Home work-3 on Reasoning with Constraints

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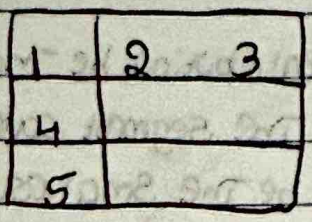


words:- add, age, aid, aim, air, axe, arm, art, bad, bat, bee, boa, dim, ear, eel, elf, lee, oaf

Ans:- The cross word problem is represented as nine squares with each square representing a variable, each variable domain consists of every letter of the Alphabet that may potentially be utilized to build a word from specified word list.

- considering each square to be a slot that can hold any letters of the alphabet. However, not just any letter may go into a slot; the letter must assist to construct a word from the word list when lapped with the letters in the adjoining

Let's discuss on questions:-

Domain consistency:-

The goal is here to ensure that the value assigned to a variable is compatible with the restrictions for example, if no word in the word list begins with the letter 'z' then 'z' cannot be in the top-level square As a result, the letter 'z' would be removed from the domain of that squares

e) Arc consistency:-

This assures that for every value of one variable, there is a compatible value in another variable so that no constraints are violated

Example:- consider two neighboring squares A and B, with A to the left of B. if A includes the letter 'u' and no word in the word list begins with 'u' followed by any letters that B may accept, then assigning 'u' to A would render B inconsistent. In such a circumstance, 'u' might be pruned from A's domain or certain values from B, guaranteeing arc consistency

F) Adequency of domain and Arc consistency:
Are they sufficient? Using domain and arc consistency reduces the number of alternative letter assignments by removing those that will not lead to a solution. They do not, however promise a complete answer. consider them filters that screen out terrible selections, but you may still need to investigate the remaining options
why? because, even if every square (variable) contains a valid letter (value) and every pair of adjacent squares (variables) adhere the word restrictions (arc-consistency), the entire grid may not include legitimate words everywhere. You are assuring that portions of the puzzle are constant, but not complete the jigsaw
To summarize, domain and arc consistency act as sieves, removing evident discrepancies, while work on puzzle although deleting impossible possibilities makes it easier, you may still need to try different combinations of the remaining options

Q2) Consider a scheduling problem, where there are five activities to be scheduled in four time slots. Suppose we represent the activity by the variables by the variables A, B, C, D and E where the domain of each variable is {1, 2, 3, 4} and constraints are $A > D$, $D > E$, $C \neq A$, $C > E$, $C \neq D$, $B \geq A$, $B \neq C$ and $C \neq D$.

a) Show how Back-tracking solve this problem?

This solution looks like tree based on variable ordering C, D, A, B, E

C=1 D:1 failure
D=2 A:1 failure
A=2 failure
B=1 failure
B=2 failure
B=3 E:1 failure
E=2 failure
E=3 failure
E=4 failure
B=4 E=1 failure
E=2 failure
E=3 failure
E=4 failuree
A=4 B:1 failure
B=2 failure
B=3 failure
B=4 E=1 failure
E=2 failure
E=3 failure
E=4 failure

D=3 A=1 failure
A=2 failure
A=3 failure
A=4 B=1 failure
B=2 failure
B=3 failure
B=4 E=1 failure
E=2 failure
E=3 failure
E=4

D=4 A=1 failure
A=2 failure
A=3 failure
A=4 failure

C=2 D=1 failure
D=2 failure
D=3 A=1 failure
A=2 failure
A=3 failure

A=4 B=1 failure
B=2 failure
B=3 failure
B=4 E=1 Solution
E=2 failure
E=3 failure
E=4 failure

