Binary Programming

**UNIT 6 Practice 1**

1. ACME construction builds homes in Albany, GA. The company has $300,000 dollars to be invested next month. Table below show potential construction sites, cost of buildings and Expected profits:

|  |  |  |
| --- | --- | --- |
| Locations | Building Cost | Expected Profit |
| Clifton | $60,000 | $5,000 |
| Auburn | $50,000 | $6,000 |
| Adams | $82,000 | $10,000 |
| Amberly | $103,000 | $12,000 |
| Norwood | $50,000 | $8,000 |
| Covington | $41,000 | $3,000 |
| Roselawn | $80,000 | $9,000 |
| Eden | $69,000 | $10,000 |

1. Find the set of projects that maximizes profits. Be sure to indicate the maximum profit.
2. Due to limitations within the company, they can no longer handle more than 4 projects at any given time. How would this change the optimal solution?
3. A company has 3 million dollars for new projects in a manufacturing facility. The facility has limited space (1500 ft2) and only 15 current employees to be assigned to the projects. Below is a summary of ten projects recommended by the plant manager:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Projected Revenue [$mil] | Required Investment [$mil] | Required Employees | Required Space [ft2] |
| Project1 | 0.65 | 0.5 | 7 | 248 |
| Project 2 | 0.48 | 0.4 | 3 | 215 |
| Project 3 | 0.84 | 0.7 | 2 | 261 |
| Project 4 | 0.48 | 0.7 | 7 | 272 |
| Project 5 | 0.55 | 0.5 | 6 | 342 |
| Project 6 | 0.66 | 0.4 | 8 | 235 |
| Project 7 | 0.44 | 0.6 | 3 | 298 |
| Project 8 | 0.66 | 0.7 | 5 | 444 |
| Project 9 | 0.84 | 0.7 | 2 | 439 |
| Project 10 | 0.36 | 0.3 | 5 | 366 |

Select the set of projects that maximizes company's revenue.

**Assignment problems**

1. Coach Bass must assign each of the four swimmers to one of the four 100-yard legs in the 400-yard medley relay: butterfly, backstroke, breaststroke, and freestyle. Coach Bass has decided to use the best times for each of his swimmers for each of the legs of the relay to determine which swimmer to use for which leg of the relay. He wants to assign the four swimmers so as to complete the four legs of the relay in the minimum total time.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | Leg | | | |
|  |  | 100-yd butterfly | 100-yd backstroke | 100-yd breaststroke | 100-yd freestyle |
| Swimmer | Schmidt | 59.59 | 59.83 | 72.83 | 52.61 |
| Reid | 60.45 | 59.56 | 74.14 | 53.31 |
| Sanchez | 61.84 | 64.63 | 73.69 | 53.70 |
| Lamartina | 62.37 | 59.13 | 74.36 | 54.77 |

1. A company has 4 projects to be assigned among 3 employees. Find the assignment that minimizes the total time spent by the employees.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Peter | Mary | Joan |
| Project 1 | 2 weeks | 3 weeks | 4 weeks |
| Project 2 | 3 weeks | 2.5 weeks | 5 weeks |
| Project 3 | 4 weeks | 3.5 weeks | 3 weeks |
| Project 4 | 6 weeks | 3 weeks | 3.5 weeks |

1. A cab company has four cabs. Three customers are requesting the service. Assign the cabs to the customers such that revenue is maximized.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Customer 1 | Customer 2 | Customer 3 |
| Taxi 1 | $300 | $250 | $280 |
| Taxi 2 | $195 | $228 | $318 |
| Taxi 3 | $198 | $193 | $308 |
| Taxi 4 | $150 | $325 | $240 |