

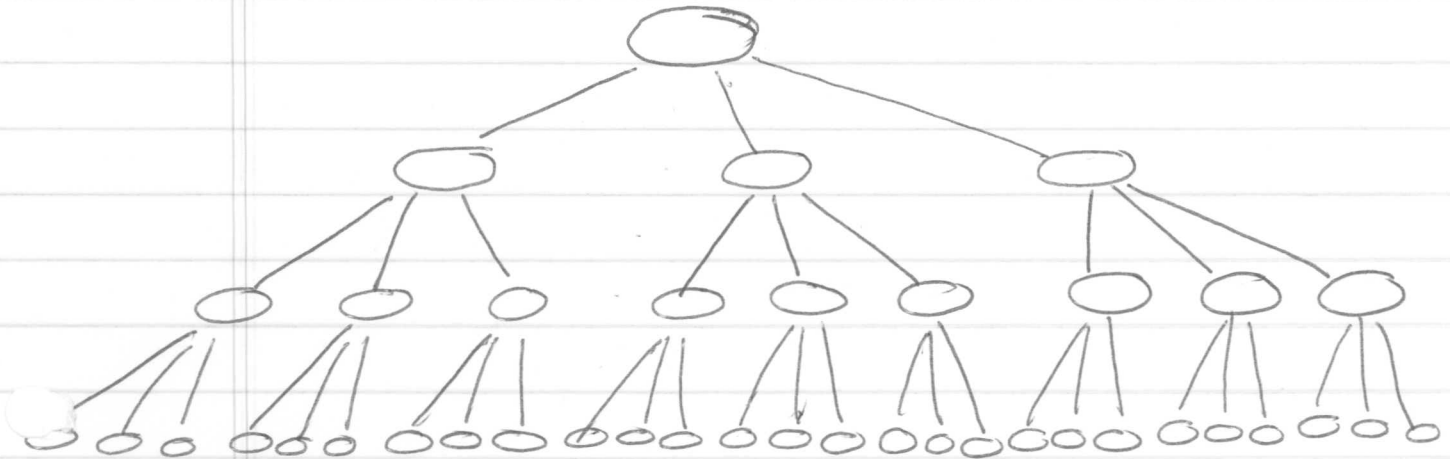
ETM 645

IMPLICIT ENUMERATION REVIEW

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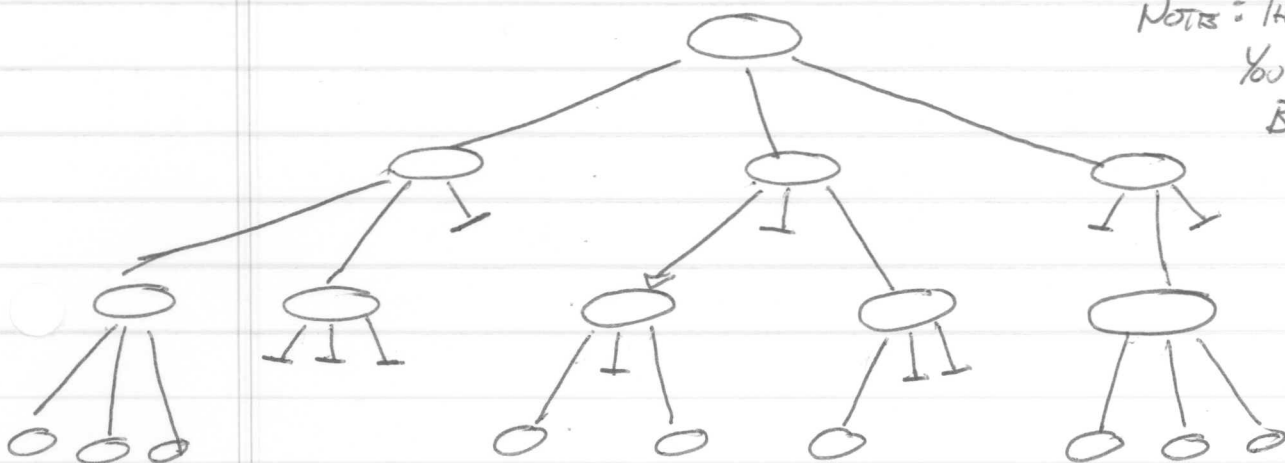
ENUMERATION

EVALUATES ALL POSSIBLE SOLUTIONS IN A COMBINATORIAL OPTIMIZATION PROBLEM.



IMPLICIT ENUMERATION

TRIES TO FATHOM/CULL AS MANY BRANCHES OF THE ENUMERATION TREE AS POSSIBLE WITHOUT ELIMINATING OPTIMAL SOLUTION.



NOTE: THE SOONER/HIGHER
YOU FATHOM, THE
BETTER!

How To Fathom/Cull Branches Of An Implicit Enumeration Tree

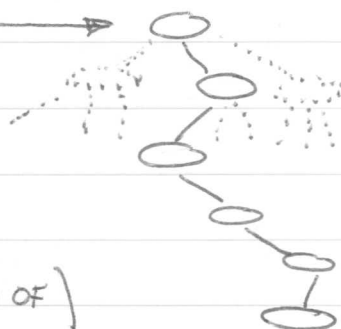
- Apply optimality condition constraints such as EDD within family from our example problem.
- Compare this lower bound to the upper bound at each node.

For Minimization Problem

• Upper Bound - Best solution/Completion found so far

• Initial Upper Bound - Found using heuristic →

• Lower Bound - An optimal solution to a relaxed version of the original problem (e.g. LP relaxation of an IP problem)



We know:

$$\boxed{\text{Lower Bound (LB)} \leq \text{Opt. Solution} \leq \text{Upper Bound (UB)}}$$

So, when evaluating a node where some variables are fixed, and the remaining are free, calculate the lower bound. This value represents an optimal solution to this relaxed problem which is $\leq$ best completion below that node. $\therefore$ If this $\text{LB} \geq \text{UB}$ then fathom the node.

(3)

AS THE IMPLICIT ENUMERATION PROGRESSES, COMPLETIONS ARE OBTAINED (BOTTOM NODES OF TREES REACHED). IF THE VALUE OF THE COMPLETION IS LESS THAN THE CURRENT UB, THEN UPDATE THE UB TO THIS NEW VALUE, AND THAT COMPLETION BECOMES THE NEW INCUMBENT SOLUTION.

SO AS THE IMP. ENUM. PROGRESSES, THE UB IS BEING REDUCED, THEREBY MAKING IT EASIER TO FATHOM NODES.

IT SHOULD NOW BE CLEAR THAT WHEN CREATING A LOWER BOUNDING TECHNIQUE THAT OBTAINING THE GREATEST (HIGHEST) LOWER BOUND POSSIBLE IS DESIRABLE.

BOTTOM LINES:

IMPLICIT ENUMERATION IS MUCH FASTER THAN ENUMERATION FOR OBTAINING AN OPTIMAL SOLUTION, BUT COULD STILL TAKE AN INORDINATE AMOUNT OF TIME.