


```

        evidence_card = [2, 2])
cpd_security = TabularCPD("security", 2,
                           [[.01, .5, .75, .31], [.99, 0.5, .25, .69]],
                           evidence = ["payment", "housing"],
                           evidence_card = [2, 2])

# Add the CPDs to the model
model.add_cpds(*[cpd_income, cpd_housing, cpd_deposit,
                  cpd_payment, cpd_security])

```

Question

Indicate whether the following independence statements are true or false according to this model. Provide a very brief justification of your answer (not more than two or three sentences)

- **Income \perp Security** - False. There's an active information path $I \rightarrow P \rightarrow S$.
 - **Income \perp Security | Payment** - True. Specifying payment breaks active paths between income and security.
 - **Income \perp Payment** - False. Income and payment have a direct connection.
 - **Income \perp Security | Payment, Deposit** - True. Specifying payment alone breaks all the direct connections between income and security
 - **Deposit \perp Payment** - False. There is a direct connection between the two
 - **Income \perp Payment | Deposit** - False. Income and payment have a direct edge; Specifying deposit might stop the influence of payment on income through deposit but there's still a direct connection through which independence can't be established.
-

Question

Show the factorized form of the joint distribution over all of the variables, $P(A, B, C, D, E)$

$$P(A, B, C, D, E) = P(A) \times P(B|A) \times P(C|B, A) \times P(E|C, B, A) \times P(D|E, C, B, A)$$

$$\therefore P(A, B, C, D, E) = P(A) \times P(B|A) \times P(C|B, A) \times P(E) \times P(D|E, C)$$

First, applying the chain rule of probability and second, since we know the structure of the graph, expressing individual CPDs in the form $P(X|Pa(X))$.

Question

Find out probability for payment is false, when no prior information is available.

```

In [ ]: infer = VariableElimination(model)
g_dist = infer.query(["income", "deposit", "payment",
                      "housing", "security"])

```

```
g_dist.marginalize(["income", "deposit", "housing", "security"])
print(g_dist)
```

```
+-----+-----+
| payment | phi(payment) |
+=====+=====+
| payment(0) | 0.4935 |
+-----+-----+
| payment(1) | 0.5065 |
+-----+-----+
```

From the above, the probability that the payment is false is 0.4935

Question

What is the probability that you have got Payment, given that the income is low?

$$P(\bar{C}|\bar{A})=?$$

```
In [ ]: infer = VariableElimination(model)
g_dist = infer.query(["income", "deposit", "payment",
                     "housing", "security"])
g_dist.marginalize(["deposit", "housing", "security"])
print(g_dist)
```

```
+-----+-----+-----+
| income | payment | phi(income,payment) |
+=====+=====+=====+
| income(0) | payment(0) | 0.1365 |
+-----+-----+-----+
| income(0) | payment(1) | 0.1635 |
+-----+-----+-----+
| income(1) | payment(0) | 0.3570 |
+-----+-----+-----+
| income(1) | payment(1) | 0.3430 |
+-----+-----+-----+
```

```
In [ ]: cbar_and_abar = g_dist.values[1][1]
```

```
In [ ]: g_dist.marginalize(["payment"])
print(g_dist)
```

```
+-----+-----+
| income | phi(income) |
+=====+=====+
| income(0) | 0.3000 |
+-----+-----+
| income(1) | 0.7000 |
+-----+-----+
```

```
In [ ]: cbar = g_dist.values[1]
```

```
In [ ]: p_cbar_given_abar = cbar_and_abar / cbar
p_cbar_given_abar
```

Out[]: 0.49

The probability of getting payment given low income is 0.49

Question

What is the probability that you have got Payment, given that the income is low and you have large deposits?

$$P(\bar{C}|\bar{A}, B) = ?$$

```
In [ ]: infer = VariableElimination(model)
g_dist = infer.query(["income", "deposit", "payment",
                     "housing", "security"])
g_dist.marginalize(["housing", "security"])
p_cbar_abar_b = g_dist.values[1][0][1]
p_cbar_abar_b
```

Out[]: 0.23099999999999998

```
In [ ]: g_dist.marginalize(["payment"])
p_abar_b = g_dist.values[1][0]
p_abar_b
```

Out[]: 0.42

```
In [ ]: p_cbar_given_abar_b = p_cbar_abar_b / p_abar_b
p_cbar_given_abar_b
```

Out[]: 0.5499999999999999

Probability of getting payment given that the income is low and having high deposits is 0.55

Question

What is the probability that you didn't default in payment given high income and no security is given?

$$P(\bar{C}|A, \bar{D}) = ?$$

```
In [ ]: infer = VariableElimination(model)
g_dist = infer.query(["income", "deposit", "payment",
                     "housing", "security"])
g_dist.marginalize(["deposit", "housing"])
p_cbar_adbar = g_dist.values[0][1][1]
p_cbar_adbar
```

Out[]: 0.08763599999999999

```
In [ ]: g_dist.marginalize(["payment"])
p_a_dbar = g_dist.values[0][1]
p_a_dbar
```

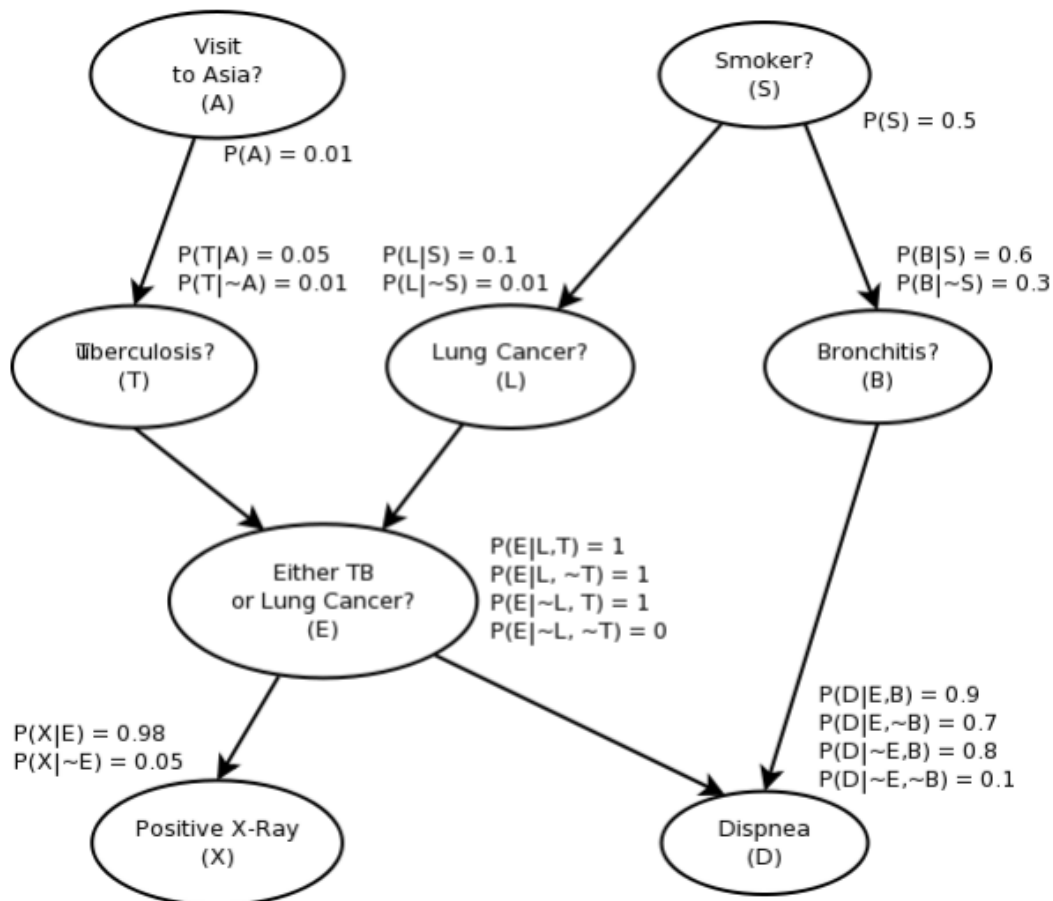
Out[]: 0.17929575

```
In [ ]: p_cbar_given_a_dbar = p_cbar_a_dbar / p_a_dbar
p_cbar_given_a_dbar
```

Out[]: 0.48877901456113704

Probability of not defaulting in payment given high income and no security is 0.4888

