ['gene96_down']],
[['gene82_down'], ['gene72_up']],
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[['gene38_down'], ['gene1_up']],
[['gene96_down'], ['gene82_down']],
[['gene10_down'], ['gene94_up']],
[['gene54_up'], ['gene1_up']],
[['gene24_down'], ['gene88_down']],
[['gene28_down'], ['gene38_down']],
[['gene70_down'], ['gene10_down']],
[['gene32_down'], ['gene38_down']],
[['gene94_up'], ['gene38_down']],
[['gene88_down'], ['gene87_up']],
[['gene72_up'], ['gene13_down']],
[['gene59_up'], ['gene82_down']],
[['gene82_down'], ['gene97_down']],
[['gene88_down'], ['gene38_down']],
[['gene88_down'], ['gene24_down']],
[['gene1_up'], ['gene67_up']],

[['gene41_down'], ['gene38_down']],
[['gene88_down'], ['gene8_up']],
[['gene38_down'], ['gene70_down']],
[['gene10_down'], ['gene28_down']],
[['gene10_down'], ['gene88_down']],
[['gene97_down'], ['gene82_down']],
[['gene82_down', 'gene59_up'], ['gene72_up']],
[['gene59_up', 'gene96_down'], ['gene72_up']],
[['gene1_up'], ['gene70_down']],
[['gene54_up'], ['gene88_down']],
[['gene82_down'], ['gene96_down']],
[['gene28_down'], ['gene32_down']],
[['gene13_down'], ['gene72_up']],
[['gene54_up'], ['gene24_down']],
[['gene13_down'], ['gene6_up']],
[['gene32_down'], ['gene6_up']],
[['gene28_down'], ['gene88_down']],
[['gene59_up', 'gene72_up'], ['gene82_down']],
[['gene6_up'], ['gene13_down']],
[['gene13_down'], ['gene28_down']],
[['gene6_up'], ['gene32_down']],
[['gene28_down'], ['gene2_down']],
[['gene91_up'], ['gene38_down']],
[['gene38_down'], ['gene10_down']],
[['gene52_down'], ['gene38_down']],
[['gene41_down'], ['gene28_down']],
[['gene28_down'], ['gene6_up']],
[['gene1_up'], ['gene72_up']],
[['gene6_up'], ['gene38_down']],
[['gene28_down'], ['gene10_down']],
[['gene28_down'], ['gene13_down']],
[['gene38_down'], ['gene91_up']],
[['gene47_up'], ['gene10_down']],
[['gene1_up'], ['gene54_up']],
[['gene52_down'], ['gene28_down']],
[['gene32_down'], ['gene28_down']],
[['gene47_up'], ['gene28_down']],
[['gene47_up'], ['gene38_down']],
[['gene28_down'], ['gene47_up']],
[['gene2_down'], ['gene38_down']],
[['gene28_down'], ['gene87_up']],
[['gene1_up'], ['gene10_down']],
[['gene41_down'], ['gene88_down']]]

19:

cnt=24

result19: (Mapped as L[0] -> L[1]

```
[[['gene82_down'], ['gene59_up', 'gene72_up']],
 [['gene96_down'], ['gene59_up']],
 [['gene6_up'], ['gene59_up']],
 [['gene88_down'], ['gene10_down']],
 [['gene82_down', 'gene72_up'], ['gene59_up']],
 [['gene13_down'], ['gene59_up']],
 [['gene10_down'], ['gene59_up']],
 [['gene88_down'], ['gene59_up']],
 [['gene96_down'], ['gene59_up', 'gene72_up']],
 [['gene72_up'], ['gene82_down', 'gene59_up']],
 [['gene94_up'], ['gene10_down']],
 [['gene87_up'], ['gene59_up']],
 [['gene32_down'], ['gene59_up']],
 [['gene28_down'], ['gene59_up']],
 [['gene1_up'], ['gene59_up']],
 [['gene96_down', 'gene72_up'], ['gene59_up']],
 [['gene38_down'], ['gene10_down']],
 [['gene82_down'], ['gene59_up']],
 [['gene72_up'], ['gene59_up']],
 [['gene28_down'], ['gene10_down']],
 [['gene47_up'], ['gene10_down']],
 [['gene1_up'], ['gene10_down']],
 [['gene38_down'], ['gene59_up']],
 [['gene70_down'], ['gene10_down']]]
```

