hw2_csps_q8_backtracking_arc_consistency

Question 8: Backtracking Arc Consistency

0.0/12.0 points (graded)

We are given a CSP with only binary constraints. Assume we run backtracking search with arc consistency as follows. Initially, when presented with the CSP, one round of arc consistency is enforced. This first round of arc consistency will typically result in variables having pruned domains. Then we start a backtracking search using the pruned domains. In this backtracking search we use filtering through enforcing arc consistency after every assignment in the search. Which of the following are true about this algorithm?

Part 1

Which of the following are true about this algorithm?

- [ ] If after a run of arc consistency during the backtracking search we end up with the filtered domains of all of the not yet assigned variables being empty, this means the CSP has no solution.
- [ ] If after a run of arc consistency during the backtracking search we end up with the filtered domain of one of the not yet assigned variables being empty, this means the CSP has no solution.
- [x] None of the above. ✔

Part 2

Which of the following are true about this algorithm?

Generating Speech Output

- [x] If after a run of arc consistency during the backtracking search we end up with the filtered domains of all of the not yet assigned variables being empty, this means the search should backtrack because this particular branch in the search tree has no solution. ✔

- [x] If after a run of arc consistency during the backtracking search we end up with the filtered domain of one of the not yet assigned variables being empty, this means the search should backtrack because this particular branch in the search tree has no solution. ✔

- [ ] None of the above.

Part 3

Which of the following are true about this algorithm?

- [x] If after a run of arc consistency during the backtracking search we end up with the filtered domains of all of the not yet assigned variables each having exactly one value left, this means we have found a solution. ✔

- [ ] If after a run of arc consistency during the backtracking search we end up with the filtered domains of all of the not yet assigned variables each having more than one value left, this means we have found a whole space of solutions and we can just pick any combination of values still left in the domains and that will be a solution.

- [x] If after a run of arc consistency during the backtracking search we end up with the filtered domains of all of the not yet assigned variables each having more than one value left, this means we can't know yet whether there is a solution somewhere further down this branch of the tree, and search has to continue down this branch to determine this. ✔

Part 1:
Both of these cases mean that along the current branch of the search tree there is no solution for the csp, and that backtracking is required. In the special case where no variables have been assigned, then both of these statements are true.
Part 2:
If any domain is empty, that means that no value in that domain can satisfy all of the currently assigned variables. This means that we have to go back and

change at least one of those assignments. In the special case where no variables have been assigned, this means that the CSP has no solution.

Part 3:

Option 1: If there is exactly one value left in every domain, that means that those values satisfy all of the binary constraints of the problem. Explicitly, for every variable, the assignment of the single remaining value has at least one possible value for every other variable, and one of those values is the one that remains in the domain.

Option 2: This case means that we have to continue searching. For example, consider the CSP used in earlier solutions with three variables, A, B, and C, each of which has two values in its domain {1,2}, with the only constraint being that no two variables can have the same value. Arc consistency does not filter anything out, but we don't know yet whether or not there is a solution.

Option 3: See the explanation for option 2.

Submit

Answers are displayed within the problem

Generating Speech Output