

ORTEC Workforce Scheduling 7

User Manual Module Schedule Optimizer

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ORTEC

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1 Shift optimizers

Shift optimizers play an important role when scheduling and managing shifts for employees. They automatically generate efficient and effective work schedules. However, setting up shift optimizers can be quite complicated. Rules and criteria greatly affect the quality of the resulting schedules.

1.1 Shift sequence optimizer

> General setting UsePatternPlanner. Contact your ORTEC representative when needed.

The Shift sequence optimizer works quickly and sticks to its decisions. Once a shift sequence is assigned, it won't be changed, even if it's not ideal in the broader schedule. This tool is useful for managing specific shifts like nights and weekends, where specific lengths and compositions matter. The Schedule optimizer, which considers more factors, may not always meet these strict criteria.

Run optimizer

1. Configure all departmental and personal shift sequences.
2. Open the master schedule.
3. Generate a solution via **Optimizers** > **Plan shift sequences**.
4. Verify whether all night and weekend shifts have been scheduled; manual adjustments may be required.
5. Fix these shifts in place to prevent the Schedule optimizer from altering them in subsequent adjustments.

> Fixing shifts might hinder the Schedule optimizer from achieving an ideal schedule later. However, the quality of the schedule is considerably greater if critical issues, especially night shifts, have been resolved first.

1.2 Vacant shift optimizer

> General setting UseBottleneckPlanner. Contact your ORTEC representative when needed.

The Vacant shift optimizer quickly adds the last few shifts to the schedule while keeping previously scheduled shifts intact unless rule violations occur. If you have

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many shifts left to schedule and want to maintain existing shifts, it's better to fix the scheduled shifts first and then use the Schedule optimizer. Nonetheless, the Vacant shift optimizer is crucial as the Schedule optimizer frequently uses it to reschedule removed shifts. Additionally, the Vacant shift optimizer relies on the Shift sequence optimizer for further processing.

Here's how the Vacant shift optimizer algorithm works:

1. It sorts unscheduled shifts based on internal criteria.
2. It evaluates employee availability for each shift.
3. It calculates a score for each employee, representing the change in the schedule's penalty score resulting from assigning the shift.
4. It attempts to assign each shift to the employee with the most favorable score, following specified rules for shift eligibility.

Run optimizer

1. Open the master schedule.
2. Generate a solution via **Optimizers** > **Vacant shift optimizer**.

1.3 Weekend shift optimizer

> ⚠ General setting UseWeekendPlanner. Contact your ORTEC representative when needed.

The Weekend shift optimizer assigns weekend shifts to employees, especially when weekend shifts play a crucial role in the overall schedule quality. This is particularly important when employees' preferences mainly revolve around weekends. Once the weekend shifts are assigned, use the Schedule optimizer to fine-tune the allocation of weekday shifts, building upon the already optimized weekend shift schedule.

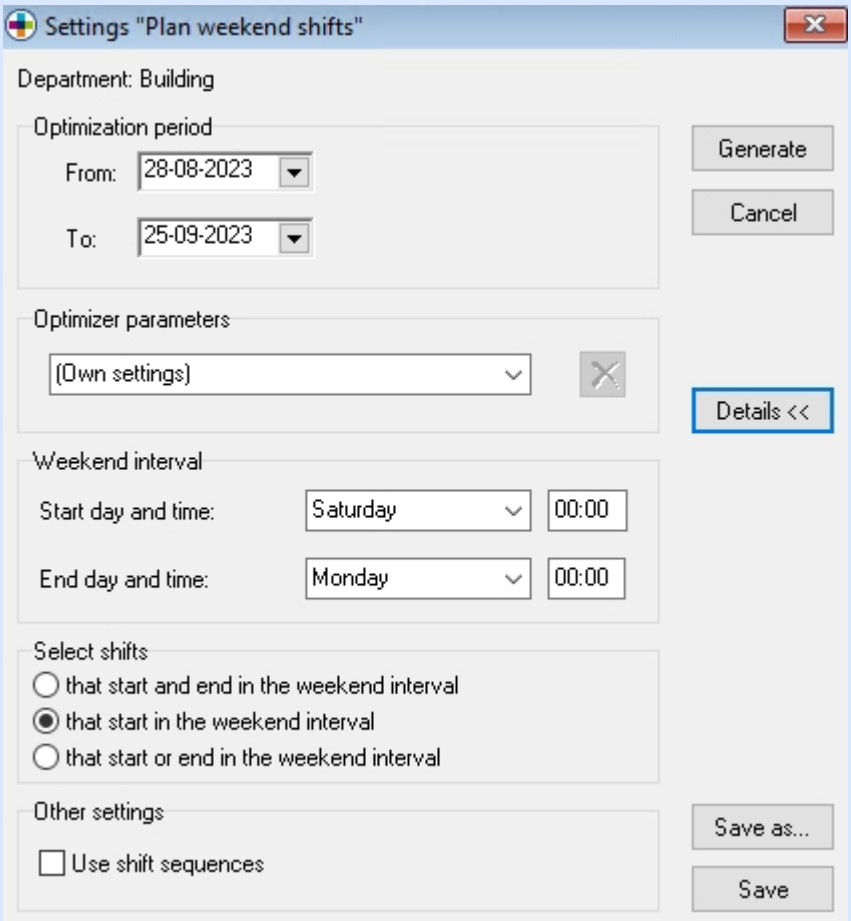
The Weekend shift optimizer automatically assigns complete weekends, where employees either work both Saturday and Sunday or not at all. If there is a need for more shifts on Saturday than on Sunday, the optimizer may leave vacant shifts on Saturday in the schedule.