Question 2



```
In [ ]: # Create a DAG
g = DAG()

# Add nodes to the DAG
g.add_nodes_from(["asia", "smoker", "tb", "lung_cancer", "bronchitis",
```

```

        "tb_or_lc", "xray", "dispnea"]])

# Define relationships in the DAG
g.add_edges_from(ebunch = [("asia", "tb"), ("smoker", "lung_cancer"),
                           ("smoker", "bronchitis"), ("tb", "tb_or_lc"),
                           ("lung_cancer", "tb_or_lc"), ("tb_or_lc", "xray"),
                           ("tb_or_lc", "dispnea"), ("bronchitis", "dispnea")])

# Marginal Distribution of Visiting Asia
cpd_asia = TabularCPD('asia', 2, [[0.01], [0.99]])

# Marginal Distribution of Smoking
cpd_smoker = TabularCPD("smoker", 2, [[0.5], [0.5]])

# Conditional Distribution of TB given visit to Asia
cpd_tb = TabularCPD("tb", 2, [[0.05, .01], [0.95, 0.99]],
                    evidence = ["asia"], evidence_card = [2])

# Conditional Distribution of Lung Cancer given smoker
cpd_lc = TabularCPD("lung_cancer", 2, [[.1, .01], [.9, .99]],
                    evidence = ["smoker"], evidence_card = [2])

# Conditional Distribution of Bronchitis given smoker
cpd_bronchitis = TabularCPD("bronchitis", 2, [[.6, .3], [.4, .7]],
                            evidence = ["smoker"], evidence_card = [2])

# TB or Lung Cancer Node modelling
cpd_lc_or_tb = TabularCPD("tb_or_lc", 2, [[1, 1, 1, 0], [0, 0, 0, 1]],
                        evidence = ["tb", "lung_cancer"],
                        evidence_card = [2, 2])

# Conditional Distribution of xray given tb or lc
cpd_xray = TabularCPD("xray", 2, [[.98, .05], [.02, .95]],
                    evidence = ["tb_or_lc"],
                    evidence_card = [2])

# Conditional Distribution of dispnea given bronchitis or either of lc/tb
cpd_dispnea = TabularCPD("dispnea", 2, [[.9, .8, .7, .1], [.1, .2, .3, .9]],
                        evidence = ["bronchitis", "tb_or_lc"],
                        evidence_card = [2, 2])

# Create a BN model and add all the conditional distributions
model = BayesianNetwork(g)
model.add_cpds(*[cpd_asia, cpd_smoker, cpd_tb, cpd_lc, cpd_bronchitis, cpd_l

```

Question

What is the probability that you have the tuberculosis, given that you have visited Asia, you have Lung Cancer, and you know that you have positive x-ray?

To find: $P(T|A, L, E, X) = \frac{P(T, A, L, E, X)}{P(A, L, E, X)}$

```
In [ ]: infer = VariableElimination(model)
```

```
g_dist = infer.query(["asia", "smoker", "tb", "lung_cancer",
                     "bronchitis", "tb_or_lc", "xray", "dispnea"])
g_dist.marginalize(["smoker", "bronchitis", "dispnea"])
p_talex = g_dist.values[0][0][0][0][0]
p_talex
```

Out[]: 2.6950000000000005e-05

```
In [ ]: g_dist.marginalize(["tb"])
p_alex = g_dist.values[0][0][0][0]
p_alex
```

Out[]: 0.00053900000000000001

```
In [ ]: required_cpd = p_talex / p_alex
required_cpd
```

Out[]: 0.05

The probability that you have the tuberculosis, given that you have visited Asia, you have Lung Cancer, and you know that you have positive x-ray is **0.05**.

Question

What is the probability of having Dispnea given that you have positive x-ray

To find: $P(D|X) = \frac{P(D,X)}{P(X)}$

```
In [ ]: infer = VariableElimination(model)
g_dist = infer.query(["asia", "smoker", "tb", "lung_cancer",
                     "bronchitis", "tb_or_lc", "xray", "dispnea"])
g_dist.marginalize(["asia", "smoker", "tb", "lung_cancer",
                     "bronchitis", "tb_or_lc"])
p_dx = g_dist.values[0][0]
p_dx
```

Out[]: 0.070670104400000002

```
In [ ]: g_dist.marginalize(["dispnea"])
p_xray = g_dist.values[0]
p_xray
```

Out[]: 0.110290040000000003

```
In [ ]: p_d_given_x = p_dx / p_xray
p_d_given_x
```

Out[]: 0.6407659694384007

Probability of having dispnea given positive X-ray is **0.641**.

Question

List all the independencies in the given graph

```
In [ ]: print(model.get_independencies())
```


(xray ⊥ dispnea, tb, bronchitis, lung_cancer, asia, smoker | tb_or_lc)
(xray ⊥ asia | tb)
(xray ⊥ smoker, bronchitis | lung_cancer)
(xray ⊥ bronchitis | smoker)
(xray ⊥ tb, bronchitis, lung_cancer, asia, smoker | dispnea, tb_or_lc)
(xray ⊥ asia | dispnea, tb)
(xray ⊥ dispnea, bronchitis, lung_cancer, asia, smoker | tb_or_lc, tb)
(xray ⊥ dispnea, tb, lung_cancer, asia, smoker | tb_or_lc, bronchitis)
(xray ⊥ dispnea, tb, bronchitis, asia, smoker | lung_cancer, tb_or_lc)
(xray ⊥ dispnea, tb, bronchitis, lung_cancer, smoker | asia, tb_or_lc)
(xray ⊥ dispnea, tb, bronchitis, lung_cancer, asia | tb_or_lc, smoker)
(xray ⊥ asia | bronchitis, tb)
(xray ⊥ asia, bronchitis, smoker | lung_cancer, tb)
(xray ⊥ asia, bronchitis | smoker, tb)
(xray ⊥ smoker | lung_cancer, bronchitis)
(xray ⊥ smoker, bronchitis | lung_cancer, asia)
(xray ⊥ bronchitis | lung_cancer, smoker)
(xray ⊥ bronchitis | asia, smoker)
(xray ⊥ lung_cancer, asia, bronchitis, smoker | dispnea, tb_or_lc, tb)
(xray ⊥ lung_cancer, asia, tb, smoker | dispnea, tb_or_lc, bronchitis)
(xray ⊥ tb, asia, bronchitis, smoker | lung_cancer, dispnea, tb_or_lc)
(xray ⊥ lung_cancer, tb, smoker, bronchitis | dispnea, tb_or_lc, asia)
(xray ⊥ lung_cancer, tb, asia, bronchitis | dispnea, tb_or_lc, smoker)
(xray ⊥ asia | bronchitis, dispnea, tb)
(xray ⊥ asia | lung_cancer, dispnea, tb)
(xray ⊥ asia | dispnea, smoker, tb)
(xray ⊥ smoker | lung_cancer, dispnea, bronchitis)
(xray ⊥ lung_cancer, dispnea, asia, smoker | bronchitis, tb_or_lc, tb)
(xray ⊥ dispnea, asia, bronchitis, smoker | lung_cancer, tb_or_lc, tb)
(xray ⊥ lung_cancer, dispnea, smoker, bronchitis | asia, tb_or_lc, tb)
(xray ⊥ lung_cancer, dispnea, asia, bronchitis | tb_or_lc, tb, smoker)
(xray ⊥ dispnea, asia, tb, smoker | lung_cancer, tb_or_lc, bronchitis)
(xray ⊥ lung_cancer, dispnea, tb, smoker | asia, tb_or_lc, bronchitis)
(xray ⊥ lung_cancer, dispnea, asia, tb | tb_or_lc, bronchitis, smoker)
(xray ⊥ tb, dispnea, smoker, bronchitis | lung_cancer, asia, tb_or_lc)
(xray ⊥ tb, dispnea, asia, bronchitis | lung_cancer, tb_or_lc, smoker)
(xray ⊥ lung_cancer, dispnea, tb, bronchitis | asia, tb_or_lc, smoker)
(xray ⊥ asia, smoker | bronchitis, lung_cancer, tb)
(xray ⊥ asia | bronchitis, smoker, tb)
(xray ⊥ smoker, bronchitis | lung_cancer, asia, tb)
(xray ⊥ asia, bronchitis | lung_cancer, smoker, tb)
(xray ⊥ bronchitis | asia, tb, smoker)
(xray ⊥ smoker | lung_cancer, asia, bronchitis)
(xray ⊥ bronchitis | lung_cancer, asia, smoker)
(xray ⊥ lung_cancer, asia, smoker | bronchitis, dispnea, tb_or_lc, tb)
(xray ⊥ asia, bronchitis, smoker | lung_cancer, dispnea, tb_or_lc, tb)
(xray ⊥ lung_cancer, bronchitis, smoker | dispnea, tb_or_lc, tb, asia)
(xray ⊥ lung_cancer, asia, bronchitis | dispnea, tb_or_lc, tb, smoker)
(xray ⊥ asia, tb, smoker | lung_cancer, dispnea, tb_or_lc, bronchitis)
(xray ⊥ lung_cancer, tb, smoker | dispnea, tb_or_lc, bronchitis, asia)
(xray ⊥ lung_cancer, asia, tb | dispnea, tb_or_lc, bronchitis, smoker)
(xray ⊥ tb, smoker, bronchitis | lung_cancer, dispnea, tb_or_lc, asia)
(xray ⊥ tb, asia, bronchitis | lung_cancer, dispnea, tb_or_lc, smoker)
(xray ⊥ lung_cancer, tb, bronchitis | dispnea, tb_or_lc, smoker, asia)
(xray ⊥ asia, smoker | bronchitis, dispnea, lung_cancer, tb)
(xray ⊥ asia | bronchitis, dispnea, smoker, tb)

```

(xray ⊥ asia | lung_cancer, dispnea, smoker, tb)
(xray ⊥ smoker | lung_cancer, dispnea, asia, bronchitis)
(xray ⊥ dispnea, asia, smoker | bronchitis, lung_cancer, tb_or_lc, tb)
(xray ⊥ lung_cancer, dispnea, smoker | bronchitis, asia, tb_or_lc, tb)
(xray ⊥ lung_cancer, dispnea, asia | bronchitis, tb_or_lc, tb, smoker)
(xray ⊥ bronchitis, dispnea, smoker | lung_cancer, asia, tb_or_lc, tb)
(xray ⊥ dispnea, asia, bronchitis | lung_cancer, tb_or_lc, tb, smoker)
(xray ⊥ lung_cancer, dispnea, bronchitis | asia, tb_or_lc, tb, smoker)
(xray ⊥ tb, dispnea, smoker | lung_cancer, asia, tb_or_lc, bronchitis)
(xray ⊥ dispnea, asia, tb | lung_cancer, tb_or_lc, bronchitis, smoker)
(xray ⊥ lung_cancer, dispnea, tb | asia, tb_or_lc, bronchitis, smoker)
(xray ⊥ tb, dispnea, bronchitis | lung_cancer, asia, tb_or_lc, smoker)
(xray ⊥ smoker | bronchitis, lung_cancer, asia, tb)
(xray ⊥ asia | bronchitis, lung_cancer, smoker, tb)
(xray ⊥ bronchitis | lung_cancer, asia, tb, smoker)
(xray ⊥ asia, smoker | tb_or_lc, dispnea, bronchitis, tb, lung_cancer)
(xray ⊥ lung_cancer, smoker | tb_or_lc, asia, dispnea, bronchitis, tb)
(xray ⊥ lung_cancer, asia | tb_or_lc, dispnea, bronchitis, tb, smoker)
(xray ⊥ bronchitis, smoker | tb_or_lc, asia, dispnea, tb, lung_cancer)
(xray ⊥ asia, bronchitis | tb_or_lc, dispnea, tb, lung_cancer, smoker)
(xray ⊥ lung_cancer, bronchitis | tb_or_lc, asia, dispnea, tb, smoker)
(xray ⊥ tb, smoker | tb_or_lc, asia, dispnea, bronchitis, lung_cancer)
(xray ⊥ asia, tb | tb_or_lc, dispnea, bronchitis, lung_cancer, smoker)
(xray ⊥ lung_cancer, tb | tb_or_lc, asia, dispnea, bronchitis, smoker)
(xray ⊥ tb, bronchitis | tb_or_lc, asia, dispnea, lung_cancer, smoker)
(xray ⊥ smoker | asia, dispnea, bronchitis, tb, lung_cancer)
(xray ⊥ asia | dispnea, bronchitis, tb, lung_cancer, smoker)
(xray ⊥ dispnea, smoker | tb_or_lc, asia, bronchitis, tb, lung_cancer)
(xray ⊥ dispnea, asia | tb_or_lc, bronchitis, tb, lung_cancer, smoker)
(xray ⊥ lung_cancer, dispnea | tb_or_lc, asia, bronchitis, tb, smoker)
(xray ⊥ dispnea, bronchitis | tb_or_lc, asia, tb, lung_cancer, smoker)
(xray ⊥ dispnea, tb | tb_or_lc, asia, bronchitis, lung_cancer, smoker)
(xray ⊥ smoker | tb_or_lc, asia, dispnea, bronchitis, tb, lung_cancer)
(xray ⊥ asia | tb_or_lc, dispnea, bronchitis, tb, lung_cancer, smoker)
(xray ⊥ lung_cancer | tb_or_lc, asia, dispnea, bronchitis, tb, smoker)
(xray ⊥ bronchitis | tb_or_lc, asia, dispnea, tb, lung_cancer, smoker)
(xray ⊥ tb | tb_or_lc, asia, dispnea, bronchitis, lung_cancer, smoker)
(xray ⊥ dispnea | tb_or_lc, asia, bronchitis, tb, lung_cancer, smoker)
(tb_or_lc ⊥ asia | tb)
(tb_or_lc ⊥ smoker, bronchitis | lung_cancer)
(tb_or_lc ⊥ bronchitis | smoker)
(tb_or_lc ⊥ asia | xray, tb)
(tb_or_lc ⊥ smoker, bronchitis | xray, lung_cancer)
(tb_or_lc ⊥ bronchitis | xray, smoker)
(tb_or_lc ⊥ asia | dispnea, tb)
(tb_or_lc ⊥ asia | bronchitis, tb)
(tb_or_lc ⊥ asia, bronchitis, smoker | lung_cancer, tb)
(tb_or_lc ⊥ asia, bronchitis | smoker, tb)
(tb_or_lc ⊥ smoker | lung_cancer, bronchitis)
(tb_or_lc ⊥ smoker, bronchitis | lung_cancer, asia)
(tb_or_lc ⊥ bronchitis | lung_cancer, smoker)
(tb_or_lc ⊥ bronchitis | asia, smoker)
(tb_or_lc ⊥ asia | xray, dispnea, tb)
(tb_or_lc ⊥ asia | xray, bronchitis, tb)
(tb_or_lc ⊥ asia, bronchitis, smoker | xray, lung_cancer, tb)
(tb_or_lc ⊥ asia, bronchitis | xray, smoker, tb)

