SAVEETHA SCHOOL OF ENGINEERING

SAVEETHA INSTITUTE OF MEDICAL AND TECHNICAL SCIENCES

CSA0697 DESIGN AND ANALYSIS OF ALGORITHM FOR LOWER BOUND THEORY

TOPIC:
Optimized Dynamic Programming for Time-Critical Applications

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DYNAMIC PROGRAMMING:

- Dynamic programming (DP) is a method used in computer science and mathematics to solve problems by breaking them down into simpler sub problems and solving each sub problem just once, storing its solution.
- The key concept is to use these stored solutions to avoid redundant calculations, thereby optimizing the overall computation.
- Develop a recursive relationship (often called the recurrence relation) that relates the solution of a problem to the solutions of its sub problems.
- Solve the sub problems starting from the smallest ones and use their solutions to build up the solution to the original problem.

TIME CRITICAL EXAMPLES FOR DYNAMIC PROGRAMMING

- Task Scheduling System
- Economic Order Quantity (EOQ)
- Stock Buy And Sell Problem
- Travelling Sales Man
- Levenshtein Distance (Edit Distance)

TASK SCHEDULING SYSTEM

- A task scheduling system is a software or program that manages and schedules tasks or jobs to be executed in a specific order and time.
- Task/Job: A unit of work to be executed, such as a program, script, or process
- 2. Scheduling: The process of assigning a time and resource allocation for a task to be executed.
- 3. Scheduler: The component that manages and schedules tasks, making decisions on when and how to execute them.
- 4. Scheduling Algorithms: Techniques used by the scheduler to determine the order and timing of task execution, such as:
  - First-Come-First-Served (FCFS)
  - - Shortest Job First (SJF)
  - - Priority Scheduling

- Task scheduling systems are used in various domains, including:
- 1. Operating Systems
- 2. Distributed Systems
- 3. Real-time Systems
- 4. Cloud Computing
- 5. Manufacturing Systems
- 6. Project Management
- Some popular task scheduling systems include:
- 1. cron (Unix/Linux)
- 2. Windows Task Scheduler
- 3. Apache Airflow
- 4. Celery (Python)
- 5. Jenkins (CI/CD)
- These systems help manage and automate tasks, ensuring efficient use of resources and timely execution of tasks.

ECONOMIC ORDER QUANTITY

- The economic order quantity (EOQ) is a company's optimal order quantity that meets demand while minimizing its total costs related to ordering, receiving, and holding inventory.
- The EOQ formula is best applied in situations where demand, ordering, and holding costs remain constant over time.
- Example of Economic Order Quantity

  The shop sells 1,000 shirts each year. It costs the company $5 per year to hold a single shirt in inventory, and the fixed cost to place an order is $2. The EOQ formula is the square root of (2 x 1,000 shirts x $2 order cost) / ($5 holding cost), or 28.3 with rounding.

FORMULA FOR EOQ

- The Economic Order Quantity formula is:
- EOQ = The square root (√) of 2x (annual demand in units, multiplied by order cost per purchase order), divided by annual holding cost per unit.

$$EOQ = \sqrt{\frac{2 * Demand * Ordering\ Costs}{Holding\ Costs}}$$

Conclusion

Dynamic programming (DP) is a powerful and versatile technique widely used in real-time applications to solve complex optimization problems efficiently. By breaking down problems into simpler sub problems and storing their solutions, DP avoids redundant computations, significantly reducing the time and space complexity compared to naive approaches. In essence, DP provides a systematic method for tackling problems that involve overlapping sub problems and optimal substructure, making it an indispensable tool in computer science and operations research for devising efficient and scalable solutions.

THANK YOU!