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Assignment - 1

① Prove of knapsack problem theory.

Ans when there is a set of items, weight & values with a knapsack it maximize the weight capacity = determine the most valuable combinition of items to include in the knapsack without exceeding its weight capacity.

Mathmetically

n items each represent a index 'i' ($1 \le i \le n$)

Let, 'wi' be the weight of 'i'.

vi be the value (profit) of item 'i'.

W be the maximum capacity of knapsack

for maximize the problem can formulate,

$$\text{Max} \sum (v_i * x_i) \text{ for } 1 \leq i \leq n$$

subject $\sum (w_i \times x_i) \leq W$ for $1 \leq i \leq n$

x_i is a binary variable representing whether item i is included in the knapsack ($x_i = 1$) or not ($x_i = 0$)

② Huffman coding optimal substructure.

Ans

Huffman coding is ~~optimal~~ exhibit optimal substructure property. it is a greedy algorithm approach. it minimize the average length of the encoded data by assigning variable length codes to characters based on their frequencies. The substructure property manifests in Huffman coding:

① splitting into Subproblems.
② optimal Solution to subproblems.
③ Constructing the Entire Solution.

(3) No sorting algorithm is better then (n log n.)

Ans For generic elements that only compare and not access the internals of, it is impossible to have a sorting algorithm faster than theta (n log n). Because there are n factorial n! possible orders of the elements and you need theta (n log n) comparisons to distinguish all of them.