```

```

(tb_or_lc ⊥ smoker | xray, lung_cancer, bronchitis)
(tb_or_lc ⊥ smoker, bronchitis | xray, lung_cancer, asia)
(tb_or_lc ⊥ bronchitis | xray, lung_cancer, smoker)
(tb_or_lc ⊥ bronchitis | xray, asia, smoker)
(tb_or_lc ⊥ asia | bronchitis, dispnea, tb)
(tb_or_lc ⊥ asia | lung_cancer, dispnea, tb)
(tb_or_lc ⊥ asia | dispnea, smoker, tb)
(tb_or_lc ⊥ smoker | lung_cancer, dispnea, bronchitis)
(tb_or_lc ⊥ asia, smoker | bronchitis, lung_cancer, tb)
(tb_or_lc ⊥ asia | bronchitis, smoker, tb)
(tb_or_lc ⊥ bronchitis, smoker | lung_cancer, asia, tb)
(tb_or_lc ⊥ asia, bronchitis | lung_cancer, smoker, tb)
(tb_or_lc ⊥ bronchitis | asia, tb, smoker)
(tb_or_lc ⊥ smoker | lung_cancer, asia, bronchitis)
(tb_or_lc ⊥ bronchitis | lung_cancer, asia, smoker)
(tb_or_lc ⊥ asia | xray, bronchitis, dispnea, tb)
(tb_or_lc ⊥ asia | xray, lung_cancer, dispnea, tb)
(tb_or_lc ⊥ asia | xray, dispnea, smoker, tb)
(tb_or_lc ⊥ smoker | xray, lung_cancer, dispnea, bronchitis)
(tb_or_lc ⊥ asia, smoker | xray, bronchitis, lung_cancer, tb)
(tb_or_lc ⊥ asia | xray, bronchitis, smoker, tb)
(tb_or_lc ⊥ bronchitis, smoker | xray, lung_cancer, asia, tb)
(tb_or_lc ⊥ asia, bronchitis | xray, lung_cancer, smoker, tb)
(tb_or_lc ⊥ bronchitis | xray, asia, tb, smoker)
(tb_or_lc ⊥ smoker | xray, lung_cancer, asia, bronchitis)
(tb_or_lc ⊥ bronchitis | xray, lung_cancer, asia, smoker)
(tb_or_lc ⊥ asia, smoker | bronchitis, dispnea, lung_cancer, tb)
(tb_or_lc ⊥ asia | bronchitis, dispnea, smoker, tb)
(tb_or_lc ⊥ asia | lung_cancer, dispnea, smoker, tb)
(tb_or_lc ⊥ smoker | lung_cancer, dispnea, asia, bronchitis)
(tb_or_lc ⊥ smoker | bronchitis, lung_cancer, asia, tb)
(tb_or_lc ⊥ asia | bronchitis, lung_cancer, smoker, tb)
(tb_or_lc ⊥ bronchitis | lung_cancer, asia, tb, smoker)
(tb_or_lc ⊥ asia, smoker | xray, dispnea, bronchitis, tb, lung_cancer)
(tb_or_lc ⊥ asia | xray, dispnea, bronchitis, tb, smoker)
(tb_or_lc ⊥ asia | xray, dispnea, tb, lung_cancer, smoker)
(tb_or_lc ⊥ smoker | xray, asia, dispnea, bronchitis, lung_cancer)
(tb_or_lc ⊥ smoker | xray, asia, bronchitis, tb, lung_cancer)
(tb_or_lc ⊥ asia | xray, bronchitis, tb, lung_cancer, smoker)
(tb_or_lc ⊥ bronchitis | xray, asia, tb, lung_cancer, smoker)
(tb_or_lc ⊥ smoker | asia, dispnea, bronchitis, tb, lung_cancer)
(tb_or_lc ⊥ asia | dispnea, bronchitis, tb, lung_cancer, smoker)
(tb_or_lc ⊥ smoker | xray, asia, dispnea, bronchitis, tb, lung_cancer)
(tb_or_lc ⊥ asia | xray, dispnea, bronchitis, tb, lung_cancer, smoker)
(asia ⊥ lung_cancer, smoker, bronchitis)
(asia ⊥ xray | tb_or_lc)
(asia ⊥ xray, dispnea, tb_or_lc, bronchitis, lung_cancer, smoker | tb)
(asia ⊥ lung_cancer, smoker | bronchitis)
(asia ⊥ smoker, bronchitis | lung_cancer)
(asia ⊥ lung_cancer, bronchitis | smoker)
(asia ⊥ dispnea, tb_or_lc, bronchitis, lung_cancer, smoker | xray, tb)
(asia ⊥ smoker, bronchitis | xray, lung_cancer)
(asia ⊥ bronchitis | xray, smoker)
(asia ⊥ xray | dispnea, tb_or_lc)
(asia ⊥ xray, tb_or_lc, bronchitis, lung_cancer, smoker | dispnea, tb)
(asia ⊥ xray, dispnea, bronchitis, lung_cancer, smoker | tb_or_lc, tb)

