Algorithm Design and Analysis - Assignment 4

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Problem1

Analysis：Assume $x_{ij}=1$ means j-th job is assigned to i-th worker. Vice versa. Considering workers can work at the same time(same time used, multiple jobs done). 也就是说考虑可以并行工作。

then we have:

$min\ max_i \sum_{j=1}^{n} C_{ij}x_{ij}$

$s.t. \sum_{i=1}^{m} x_{ij}=1$ for all j

$x_{ij}=0/1$ for all i and j

Problem2

Analysis：Assume $x_i=1$ means i-th food is bought. Vice versa. At the same time, we say the nutrition is satisfied when it is greater than 0.

then we have:

$min \sum_{i=1}^{m} C_i x_i$

$s.t. \sum_{i=1}^{m} x_i W_{ij} > 0$ for all j

$x_i=0/1$ for all i

Problem3

Analysis：Assume x_{ij} is the amount of A of i-th place that is delivered to j-th market. Assume that the balance is achieved if and only if all A delivered is below the sum-output and all A accepted is below the sum-demand.

then we have:

$min \sum_{i=1}^{n} \sum_{j=1}^{m} C_{ij}x_{ij}$

$s.t. \sum_{j=1}^{m} x_{ij} \leq a_i$ for all i

$\sum_{i=1}^{n} x_{ij} \leq b_i$ for all j

$x_{ij} \geq 0$ for all i and j

Problem4

Analysis: Assume $x_{ij} = 1$ means i-th stuff is packed into j-th box. Vice versa.

then we have:

$min \sum_{j=1}^{n} \vee_{i=1}^{m} x_{ij}$

$s.t. \sum_{j=1}^{n} x_{ij} \leq 1$ for all i

$\sum_{i=1}^{n} x_{ij} C_i \leq S_j$ for all j

$x_{ij} = 0/1$ for all i and j

Problem6

Analysis: Assume $x_i = 1$ means i-th project is fund. Vice versa.

then we have:

$max \sum_{i=1}^{n} (c_i - b_i) x_i$

$s.t. \sum_{i=1}^{n} x_i b_i \leq B$

$x_i = 0/1$ for all i

Problem 7

Analysis: Assume we bulid x A-dorms and y B-dorms. Assume that profit is sum of c_i.

then we have:

$max\ x c_i + y c_j$

$s.t. x \leq n_i$

$y \leq n_j$

$x s_i + y s_j \leq s$

$x, y \geq 0$

Problem 8

Analysis: Assume $x_i = 1$ means place A_i is chosen. Vice versa.

then we have:

$max \sum_{i=1}^{7} (c_i - b_i)x_i$

$s.t. \sum_{i=1}^{7} x_i b_i \leq B$

$x_1 + x_2 + x_3 \leq 2$

$x_4 + x_5 \geq 1$

$x_6 + x_7 \leq 1$

$x_i = 0/1$ for all i

Problem 9

Analysis: Assume $x_i = 1$ means i-th item is packed. Vice versa. Assume there are n items in total.

then we have:

$max \sum_{i=1}^{n} c_i x_i$

$s.t. \sum_{i=1}^{n} x_i a_i \leq b$

$x_i = 0/1$ for all i

Problem 10

Analysis: Assume $x_{ij} = 1$ means j-th job is assigned to i-th worker. Vice versa. Assume that num of jobs is less than num of workers, and there are m workers and n jobs. So m$\leq$n. Considering every job is assigned, but not every worker has job to do.

then we have:

$max \sum_{i=1}^{m} \sum_{j=1}^{n} c_{ij} x_{ij}$

$s.t. \sum_{i=1}^{m} x_{ij} = 1$ for all j

$\sum_{j=1}^{n} x_{ij} \leq 1$ for all i

$x_{ij} = 0/1$ for all i and j