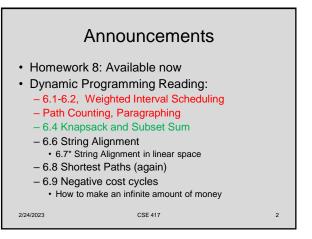
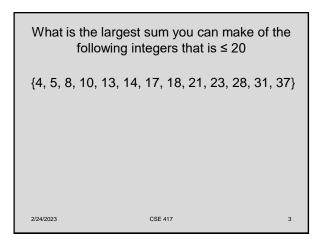
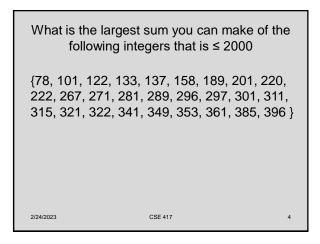
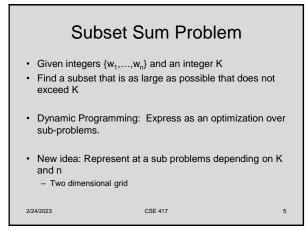
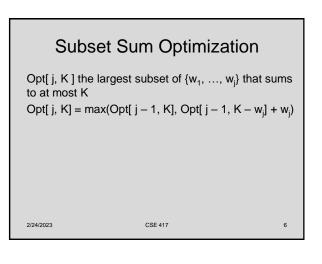
| | CSE 417 Algorithms | |
|-----------|---|---|
| | Lecture 20, Winter 2023 Dynamic Programming Subset Sum etc. | |
| 2/24/2023 | CSE 417 | 1 |

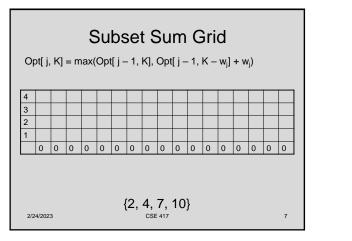




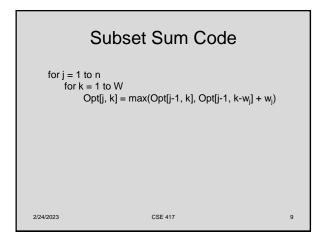


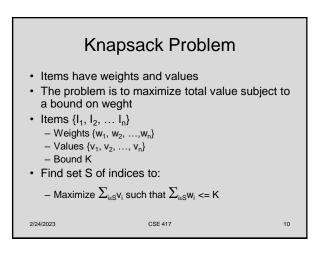


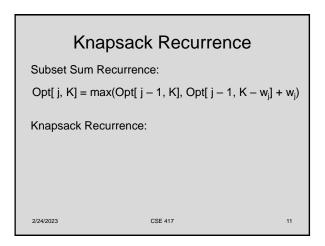


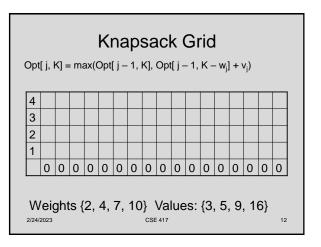


| | 1 | - | - | | | | - | - | | | | | | | | | |
|---|---|---|---|---|---|---|-----|----|----|-----|----|----|----|----|----|----|----|
| 4 | 0 | 2 | 2 | 4 | 4 | 6 | 7 | 7 | 9 | 10 | 11 | 12 | 13 | 14 | 14 | 16 | 17 |
| 3 | 0 | 2 | 2 | 4 | 4 | 6 | 7 | 7 | 9 | 9 | 11 | 11 | 13 | 13 | 13 | 13 | 13 |
| 2 | 0 | 2 | 2 | 4 | 4 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 1 | 0 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | 4 | [2, | 4, | 7, | 10] | } | | | | | | |





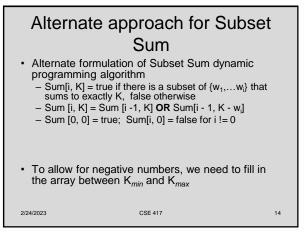




Knapsack Grid

 $Opt[j, K] = max(Opt[j - 1, K], Opt[j - 1, K - w_j] + v_j)$

| | 17 | 17 | 47 | | | 16 | 16 | 12 | 9 | 9 | 8 | 5 | 5 | 3 | 3 | 0 | 4 |
|---|----|----|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|
| | | | 17 | 17 | 14 | 14 | 12 | 12 | 9 | 9 | 8 | 5 | 5 | 3 | 3 | 0 | 3 |
| 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 5 | 5 | 3 | 3 | 0 | 2 |
| 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 0 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |



Run time for Subset Sum With n items and target sum K, the run time is O(nK) If K is 1,000,000,000,000,000,000,000,000 this is very slow Alternate brute force algorithm: examine all subsets: O(n2ⁿ) Point of confusion: Subset sum is NP Complete

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 Two dimensional dynamic programming

 Subset sum and knapsack

 Opt[j, K] = max(Opt[j - 1, K], Opt[j - 1, K - w_j] + w_j)

 Opt[j, K] = max(Opt[j - 1, K], Opt[j - 1, K - w_j] + v_j)

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