```

(asia ⊥ xray, dispnea | tb_or_lc, bronchitis)
(asia ⊥ xray, dispnea, smoker, bronchitis | lung_cancer, tb_or_lc)
(asia ⊥ xray, dispnea, bronchitis | tb_or_lc, smoker)
(asia ⊥ xray, dispnea, tb_or_lc, lung_cancer, smoker | bronchitis, tb)
(asia ⊥ xray, dispnea, tb_or_lc, bronchitis, smoker | lung_cancer, tb)
(asia ⊥ xray, dispnea, tb_or_lc, bronchitis, lung_cancer | smoker, tb)
(asia ⊥ smoker | lung_cancer, bronchitis)
(asia ⊥ lung_cancer | smoker, bronchitis)
(asia ⊥ bronchitis | lung_cancer, smoker)
(asia ⊥ lung_cancer, tb_or_lc, bronchitis, smoker | xray, dispnea, tb)
(asia ⊥ lung_cancer, dispnea, smoker, bronchitis | xray, tb_or_lc, tb)
(asia ⊥ dispnea | xray, tb_or_lc, bronchitis)
(asia ⊥ dispnea, smoker, bronchitis | xray, lung_cancer, tb_or_lc)
(asia ⊥ dispnea, bronchitis | xray, tb_or_lc, smoker)
(asia ⊥ lung_cancer, dispnea, tb_or_lc, smoker | xray, bronchitis, tb)
(asia ⊥ dispnea, tb_or_lc, bronchitis, smoker | xray, lung_cancer, tb)
(asia ⊥ lung_cancer, dispnea, tb_or_lc, bronchitis | xray, smoker, tb)
(asia ⊥ smoker | xray, lung_cancer, bronchitis)
(asia ⊥ bronchitis | xray, lung_cancer, smoker)
(asia ⊥ xray, lung_cancer, bronchitis, smoker | dispnea, tb_or_lc, tb)
(asia ⊥ xray | dispnea, tb_or_lc, bronchitis)
(asia ⊥ xray, smoker, bronchitis | lung_cancer, dispnea, tb_or_lc)
(asia ⊥ xray, bronchitis | dispnea, tb_or_lc, smoker)
(asia ⊥ xray, lung_cancer, tb_or_lc, smoker | bronchitis, dispnea, tb)
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(asia ⊥ xray, lung_cancer, tb_or_lc, bronchitis | dispnea, smoker, tb)
(asia ⊥ smoker | lung_cancer, dispnea, bronchitis)
(asia ⊥ xray, lung_cancer, dispnea, smoker | bronchitis, tb_or_lc, tb)
(asia ⊥ xray, bronchitis, dispnea, smoker | lung_cancer, tb_or_lc, tb)
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(asia ⊥ xray, dispnea | tb_or_lc, bronchitis, smoker)
(asia ⊥ xray, dispnea, bronchitis | lung_cancer, tb_or_lc, smoker)
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(asia ⊥ lung_cancer, bronchitis, smoker | xray, dispnea, tb_or_lc, tb)
(asia ⊥ smoker, bronchitis | xray, lung_cancer, dispnea, tb_or_lc)
(asia ⊥ bronchitis | xray, dispnea, tb_or_lc, smoker)
(asia ⊥ lung_cancer, tb_or_lc, smoker | xray, bronchitis, dispnea, tb)
(asia ⊥ tb_or_lc, bronchitis, smoker | xray, lung_cancer, dispnea, tb)
(asia ⊥ lung_cancer, tb_or_lc, bronchitis | xray, dispnea, smoker, tb)
(asia ⊥ smoker | xray, lung_cancer, dispnea, bronchitis)
(asia ⊥ lung_cancer, dispnea, smoker | xray, bronchitis, tb_or_lc, tb)
(asia ⊥ bronchitis, dispnea, smoker | xray, lung_cancer, tb_or_lc, tb)
(asia ⊥ lung_cancer, dispnea, bronchitis | xray, tb_or_lc, tb, smoker)
(asia ⊥ dispnea, smoker | xray, lung_cancer, tb_or_lc, bronchitis)
(asia ⊥ dispnea | xray, tb_or_lc, bronchitis, smoker)
(asia ⊥ dispnea, bronchitis | xray, lung_cancer, tb_or_lc, smoker)
(asia ⊥ dispnea, tb_or_lc, smoker | xray, bronchitis, lung_cancer, tb)
(asia ⊥ lung_cancer, dispnea, tb_or_lc | xray, bronchitis, smoker, tb)
(asia ⊥ dispnea, tb_or_lc, bronchitis | xray, lung_cancer, smoker, tb)
(asia ⊥ xray, lung_cancer, smoker | bronchitis, dispnea, tb_or_lc, tb)
(asia ⊥ xray, bronchitis, smoker | lung_cancer, dispnea, tb_or_lc, tb)
(asia ⊥ xray, lung_cancer, bronchitis | dispnea, tb_or_lc, tb, smoker)
(asia ⊥ xray, smoker | lung_cancer, dispnea, tb_or_lc, bronchitis)

```

(asia ⊥ xray | dispnea, tb_or_lc, bronchitis, smoker)
(asia ⊥ xray, bronchitis | lung_cancer, dispnea, tb_or_lc, smoker)
(asia ⊥ xray, tb_or_lc, smoker | bronchitis, dispnea, lung_cancer, tb)
(asia ⊥ xray, lung_cancer, tb_or_lc | bronchitis, dispnea, smoker, tb)
(asia ⊥ xray, tb_or_lc, bronchitis | lung_cancer, dispnea, smoker, tb)
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(asia ⊥ xray, dispnea, tb_or_lc | bronchitis, lung_cancer, smoker, tb)
(asia ⊥ lung_cancer, smoker | xray, tb_or_lc, dispnea, bronchitis, tb)
(asia ⊥ bronchitis, smoker | xray, tb_or_lc, dispnea, tb, lung_cancer)
(asia ⊥ lung_cancer, bronchitis | xray, tb_or_lc, dispnea, tb, smoker)
(asia ⊥ smoker | xray, tb_or_lc, dispnea, bronchitis, lung_cancer)
(asia ⊥ bronchitis | xray, tb_or_lc, dispnea, lung_cancer, smoker)
(asia ⊥ tb_or_lc, smoker | xray, dispnea, bronchitis, tb, lung_cancer)
(asia ⊥ lung_cancer, tb_or_lc | xray, dispnea, bronchitis, tb, smoker)
(asia ⊥ tb_or_lc, bronchitis | xray, dispnea, tb, lung_cancer, smoker)
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(asia ⊥ dispnea | xray, tb_or_lc, bronchitis, lung_cancer, smoker)
(asia ⊥ dispnea, tb_or_lc | xray, bronchitis, tb, lung_cancer, smoker)
(asia ⊥ xray, smoker | tb_or_lc, dispnea, bronchitis, tb, lung_cancer)
(asia ⊥ xray, lung_cancer | tb_or_lc, dispnea, bronchitis, tb, smoker)
(asia ⊥ xray, bronchitis | tb_or_lc, dispnea, tb, lung_cancer, smoker)
(asia ⊥ xray | tb_or_lc, dispnea, bronchitis, lung_cancer, smoker)
(asia ⊥ xray, tb_or_lc | dispnea, bronchitis, tb, lung_cancer, smoker)
(asia ⊥ xray, dispnea | tb_or_lc, bronchitis, tb, lung_cancer, smoker)
(asia ⊥ smoker | xray, tb_or_lc, dispnea, bronchitis, tb, lung_cancer)
(asia ⊥ lung_cancer | xray, tb_or_lc, dispnea, bronchitis, tb, smoker)
(asia ⊥ bronchitis | xray, tb_or_lc, dispnea, tb, lung_cancer, smoker)
(asia ⊥ tb_or_lc | xray, dispnea, bronchitis, tb, lung_cancer, smoker)
(asia ⊥ dispnea | xray, tb_or_lc, bronchitis, tb, lung_cancer, smoker)
(asia ⊥ xray | tb_or_lc, dispnea, bronchitis, tb, lung_cancer, smoker)
(dispnea ⊥ xray | tb_or_lc)
(dispnea ⊥ asia | tb)
(dispnea ⊥ asia | xray, tb)
(dispnea ⊥ xray, asia | tb_or_lc, tb)
(dispnea ⊥ xray, tb, lung_cancer, asia, smoker | tb_or_lc, bronchitis)
(dispnea ⊥ xray, asia, tb | lung_cancer, tb_or_lc)
(dispnea ⊥ xray | asia, tb_or_lc)
(dispnea ⊥ xray, lung_cancer, asia, tb | tb_or_lc, smoker)
(dispnea ⊥ asia | bronchitis, tb)
(dispnea ⊥ asia | lung_cancer, tb)
(dispnea ⊥ asia | smoker, tb)
