CS301 Assignment 5

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- State the decision version of this optimization problem: Input? Output?

Decision problem: Given a set T of projects, a positive integer c, and a positive integer p, does there exist a subset of projects in T such that the total effort required to complete the projects is at most c and the total profit gained is at least Pt.

Decision input: A set T of projects, a positive integer c, and a positive integer p.

Decision output: YES or NO.

So, the input to the decision problem consists of a set T of projects, a positive integer c representing the maximum amount of effort that can be spent on the projects, and a positive integer p representing the minimum profit that must be gained. The output is either YES (indicating that there exists a subset of projects that meets the required conditions) or NO (indicating that no such subset exists).

Therefore, the set T of projects, positive integer c denoting the greatest effort that can be put into the projects, and positive integer p denoting the required minimum profit make up the input to the decision issue. The result is either YES (showing that a subset of projects exist that satisfy the necessary conditions) or NO (indicating that no such subset exists).

- Prove that the decision version is in NP

To prove that this decision problem is in NP, we need to show that it can be solved in polynomial time on a nondeterministic computer. Here's how we can do that:

To begin, we must clearly and formally define the decision version of the problem, which this should include a description of the problem's inputs (a set T of projects, a positive integer c, and a positive integer p), the possible outputs (YES or NO), and the relationship between the inputs and the outputs, as I described in part 1's answer.

Second, we must demonstrate that it is simple to confirm that a given solution is accurate. It is simple to determine if the total work needed to accomplish the projects is at most c and the total profit obtained is at least p given a suggested solution (a subset of projects in T). By simply summing the effort and profit values of the projects in the subset and comparing the results to c and p, this can be completed in polynomial time.

Finally, demonstrate that a nondeterministic computer can solve the issue in polynomial time. A brute-force search technique that creates every conceivable subset of projects in T and determines whether the total effort and profit for each subset satisfy the necessary requirements can be used to do this. This procedure runs in polynomial time since its time complexity is O(2n), where n is the total number of projects in T.

Therefore, we can conclude that the decision version of the problem is in NP.