D=4 A=1 failure
A=2 failure
A=3 failure
A=4 failure

C=3 B=1 A=1 failure

A=2 B=1 failure

B=2 failure

B=3 failure

B=4 E=1 failure

E=2 failure

E=3 failure

E=4 failure

D=2 failure

D=3 failure

D=4 A=1 failure

A=2 failure

A=3 failure

A=4 failure

C=4 D=1 A=1 failure

A=2 B=1 failure

B=2 E=1 failure

E=2 failure

E=3 failure

E=4 failure

B=3 E=1 failure

E=2 failure

E=3 failure

E=4 failure

B=4 failure

A=3 failure

D=2 A=1 failure

A=2 failure

A=3 B=1 failure

B=2 failure

B=3 E=1 solution

E=2 failure

E=3 failure

E=4 failure

B=4 failure

A=4 failure

D=3 A=1 failure

A=2 failure

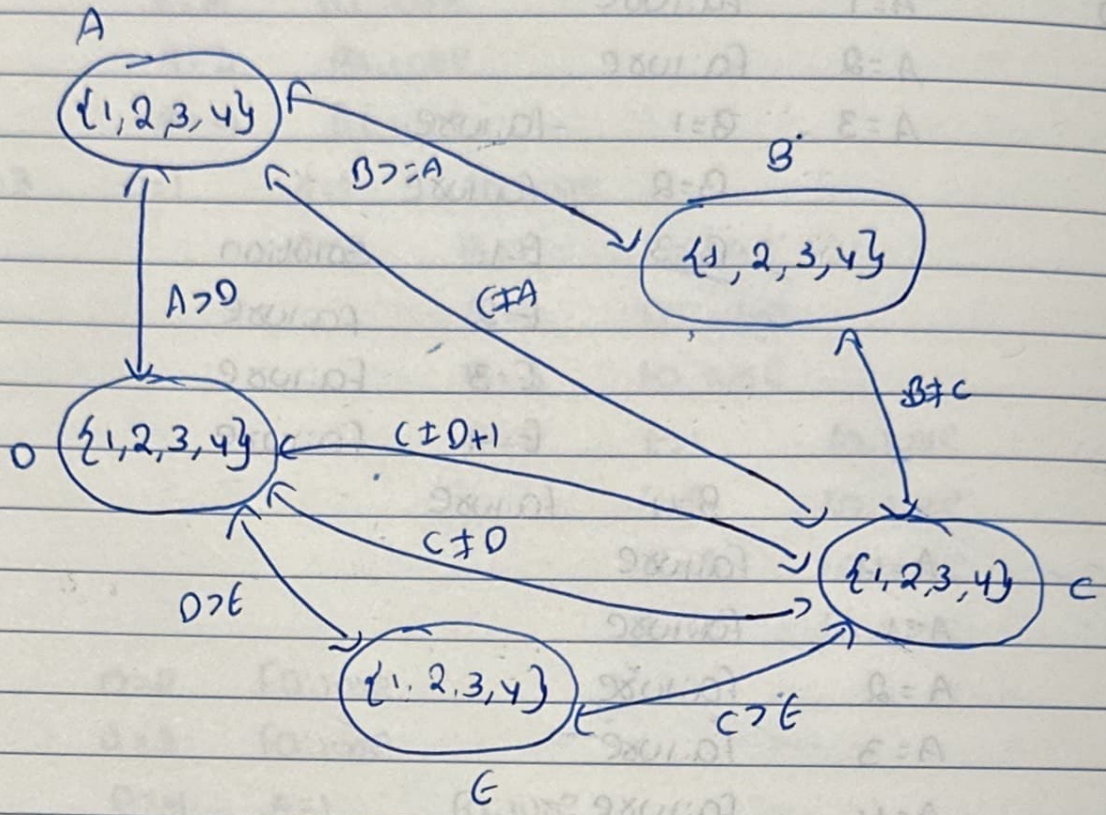
A=3 failure

A=4 failure

D=4 failure

Q2) ARC consistency

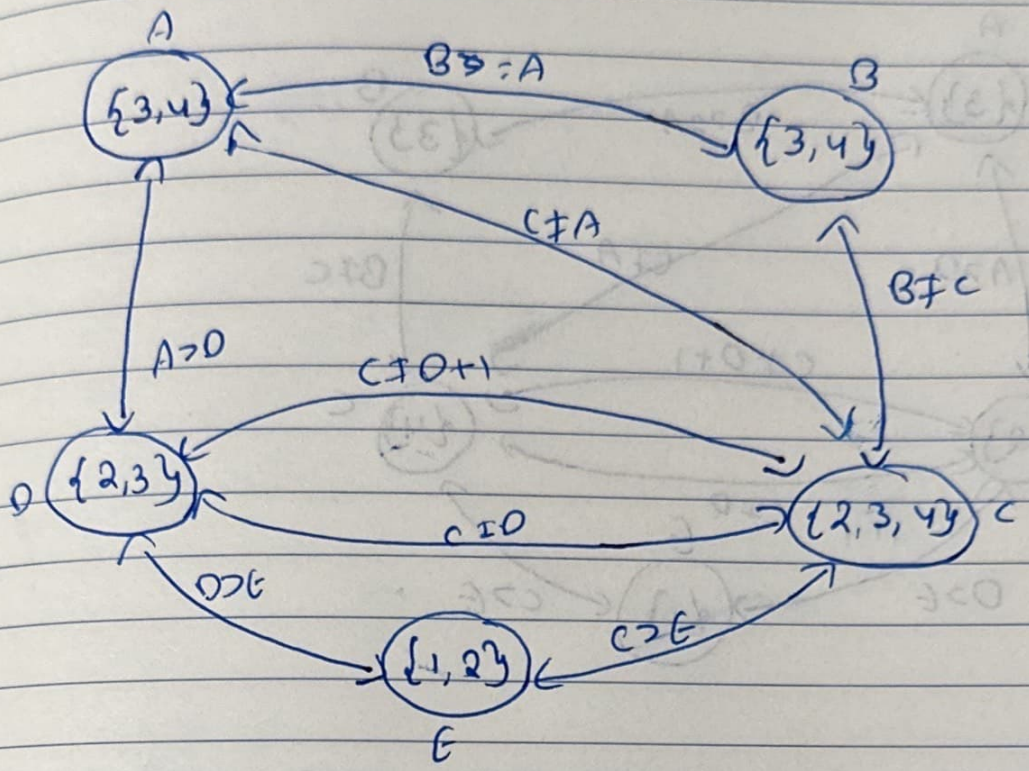
b)



