1 Statement of Principle of Optimality

"An optimal policy has the property that what ever the initial state and initial decision are the remaining decision must constitute an optimal policy with regard to the state resulting from the first decision." If an optimal state P results in a state Q , this initial state to

Figure 1: Optimal policy

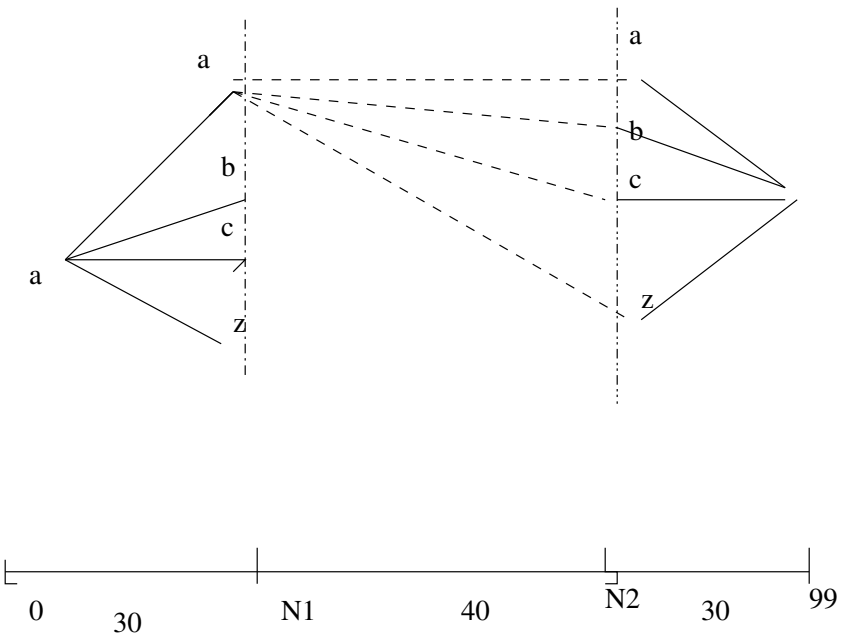
this final state ,the portion of the original must be optimum.That is every part of optimal policy is optimal.

1.1 How to use this principle ?

The important part of the optimum is the initial state and final state. Also by the meaning of the optimum in terms of control it is the input and not the trajectories concerned, what input must be applied optimally to take the trajectory from one state to other. Consider a problem of 26 states and 3 inputs a shown in figure. Here the optimum is with respect to state and optimum policy is with respect to total cost.Using BrootForce method say for 100 stages and 3 inputs the total computation involved is 3^{100}, which requires a super compuetr network to solve this problem.Hence parellel processing approach is used and while programming the least steps at each state is calculated and stored. This avoids looking up all the possibilities hence making the computing the minimum.

1.2 How much small ?

Consider a 100 state problem with 3 inputs Let us partition the problem in to 3 stages with 30 states , 40 states and 30 states i.e. 0 through N1 through N2 to 99.
With the 3 inputs it is found that the computational coplexity is if the order of 3^{43} whichis much less than normal 3^{10} using Brootforce method. In general case for solving 100 stage problem we assume that solution of 99 stage is available then decided the solution of one stage add to it to get the complete optimal solution.



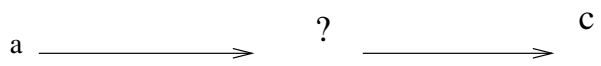
With 3 inputs
Sum = 3**30 + 26*3**10 + 26*3**30

approx 3** 43 = 10 **20

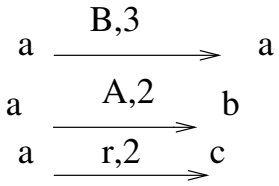
Figure 2: 3 stage problem

1.3 Solve the example problem of lecture No.26 as a 2 stage problem using Bellmans optimality principle

Solution referring figure.3. Here first stage has total of 9 computations.
Here the solution of each problem is helped by the previous problem.Hence the optimal solution is found as state a through a to c resulting in an optimal cost of 5.
The problem is defined in this case as initial and final states transfer to be acheived. But the same problem become complex for undefined intial and final states.



I stage problem



II stage problem

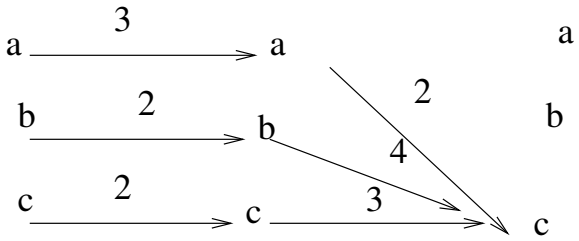


Figure 3: 2 stage problem

1.4 Solve the above problem by the method of back propogation with defined initial state transfer a and final state c ?Also solve the above problem for undefined initial and final states.