**BỘ GIÁO DỤC VÀ ĐÀO TẠO**

**TRƯỜNG ĐẠI HỌC CÔNG NGHỆ THÔNG TIN – ĐHQG TPHCM**

**KHOA: KHOA HỌC MÁY TÍNH**

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**Ảnh có chứa Đồ họa, biểu tượng, hình mẫu, thiết kế đồ họa

Mô tả được tạo tự động**

**BÀI BÁO CÁO**

**BÀI TẬP 3**

***Solving Knapsack Problems Using Google OR Tools***

LỚP HỌC PHẦN: **CS106.O22**

GIẢNG VIÊN HƯỚNG DẪN: **LƯƠNG NGỌC HOÀNG**

SINH VIÊN THỰC HÀNH: **HUỲNH DANH ĐẠT**

MÃ SỐ SINH VIÊN: **22520211**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test case | N | Capacities | Total Weight | Total Value | Optimized |
| s016 | 50 | 105247 | 104590 | 192182 | x |
| s045 | 100 | 271891 | 271403 | 399952 | x |
| s032 | 200 | 459071 | 458811 | 812149 | x |
| s042 | 500 | 1296365 | 1296342 | 2004463 | x |
| s056 | 1000 | 2451009 | 2450951 | 4033710 | x |
| s001 | 2000 | 4927208 | 4927182 | 8095793 | x |
| s062 | 5000 | 12504907 | 12504891 | 20337338 | x |
| s043 | 10000 | 24839422 | 24839421 | 40422816 | x |

Bảng 1: 00Uncorrelated

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test case | N | Capacities | Total Weight | Total Value | Optimized |
| s041 | 50 | 123295 | 123231 | 136932 | x |
| s075 | 100 | 257206 | 257205 | 281863 | x |
| s099 | 200 | 499850 | 499833 | 541401 | x |
| s048 | 500 | 1312573 | 1312572 | 1433851 | x |
| s022 | 1000 | 2461918 | 2461917 | 2722916 | x |
| s027 | 2000 | 5053767 | 5053765 | 5596288 | x |
| s017 | 5000 | 12422197 | 12422196 | 13686980 | x |
| s054 | 10000 | 24833898 | 24833898 | 27439768 | x |

Bảng 2: 01WeaklyCorrelated

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test case | N | Capacities | Total Weight | Total Value | Optimized |
| s034 | 50 | 132881 | 132847 | 166847 | x |
| s014 | 100 | 224503 | 224503 | 295503 | x |
| s051 | 200 | 546390 | 546390 | 682390 |  |
| s097 | 500 | 1260304 | 1259998 | 1610998 |  |
| s064 | 1000 | 2476100 | 2474797 | 3178797 |  |
| s063 | 2000 | 4943877 | 4943877 | 6349877 |  |
| s091 | 5000 | 12436906 | 12435902 | 15948902 |  |
| s031 | 10000 | 25008094 | 25005890 | 32028890 |  |

Bảng 3: 02StronglyCorrelated

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test case | N | Capacities | Total Weight | Total Value | Optimized |
| s078 | 50 | 145301 | 144614 | 129614 | x |
| s004 | 100 | 288118 | 287742 | 257742 | x |
| s032 | 200 | 581938 | 581938 | 521938 |  |
| s032 | 500 | 1445880 | 1445880 | 1292880 | x |
| s026 | 1000 | 2926791 | 2925209 | 2616209 |  |
| s052 | 2000 | 5954561 | 5954561 | 5323561 |  |
| s015 | 5000 | 14967409 | 14964126 | 13388126 |  |
| s063 | 10000 | 29645976 | 29645852 | 26499852 |  |

Bảng 4: 03InverseStronglyCorrelated

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test case | N | Capacities | Total Weight | Total Value | Optimized |
| s060 | 50 | 113897 | 113896 | 148964 | x |
| s001 | 100 | 253672 | 253672 | 322602 | x |
| s010 | 200 | 501309 | 501309 | 639320 |  |
| s085 | 500 | 1209405 | 1209399 | 1562875 |  |
| s025 | 1000 | 2443749 | 2443335 | 3153752 |  |
| s050 | 2000 | 5011155 | 5006886 | 6406480 |  |
| s026 | 5000 | 12419674 | 12418838 | 15933402 |  |
| s025 | 10000 | 24885625 | 24885625 | 31923106 | x |

Bảng 5: 04AlmostStronglyCorrelated

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test case | N | Capacities | Total Weight | Total Value | Optimized |
| s015 | 50 | 130780 | 130780 | 130780 | x |
| s038 | 100 | 230363 | 230363 | 230363 | x |
| s066 | 200 | 498185 | 498185 | 498185 | x |
| s062 | 500 | 1211596 | 1211596 | 1211596 | x |
| s020 | 1000 | 2418676 | 2418676 | 2418676 | x |
| s065 | 2000 | 5004504 | 5004504 | 5004504 | x |
| s064 | 5000 | 12482901 | 12482901 | 12482901 | x |
| s020 | 10000 | 24753502 | 24753502 | 24753502 | x |

Bảng 6: 05SubsetSum

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test case | N | Capacities | Total Weight | Total Value | Optimized |
| s099 | 50 | 2476303 | 2401138 | 18610 | x |
| s023 | 100 | 4952931 | 4902508 | 37499 | x |
| s067 | 200 | 9905790 | 9904989 | 75395 | x |
| s043 | 500 | 24764677 | 24711869 | 182963 |  |
| s053 | 1000 | 49530330 | 49525707 | 370698 | x |
| s068 | 2000 | 99060268 | 99048984 | 749750 |  |
| s097 | 5000 | 247648849 | 247625059 | 1855538 |  |
| s070 | 10000 | 495295671 | 495245554 | 3725738 |  |

