Intern Roster

Introduction

We have 11 interns. Let each intern be i.

We have 13 rotations. Let each rotation be j. There are also three annual leave rotations. These shall be j values 14, 15, 16. Therefore the total is 16.

We have 54 weeks for the whole period of the roster. Let each week be k.

j	Duration	Maximum Interns per week
1	8	2
2	4	1
3	4	1
4	4	1
5	2	1
6	3	1
7	3	no limit
8	2	no limit
9	4	2
10	3	no limit
11	5	no limit
12	1	1
13	1	1
14	1	11
15	1	6
16	1	5

Decision Variables

x^i_{jk}

C_{ij}

$y^i_{j,k+\alpha}$ where $\alpha \in \mathbb{Z}$

z_k

Objective Function

$$\max \sum_i \sum_j \sum_k C_{ij} x^i_{jk}$$

Constraints

Intern Rotation Completiion Constraint

Let $x^i_{jk} = 1$ if person i is doing rotation j for week k.

$$\sum_k x^i_{jk} \geq 1 \quad \forall i, \quad \forall j$$

Intern Rotation Capacity Constraint

$$\sum_i x^i_{1,k} \leq 2 \quad \forall k$$
$$\sum_i x^i_{2,k} \leq 1 \quad \forall k$$
$$\sum_i x^i_{3,k} \leq 1 \quad \forall k$$
$$\sum_i x^i_{4,k} \leq 1 \quad \forall k$$
$$\sum_i x^i_{5,k} \leq 1 \quad \forall k$$
$$\sum_i x^i_{6,k} \leq 1 \quad \forall k$$
$$\sum_i x^i_{7,k} \geq 0 \quad \forall k$$
$$\sum_i x^i_{8,k} \geq 0 \quad \forall k$$
$$\sum_i x^i_{9,k} \leq 2 \quad \forall k$$
$$\sum_i x^i_{10,k} \geq 0 \quad \forall k$$
$$\sum_i x^i_{11,k} \geq 0 \quad \forall k$$
$$\sum_i x^i_{12,k} \leq 1 \quad \forall k$$
$$\sum_i x^i_{13,k} \leq 1 \quad \forall k$$
$$\sum_i x^i_{14,k} = 11 \quad \forall k$$
$$\sum_{i=1}^{6} x^i_{15,k} = 6 \quad \forall k$$
$$\sum_{i=7}^{11} x^i_{16,k} = 5 \quad \forall k$$

Intern Rotation Duration Constraint

$$\sum_{\alpha=0}^{7} y_{1,k+\alpha}^{i} = 8 \ \text{ if } \ x_{1,k}^{i} = 1$$

$$\sum_{\alpha=0}^{3} y_{2,k+\alpha}^{i} = 4 \ \text{ if } \ x_{2,k}^{i} = 1$$

$$\sum_{\alpha=0}^{3} y_{3,k+\alpha}^{i} = 4 \ \text{ if } \ x_{3,k}^{i} = 1$$

$$\sum_{\alpha=0}^{3} y_{4,k+\alpha}^{i} = 4 \ \text{ if } \ x_{4,k}^{i} = 1$$

$$\sum_{\alpha=0}^{1} y_{5,k+\alpha}^{i} = 2 \ \text{ if } \ x_{5,k}^{i} = 1$$

$$\sum_{\alpha=0}^{2} y_{6,k+\alpha}^{i} = 3 \ \text{ if } \ x_{6,k}^{i} = 1$$

$$\sum_{\alpha=0}^{2} y_{7,k+\alpha}^{i} = 3 \ \text{ if } \ x_{7,k}^{i} = 1$$

$$\sum_{\alpha=0}^{1} y_{8,k+\alpha}^{i} = 2 \ \text{ if } \ x_{8,k}^{i} = 1$$

$$\sum_{\alpha=0}^{3} y_{9,k+\alpha}^{i} = 4 \ \text{ if } \ x_{9,k}^{i} = 1$$

$$\sum_{\alpha=0}^{2} y_{10,k+\alpha}^{i} = 3 \ \text{ if } \ x_{10,k}^{i} = 1$$

$$\sum_{\alpha=0}^{4} y_{11,k+\alpha}^{i} = 5 \ \text{ if } \ x_{11,k}^{i} = 1$$

$$y_{12,k}^{i} = 1 \ \text{ if } \ x_{12,k}^{i} = 1$$

$$y_{13,k}^{i} = 1 \ \text{ if } \ x_{13,k}^{i} = 1$$

$$y_{14,k}^{i} = 1 \ \text{ if } \ x_{14,k}^{i} = 1$$

$$y_{15,k}^{i} = 1 \ \text{ if } \ x_{15,k}^{i} = 1$$

$$y_{16,k}^{i} = 1 \ \text{ if } \ x_{16,k}^{i} = 1$$

Intern Leave Constraint

$$\sum_i x^i_{14,k} = 11 z_k \quad \text{if} \quad \sum_k z_k = 1$$

$$\sum_i x^i_{15,k} = 6 z_k \quad \text{if} \quad \sum_k z_k = 1$$

$$\sum_i x^i_{16,k} = 5 z_k \quad \text{if} \quad \sum_k z_k = 1$$