Abstract
PROBLEMS IN SCHEDULING THEORY

Tamir Parasha	Arye Gross	Danny Gan or
200762961	308431642	302960786

Introduction:
This project delves into the scheduling problem presented in the article by Kellerer and Strusevich dealing with difficult NP knapsack problems, process scheduling and with finding approximate FPTAS solutions[1].
Knapsack Problem: The term refers to problems involving placing objects with a maximum quantity of values in a knapsack with a limited volume.
Complex Knapsack Problems: A group comprising of thousands of problems where if a polynomial solution for one of the problems is found then it can be proved that is computationally easy to examine every problem in order to determine if the proposed solution is valid[2].
Approximate FPTAS format Solution: A Solution that includes the use of approximation algorithms and is considered the most effective approximation algorithm type for complex NP problems. This approximation algorithm gives for each ϵ selected, approximation of $S*(1+\epsilon)$(for minimal problems) in polynomial complexity for variables $1/\epsilon$,n[3].
Problem Description: Given, one machine and a number of tasks, each with a known process time P_j and importance W_j, the time at which each task ends is C_j, and there is also a time interval [s, t] where the machine is disabled from work. In addition, it was defined that if a particular task ceased in the middle, the same task should start from the beginning after the break. The target function is to minimize $\sum_{i=1}^{n} W_j C_j$. In the article a pseudo-polynomial solution to this problem was presented, utilising a FPTAS-shaped solution. Furthermore, we will design a pseudo-polynomial solution to the same problem where it is possible to postpone some tasks, given a limit on the amount of deferral costs that can be incurred. That is, in the case where each task has an (additional) cost of deferment E_j and there is a total deferment cost of U., we will try to further minimize the target function within the restriction that the total sum of rejections must be less than or equal to U. In addition, a pseudo-polynomial solution for a FPTAS-like solution was presented to a problem identical to the first, with the exception that a ceased task could continue, after the break, from the point at which it had stopped. This solution is also implemented and we will design a pseudo-polynomial algorithm given the deferral option described above.

---

[1]Kellerer, H.,& Strusevich, V. A.(2010). Fully polynomial approximation schemes for a symmetric quadratic knapsack problem and its scheduling applications. Algorithmica, 57(4), 769-795. [2]This is considered one of the most complex and analyzed problems in computer science. Formally: If the solution exists then $P = NP$, otherwise $P \neq NP$.[3]
For example,$n^2 * \frac{1}{\epsilon^4}$