1: Problem1

(a)
Cuboids in data cube: $2^{10} = 1024$

(b)
Nonempty closed cells : 3
(a1,a2,a3,... ,a10) :1, (a1,b2,a3,... ,b10) :1, (a1,*,a3,... ,a9, *) :2

(c)
Nonempty aggregate cells is $2 * 2^{10} - 2 - 8 = 2038$

(d)
aggregate closed cells: 1
(a1,*,a3,... ,a9, *) :2

(e)
Set minimum support = 2, we have 8 nonempty aggregate cells

2: Problem2

(a)
Algebraic measure, we can compute the standard deviation by $\sqrt{\frac{(sum()-avg())^2}{count()}}$ It's based on distributive function.

(b)
Algebraic, we can compute by distributive $\frac{min}{count()}, \frac{max}{count()}$ It's based on distributive function.

(c)
Algebraic. It can be computed by calculating based on each partition.

(d)
Holistic. The number of data points is unknown. No constant bound on the storage size.

(e)
Holistic. No constant bound on the storage size and partitions. It can not computed by distributive function.

3: Problem 3

(a)
3 itemset:
{B,C,D} $=\frac{3}{5} = 0.6$

(b)
{A,B}

A is frequent itemset, but AB is not frequent itemset.

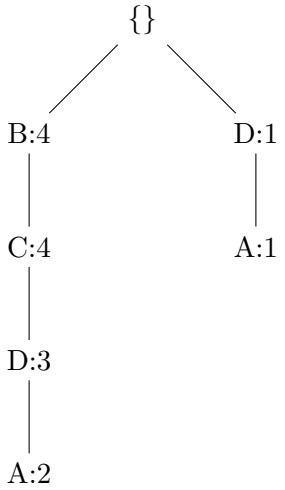
(c)
All closed patterns:
{D}:4,{A,D} : 3, {B,C,D} : 3, {B,C}:4

(d)
Max patterns:
{A,D}, {B,C,D}

(e)

$$x \in \{001, 002, \ldots 005\}, buys(x; B) \wedge buys(x; C)) \Rightarrow buys(x; D).[0.6; 0.75].$$
$$x \in \{001, 002, \ldots 005\}, buys(x; B) \wedge buys(x; D)) \Rightarrow buys(x; D).[0.6; 1].$$
$$x \in \{001, 002, \ldots 005\}, buys(x; C) \wedge buys(x; D)) \Rightarrow buys(x; B).[0.6; 1].$$

(f)



(g)
A : BCD :2, D :1

4: Problem 4

(a)
{B,C}, {B,D}, {C,D}, {B,C,D}

(b)
sum(price) $\geq$ 45 – monotonic
sum(price) $\leq$ 45 – anti-monotonic
Use Apriori method

(c)

avg(S.price) $\geq$ 30 is convertable. It can be converted as anti-monotonic by value-descending order(price).
avg(S.price) $\leq$ 30 is convertable. It can be converted as anti-monotonic by value-ascending order(price).