CS301 Assignment 5 Answers
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Question 1:

Input:
- A set T of projects: where for each project $t \in T$:
  - e_t denotes the required ammount of effort for the project t
  - p_t denotes the profit gained by completing the project t

- A positive integer c: denotes the maximum amount of effort that can be spent
- A positive integer k: denotes the maximum amount of profit that can be gained from the projects in T

Output:
Is there a possible solution subset of T that total amount of effort spent on projects is at most c while the profit is at least k?

Question 2:

For a problem to be in NP, the solution of the problem has to be guessed with a non-deterministic algorithm and the correctness of the solution has to be verified in polynomial time.

At first, this problem can be solved by an algorithm that tries all possible subsets with brute force method and find the subset that has a maximum profit. A set can be have 2^n subsets, thus the algorithm has to carry out 2^n comparison operations. This operation can be done with non-deterministic approach that can guess parallely and compare the results, which can be done in polynomial time. This shows that the first condition to be in NP is satisfied.

Secondly, if we say B is a guessed solution for the problem. In order to verify the correctness of the solution B we need to find the sum of all p_t values of the projects in the solution set and compare it with k. For sum operation it can be done in O(n) time and comparison with k is O(1).