(dispnea ⊥ smoker | lung_cancer, bronchitis)
(dispnea ⊥ asia | xray, tb_or_lc, tb)
(dispnea ⊥ lung_cancer, asia, tb, smoker | xray, tb_or_lc, bronchitis)
(dispnea ⊥ asia, tb | xray, lung_cancer, tb_or_lc)
(dispnea ⊥ lung_cancer, asia, tb | xray, tb_or_lc, smoker)
(dispnea ⊥ asia | xray, bronchitis, tb)
(dispnea ⊥ asia | xray, lung_cancer, tb)
(dispnea ⊥ asia | xray, smoker, tb)
(dispnea ⊥ smoker | xray, lung_cancer, bronchitis)
(dispnea ⊥ xray, lung_cancer, asia, smoker | bronchitis, tb_or_lc, tb)

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(dispatchnea ⊥ xray, asia | lung_cancer, tb_or_lc, tb)
(dispatchnea ⊥ xray | asia, tb_or_lc, tb)
(dispatchnea ⊥ xray, lung_cancer, asia | tb_or_lc, tb, smoker)
(dispatchnea ⊥ xray, asia, tb, smoker | lung_cancer, tb_or_lc, bronchitis)
(dispatchnea ⊥ xray, lung_cancer, tb, smoker | asia, tb_or_lc, bronchitis)
(dispatchnea ⊥ xray, lung_cancer, asia, tb | tb_or_lc, bronchitis, smoker)
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(dispatchnea ⊥ xray, asia, tb | lung_cancer, tb_or_lc, smoker)
(dispatchnea ⊥ xray, lung_cancer, tb | asia, tb_or_lc, smoker)
(dispatchnea ⊥ asia, smoker | bronchitis, lung_cancer, tb)
(dispatchnea ⊥ asia | bronchitis, smoker, tb)
(dispatchnea ⊥ asia | lung_cancer, smoker, tb)
(dispatchnea ⊥ smoker | lung_cancer, asia, bronchitis)
(dispatchnea ⊥ lung_cancer, asia, smoker | xray, bronchitis, tb_or_lc, tb)
(dispatchnea ⊥ asia | xray, lung_cancer, tb_or_lc, tb)
(dispatchnea ⊥ lung_cancer, asia | xray, tb_or_lc, tb, smoker)
(dispatchnea ⊥ asia, tb, smoker | xray, lung_cancer, tb_or_lc, bronchitis)
(dispatchnea ⊥ lung_cancer, tb, smoker | xray, asia, tb_or_lc, bronchitis)
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(dispatchnea ⊥ asia, tb | xray, lung_cancer, tb_or_lc, smoker)
(dispatchnea ⊥ lung_cancer, tb | xray, asia, tb_or_lc, smoker)
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(dispatchnea ⊥ asia | xray, bronchitis, smoker, tb)
(dispatchnea ⊥ asia | xray, lung_cancer, smoker, tb)
(dispatchnea ⊥ smoker | xray, lung_cancer, asia, bronchitis)
(dispatchnea ⊥ xray, asia, smoker | bronchitis, lung_cancer, tb_or_lc, tb)
(dispatchnea ⊥ xray, lung_cancer, smoker | bronchitis, asia, tb_or_lc, tb)
(dispatchnea ⊥ xray, lung_cancer, asia | bronchitis, tb_or_lc, tb, smoker)
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(dispatchnea ⊥ xray, asia | lung_cancer, tb_or_lc, tb, smoker)
(dispatchnea ⊥ xray, lung_cancer | asia, tb_or_lc, tb, smoker)
(dispatchnea ⊥ xray, tb, smoker | lung_cancer, asia, tb_or_lc, bronchitis)
(dispatchnea ⊥ xray, asia, tb | lung_cancer, tb_or_lc, bronchitis, smoker)
(dispatchnea ⊥ xray, lung_cancer, tb | asia, tb_or_lc, bronchitis, smoker)
(dispatchnea ⊥ xray, tb | lung_cancer, asia, tb_or_lc, smoker)
(dispatchnea ⊥ smoker | bronchitis, lung_cancer, asia, tb)
(dispatchnea ⊥ asia | bronchitis, lung_cancer, smoker, tb)
(dispatchnea ⊥ asia, smoker | xray, tb_or_lc, bronchitis, tb, lung_cancer)
(dispatchnea ⊥ lung_cancer, smoker | xray, tb_or_lc, asia, bronchitis, tb)
(dispatchnea ⊥ lung_cancer, asia | xray, tb_or_lc, bronchitis, tb, smoker)
(dispatchnea ⊥ asia | xray, tb_or_lc, tb, lung_cancer, smoker)
(dispatchnea ⊥ lung_cancer | xray, tb_or_lc, asia, tb, smoker)
(dispatchnea ⊥ tb, smoker | xray, tb_or_lc, asia, bronchitis, lung_cancer)
(dispatchnea ⊥ asia, tb | xray, tb_or_lc, bronchitis, lung_cancer, smoker)
(dispatchnea ⊥ lung_cancer, tb | xray, tb_or_lc, asia, bronchitis, smoker)
(dispatchnea ⊥ tb | xray, tb_or_lc, asia, lung_cancer, smoker)
(dispatchnea ⊥ smoker | xray, asia, bronchitis, tb, lung_cancer)
(dispatchnea ⊥ asia | xray, bronchitis, tb, lung_cancer, smoker)
(dispatchnea ⊥ xray, smoker | tb_or_lc, asia, bronchitis, tb, lung_cancer)
(dispatchnea ⊥ xray, asia | tb_or_lc, bronchitis, tb, lung_cancer, smoker)
(dispatchnea ⊥ xray, lung_cancer | tb_or_lc, asia, bronchitis, tb, smoker)
(dispatchnea ⊥ xray | tb_or_lc, asia, tb, lung_cancer, smoker)
(dispatchnea ⊥ xray, tb | tb_or_lc, asia, bronchitis, lung_cancer, smoker)
(dispatchnea ⊥ smoker | xray, tb_or_lc, asia, bronchitis, tb, lung_cancer)
(dispatchnea ⊥ asia | xray, tb_or_lc, bronchitis, tb, lung_cancer, smoker)

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(dispnea ⊥ lung_cancer | xray, tb_or_lc, asia, bronchitis, tb, smoker)
(dispnea ⊥ tb | xray, tb_or_lc, asia, bronchitis, lung_cancer, smoker)
(dispnea ⊥ xray | tb_or_lc, asia, bronchitis, tb, lung_cancer, smoker)
(tb ⊥ lung_cancer, smoker, bronchitis)
(tb ⊥ xray | tb_or_lc)
(tb ⊥ lung_cancer, smoker | bronchitis)
(tb ⊥ smoker, bronchitis | lung_cancer)
(tb ⊥ lung_cancer, smoker, bronchitis | asia)
(tb ⊥ lung_cancer, bronchitis | smoker)
(tb ⊥ smoker, bronchitis | xray, lung_cancer)
(tb ⊥ bronchitis | xray, smoker)
(tb ⊥ xray | dispnea, tb_or_lc)
(tb ⊥ xray, dispnea | tb_or_lc, bronchitis)
(tb ⊥ xray, dispnea, smoker, bronchitis | lung_cancer, tb_or_lc)
(tb ⊥ xray | asia, tb_or_lc)
(tb ⊥ xray, dispnea, bronchitis | tb_or_lc, smoker)
(tb ⊥ smoker | lung_cancer, bronchitis)
(tb ⊥ lung_cancer, smoker | asia, bronchitis)
(tb ⊥ lung_cancer | smoker, bronchitis)
(tb ⊥ smoker, bronchitis | lung_cancer, asia)
(tb ⊥ bronchitis | lung_cancer, smoker)
(tb ⊥ lung_cancer, bronchitis | asia, smoker)
(tb ⊥ dispnea | xray, tb_or_lc, bronchitis)
(tb ⊥ dispnea, smoker, bronchitis | xray, lung_cancer, tb_or_lc)
(tb ⊥ dispnea, bronchitis | xray, tb_or_lc, smoker)
(tb ⊥ smoker | xray, lung_cancer, bronchitis)
(tb ⊥ smoker, bronchitis | xray, lung_cancer, asia)
(tb ⊥ bronchitis | xray, lung_cancer, smoker)
(tb ⊥ bronchitis | xray, asia, smoker)
(tb ⊥ xray | dispnea, tb_or_lc, bronchitis)
(tb ⊥ xray, smoker, bronchitis | lung_cancer, dispnea, tb_or_lc)
(tb ⊥ xray | dispnea, tb_or_lc, asia)
(tb ⊥ xray, bronchitis | dispnea, tb_or_lc, smoker)
(tb ⊥ smoker | lung_cancer, dispnea, bronchitis)
(tb ⊥ xray, dispnea, smoker | lung_cancer, tb_or_lc, bronchitis)
(tb ⊥ xray, dispnea | asia, tb_or_lc, bronchitis)
(tb ⊥ xray, dispnea | tb_or_lc, bronchitis, smoker)
(tb ⊥ xray, bronchitis, dispnea, smoker | lung_cancer, asia, tb_or_lc)
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(tb ⊥ xray, dispnea, bronchitis | asia, tb_or_lc, smoker)
(tb ⊥ smoker | lung_cancer, asia, bronchitis)
(tb ⊥ lung_cancer | asia, bronchitis, smoker)
(tb ⊥ bronchitis | lung_cancer, asia, smoker)
(tb ⊥ smoker, bronchitis | xray, lung_cancer, dispnea, tb_or_lc)
(tb ⊥ bronchitis | xray, dispnea, tb_or_lc, smoker)
(tb ⊥ smoker | xray, lung_cancer, dispnea, bronchitis)
(tb ⊥ dispnea, smoker | xray, lung_cancer, tb_or_lc, bronchitis)
(tb ⊥ dispnea | xray, asia, tb_or_lc, bronchitis)
(tb ⊥ dispnea | xray, tb_or_lc, bronchitis, smoker)
(tb ⊥ bronchitis, dispnea, smoker | xray, lung_cancer, asia, tb_or_lc)
(tb ⊥ dispnea, bronchitis | xray, lung_cancer, tb_or_lc, smoker)
(tb ⊥ dispnea, bronchitis | xray, asia, tb_or_lc, smoker)
(tb ⊥ smoker | xray, lung_cancer, asia, bronchitis)
(tb ⊥ bronchitis | xray, lung_cancer, asia, smoker)
(tb ⊥ xray, smoker | lung_cancer, dispnea, tb_or_lc, bronchitis)
(tb ⊥ xray | dispnea, tb_or_lc, bronchitis, asia)

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(tb ⊥ xray | dispnea, tb_or_lc, bronchitis, smoker)
(tb ⊥ xray, bronchitis, smoker | lung_cancer, dispnea, tb_or_lc, asia)
(tb ⊥ xray, bronchitis | lung_cancer, dispnea, tb_or_lc, smoker)
(tb ⊥ xray, bronchitis | dispnea, tb_or_lc, smoker, asia)
(tb ⊥ smoker | lung_cancer, dispnea, asia, bronchitis)
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(tb ⊥ xray, dispnea | lung_cancer, tb_or_lc, bronchitis, smoker)
(tb ⊥ xray, dispnea | asia, tb_or_lc, bronchitis, smoker)
(tb ⊥ xray, dispnea, bronchitis | lung_cancer, asia, tb_or_lc, smoker)
(tb ⊥ smoker | xray, tb_or_lc, dispnea, bronchitis, lung_cancer)
(tb ⊥ bronchitis, smoker | xray, tb_or_lc, asia, dispnea, lung_cancer)
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(tb ⊥ bronchitis | xray, tb_or_lc, asia, dispnea, smoker)
(tb ⊥ smoker | xray, asia, dispnea, bronchitis, lung_cancer)
(tb ⊥ dispnea, smoker | xray, tb_or_lc, asia, bronchitis, lung_cancer)
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(tb ⊥ dispnea | xray, tb_or_lc, asia, bronchitis, smoker)
(tb ⊥ dispnea, bronchitis | xray, tb_or_lc, asia, lung_cancer, smoker)
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(tb ⊥ xray, bronchitis | tb_or_lc, asia, dispnea, lung_cancer, smoker)
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(tb ⊥ dispnea | xray, tb_or_lc, asia, bronchitis, lung_cancer, smoker)
(tb ⊥ xray | tb_or_lc, asia, dispnea, bronchitis, lung_cancer, smoker)
(bronchitis ⊥ asia, tb)
(bronchitis ⊥ xray | tb_or_lc)
(bronchitis ⊥ asia | tb)
(bronchitis ⊥ xray, asia, tb_or_lc, tb | lung_cancer)
(bronchitis ⊥ tb | asia)
(bronchitis ⊥ xray, tb_or_lc, tb, lung_cancer, asia | smoker)
(bronchitis ⊥ asia | xray, tb)
(bronchitis ⊥ asia, tb_or_lc, tb | xray, lung_cancer)
(bronchitis ⊥ lung_cancer, asia, tb_or_lc, tb | xray, smoker)
(bronchitis ⊥ xray | dispnea, tb_or_lc)
(bronchitis ⊥ asia | dispnea, tb)
(bronchitis ⊥ xray, asia | tb_or_lc, tb)
(bronchitis ⊥ xray, asia, tb | lung_cancer, tb_or_lc)
(bronchitis ⊥ xray | asia, tb_or_lc)
(bronchitis ⊥ xray, lung_cancer, asia, tb | tb_or_lc, smoker)
(bronchitis ⊥ xray, asia, tb_or_lc | lung_cancer, tb)
(bronchitis ⊥ xray, lung_cancer, asia, tb_or_lc | smoker, tb)
(bronchitis ⊥ xray, tb_or_lc, tb | lung_cancer, asia)
(bronchitis ⊥ xray, asia, tb_or_lc, tb | lung_cancer, smoker)
(bronchitis ⊥ xray, lung_cancer, tb_or_lc, tb | asia, smoker)
(bronchitis ⊥ asia | xray, dispnea, tb)
(bronchitis ⊥ asia | xray, tb_or_lc, tb)
(bronchitis ⊥ asia, tb | xray, lung_cancer, tb_or_lc)
(bronchitis ⊥ lung_cancer, asia, tb | xray, tb_or_lc, smoker)
(bronchitis ⊥ asia, tb_or_lc | xray, lung_cancer, tb)
(bronchitis ⊥ lung_cancer, asia, tb_or_lc | xray, smoker, tb)
(bronchitis ⊥ tb_or_lc, tb | xray, lung_cancer, asia)
(bronchitis ⊥ asia, tb_or_lc, tb | xray, lung_cancer, smoker)
(bronchitis ⊥ lung_cancer, tb_or_lc, tb | xray, asia, smoker)

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(bronchitis ⊥ xray, asia | dispnea, tb_or_lc, tb)
(bronchitis ⊥ xray, asia, tb | lung_cancer, dispnea, tb_or_lc)
(bronchitis ⊥ xray | dispnea, tb_or_lc, asia)
(bronchitis ⊥ xray, lung_cancer, asia, tb | dispnea, tb_or_lc, smoker)
(bronchitis ⊥ asia | lung_cancer, dispnea, tb)
(bronchitis ⊥ asia | dispnea, smoker, tb)
(bronchitis ⊥ xray, asia | lung_cancer, tb_or_lc, tb)
(bronchitis ⊥ xray | asia, tb_or_lc, tb)
(bronchitis ⊥ xray, lung_cancer, asia | tb_or_lc, tb, smoker)
(bronchitis ⊥ xray, tb | lung_cancer, asia, tb_or_lc)
(bronchitis ⊥ xray, asia, tb | lung_cancer, tb_or_lc, smoker)
(bronchitis ⊥ xray, lung_cancer, tb | asia, tb_or_lc, smoker)
(bronchitis ⊥ xray, tb_or_lc | lung_cancer, asia, tb)
(bronchitis ⊥ xray, asia, tb_or_lc | lung_cancer, smoker, tb)
(bronchitis ⊥ xray, lung_cancer, tb_or_lc | asia, tb, smoker)
(bronchitis ⊥ xray, tb_or_lc, tb | lung_cancer, asia, smoker)
(bronchitis ⊥ asia | xray, dispnea, tb_or_lc, tb)
(bronchitis ⊥ asia, tb | xray, lung_cancer, dispnea, tb_or_lc)
(bronchitis ⊥ lung_cancer, asia, tb | xray, dispnea, tb_or_lc, smoker)
(bronchitis ⊥ asia | xray, lung_cancer, dispnea, tb)
(bronchitis ⊥ asia | xray, dispnea, smoker, tb)
(bronchitis ⊥ asia | xray, lung_cancer, tb_or_lc, tb)
(bronchitis ⊥ lung_cancer, asia | xray, tb_or_lc, tb, smoker)
(bronchitis ⊥ tb | xray, lung_cancer, asia, tb_or_lc)
(bronchitis ⊥ asia, tb | xray, lung_cancer, tb_or_lc, smoker)
(bronchitis ⊥ lung_cancer, tb | xray, asia, tb_or_lc, smoker)
(bronchitis ⊥ tb_or_lc | xray, lung_cancer, asia, tb)
(bronchitis ⊥ asia, tb_or_lc | xray, lung_cancer, smoker, tb)
(bronchitis ⊥ lung_cancer, tb_or_lc | xray, asia, tb, smoker)