Template 2:

21:

```
cnt= 9
result21: (Mapped as L[0] -> L[1]
[[['gene96_down', 'gene72_up'], ['gene59_up']],
 [['gene82_down'], ['gene59_up', 'gene72_up']],
 [['gene82_down', 'gene72_up'], ['gene59_up']],
 [['gene82_down', 'gene59_up'], ['gene72_up']],
 [['gene59_up', 'gene96_down'], ['gene72_up']],
 [['gene59_up', 'gene72_up'], ['gene96_down']],
 [['gene96_down'], ['gene59_up', 'gene72_up']],
 [['gene72_up'], ['gene82_down', 'gene59_up']],
 [['gene59_up', 'gene72_up'], ['gene82_down']]]
```

22:

```
cnt= 6
result22: (Mapped as L[0] -> L[1]
[[['gene96_down', 'gene72_up'], ['gene59_up']],
 [['gene82_down', 'gene72_up'], ['gene59_up']],
 [['gene82_down', 'gene59_up'], ['gene72_up']],
 [['gene59_up', 'gene96_down'], ['gene72_up']],
```

[['gene59_up', 'gene72_up'], ['gene96_down']],
[['gene59_up', 'gene72_up'], ['gene82_down']]]

23:

cnt= 117

result23: (Mapped as L[0] -> L[1]

[[['gene67_up'], ['gene38_down']],
[['gene82_down'], ['gene59_up', 'gene72_up']],
[['gene38_down'], ['gene32_down']],
[['gene10_down'], ['gene70_down']],
[['gene6_up'], ['gene59_up']],
[['gene88_down'], ['gene10_down']],
[['gene32_down'], ['gene72_up']],
[['gene59_up'], ['gene88_down']],
[['gene38_down'], ['gene52_down']],
[['gene28_down'], ['gene52_down']],
[['gene72_up'], ['gene1_up']],
[['gene87_up'], ['gene88_down']],
[['gene38_down'], ['gene28_down']],
[['gene88_down'], ['gene28_down']],
[['gene59_up'], ['gene72_up']],
[['gene88_down'], ['gene59_up']],
[['gene65_down'], ['gene38_down']],
[['gene70_down'], ['gene1_up']],
[['gene59_up', 'gene72_up'], ['gene96_down']],
[['gene24_down'], ['gene54_up']],
[['gene97_down'], ['gene72_up']],
[['gene10_down'], ['gene47_up']],
[['gene10_down'], ['gene1_up']],
[['gene88_down'], ['gene54_up']],
[['gene10_down'], ['gene38_down']],
[['gene28_down'], ['gene41_down']],
[['gene94_up'], ['gene10_down']],
[['gene87_up'], ['gene59_up']],
[['gene32_down'], ['gene59_up']],
[['gene6_up'], ['gene28_down']],
[['gene72_up'], ['gene82_down']],
[['gene72_up'], ['gene96_down']],
[['gene96_down', 'gene72_up'], ['gene59_up']],
[['gene67_up'], ['gene1_up']],
[['gene82_down'], ['gene59_up']],
[['gene8_up'], ['gene88_down']],
[['gene87_up'], ['gene28_down']],
[['gene1_up'], ['gene38_down']],
[['gene72_up'], ['gene59_up']],
[['gene59_up'], ['gene13_down']],
[['gene96_down'], ['gene72_up']],

