|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| The Hiker Problem: | | | | | | | |  | | | | | | | | | | | | |
|  | | | | | | | | 1. a greedy heuristic algorithm | | | | | | | | | | | | |
|  | | | | | | | | 2. Dijkstra | | | | | Stage: (过程)，current state: ; destination at end of : ; opt+\* | | | | | | | |
|  | | | | | | | |  | | | | | At stage : (倒着来)  Start on or  If , then and ; if …  (If stages don’t work, we can calculate node by node | | | | | | | |
| Dynamic Programming | | | | | | | : number of stages | | | | | | : label for the current stage | | | | | | : current state for stage | |
|  | | | | | | | : decision variable for stage | | | | | | | | | | : optimal value of xn given | | | |
|  | | | | | | | : contribution of stages ; from to | | | | | | | | | | | | | |
|  | | | | | | |  | | | | | | | | | | | | | |
| Critical Path Method | | | | | | | immediate predecessors(前置); immediate successor(后置); Duration(持续时间) | | | | | | | | | | | | | |
|  | | | | | | | Project Network | | | | | | | | | (AOA) Activity-on-arc project network | | | | |
|  | | | | | | |  | | | | | | | | | (AON) Activity-on-node project network | | | | |
|  | | | | | | |  | | | | | | | | | All activities are between at node ‘Start’ and ‘Finish’ | | | | |
|  | | | | | | | critical path | | | | | | | | | (ES) earliest start time; (EF) earliest finish time | | | | |
|  | | | | | | |  | | | | | | | | | (LF) latest finish time; (LS) latest start time | | | | |
|  | | | | | | | Forward DP | | | | | |  | | ; | | | |  | |
|  | | | | | | | Backward DP | | | | | | ; | | | |  | |
|  | | | | | | | Slack (S) | | | | | |  | |  | | | | | |
|  | | | | | | | 表头 | start from ‘Start’ or ‘Finish’ | | | | | | | |  | | Next node is | | LS/LF or ES/EF |
| Inventory Problem | | | | | | | 确定 stages, states; 找递归profit , is stage and is state(number of ?) | | | | | | | | | | | | | |
| Probabilistic Dynamic Programming | | | | | | | | | | | |  | | | | | | | | |
| Integer | | | |  | | | | | | | | | | | | | | | | |
|  | | | | and and | | | | | | | | | | | | | | | | |
|  | | | | ; | | | | | | | | | | | | | | | | |
| Logical | | | | 1. If job 1 is done, then job 2 is also done. | | | | | | | | | | , | | | | | | |
|  | | | | 2.1 If job 1 is done, then job 2 is not done. | | | | | | | | | | , | | | | | | |
|  | | | | 2.2 equal to at most one can be done | | | | | | | | | | , | | | | | | |
| Either-Or | | | | Either ,  Or | | | | | | | | | |  | | | | | | |
| If-Then | | | | If ,  Then g | | | | | | | | | |  | | | | | | |
| piecewise linear function | | | | | | | | |  | | | | | | | | | | 只有一个激活，  控制两个 | |
|  | | | | | | | | |
|  | | | | , 是断点处函数值 | | | | | | | | | | | | | | | | |
|  | | | | ; | | | | | | | | | | | | | | | | |
|  | | | | , ,…, , ; | | | | | | | | | | | | | | | | |
|  | | | | , , | | | | | | | | | | | | | | | | |
| Branch-and-Bound Method | | | | | | | | | | |  | | | | | | | | | |
| Branch-and-Bound  for a Mixed Integer Problem | | | | | | | | | | |
|  | | | | | | | | | | | Add new constraint to the original problem | | | | | | | | | |
| Gomory cuts | | | |  | 取positive fractional part: | | | | | | | | | | | | | | | |
|  | | | |  | fractional part放右侧放缩: | | | | | | | | | | | | | | | |
|  | | | |  | 取negative fractional part | | | | | | | | | | | | | | | |
|  | | | | 1. get LP solution and its active constraints e.g. , | | | | | | | | | | | | | | | | |