(bronchitis ⊥ tb_or_lc, tb | xray, lung_cancer, asia, smoker)
(bronchitis ⊥ xray, asia | lung_cancer, dispnea, tb_or_lc, tb)
(bronchitis ⊥ xray | dispnea, tb_or_lc, tb, asia)
(bronchitis ⊥ xray, lung_cancer, asia | dispnea, tb_or_lc, tb, smoker)
(bronchitis ⊥ xray, tb | lung_cancer, dispnea, tb_or_lc, asia)
(bronchitis ⊥ xray, asia, tb | lung_cancer, dispnea, tb_or_lc, smoker)
(bronchitis ⊥ xray, lung_cancer, tb | dispnea, tb_or_lc, smoker, asia)
(bronchitis ⊥ asia | lung_cancer, dispnea, smoker, tb)
(bronchitis ⊥ xray | lung_cancer, asia, tb_or_lc, tb)
(bronchitis ⊥ xray, asia | lung_cancer, tb_or_lc, tb, smoker)
(bronchitis ⊥ xray, lung_cancer | asia, tb_or_lc, tb, smoker)
(bronchitis ⊥ xray, tb | lung_cancer, asia, tb_or_lc, smoker)
(bronchitis ⊥ xray, tb_or_lc | lung_cancer, asia, tb, smoker)
(bronchitis ⊥ asia | xray, tb_or_lc, dispnea, tb, lung_cancer)
(bronchitis ⊥ lung_cancer, asia | xray, tb_or_lc, dispnea, tb, smoker)
(bronchitis ⊥ tb | xray, tb_or_lc, asia, dispnea, lung_cancer)
(bronchitis ⊥ asia, tb | xray, tb_or_lc, dispnea, lung_cancer, smoker)
(bronchitis ⊥ lung_cancer, tb | xray, tb_or_lc, asia, dispnea, smoker)
(bronchitis ⊥ asia | xray, dispnea, tb, lung_cancer, smoker)
(bronchitis ⊥ asia | xray, tb_or_lc, tb, lung_cancer, smoker)
(bronchitis ⊥ lung_cancer | xray, tb_or_lc, asia, tb, smoker)
(bronchitis ⊥ tb | xray, tb_or_lc, asia, lung_cancer, smoker)
(bronchitis ⊥ tb_or_lc | xray, asia, tb, lung_cancer, smoker)
(bronchitis ⊥ xray | tb_or_lc, asia, dispnea, tb, lung_cancer)
(bronchitis ⊥ xray, asia | tb_or_lc, dispnea, tb, lung_cancer, smoker)
(bronchitis ⊥ xray, lung_cancer | tb_or_lc, asia, dispnea, tb, smoker)
(bronchitis ⊥ xray, tb | tb_or_lc, asia, dispnea, lung_cancer, smoker)

(bronchitis ⊥ xray | tb_or_lc, asia, tb, lung_cancer, smoker)
(bronchitis ⊥ asia | xray, tb_or_lc, dispnea, tb, lung_cancer, smoker)
(bronchitis ⊥ lung_cancer | xray, tb_or_lc, asia, dispnea, tb, smoker)
(bronchitis ⊥ tb | xray, tb_or_lc, asia, dispnea, lung_cancer, smoker)
(bronchitis ⊥ xray | tb_or_lc, asia, dispnea, tb, lung_cancer, smoker)
(lung_cancer ⊥ asia, tb)
(lung_cancer ⊥ xray | tb_or_lc)
(lung_cancer ⊥ asia | tb)
(lung_cancer ⊥ asia, tb | bronchitis)
(lung_cancer ⊥ tb | asia)
(lung_cancer ⊥ tb, asia, bronchitis | smoker)
(lung_cancer ⊥ asia | xray, tb)
(lung_cancer ⊥ bronchitis | xray, smoker)
(lung_cancer ⊥ xray | dispnea, tb_or_lc)
(lung_cancer ⊥ asia | dispnea, tb)
(lung_cancer ⊥ xray, asia | tb_or_lc, tb)
(lung_cancer ⊥ xray, dispnea | tb_or_lc, bronchitis)
(lung_cancer ⊥ xray | asia, tb_or_lc)
(lung_cancer ⊥ xray, dispnea, bronchitis | tb_or_lc, smoker)
(lung_cancer ⊥ asia | bronchitis, tb)
(lung_cancer ⊥ asia, bronchitis | smoker, tb)
(lung_cancer ⊥ tb | asia, bronchitis)
(lung_cancer ⊥ asia, tb | smoker, bronchitis)
(lung_cancer ⊥ tb, bronchitis | asia, smoker)
(lung_cancer ⊥ asia | xray, dispnea, tb)
(lung_cancer ⊥ asia | xray, tb_or_lc, tb)
(lung_cancer ⊥ dispnea | xray, tb_or_lc, bronchitis)
(lung_cancer ⊥ dispnea, bronchitis | xray, tb_or_lc, smoker)
(lung_cancer ⊥ asia | xray, bronchitis, tb)
(lung_cancer ⊥ asia, bronchitis | xray, smoker, tb)
(lung_cancer ⊥ bronchitis | xray, asia, smoker)
(lung_cancer ⊥ xray, asia | dispnea, tb_or_lc, tb)
(lung_cancer ⊥ xray | dispnea, tb_or_lc, bronchitis)
(lung_cancer ⊥ xray | dispnea, tb_or_lc, asia)
(lung_cancer ⊥ xray, bronchitis | dispnea, tb_or_lc, smoker)
(lung_cancer ⊥ asia | bronchitis, dispnea, tb)
(lung_cancer ⊥ asia | dispnea, smoker, tb)
(lung_cancer ⊥ xray, dispnea, asia | bronchitis, tb_or_lc, tb)
(lung_cancer ⊥ xray | asia, tb_or_lc, tb)
(lung_cancer ⊥ xray, dispnea, asia, bronchitis | tb_or_lc, tb, smoker)
(lung_cancer ⊥ xray, dispnea | asia, tb_or_lc, bronchitis)
(lung_cancer ⊥ xray, dispnea | tb_or_lc, bronchitis, smoker)
(lung_cancer ⊥ xray, dispnea, bronchitis | asia, tb_or_lc, smoker)
(lung_cancer ⊥ asia | bronchitis, smoker, tb)
(lung_cancer ⊥ bronchitis | asia, tb, smoker)
(lung_cancer ⊥ tb | asia, bronchitis, smoker)
(lung_cancer ⊥ asia | xray, dispnea, tb_or_lc, tb)
(lung_cancer ⊥ bronchitis | xray, dispnea, tb_or_lc, smoker)
(lung_cancer ⊥ asia | xray, bronchitis, dispnea, tb)
(lung_cancer ⊥ asia | xray, dispnea, smoker, tb)
(lung_cancer ⊥ dispnea, asia | xray, bronchitis, tb_or_lc, tb)
(lung_cancer ⊥ dispnea, asia, bronchitis | xray, tb_or_lc, tb, smoker)
(lung_cancer ⊥ dispnea | xray, asia, tb_or_lc, bronchitis)
(lung_cancer ⊥ dispnea | xray, tb_or_lc, bronchitis, smoker)
(lung_cancer ⊥ dispnea, bronchitis | xray, asia, tb_or_lc, smoker)
(lung_cancer ⊥ asia | xray, bronchitis, smoker, tb)

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(lung_cancer ⊥ bronchitis | xray, asia, tb, smoker)
(lung_cancer ⊥ xray, asia | bronchitis, dispnea, tb_or_lc, tb)
(lung_cancer ⊥ xray | dispnea, tb_or_lc, tb, asia)
(lung_cancer ⊥ xray, asia, bronchitis | dispnea, tb_or_lc, tb, smoker)
(lung_cancer ⊥ xray | dispnea, tb_or_lc, bronchitis, asia)
(lung_cancer ⊥ xray | dispnea, tb_or_lc, bronchitis, smoker)
(lung_cancer ⊥ xray, bronchitis | dispnea, tb_or_lc, smoker, asia)
(lung_cancer ⊥ asia | bronchitis, dispnea, smoker, tb)
(lung_cancer ⊥ xray, dispnea | bronchitis, asia, tb_or_lc, tb)
(lung_cancer ⊥ xray, dispnea, asia | bronchitis, tb_or_lc, tb, smoker)
(lung_cancer ⊥ xray, dispnea, bronchitis | asia, tb_or_lc, tb, smoker)
(lung_cancer ⊥ xray, dispnea | asia, tb_or_lc, bronchitis, smoker)
(lung_cancer ⊥ asia | xray, tb_or_lc, dispnea, bronchitis, tb)
(lung_cancer ⊥ asia, bronchitis | xray, tb_or_lc, dispnea, tb, smoker)
(lung_cancer ⊥ bronchitis | xray, tb_or_lc, asia, dispnea, smoker)
(lung_cancer ⊥ asia | xray, dispnea, bronchitis, tb, smoker)
(lung_cancer ⊥ dispnea | xray, tb_or_lc, asia, bronchitis, tb)
(lung_cancer ⊥ dispnea, asia | xray, tb_or_lc, bronchitis, tb, smoker)
(lung_cancer ⊥ dispnea, bronchitis | xray, tb_or_lc, asia, tb, smoker)