[['gene70_down'], ['gene38_down']],
[['gene38_down'], ['gene47_up']],
[['gene82_down'], ['gene13_down']],
[['gene2_down'], ['gene28_down']],
[['gene88_down'], ['gene41_down']],
[['gene59_up'], ['gene96_down']],
[['gene82_down'], ['gene72_up']],
[['gene13_down'], ['gene82_down']],
[['gene38_down'], ['gene1_up']],
[['gene96_down'], ['gene82_down']],
[['gene10_down'], ['gene94_up']],
[['gene54_up'], ['gene1_up']],
[['gene24_down'], ['gene88_down']],
[['gene28_down'], ['gene38_down']],
[['gene38_down'], ['gene59_up']],
[['gene70_down'], ['gene10_down']],
[['gene32_down'], ['gene38_down']],
[['gene94_up'], ['gene38_down']],
[['gene88_down'], ['gene87_up']],
[['gene72_up'], ['gene13_down']],
[['gene59_up'], ['gene82_down']],
[['gene82_down'], ['gene97_down']],
[['gene88_down'], ['gene38_down']],
[['gene88_down'], ['gene24_down']],
[['gene96_down'], ['gene59_up']],
[['gene1_up'], ['gene67_up']],
[['gene41_down'], ['gene38_down']],
[['gene82_down', 'gene72_up'], ['gene59_up']],
[['gene88_down'], ['gene8_up']],
[['gene38_down'], ['gene70_down']],
[['gene10_down'], ['gene28_down']],
[['gene13_down'], ['gene59_up']],
[['gene10_down'], ['gene88_down']],
[['gene97_down'], ['gene82_down']],
[['gene82_down', 'gene59_up'], ['gene72_up']],
[['gene59_up', 'gene96_down'], ['gene72_up']],
[['gene1_up'], ['gene70_down']],
[['gene10_down'], ['gene59_up']],
[['gene54_up'], ['gene88_down']],
[['gene82_down'], ['gene96_down']],
[['gene28_down'], ['gene32_down']],
[['gene13_down'], ['gene72_up']],
[['gene54_up'], ['gene24_down']],
[['gene13_down'], ['gene6_up']],
[['gene96_down'], ['gene59_up', 'gene72_up']],
[['gene32_down'], ['gene6_up']],
[['gene72_up'], ['gene82_down', 'gene59_up']],

[['gene28_down'], ['gene88_down']],
[['gene59_up', 'gene72_up'], ['gene82_down']],
[['gene6_up'], ['gene13_down']],
[['gene13_down'], ['gene28_down']],
[['gene6_up'], ['gene32_down']],
[['gene28_down'], ['gene59_up']],
[['gene28_down'], ['gene2_down']],
[['gene1_up'], ['gene59_up']],
[['gene91_up'], ['gene38_down']],
[['gene38_down'], ['gene10_down']],
[['gene52_down'], ['gene38_down']],
[['gene41_down'], ['gene28_down']],
[['gene28_down'], ['gene6_up']],
[['gene1_up'], ['gene72_up']],
[['gene6_up'], ['gene38_down']],
[['gene28_down'], ['gene10_down']],
[['gene28_down'], ['gene13_down']],
[['gene38_down'], ['gene91_up']],
[['gene47_up'], ['gene10_down']],
[['gene1_up'], ['gene54_up']],
[['gene52_down'], ['gene28_down']],
[['gene32_down'], ['gene28_down']],
[['gene47_up'], ['gene28_down']],
[['gene47_up'], ['gene38_down']],
[['gene28_down'], ['gene47_up']],
[['gene2_down'], ['gene38_down']],
[['gene28_down'], ['gene87_up']],
[['gene1_up'], ['gene10_down']],
[['gene41_down'], ['gene88_down']]]

Template 3:

31:

cnt= 24
result31: (Mapped as L[0] -> L[1]
[[['gene10_down'], ['gene70_down']],
[['gene10_down'], ['gene88_down']],
[['gene10_down'], ['gene94_up']],
[['gene10_down'], ['gene28_down']],
[['gene10_down'], ['gene59_up']],
[['gene10_down'], ['gene1_up']],
[['gene10_down'], ['gene47_up']],
[['gene10_down'], ['gene38_down']],
[['gene1_up'], ['gene59_up']],
[['gene82_down'], ['gene59_up', 'gene72_up']],
[['gene82_down', 'gene72_up'], ['gene59_up']],
[['gene32_down'], ['gene59_up']],

