Rotating Workforce Scheduling: Problem Description ([1])

November 12, 2004

Instance:

- Number of employees: n.
- Set A of m shifts (activities) : $a_1, a_2, \ldots, a_m$, where a_m represents the special day-off "shift".
- w: length of schedule. The total length of a planning period is $n \times w$ because of the cyclic characteristics of the schedules.
- A cyclic schedule is represented by an $n \times w$ matrix $S \in A^{nw}$. Each element $s_{i,j}$ of matrix S corresponds to one shift. Element $s_{i,j}$ shows which shift employee i works during day j or whether the employee has time off. In a cyclic schedule, the schedule for one employee consists of a sequence of all rows of the matrix S. The last element of a row is adjacent to the first element of the next row, and the last element of the matrix is adjacent to its first element.
- Temporal requirements: The requirement matrix R ($(m-1) \times w$), where each element $r_{i,j}$ of the requirement matrix R shows the required number of employees for shift i during day j.
- Constraints:
  - Sequences of shifts permitted to be assigned to employees (the complement of inadmissible sequences): Shift change $m \times m \times m$ matrix $C \in A^{(m^3)}$. If element $c_{i,j,k}$ of matrix C is 1, the sequence of shifts (a_i, a_j, a_k) is permitted, otherwise it is not.

- Maximum and minimum length of periods of consecutive shifts: Vectors $MAXS_m$, $MINS_m$, where each element shows the maximum respectively minimum permitted length of periods of consecutive shifts.
- Maximum and minimum length of blocks of workdays: $MAXW$, $MINW$.

Problem: Find a cyclic schedule (assignment of shifts to employees) that satisfies the requirement matrix, and all other constraints.

Note that in [1], finding as many non-isomorphic cyclic schedules as possible that satisfy all constraints, and are optimal in terms of weekends without scheduled work shifts (weekends off), is required. We consider in this paper the generation of only one schedule, which satisfies all constraints. Furthermore, in this paper we do not consider the optimization of weekends off.

References

[1] Nysret Musliu, Johannes Gärtner, and Wolfgang Slany. Efficient generation of rotating workforce schedules. *Discrete Applied Mathematics*, 118(1-2):85–98, 2002.