

Discrete Optimization II

COMP657

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One of the complex problems in the open pit mining process is to calculate and design the mining schedule. The schedule refers to the amount of material that is mined in every period during the mine life. It is assumed that a representation of the deposit underground is known; this representation is a discretized model where every element belonging to it has a specific value. The idea is to obtain the maximum profit from extracting the material from the ground given a certain model. During the mining process several operations are performed these are: drilling, blasting, loading and hauling material (tasks performed in the mine site), processing the material that reports profit, discard material with no interesting value and stockpile material that in the current period does not represent profit but in future periods may have a significant economic value. Hence along with deciding the amount of material to be mined in a specific period, the decision of what to do with this material has to be made; the material that gives value to the project it is called ore and after extracting it, it is sent to a processing plant, the material that does not give value to the project it is labelled as waste and it is sent to a waste dump, and finally the material that can report profit in future periods is sent to a stockpile. These decisions have to be optimised in order to generate the maximum value to the project.

There are technical limitations in the mining operation such as the capacity of the mining equipment (drills, shovels, trucks, etc), the capacity of the processing plant and the capacity of the stockpile site. There are another limitations to the problem referring to the safety of the operation and the stability of the pit. Given some geomechanical restrictions the walls of the pit cannot exceed a certain angle, these constraints are referred as the slopes constraint, and give the shape of cone to the open pit mine. Another restriction has to be taken into consideration; it is not possible to mine an element of the model before mining the elements that are above of this element, these restrictions are named precedence constraints. The problem is considered an integer programming problem given that an element of the model cannot be mined partially given the precedence constraints.