[['gene87_up'], ['gene59_up']],
[['gene96_down', 'gene72_up'], ['gene59_up']],
[['gene88_down'], ['gene59_up']],
[['gene6_up'], ['gene59_up']],
[['gene38_down'], ['gene59_up']],
[['gene72_up'], ['gene59_up']],
[['gene96_down'], ['gene59_up']],
[['gene13_down'], ['gene59_up']],
[['gene96_down'], ['gene59_up', 'gene72_up']],
[['gene28_down'], ['gene59_up']],
[['gene82_down'], ['gene59_up']],
[['gene72_up'], ['gene59_up', 'gene82_down']]]

32:
cnt=1
result32: (Mapped as L[0] -> L[1]
[[['gene10_down'], ['gene59_up']]]

33:
cnt=11
result33: (Mapped as L[0] -> L[1]
[[['gene10_down'], ['gene70_down']],
[['gene10_down'], ['gene88_down']],
[['gene10_down'], ['gene94_up']],
[['gene10_down'], ['gene28_down']],
[['gene10_down'], ['gene59_up']],
[['gene10_down'], ['gene1_up']],
[['gene10_down'], ['gene47_up']],
[['gene10_down'], ['gene38_down']],
[['gene82_down'], ['gene59_up', 'gene72_up']],
[['gene96_down'], ['gene59_up', 'gene72_up']],
[['gene72_up'], ['gene59_up', 'gene82_down']]]

34:
cnt=0
result34: (Mapped as L[0] -> L[1]
[]

35:
cnt= 117
result35: (Mapped as L[0] -> L[1]
[[['gene82_down'], ['gene96_down']],
[['gene2_down'], ['gene38_down']],
[['gene88_down'], ['gene54_up']],
[['gene88_down'], ['gene24_down']],
[['gene54_up'], ['gene1_up']],
[['gene32_down'], ['gene6_up']],

[['gene28_down'], ['gene88_down']],
[['gene38_down'], ['gene52_down']],
[['gene88_down'], ['gene10_down']],
[['gene8_up'], ['gene88_down']],
[['gene82_down', 'gene72_up'], ['gene59_up']],
[['gene47_up'], ['gene10_down']],
[['gene32_down'], ['gene59_up']],
[['gene65_down'], ['gene38_down']],
[['gene6_up'], ['gene38_down']],
[['gene38_down'], ['gene70_down']],
[['gene6_up'], ['gene13_down']],
[['gene70_down'], ['gene10_down']],
[['gene6_up'], ['gene28_down']],
[['gene47_up'], ['gene38_down']],
[['gene1_up'], ['gene10_down']],
[['gene59_up'], ['gene13_down']],
[['gene28_down'], ['gene2_down']],
[['gene41_down'], ['gene28_down']],
[['gene10_down'], ['gene59_up']],
[['gene38_down'], ['gene47_up']],
[['gene59_up'], ['gene72_up']],
[['gene88_down'], ['gene87_up']],
[['gene28_down'], ['gene13_down']],
[['gene97_down'], ['gene82_down']],
[['gene10_down'], ['gene38_down']],
[['gene6_up'], ['gene32_down']],
[['gene28_down'], ['gene41_down']],
[['gene38_down'], ['gene59_up']],
[['gene82_down'], ['gene97_down']],
[['gene38_down'], ['gene1_up']],
[['gene97_down'], ['gene72_up']],
[['gene2_down'], ['gene28_down']],
[['gene59_up', 'gene72_up'], ['gene82_down']],
[['gene59_up'], ['gene88_down']],
[['gene10_down'], ['gene28_down']],
[['gene88_down'], ['gene28_down']],
[['gene1_up'], ['gene70_down']],
[['gene72_up'], ['gene13_down']],
[['gene13_down'], ['gene59_up']],
[['gene96_down'], ['gene59_up', 'gene72_up']],
[['gene32_down'], ['gene72_up']],
[['gene28_down'], ['gene87_up']],
[['gene59_up', 'gene82_down'], ['gene72_up']],
[['gene47_up'], ['gene28_down']],
[['gene28_down'], ['gene10_down']],
[['gene96_down', 'gene59_up'], ['gene72_up']],
[['gene59_up'], ['gene82_down']],