(lung_cancer ⊥ dispnea | xray, tb_or_lc, asia, bronchitis, smoker)
(lung_cancer ⊥ xray | tb_or_lc, asia, dispnea, bronchitis, tb)
(lung_cancer ⊥ xray, asia | tb_or_lc, dispnea, bronchitis, tb, smoker)
(lung_cancer ⊥ xray, bronchitis | tb_or_lc, asia, dispnea, tb, smoker)
(lung_cancer ⊥ xray | tb_or_lc, asia, dispnea, bronchitis, smoker)
(lung_cancer ⊥ xray, dispnea | tb_or_lc, asia, bronchitis, tb, smoker)
(lung_cancer ⊥ asia | xray, tb_or_lc, dispnea, bronchitis, tb, smoker)
(lung_cancer ⊥ bronchitis | xray, tb_or_lc, asia, dispnea, tb, smoker)
(lung_cancer ⊥ dispnea | xray, tb_or_lc, asia, bronchitis, tb, smoker)
(lung_cancer ⊥ xray | tb_or_lc, asia, dispnea, bronchitis, tb, smoker)
(smoker ⊥ asia, tb)
(smoker ⊥ xray | tb_or_lc)
(smoker ⊥ asia | tb)
(smoker ⊥ asia, tb | bronchitis)
(smoker ⊥ xray, asia, tb_or_lc, tb | lung_cancer)
(smoker ⊥ tb | asia)
(smoker ⊥ asia | xray, tb)
(smoker ⊥ asia, tb_or_lc, tb | xray, lung_cancer)
(smoker ⊥ xray | dispnea, tb_or_lc)
(smoker ⊥ asia | dispnea, tb)
(smoker ⊥ xray, asia | tb_or_lc, tb)
(smoker ⊥ xray, dispnea | tb_or_lc, bronchitis)
(smoker ⊥ xray, asia, tb | lung_cancer, tb_or_lc)
(smoker ⊥ xray | asia, tb_or_lc)
(smoker ⊥ asia | bronchitis, tb)
(smoker ⊥ xray, asia, tb_or_lc | lung_cancer, tb)
(smoker ⊥ xray, dispnea, tb_or_lc, tb, asia | lung_cancer, bronchitis)
(smoker ⊥ tb | asia, bronchitis)
(smoker ⊥ xray, tb_or_lc, tb | lung_cancer, asia)
(smoker ⊥ asia | xray, dispnea, tb)
(smoker ⊥ asia | xray, tb_or_lc, tb)
(smoker ⊥ dispnea | xray, tb_or_lc, bronchitis)
(smoker ⊥ asia, tb | xray, lung_cancer, tb_or_lc)
(smoker ⊥ asia | xray, bronchitis, tb)
(smoker ⊥ asia, tb_or_lc | xray, lung_cancer, tb)
(smoker ⊥ dispnea, tb_or_lc, tb, asia | xray, lung_cancer, bronchitis)
(smoker ⊥ tb_or_lc, tb | xray, lung_cancer, asia)

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(smoker ⊥ xray, asia | dispnea, tb_or_lc, tb)
(smoker ⊥ xray | dispnea, tb_or_lc, bronchitis)
(smoker ⊥ xray, asia, tb | lung_cancer, dispnea, tb_or_lc)
(smoker ⊥ xray | dispnea, tb_or_lc, asia)
(smoker ⊥ asia | bronchitis, dispnea, tb)
(smoker ⊥ asia | lung_cancer, dispnea, tb)
(smoker ⊥ xray, tb_or_lc, asia, tb | lung_cancer, dispnea, bronchitis)
(smoker ⊥ xray, dispnea, asia | bronchitis, tb_or_lc, tb)
(smoker ⊥ xray, asia | lung_cancer, tb_or_lc, tb)
(smoker ⊥ xray | asia, tb_or_lc, tb)
(smoker ⊥ xray, dispnea, asia, tb | lung_cancer, tb_or_lc, bronchitis)
(smoker ⊥ xray, dispnea | asia, tb_or_lc, bronchitis)
(smoker ⊥ xray, tb | lung_cancer, asia, tb_or_lc)
(smoker ⊥ xray, dispnea, tb_or_lc, asia | bronchitis, lung_cancer, tb)
(smoker ⊥ xray, tb_or_lc | lung_cancer, asia, tb)
(smoker ⊥ xray, dispnea, tb_or_lc, tb | lung_cancer, asia, bronchitis)
(smoker ⊥ asia | xray, dispnea, tb_or_lc, tb)
(smoker ⊥ asia, tb | xray, lung_cancer, dispnea, tb_or_lc)
(smoker ⊥ asia | xray, bronchitis, dispnea, tb)
(smoker ⊥ asia | xray, lung_cancer, dispnea, tb)
(smoker ⊥ tb_or_lc, asia, tb | xray, lung_cancer, dispnea, bronchitis)
(smoker ⊥ dispnea, asia | xray, bronchitis, tb_or_lc, tb)
(smoker ⊥ asia | xray, lung_cancer, tb_or_lc, tb)
(smoker ⊥ dispnea, asia, tb | xray, lung_cancer, tb_or_lc, bronchitis)
(smoker ⊥ dispnea | xray, asia, tb_or_lc, bronchitis)
(smoker ⊥ tb | xray, lung_cancer, asia, tb_or_lc)
(smoker ⊥ dispnea, tb_or_lc, asia | xray, bronchitis, lung_cancer, tb)
(smoker ⊥ tb_or_lc | xray, lung_cancer, asia, tb)
(smoker ⊥ dispnea, tb_or_lc, tb | xray, lung_cancer, asia, bronchitis)
(smoker ⊥ xray, asia | bronchitis, dispnea, tb_or_lc, tb)
(smoker ⊥ xray, asia | lung_cancer, dispnea, tb_or_lc, tb)
(smoker ⊥ xray | dispnea, tb_or_lc, tb, asia)
(smoker ⊥ xray, asia, tb | lung_cancer, dispnea, tb_or_lc, bronchitis)
(smoker ⊥ xray | dispnea, tb_or_lc, bronchitis, asia)
(smoker ⊥ xray, tb | lung_cancer, dispnea, tb_or_lc, asia)
(smoker ⊥ xray, tb_or_lc, asia | bronchitis, dispnea, lung_cancer, tb)
(smoker ⊥ xray, tb_or_lc, tb | lung_cancer, dispnea, asia, bronchitis)
(smoker ⊥ xray, dispnea, asia | bronchitis, lung_cancer, tb_or_lc, tb)
(smoker ⊥ xray, dispnea | bronchitis, asia, tb_or_lc, tb)
(smoker ⊥ xray | lung_cancer, asia, tb_or_lc, tb)
(smoker ⊥ xray, dispnea, tb | lung_cancer, asia, tb_or_lc, bronchitis)
(smoker ⊥ xray, dispnea, tb_or_lc | bronchitis, lung_cancer, asia, tb)
(smoker ⊥ asia | xray, tb_or_lc, dispnea, bronchitis, tb)
(smoker ⊥ asia | xray, tb_or_lc, dispnea, tb, lung_cancer)
(smoker ⊥ asia, tb | xray, tb_or_lc, dispnea, bronchitis, lung_cancer)
(smoker ⊥ tb | xray, tb_or_lc, asia, dispnea, lung_cancer)
(smoker ⊥ tb_or_lc, asia | xray, dispnea, bronchitis, tb, lung_cancer)
(smoker ⊥ tb_or_lc, tb | xray, asia, dispnea, bronchitis, lung_cancer)
(smoker ⊥ dispnea, asia | xray, tb_or_lc, bronchitis, tb, lung_cancer)
(smoker ⊥ dispnea | xray, tb_or_lc, asia, bronchitis, tb)
(smoker ⊥ dispnea, tb | xray, tb_or_lc, asia, bronchitis, lung_cancer)
(smoker ⊥ dispnea, tb_or_lc | xray, asia, bronchitis, tb, lung_cancer)
(smoker ⊥ xray, asia | tb_or_lc, dispnea, bronchitis, tb, lung_cancer)
(smoker ⊥ xray | tb_or_lc, asia, dispnea, bronchitis, tb)
(smoker ⊥ xray | tb_or_lc, asia, dispnea, tb, lung_cancer)
(smoker ⊥ xray, tb | tb_or_lc, asia, dispnea, bronchitis, lung_cancer)

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(smoker ⊥ xray, tb_or_lc | asia, dispnea, bronchitis, tb, lung_cancer)
(smoker ⊥ xray, dispnea | tb_or_lc, asia, bronchitis, tb, lung_cancer)
(smoker ⊥ asia | xray, tb_or_lc, dispnea, bronchitis, tb, lung_cancer)
(smoker ⊥ tb | xray, tb_or_lc, asia, dispnea, bronchitis, lung_cancer)
(smoker ⊥ tb_or_lc | xray, asia, dispnea, bronchitis, tb, lung_cancer)
(smoker ⊥ dispnea | xray, tb_or_lc, asia, bronchitis, tb, lung_cancer)
(smoker ⊥ xray | tb_or_lc, asia, dispnea, bronchitis, tb, lung_cancer)
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