Bảng 7: 06UncorrelatedWithSimilarWeights

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test case | N | Capacities | Total Weight | Total Value | Optimized |
| s089 | 50 | 72678 | 72436 | 86406 | x |
| s011 | 100 | 150570 | 150432 | 165118 | x |
| s062 | 200 | 317976 | 317520 | 303480 |  |
| s019 | 500 | 613541 | 613101 | 930495 |  |
| s053 | 1000 | 1472113 | 1471720 | 1957348 |  |
| s028 | 2000 | 1946962 | 1946570 | 843965 |  |
| s021 | 5000 | 6773828 | 6773559 | 8814375 |  |
| s041 | 10000 | 13338611 | 13337805 | 11817147 |  |

Bảng 8: 07SpannerUncorrelated

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test case | N | Capacities | Total Weight | Total Value | Optimized |
| s029 | 50 | 54733 | 54596 | 138374 | x |
| s040 | 100 | 148930 | 148845 | 94534 |  |
| s001 | 200 | 238323 | 238094 | 596858 |  |
| s040 | 500 | 783583 | 782838 | 498348 |  |
| s017 | 1000 | 1625757 | 1625252 | 4244228 |  |
| s014 | 2000 | 1981100 | 1981084 | 7491279 |  |
| s018 | 5000 | 5193612 | 5193283 | 6892279 |  |
| s016 | 10000 | 10417251 | 10417092 | 17287214 |  |

Bảng 9: 08SpannerWeaklyCorrelated

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test case | N | Capacities | Total Weight | Total Value | Optimized |
| s078 | 50 | 70699 | 70293 | 270293 |  |
| s071 | 100 | 110762 | 110577 | 412577 |  |
| s020 | 200 | 360631 | 360595 | 925595 |  |
| s038 | 500 | 666820 | 666817 | 2294817 |  |
| s045 | 1000 | 928811 | 928622 | 4198622 |  |
| s013 | 2000 | 2277858 | 2277485 | 9368485 |  |
| s095 | 5000 | 8006779 | 8006765 | 24069765 |  |
| s073 | 10000 | 9555309 | 9555182 | 42566182 |  |

Bảng 10: 09SpannerStronglyCorrelated

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test case | N | Capacities | Total Weight | Total Value | Optimized |
| s092 | 50 | 138210 | 138197 | 211197 | x |
| s044 | 100 | 226908 | 226907 | 380907 | x |
| s068 | 200 | 512466 | 512463 | 819463 | x |
| s033 | 500 | 1234488 | 1234488 | 2010488 |  |
| s055 | 1000 | 2491722 | 2491722 | 4041722 | x |
| s074 | 2000 | 5093610 | 5093610 | 8154610 | x |
| s099 | 5000 | 12287280 | 12286087 | 20016087 |  |
| s056 | 10000 | 24871974 | 24871683 | 40319683 |  |

Bảng 11: 10MultipleStronglyCorrelated

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test case | N | Capacities | Total Weight | Total Value | Optimized |
| s083 | 50 | 122235 | 122235 | 122229 | x |
| s016 | 100 | 224429 | 224428 | 224412 |  |
| s098 | 200 | 499800 | 499800 | 499782 | x |
| s007 | 500 | 1188095 | 1188093 | 1188060 |  |
| s090 | 1000 | 2530461 | 2530461 | 2530371 |  |
| s096 | 2000 | 5029273 | 5029272 | 5029065 |  |
| s005 | 5000 | 12383201 | 12383201 | 12382764 |  |
| s005 | 10000 | 24837736 | 24837735 | 24836877 |  |

Bảng 12: 11ProfitCeiling

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test case | N | Capacities | Total Weight | Total Value | Optimized |
| s023 | 50 | 112283 | 112283 | 7485154 | x |
| s014 | 100 | 224503 | 224503 | 14966110 | x |
| s039 | 200 | 457464 | 457464 | 30496054 |  |
| s099 | 500 | 1209964 | 1209964 | 80660190 |  |
| s053 | 1000 | 2484840 | 2484840 | 165647615 |  |
| s058 | 2000 | 5064575 | 5064575 | 337621262 |  |
| s099 | 5000 | 12287283 | 12287283 | 819110785 |  |
| s081 | 10000 | 24742556 | 24742556 | 1649420332 |  |

Bảng 13: 12Circle

# Nhận xét:

* Các nhóm **00Uncorrelated**, **01WeaklyCorrelated**, **05SubsetSum** lời giải tìm thấy đều là lời giải tối ưu => Các nhóm dễ
* Các nhóm **02StronglyCorrelated**, **07SpannerUncorrelated**, **08SpannerWeaklyCorrelated**, **09SpannerStronglyCorrelated**, **11ProfitCeiling**, **12Circle** chỉ có lời giải tối ưu với số lượng vật thể nhỏ khi đặt giới hạn thời gian là 3 phút
* Các nhóm **06UncorrelatedWithSimilarWeights, 04AlmostStronglyCorrelated, 03InverseStronglyCorrelated, 10MultipleStronglyCorrelated**, có thể tìm được lời giải tối ưu từ 3 testcase trở lên.