

## Comparison of dynamic programming and greedy algorithms and the way to solve 0-1 knapsack problem

Yitian Wu

School of Computer Science, Central South University for Nationalities, Wuhan, Hubei Province, China, 430000

wuyitian2022@163.com

**Abstract.** The 0-1 knapsack problem is widely used in reality and it belongs to NP-hard problems. Starting from the basic ideas and time complexity of the algorithm, this paper analyzes how to choose a strategy to solve the problem. This paper aims to solve practical problems and analyzes the 0-1 knapsack problem in combination with the real-life cargo delivery problem. Dynamic programming and greedy algorithms are used to tackle the problem respectively, and the advantages and disadvantages of two strategies are discussed, so as to analyze how to decide which strategy to adopt to solve the problem when encountering the 0-1 knapsack problem in an actual situation. In the face of large-scale problems, this paper suggests choosing greedy algorithm because it will save a lot of time. In the face of small-scale problems that require absolute solutions, this paper suggests choosing dynamic programming to solve the problem.

**Keywords:** 0-1 Knapsack Problem, Dynamic Programming, Greedy Algorithm, Maximal Knapsack Packing, Optimal Solution.

### 1. Introduction

The knapsack problem was proposed by Merkel and Heilmann in 1978. Later, by studying its characteristics, it is shown that this problem is a typical NP-complete problem. It is widely used in various industrial situations, such as capital budget, cargo handling, and storage allocation problems, which can be transformed into the 0-1 knapsack problem, so the study of the solution of the 0-1 knapsack problem has important practical significance [1]. At present, the existing solution methods can be divided into two categories: the exact algorithm, such as dynamic programming algorithms, backtracking method, and branch and bound method. The other is approximate algorithms, such as greedy, ant colony algorithm and genetic algorithm. This paper mainly selects a typical algorithm for analysis from two types of algorithms, namely dynamic programming algorithm and greedy algorithm [2]. In the early 1950s, the American mathematician R. Behlman and others proposed the famous optimization principle when studying the optimization problem of a multi-stage decision-making process, and thus established dynamic programming. Dynamic programming has a wide range of applications, including engineering technology, the economy, industrial production, military and automation control, and other fields. Greedy algorithm was first proposed by J. C. Wnsdorff in 1823, which means that the current optimal choice is always made when solving a problem, that is, the local optimal solution. Greedy algorithms have two basic elements: greedy selection and optimal substructure. It is the closest to the human daily thinking of a problem-solving strategy and is essentially an improved

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## **Table of Contents Practice Problems Dynamic Programming And Greedy Algorithms**

1. Understanding the eBook Practice Problems Dynamic Programming And Greedy Algorithms
  - The Rise of Digital Reading Practice Problems Dynamic Programming And Greedy Algorithms
  - Advantages of eBooks Over Traditional Books
2. Identifying Practice Problems Dynamic Programming And Greedy Algorithms
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
3. Choosing the Right eBook Platform
  - Popular eBook Platforms
  - Features to Look for in an Practice Problems Dynamic Programming And Greedy Algorithms
  - User-Friendly Interface
4. Exploring eBook Recommendations from Practice Problems Dynamic Programming And Greedy Algorithms
  - Personalized Recommendations
  - Practice Problems Dynamic Programming And Greedy Algorithms User Reviews and Ratings
  - Practice Problems Dynamic Programming And Greedy Algorithms and Bestseller Lists
5. Accessing Practice Problems Dynamic Programming And Greedy Algorithms Free and Paid eBooks

- Practice Problems Dynamic Programming And Greedy Algorithms Public Domain eBooks
  - Practice Problems Dynamic Programming And Greedy Algorithms eBook Subscription Services
  - Practice Problems Dynamic Programming And Greedy Algorithms Budget-Friendly Options
6. Navigating Practice Problems Dynamic Programming And Greedy Algorithms eBook Formats
    - ePub, PDF, MOBI, and More
    - Practice Problems Dynamic Programming And Greedy Algorithms Compatibility with Devices
    - Practice Problems Dynamic Programming And Greedy Algorithms Enhanced eBook Features
  7. Enhancing Your Reading Experience
    - Adjustable Fonts and Text Sizes of Practice Problems Dynamic Programming And Greedy Algorithms
    - Highlighting and Note-Taking Practice Problems Dynamic Programming And Greedy Algorithms
    - Interactive Elements Practice Problems Dynamic Programming And Greedy Algorithms
  8. Staying Engaged with Practice Problems Dynamic Programming And Greedy Algorithms
    - Joining Online Reading Communities
    - Participating in Virtual Book Clubs
    - Following Authors and Publishers Practice Problems Dynamic Programming And Greedy Algorithms
  9. Balancing eBooks and Physical Books Practice Problems Dynamic Programming And Greedy Algorithms
    - Benefits of a Digital Library
    - Creating a Diverse Reading Collection Practice Problems Dynamic Programming And Greedy Algorithms
  10. Overcoming Reading Challenges
    - Dealing with Digital Eye Strain
    - Minimizing Distractions
    - Managing Screen Time
  11. Cultivating a Reading Routine Practice Problems Dynamic Programming And Greedy Algorithms
    - Setting Reading Goals Practice Problems Dynamic Programming And Greedy Algorithms
    - Carving Out Dedicated Reading Time
  12. Sourcing Reliable Information of Practice Problems Dynamic Programming And Greedy Algorithms
    - Fact-Checking eBook Content of Practice Problems Dynamic Programming And Greedy Algorithms
    - Distinguishing Credible Sources
  13. Promoting Lifelong Learning
    - Utilizing eBooks for Skill Development

- Exploring Educational eBooks
14. Embracing eBook Trends
- Integration of Multimedia Elements
  - Interactive and Gamified eBooks

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