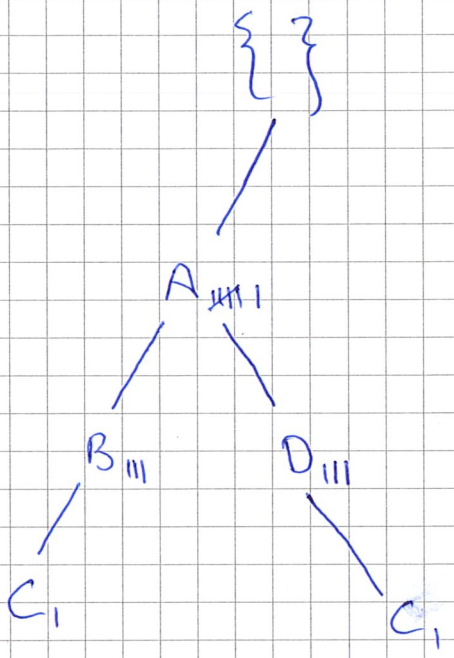
Step 3: Form a tree



Step 4: Form Conditional Database

A	—
B	A: 3
C	AB: 1, AD: 1
D	A: 3

Step 5: for each x-conditional database form frequent pattern by recursively calling FP-Grow

A - Conditional DB

—

B - Conditional Database:

items : A

Support : 3

Sort : A

Output : AB

{}

/

A_{III}

AB | —

AB - Cond

—

C - Conditional DB

items :	A	B	D
Support :	2	1	1
Sort :	A	B	D

Output : AC, BC, DC

{}

/

A_{II}

/ \

B_1 D_1

AC | —

BC | A : 1

DC | A : 1

BC - Cond

items : A

Sup : 2

Order : A

Output : ABC

{{}}

/

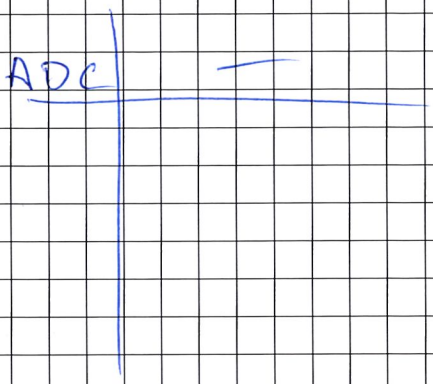
A_{II}

ABC | —

DC - Cond

items : A
support : 1
sort : A
Output : ADC

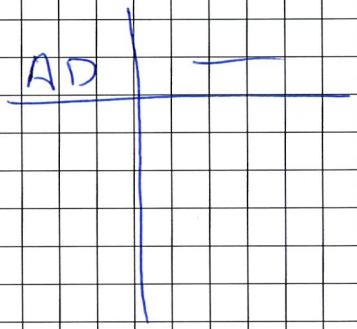
{{ A1 }}



D - Conditional Database

items : A
support : 3
sort : A
output : AD

{{ A111 }}



Q.8 (a)

range < 5 is an example of antimonotone constraint since it implies

$C(A)$ = true then $C(B)$ = true,

for $B \subseteq A$

range > 5 is an example of monotone constraint as in monotone constraint

$C(A)$ = true then $C(B)$ = true

for $A \subseteq B$

avg(S) $\geq$ c is an example of convertible monotone if data is arranged in order R which does not make it monotone but it can be made monotone if order will be changed i-e rearrange data in decreasing order.

avg(s) > c is also an convertible
example of ↗ antimonotone constraint
if data is arranged in some
sequence R which does not
satisfy the condition C(B) = true
then C(A) = true for B ⊆ A

It can be made antimonotone
by changing seq 'R' that is
arrange in increasing order
of value.

Q.8 (b)

$$50\% = \frac{50}{100} = 0.5$$

$$\text{min conf} \geq 0.5$$

ABC

$$AB \longrightarrow C \Rightarrow \frac{\text{support}(ABC)}{\text{support}(AB)}$$

$$= \frac{1}{3} < 0.5 \quad (\text{i.e } 30\% < 50\%)$$

Since $AB \longrightarrow C$ does not satisfy the min conf and is not a valid rule thus

$$A \longrightarrow BC$$
$$B \longrightarrow AC$$

will not satisfy it either and thus not a frequent rule.

$$BC \longrightarrow A \Rightarrow \frac{\text{support}(ABC)}{\text{support}(BC)} = \frac{1}{1} = 1$$

$$= 100\% > 50\%$$

Since it satisfies the min conf thus it is a valid association rule

and so will its subsets i-e

$B \longrightarrow CA$

$C \longrightarrow BA$

$AC \longrightarrow B \Rightarrow \frac{support(ABC)}{support(AC)} = \frac{1}{2}$

$= 0.5 \geq 0.5$

$50\% = 50\%$

since it satisfies the minconf thus a valid association rule.

2

Q. 8 (c)

Consider a scenario where X is dependent on Y and Y is dependent on Z but X is independent of Z.

If there are no hidden variables, then it could be due to

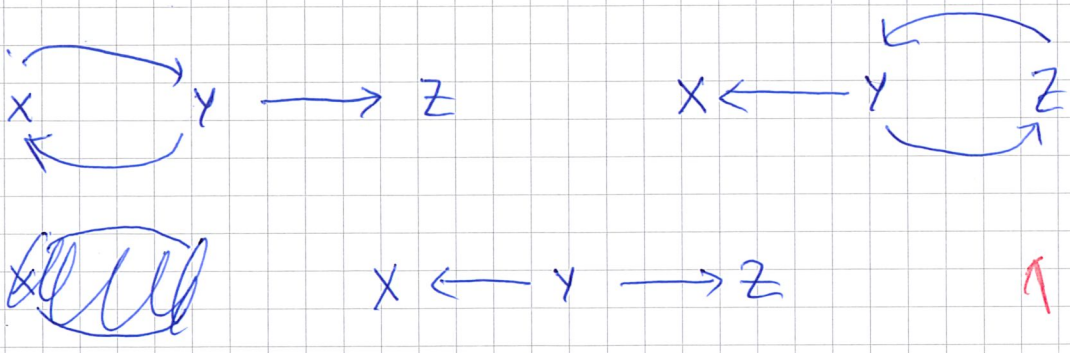
$X \longrightarrow Y \longrightarrow Z$

$X \longleftarrow Y \longleftarrow Z$

$X \longrightarrow Y \longleftarrow Z$

or selection bias, confounding, feedback

but never due to



If we say X is dependent on Y and Y & Z are dependent but X is not caused by Y then

$X \longrightarrow Y \longrightarrow Z$ is the only explanation

Here, $X \not\perp Y$ i.e

$X \longrightarrow Y$ shows the causal relation

Similarly $Y \longrightarrow Z$ shows the causal relation.