The domain items that are removed at each phase are listed below along with arc that is incharge

Arc	Relation	Deleted value
<D,E>	D>E	D=1
<C,E>	C>E	C=1
<E,D>	D>E	E=4
<D,A>	A>D	D=4
<A,D>	A>D	A=1 and 2
<B,A>	B≥A	B=1 and 2
<E,D>	D>E	E=3

There is a step to arc consistency



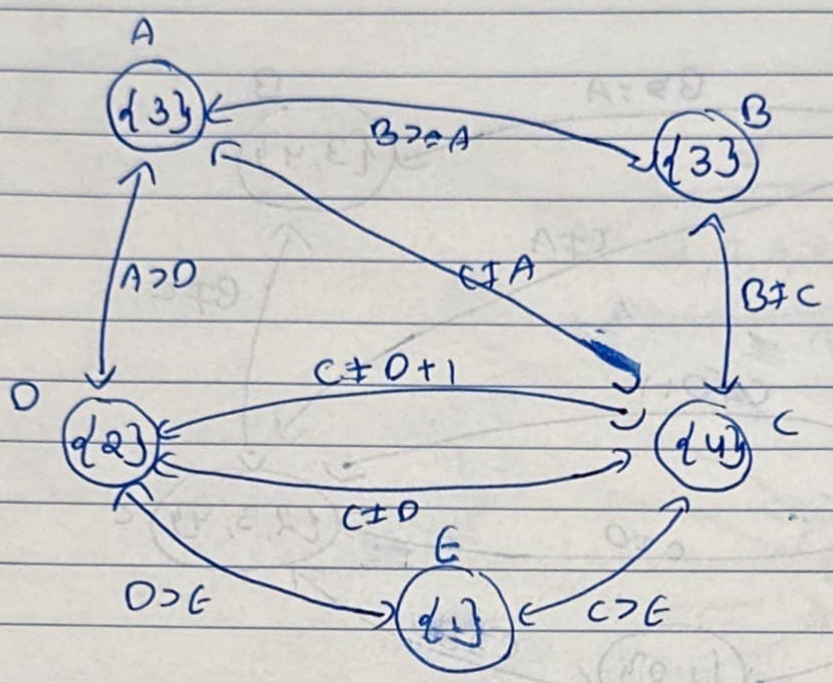
→ we need to take note that are between C and D labelled then C=3 can be deleted by considering the arc <C, d>

→ we will split the domain of D, we have 2 cases. D=2 and 3

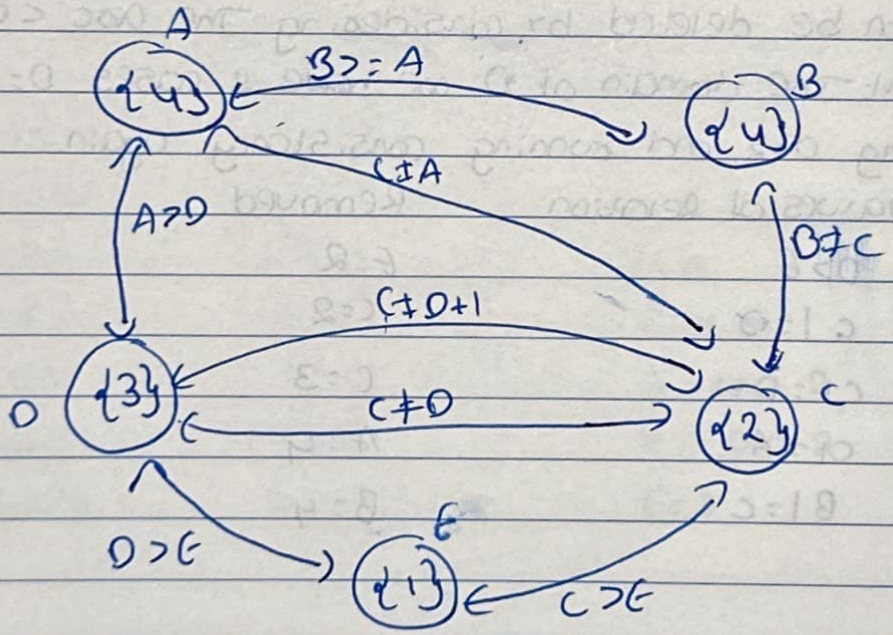
Case-1 :- Putting D=2 and running consistency again

Arc	values of Relation	Removed
<E,D>	D>E	E=2
<C,D>	C!=D	C=2
<C,D>	C!=D+1	C=3
<A,C>	C!=A	A=4
<B,C>	B!=C	B=4

The result will be



Case 2:- we will not choose D=3 in the constraint and run arc consistency



These are 2 constraints are the solution