

Simple Knapsack algorithm

subject to and .

Brute force algorithm

- Maximize the value of N elements (w_i, v_i) while keeping the total weight
- less than a maximum value W.
- Maximize $\sum(x_i * v_i)$ $i = 0, \dots, n$ and $v_i = 0$ or $v_i = 1$
- Subject to $\sum(x_i * w_i) \leq W$ $i = 0, \dots, n$ and $v_i = 0$ or $v_i = 1$
- $V_0 + V_1 + V_2 + \dots + V_i + \dots + V_n$
- 0/1 0/1 0/1 0/1 0/1
- This results in 2^{*n} different sums (2^{*n} binary numbers with n bits)

Brute force algorithm

- Requires the computation of $2^{**}n$ sums
- 20 items $\rightarrow 2^{**}20$ computations $\sim 10^{**}6$
- 40 items $\rightarrow 2^{**}40$ computations $\sim 10^{**}12$
- Complexity $O(2^{**}n)$
- Only possible for small sets of items

Knapsack algorithm

- Evaluate for all constraints less than maximum constraint W
- The current element is included in the subset when adding it does not exceed the constraint and improves the best value computed in prior iteration

Knapsack algorithm (Wikipedia)

```
1 // Input:
2 // Values (stored in array v)
3 // Weights (stored in array w)
4 // Number of distinct items (n)
5 // Knapsack capacity (W)
6 // NOTE: The array "v" and array "w" are assumed to store all relevant values starting at index 1.
7
8 array m[0..n, 0..W];
9 for j from 0 to W do:
10     m[0, j] := 0
11 for i from 1 to n do:
12     m[i, 0] := 0
13
14 for i from 1 to n do:
15     for j from 0 to W do:
16         if w[i] > j then:
17             m[i, j] := m[i-1, j]
18         else:
19             m[i, j] := max(m[i-1, j], m[i-1, j-w[i]] + v[i])
```

Knapsack algorithm

- Complexity time $O(nw)$
- Complexity space $O(nw)$

Knapsack algorithm : Dataset 1

- Total investment: 499.95
 - Total profit: 198.53
-
- Previous Results
 - Total investment: 498.76
 - Total profit: 196.61

Knapsack algorithm: Dataset 2

- Total investment: 499.9
 - Total profit: 197.95
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- Previous Results
 - Total investment: 489.24
 - Total profit: 193.78

Sienna bought:

Share-GRUT

Share-KMTG	Value:23.21	Profit:9.277037
Share-GHIZ	Value:28.00	Profit:11.169200
Share-NHWA	Value:29.18	Profit:11.604886
Share-UEZB	Value:24.87	Profit:9.806241
Share-LPDM	Value:39.35	Profit:15.629820
Share-MTLR	Value:16.48	Profit:6.587056
Share-USSR	Value:25.62	Profit:10.135272
Share-GTQK	Value:15.40	Profit:6.152300
Share-FKJW	Value:21.08	Profit:8.385624
Share-MLGM	Value:0.01	Profit:0.001886
Share-QLMK	Value:17.38	Profit:6.863362
Share-WPLI	Value:34.64	Profit:13.821360
Share-LGWG	Value:31.41	Profit:12.406950
Share-ZSDE	Value:15.11	Profit:6.025868
Share-SKKC	Value:24.87	Profit:9.821163
Share-QQTU	Value:33.19	Profit:13.143240
Share-GIAJ	Value:10.75	Profit:4.289250
Share-XJMO	Value:9.39	Profit:3.753183
Share-LRBZ	Value:32.90	Profit:13.143550
Share-KZBL	Value:28.99	Profit:11.346686
Share-EMOV	Value:8.89	Profit:3.513328
Share-IFCP	Value:29.23	Profit:11.656924

Sienna bought:

Share-ECAQ	3166
Share-IXCI	2632
Share-FWBE	1830
Share-ZOFA	2532
Share-PLLK	1994
Share-YFVZ	2255
Share-ANFX	3854
Share-PATS	2770
Share-NDKR	3306
Share-ALIY	2908
Share-JWGF	4869
Share-JGTW	3529
Share-FAPS	3257
Share-VCAX	2742
Share-LFXB	1483
Share-DWSK	2949
Share-XQII	1342
Share-ROOM	1506

Share-ECAQ	Value:31.66	Profit:12.502534
Share-IXCI	Value:26.32	Profit:10.370080
Share-FWBE	Value:18.30	Profit:7.287060
Share-ZOFA	Value:25.32	Profit:10.072296
Share-PLLK	Value:19.94	Profit:7.956060
Share-LXZU	Value:4.24	Profit:1.676496
Share-YFVZ	Value:22.55	Profit:8.817050
Share-ANFX	Value:38.54	Profit:15.308088
Share-PATS	Value:27.70	Profit:11.071690
Share-SCWM	Value:6.42	Profit:2.446020
Share-NDKR	Value:33.06	Profit:13.190940
Share-ALIY	Value:29.08	Profit:11.611644
Share-JWGF	Value:48.69	Profit:19.441917
Share-JGTW	Value:35.29	Profit:13.914847
Share-FAPS	Value:32.57	Profit:12.878178
Share-VCAX	Value:27.42	Profit:10.691058
Share-LFXB	Value:14.83	Profit:5.900857
Share-DWSK	Value:29.49	Profit:11.604315
Share-XQII	Value:13.42	Profit:5.302242
Share-ROOM	Value:15.06	Profit:5.906532