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Run optimizer

1. Generate a solution via **Optimizers** > **Plan weekend shifts**.

Example



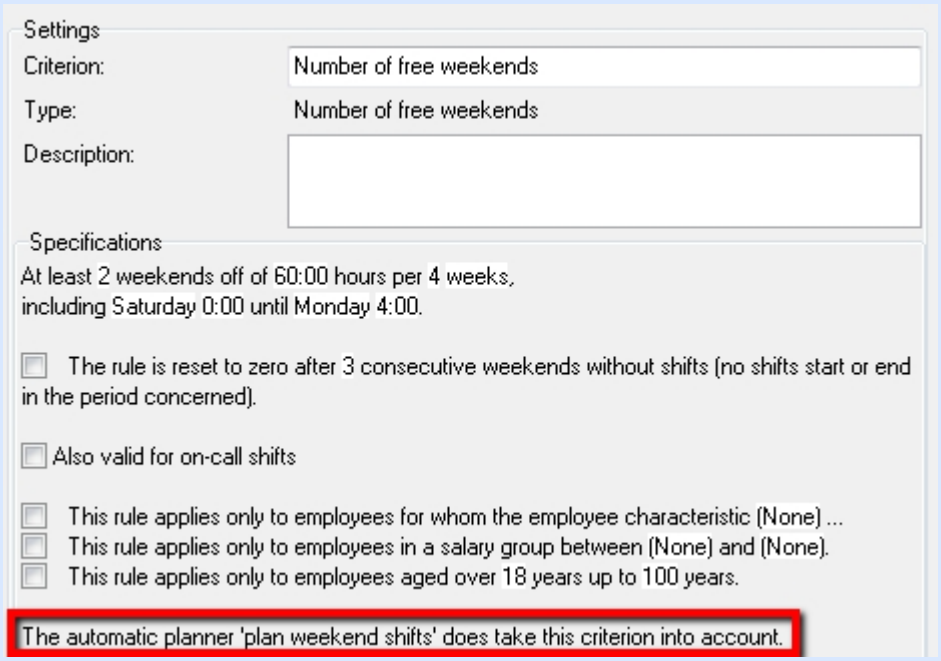
2. Define the shift assignment **Optimization period**.
3. Define the **Optimizer parameters**.
   - (Optional) To define or adjust a parameter set, click the **Details** button.
   - Define the **Weekend interval**.
   - Define how to **Select shifts**.
   - (Optional) To only assign shift sequences, select the checkbox **Use shift sequences**. Deployment of this setting is restricted to shift sequences within the defined parameters of **Weekend interval** and **Select shifts**.
   - To save changes, click **Save**. To create a new set of parameters, click **Save as**.
4. Click **Generate**.

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The Weekend shift optimizer focuses on a subset of scheduling criteria, considering each criterion's relevance.

Example

Each scheduling criterion is marked to indicate if the Weekend shift optimizer considers it. See the following example:



1.4 Schedule optimizer

General setting UseGeneticPlanner. Contact your ORTEC representative when needed.

The Schedule optimizer is capable of producing multiple schedules simultaneously. It utilizes the Shift sequence optimizer and Vacant shift optimizer. As a result, the output from the Schedule optimizer is always of at least equal quality compared to the other two automatic optimizers. The Schedule optimizer operates in two phases:

1. **Genetic algorithm phase (general optimization)**: In this phase, a genetic algorithm is used, employing multiple schedules in parallel, collectively referred to as a generation. The process starts with generation 0, followed by generation 1, generation 2, and so on. Each new generation is derived from the

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previous one by combining two previous schedules or by reassigning shifts within one schedule. The newly generated schedules and their predecessors are used to create the next generation. Users can define the number of parallel schedules, known as the generation's scope. A larger scope generally yields better results but requires more computation time. The user can also set a maximum computation time, which may limit the scope to ensure results are generated within the specified time frame.

2. **Refinement phase (detailed optimization)**: Once the genetic algorithm phase is complete, the best schedule from the first phase undergoes thorough scrutiny to identify possible refinements. If refinements are found, the process restarts. This phase can be time-consuming but often leads to significant improvements in the schedule's quality.

It's possible to skip the first algorithm phase by setting the generation scope to 1. This is advisable when working with a schedule that's already of high quality but may require minor adjustments, such as shift switches made manually. In such cases, the optimizer can be used to fine-tune the schedule efficiently.

