Exercises:

2.

    a. Support for e = 8/10 = .8
        Support for item {b,d} = 2/10 = .2
        Support for item {b,d,e} = 2/10 = .2

    b. Confidence for rule {b,d} → {e} = .2/.2 = 100%
        Confidence for rule {e} → {b,d} = .2/.8 = 25%
        Confidence is not symmetric.

    c. Support for {e} = ⅘ = .8
        Support for {b,d} = 5/5= 1
        Support for {b,d,e} = ⅘ = .8

    d. Confidence {b,d} → {e} = .8/1 = 80%
        Confidence {e} → {b,d} = .8/.8 = 100%

    e. There are no apparent relationships between s_1, s_2, c_1, c_2 according to our measured values.

6.

    a. Total Rules = $3^{items} - 2^{(items+1)} + 1$
        Total Rules = $3^6 - 2^7 + 1$ = 602
        Maximum number of rules is 602

    b. Since *minsup > 0*, all items are frequent items.
        But the maximum size of frequent item sets that can be is the maximum number of items in one
        transaction, so in this case, 4.

    c. Number of data items = 6
        $\binom{6}{3} = 20$

    d.

Item Set	Support Count
milk, beer	1
milk, diapers	4
mild, bread	3
milk, butter	2

milk, cookies	1
beer, diapers	3
beer, bread	0
beer, butter	0
beer, cookies	2
diapers, bread	2
diapers, butter	3
diapers, cookies	1
bread, butter	5
bread, cookies	1
butter, cookies	1

    e.   Confidence of {a} → {b} = support{a,b}/support{a}

         Confidence {bread} → {butter} = 5/5 = 1

         Confidence {butter} → {bread} = 5/5 = 1

8.

    a.

Item	Support
1	5
2	5
3	6
4	4
5	4

         {1,2,3}: {1,2,3,4}, {1,2,3,5}

         {1,2,4}: {1,2,4,5}

         {1,2,5}: not possible to extend

         {1,3,4}: {1,3,4,5}

         {1,3,4}: no new items

         {2,3,4}: {2,3,4,5}

         {2,3,5}: no new items

         {3,4,5}: not possible to extend

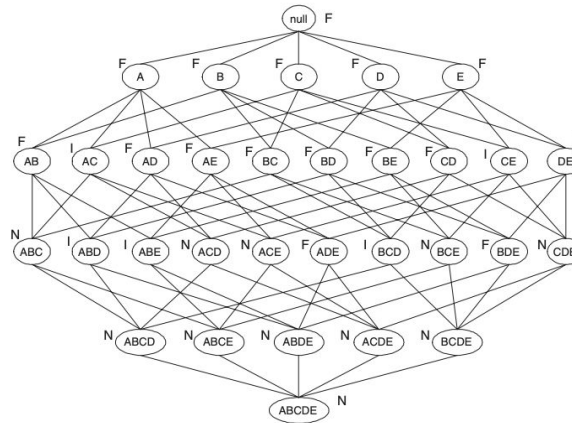   All candidates: {1,2,3,4},{1,2,3,5},{1,2,3,6},{1,2,4,5},{1,2,4,6},{1,2,5,6}

    b.   All candidates: {1,2,3,4},{1,2,3,5}, {1,2,4,5},{2,3,4,5},{2,3,4,6}

    c.   {1,2,3,4} is the only candidate that will survive the pruning step.

9.
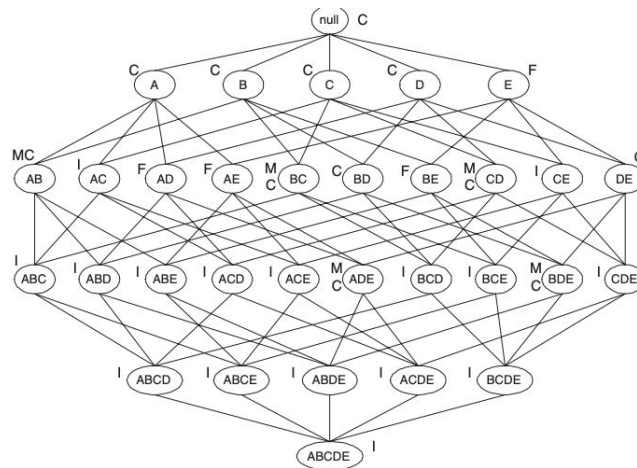
    a.   Lattice set:

b. The number of frequent itemsets is given by f/total number = 16/32 = 50%

c. The pruning ratio is given by the ratio of N to the total number of itemsets(32). $N=11$, so 11/32 = 34%

d. The number of I is 5, so 5/32 = 15.6%

12.

With threshold equal to 30%, we come up with the following lattice structure:

13.

a.

	c	$\bar{c}$
b	3	4
$\bar{b}$	2	1

	d	$\bar{d}$
a	4	1
$\bar{a}$	5	0

	d	$\bar{d}$
b	6	1
$\bar{b}$	3	0

	c	$\bar{c}$
e	2	4
$\bar{e}$	3	1

	a	$\bar{a}$
c	2	3
$\bar{c}$	3	2

a.

Support

Rules	Support	Rank
b --> c	0.3	3
a --> d	0.4	2
b --> d	0.6	1
e --> c	0.2	4
c --> a	0.2	4

Confidence

Rules	Confidence	Rank
b --> c	3/7	3
a --> d	4/5	2
b --> d	6/7	1
e --> c	2/6	5
c --> a	2/5	4

Interest $(x \rightarrow y)$

Rules	Interest	Rank
b --> c	0.214	3
a --> d	0.72	2
b --> d	0.771	1
e --> c	0.167	5
c --> a	0.2	4

IS $(x \rightarrow y)$

Rules	IS(x --> y)	Rank
b --> c	0.507	3
a --> d	0.596	2
b --> d	0.756	1
e --> c	0.365	5
c --> a	0.4	4

Klosgen $(x \rightarrow y)$

Rules	Klosgen	Rank
b --> c	-0.039	2
a --> d	-0.063	4
b --> d	-0.033	1
e --> c	-0.075	5

c --> a	-0.045	3

Odds Ratio $(x \rightarrow y)$

Rules	Odds Ratio	Rank
b --> c	0.375	2
a --> d	0	4
b --> d	0	4
e --> c	0.167	3
c --> a	0.444	1

20.

    a. Support(A) = .1, Support(B) = .9, Support (A,B) = .09
       Interest(A,B) = 9, ϕ(A,B) = .89
       c(A $\rightarrow$ B) = .9, c(B $\rightarrow$ A)=.9

    b. Support(A) = .9, Support(B) = .9, Support(A,B) = .89
       Interest(A,B) = 1.09, ϕ(A,B) = .89
       c(A $\rightarrow$ B) = .98, c(B$\rightarrow$ A) = .98

    c. Interest, support, and confidence are non-invariant if and only if the ϕ-coefficient is invariant. This is because the ϕ-coefficient takes into account absence and presence of an item.