Page No.
Date

NAME:- AFNAN ATTAR PRN:- F19112003 CLASS:- BE COMP2 SUBJECT:- DAA ASSIGNMENT No:- 04

Q1) Write time & space complexity of 0/1 knapsack algorithm using dynamic programming.

Ans: Since our memoization array using dynamic programming stores the result for all the subproblems we can conclude that we will not have more than N * C subproblems (where 'N' is the number of items and 'C' is the knapsack capacity).
Therefore, Time complexity = O(N * C)
And, Space complexity = O(N * C)
But we will also use O(N) space for call-stack
hence, space complexity = O(N * C + N)

Q2 Write realistic application of this experiment in brief.

Ans I] Optimal load shedding model for microgrid :-
- The branch and bound algorithm to solve 0-1 knapsack problem one of the most widely-used combinatorial optimization algorithms, is used to capture the customer values and the discrete characteristics of loads.

II] Download Managers :
- One of the application is in Internet Download Manager (IDM).
- The data is broken into chunks, as per the maximum size of data that can be retrived in one go, the server uses this algorithm and packs the chunks so as to utilize the full size limit.

Page No.
Date

Q3) The weight limit for this knapsack is 10 find solution using dynamic programming.

Item	0	1	2	3
Weight	2	2	4	5
Benefit	3	7	2	9

Ans
- We will create a table of 4 rows and 10 columns.
- We will use the formula:
  cell[i][j] = max(cell[i-1][j], value of current item + cell[i-1][j - item's weight])
- Let us solve:

Item \ Weight	1	2	3	4	5	6	7	8	9	10
0	0	3	3	3	3	3	3	3	3	3
1	0	7	7	10	10	10	10	10	10	10
2	0	7	7	10	10	10	10	12	12	12
3	0	7	7	10	10	10	16	16	16	19

Solution :- Maximum profit = 19 which can be achieved by stealing Item 3, Item 1 and Item 0.

Page No.
Date

NAME :- AFNAN ATTAR PRN :- F19112003 CLASS :- BE COMP 2
SUBJECT :- DAA ASSIGNMENT No :- 05

Q1) What is backtracking? What are the peculiar characteristics & applications of this approach?

Ans 1. Backtracking is a general algorithm for solving some computational problems, most notably constraint satisfaction problems, that incrementally builds candidates to the solutions and abandons a candidate's backtracks as soon it determines that the candidate cannot be completed to a resonable solution.

2. In bactracking problem, the algorithm tries to find a sequence path to the solution which has some small checkpoints from where the problem can backtrack if no feasible solution is found.

3. Applications :-

i) Decision problems used to find a feasible solution.

ii) Optimisation problems used to find the best solution that can be applied.

iii) Enumeration problem used to find the set of all feasible solutions of the problem.

Q2) Explain Explicit & Implicit constraints with respect to 8 queen's problem?

Ans 1. A classic problem in combinatorics is to place 8 queens on an 8 by 8 chessboard so that no two can attack each other (row, column or diagonal wise).

2. Since each queen (1-8) must be on a different row, we can assume queen i is on row i.

Page No.
Date

3. All solutions to the 8-queens problem can be represented as an 8-tuple $(x_1, x_2, \ldots, x_8)$ where queen i is on column x_i.
4. Explicit Constraints:- $S_i = \{1, 2, \ldots 8\}$, $1 \le i \le 8$
The solution space consists of 8^8 8-Tuples.
5. Implicit Constraints:- No two x_i's can be the same (as queens must be on different columns) and no two queens can be on the same diagonal.

Q3) Compare the space & time complexity of recursive & Non-recursive technique of backtracking.

Ans I] Recursive :-
In the worst possible case we may end up trying out of all possible arrangement of N-Queens as N!. We are using a matrix of size N*N to represent the board.
Time Complexity : O(N!) | Space Complexity :- O(N*N)

II] Non-recursive:
Non-recursive algorithm can be implemented using stack data structure, hence space and time complexity remains same as recursive
Time Complexity: O(N!) | Space Complexity :- $O(N^2)$

Q4) Write realistic applications of this experiment in brief.

Ans I] Artificial Intelligence in Video Games :-
- Backtracking algorithm can be used to devise AI to play tic-tac-toe, chess and various video games.

II] Programming languages :-
- Logic Programming languages such as Icon, Planner, Prolog use backtracking internally to generate answer.