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AI Assignment 3 Report

[A] Implementation Details:

1. Backtracking Search (BS)

Backtracking search recursively finds optimal solution for given TA and course values considering lecture timings, lecture recitation timings, TA skills, course details and course requirements. This plain backtracking technique doesn't use any pruning technique which will reduce possible domain values for a particular course. Without any pruning technique it finds optimal solution which is found by assigning score values to every solution we get.

Note:
Domain values for a particular course are the set of TAs which can be assigned to that course.

2. Backtracking Search (BS)+Forward Checking(FC)

In this technique we prune domain values of courses if domain values of different courses are matching so that no two courses are assigned same TA at the same time. Pruning is done by finding all the adjacent courses of a particular course. Adjacent courses are the ones which have same lecture time and same lecture recitation time. This a adjacency concept helps to prune domain values of courses by placing constraint that no two adjacent courses will have same TA assigned and optimal solution is found after pruning domain values of all the courses based on adjacency concept.

3. Backtracking Search (BS)+Forward Checking(FC)+Constraint Propagation(CP)

In this technique we use the concept of arc consistency wherein we prune domain values of a course by making consistency checks between parent and child nodes. This consistency checks are done so that no two courses which are clashing get same TA. Additional pruning is done which reduces the domain values of the courses and finds optimal solution quickly as compared to previous two techniques.

Following formula Is used for finding score of each solution in above three techniques:

score = Number of courses with TA assigned +
Number of completely satisfied courses+
Number of TA which are assigned to courses

Solution with higher score is considered as the optimal solution.

[B] Statistics:

Dataset File Name:sample_data_set2

1. Backtracking Search (BS)

Assignment: ({'cse532': ['ta5', 'ta5', 'ta2', 'ta1'], 'cse306': ['ta2'], 'cse529': ['ta1']},)
Plain Backtracking search (BS) Execution Time:: 0.0201778411865 seconds
Number of Recursion Calls:: 2691

2. Backtracking Search (BS)+Forward Checking(FC)

Course Domains: {'cse532': ['ta5', 'ta2', 'ta1'], 'cse306': ['ta5', 'ta2'], 'cse307': ['ta5', 'ta2'], 'cse529': ['ta5', 'ta2', 'ta1']}

Graph: {'cse306': set(['cse307']), 'cse307': set(['cse306'])}

Assignment: ({'cse532': ['ta5', 'ta5', 'ta2', 'ta1'], 'cse306': ['ta2'], 'cse307': [], 'cse529': ['ta1']},)
BS + Forward Checking (FC) Execution Time:: 0.0194361904144 seconds
Number of Recursion Calls: 2691

3. Backtracking Search (BS)+Forward Checking(FC) +Constraint Propagation(CP)

Course Domains: {'cse532': ['ta5', 'ta2', 'ta1'], 'cse306': ['ta5', 'ta2'], 'cse307': ['ta5', 'ta2'], 'cse529': ['ta5', 'ta2', 'ta1']}

Graph: {'cse306': set(['cse307']), 'cse307': set(['cse306'])}

New Best: ({'cse532': ['ta5', 'ta5', 'ta2', 'ta1'], 'cse306': ['ta2'], 'cse307': [], 'cse529': ['ta1']},)
BS+FC + Constraint propagation Execution Time:: 0.0192840099335 seconds
Number of Recursion Calls: 2691

Dataset File Name:sample_data_set1

1. Backtracking Search (BS)

Assignment: ({'cse306': ['ta2']},)
Plain Backtracking search (BS) Execution Time:: 5.29289245605e-05 seconds
Number of Recursion Calls:: 9

2. Backtracking Search (BS)+Forward Checking(FC)

Course Domains: {'cse306': ['ta2'], 'cse307': ['ta2']}
Graph: {'cse306': set(['cse307']), 'cse307': set(['cse306'])}

Assignment: ({'cse306': ['ta2'], 'cse307': []},)
BS + Forward Checking (FC) Execution Time:: 4.81605529785e-05 seconds
Number of Recursion Calls: 9

3. Backtracking Search (BS)+Forward Checking(FC) +Constraint Propagation(CP)

Course Domains: {'cse306': ['ta2'], 'cse307': ['ta2']}
Graph: {'cse306': set(['cse307']), 'cse307': set(['cse306'])}

Assignment: ({'cse306': [], 'cse307': ['ta2', 'ta2']},)
BS+FC + Constraint propagation Execution Time:: 3.60012054443e-05 seconds
Number of Recursion Calls: 7

Note: It should be noted that, the order in which courses are assigned TAs also plays important role for this TA assignment problem.

[C] Critical Analysis:

For Dataset File Name: sample_data_set1

	BS	BS+FC	BS+FC+CP
Time	**5.29 Seconds**	**4.81 Seconds**	**3.6 Seconds**
Number of Recursion Calls	**9**	**9**	**7**

For Dataset File Name: sample_data_set2

	BS	BS+FC	BS+FC+CP
Time	**0.020 Seconds**	**0.0194 Seconds**	**0.0192 Seconds**
Number of Recursion Calls	**2691**	**2691**	**2691**

[D] Conclusion:

Based on above statistics we can conclude that third approach which is **Backtracking Search(BS)+Forward Checking(FC)+Constraint Propagation(CP)** works better than other techniques since it prunes domain values of all the courses using the concept of arc consistency and recursively finds optimal solution.