|  | | | | 2. add slack variables e.g. , , | | | | | | | | | | | | | | | | |
|  | | | | 3. 整理用表示: ; | | | | | | | | | | | | | | | | |
|  | | | | 4. 选一个式子将’’分解为’’ and ‘’, 然后放缩, 整理消掉, 常数取整！！ | | | | | | | | | | | | | | | | |
| Zero-Sum Games | | | | | Payoff table: 行列标是strategies, 矩阵元素是gain (positive or negative) for row player | | | | | | | | | | | | | | | |
|  | | | | | Row player wants bigger num; column plater wants smaller num | | | | | | | | | | | | | | | |
|  | dominated strategies | | | | | | | 1. Strategy A is dominated by strategy B: e.g. | | | | | | | | | | | | |
|  |  | | | | | | | 2. Eliminate/delete dominated strategy A | | | | | | | | | | | | |
|  | value of the game | | | | | | | payoff to player 1 when both players play optimally | | | | | | | | | | | | |
|  | Fair game | | | | | | | value of the game is zero | | | | | | | | | | | | |
|  | minimax criterion | | | | | | | 最小化 可能的最大损失 （绝对保守） | | | | | | | | | | | | |
|  |  | | | | | | | player 1: select the strategy whose minimum payoff is maximum | | | | | | | | | | | | |
|  |  | | | | | | | player 2: choose the strategy whose maximum payoff is minimum | | | | | | | | | | | | |
|  |  | | saddle point | | | | | | the same entry in this payoff table yields both the maximin and the minimax values | | | | | | | | | | | |
|  |  | | stable solution | | | | | | Or equilibrium position: 彼此不能通过改变策略去沾光 | | | | | | | | | | | |
|  |  | | unstable solution | | | | | |  | | | | | | | | | | | |
| Games with Mixed Strategies | | | | | | | | | player根据概率分布选择strategy i.e. 是player1选择strategy 的概率 | | | | | | | | | | | |
|  | | mixed strategies | | | | | | | Plans for player1 and Plans for player2 | | | | | | | | | | | |
|  | | pure strategy | | | | | | | the original strategies | | | | | | | | | | | |
|  | | expected payoff | | | | | | | , where is payoff | | | | | | | | | | | |
|  | | This optimal value for player 1 is represented with : maximum minimum expected payoff. | | | | | | | | | | | | | | | | | | |
|  | | The optimal value for player 2 is represented with : minimum maximum expected loss. | | | | | | | | | | | | | | | | | | |
| Minimax Theorem | | | | | | If mixed strategies are allowed, the pair of mixed strategies that is optimal according to the  minimax criterion provides a stable solution with | | | | | | | | | | | | | | |
| 在没有stable solution的时候，就要用到mix，在假定A player use pure, B player计算mix的概率 | | | | | | | | | | | | | | | | | | | | |
| Graphical Solution Procedure | | | | | | | | | | 1. 选一个player A去掉dominated strategies | | | | | | | | | | |
|  | | | | | | | | | | 2. 设A选策略概率, 如果只有两个，则; | | | | | | | | | | |
| (maximin or minimax) | | | | | | | | | | 3. 列出B每个pure strategy 下player1的expected payoff | | | | | | | | | | |
|  | | | | | | | | | | 真正的expected payoff for A: | | | | | | | | | | |
|  | | | | | | | | | | 画横轴为, 纵轴为expected payoff的图 | | | | | | | | | | |
|  | | | | | | | | | | 对于每个, B都会选对方获得最少的线（strategy）  , e.g. player2 want min E for player1 | | | | | | | | | | |
|  | | | | | | | | | | 在B选好的线里, 让A选出对自己获利最大的点 | | | | | | | | | | |
|  | | | | | | | | | | 选线中只有两个被用, 没用的, 利用  列出A每个pure strategy 下player1的expected payoff | | | | | | | | | | |
| （） | | | | | | | | | | 对于每个给定的, A会选择对自己有利的, 然后B在此基础上选 | | | | | | | | | | |
|  | | | | | | | | | |  | | | | | | | | | | |
| Solution with Linear Programming | | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | | |