Nurse Scheduling Problem

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agenda

1. Introduction and justification

2. Background

3. Problem definition

4. Model

5. Objectives

6. Methodology, activities, and reach

Introduction and justification

- **Schedule** (verb): to appoint, assign, or designate for a fixed time.

- Very important when managing all kinds of employees and resources.

- Specially important and complex to healthcare professionals.

- Problem of great interest
  - Academic
  - practical

Background

- As seen in Burke et Al.(2004), scheduling approached by several investigators for more than 40 years.

- Until recently solved manually in a very time consuming process.

- First papers were based on a strictly mathematical approach.

- Heuristic and metaheuristic approaches are seen later.

Problem definition

According to Chesia et Al.(2014)

Basic problem
- Weekly scheduling of a fixed number of nurses.
- Each day split in shifts.
- Skills with different requirements.

General Problem
- Solution to the problem for a set of n weeks.
- Requests of the nurses accounted for as soft constraints.
- History of every week and overall history to account for contractual constraints.

Model

$$Min\ Z = \sum_i \sum_j \sum_k p_{ijk} x_{ijk}$$

$$\sum_i x_{ijk} \geq R_{jk}\ , \forall\ i\ in\ N, j, k$$

$$m \leq \sum_j \sum_k x_{ijk} \leq M, \forall\ i\ in\ N$$

$$\sum_k x_{ijk} = 1\ , \forall\ i\ in\ N, j$$

$$\sum_{j=t}^{t+K} \sum_k x_{ijk} \leq K\ , \forall\ i\ in\ N, t$$

$$x_{ijk} \epsilon \{0,1\}\ , \forall\ i\ in\ N, j, k$$

- MILP
- Set N of n nurses given
- Nurse i, shift k, and day j
- R: minimal number of nurses
- m, M : Range of working hours for nurses
- K: max consecutive working days

Objectives

General objective

propose algorithms for the optimization of nurse scheduling using elements derived from heuristics, metaheuristics, and modeling.

Specific objectives

◦ Design and evaluate mathematical models.

◦ Design and implement optimization algorithms.

◦ Write an article/report.

◦ Participate in "The Second International Nurse Competition". More info on INRC-II. (2015)

Methodology, activities, and reach

Weekly meetings with tutor

Four phases:

- Revision of state of art (weeks 4 – 6).

- Proposal of different models (week 7).

- Development of algorithms and experimentation(week 8 – 13).

- Drafting of report or article and submission to the competition (week 14 – 19).

References

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- CESCHIA, Sara, THANH DANG, Nguyen Thi y De CAUSMAECKER, Patrick. 2014. "Second International Nurse Rostering Competition (INRC-II) — Problem Description and Rules —".

- INRC-II. 2015. "The Second International Nurse Rostering Competition". Disponible en: <http://mobiz.vives.be/inrc2/>.

Questions?

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