[['gene28_down'], ['gene47_up']],
[['gene82_down'], ['gene59_up']],
[['gene1_up'], ['gene54_up']],
[['gene13_down'], ['gene82_down']],
[['gene70_down'], ['gene38_down']],
[['gene38_down'], ['gene10_down']],
[['gene28_down'], ['gene6_up']],
[['gene70_down'], ['gene1_up']],
[['gene28_down'], ['gene52_down']],
[['gene72_up'], ['gene59_up', 'gene82_down']],
[['gene24_down'], ['gene54_up']],
[['gene1_up'], ['gene59_up']],
[['gene10_down'], ['gene70_down']],
[['gene94_up'], ['gene10_down']],
[['gene52_down'], ['gene38_down']],
[['gene72_up'], ['gene1_up']],
[['gene54_up'], ['gene88_down']],
[['gene38_down'], ['gene91_up']],
[['gene10_down'], ['gene94_up']],
[['gene82_down'], ['gene59_up', 'gene72_up']],
[['gene1_up'], ['gene38_down']],
[['gene59_up', 'gene72_up'], ['gene96_down']],
[['gene72_up'], ['gene96_down']],
[['gene87_up'], ['gene59_up']],
[['gene88_down'], ['gene38_down']],
[['gene38_down'], ['gene28_down']],
[['gene87_up'], ['gene28_down']],
[['gene28_down'], ['gene32_down']],
[['gene94_up'], ['gene38_down']],
[['gene96_down', 'gene72_up'], ['gene59_up']],
[['gene59_up'], ['gene96_down']],
[['gene13_down'], ['gene28_down']],
[['gene88_down'], ['gene8_up']],
[['gene82_down'], ['gene13_down']],
[['gene91_up'], ['gene38_down']],
[['gene88_down'], ['gene59_up']],
[['gene1_up'], ['gene72_up']],
[['gene10_down'], ['gene1_up']],
[['gene72_up'], ['gene82_down']],
[['gene41_down'], ['gene38_down']],
[['gene10_down'], ['gene47_up']],
[['gene67_up'], ['gene1_up']],
[['gene32_down'], ['gene28_down']],
[['gene6_up'], ['gene59_up']],
[['gene67_up'], ['gene38_down']],
[['gene38_down'], ['gene32_down']],
[['gene72_up'], ['gene59_up']],

```
 [['gene96_down'], ['gene82_down']],
 [['gene10_down'], ['gene88_down']],
 [['gene1_up'], ['gene67_up']],
 [['gene41_down'], ['gene88_down']],
 [['gene96_down'], ['gene59_up']],
 [['gene54_up'], ['gene24_down']],
 [['gene32_down'], ['gene38_down']],
 [['gene52_down'], ['gene28_down']],
 [['gene82_down'], ['gene72_up']],
 [['gene88_down'], ['gene41_down']],
 [['gene28_down'], ['gene38_down']],
 [['gene96_down'], ['gene72_up']],
 [['gene24_down'], ['gene88_down']],
 [['gene28_down'], ['gene59_up']],
 [['gene13_down'], ['gene72_up']],
 [['gene87_up'], ['gene88_down']],
 [['gene13_down'], ['gene6_up']]]
```

36:

```
cnt= 3
result36: (Mapped as L[0] -> L[1]
[[['gene82_down'], ['gene59_up', 'gene72_up']],
 [['gene96_down'], ['gene59_up', 'gene72_up']],
 [['gene72_up'], ['gene59_up', 'gene82_down']]]
```