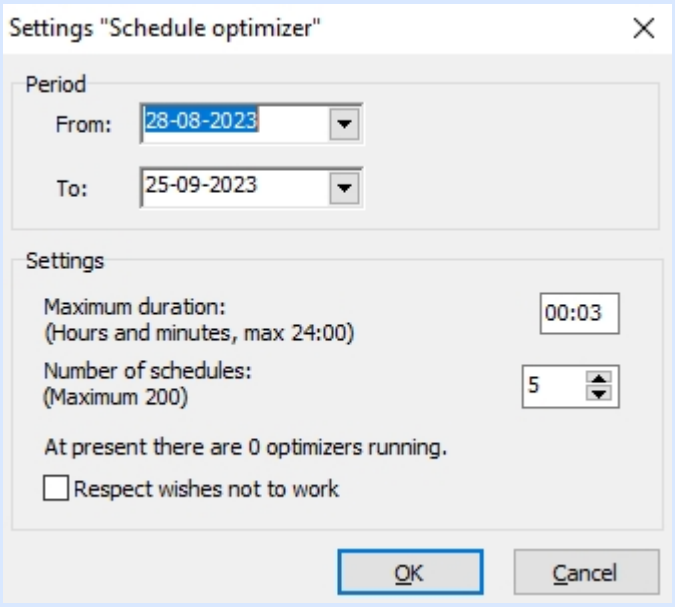
Run optimizer

1. Open the master schedule.

   This can be a party published schedule.

2. Generate a solution via **Optimizers** > **Schedule optimizer**.

3. Example



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4. Define the **Period**.
5. Define the **Settings**.
6. (Optional) Select the checkbox **Respect wishes not to work**.
7. Click **OK**.

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2 Rules and criteria

Rules define what an optimizer can and cannot do, ensuring compliance. Criteria determine schedule quality based on penalty scores, with lower scores indicating better adherence to defined criteria. Optimizers aim to schedule as many shifts as possible while respecting rules and minimizing penalties.

2.1 Rule types

Three different rule types need to be defined:

- Organization rules: defined via **Maintenance** > **Employment conditions**.
- Group rules: defined via **Planning** > **Schedule management** > **Scheduling criteria** tab > **Maintenance of work agreements** pane. For more information, see "Scheduling criteria" on page 38.

  > Work agreements encompass rules and scheduling criteria, with the latter denoted by the suffix '(crit)' and organized under the **Scheduling criteria** section in the tree structure. Weightings can also be applied to these criteria. To associate work agreements with employees, utilize the **Work Agreements** tab.

- Personal rules: defined when handling requests.

  > A request that's marked as **Required** is in effect a rule and will not be violated by the optimizer.

2.2 Criteria levels

Criteria need to be defined on four different levels:

- Departmental level: defined via **Planning** > **Schedule management** > **Scheduling criteria** tab > **Scheduling criteria** section. Criteria defined here automatically apply to all employees in the relevant department whose availability is within the defined range. For more information, see "Scheduling criteria" on page 38.
- Subgroup level: defined via **Planning** > **Schedule management** > **Scheduling criteria** tab > **Maintenance of work agreements** section. Work agreements consist of rules and Scheduling criteria; the Scheduling criteria are identified by the suffix (crit). When created, a criterion is assigned a weighting of between 1 and 100. Work agreements need to be associated with employees via **Employee** > **Employee management** > **Work agreements** tab.

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- Personal level: defined when handling requests. All requests not marked as requirements are considered criteria; the optimizer is not obligated to comply with such requests. The default weighting assigned to a request is 100.
- Vertical standards level: defined via **Planning** > **Schedule management > Daily requirements** tab. Standards are like ordinary requests, not rules: the optimizer isn't obliged to comply with them. However, standards carry a high weighting (1000).

No weighting can be given to a 'Request with description' or to a 'Workstation demand' daily requirement, since the optimizer does not take requests/standards of either type into consideration.

2.3 Fixed shifts that violate rules

At times, fixed shifts may breach rules, hindering the optimizer from complying with all rules when generating schedules. Instead of halting, the optimizer prioritizes eliminating these breaches. It removes non-fixed shifts linked to employees with violation-involved fixed shifts. This approach is taken because, while removing a shift may correct a violation, it will almost never cause one.

After addressing violations, the optimizer saves remaining issues. At each phase, it checks for new violations; if found, the solution is rejected. The outcome of this approach can sometimes be a little puzzling. For instance, if a rule allows only five consecutive night shifts and six are fixed, the sixth is the violation. Adding a seventh shift at the end doesn't create a new violation, but adding one at the start will not be possible, as it would result in the violation being moved to a previously permissible shift.

2.4 Penalties

As indicated above, the optimizer takes into account rules and criteria. It will first ensure that no rules are violated. Afterward, it will seek to schedule as many shifts as possible, and finally, to incur as few penalties as possible. So, a schedule that includes all the necessary shifts but incurs 3248 penalty points is regarded as preferable to a schedule that fails to cover some shifts but incurs no penalties. This leads to the question of how penalties are calculated. The penalty score associated with a schedule is the sum of the penalties for all the criteria that the schedule violates. A penalty is imposed for each violation of each criterion. The individual penalty is the basic cost of the violation multiplied by the weighting assigned to the criterion. No cost or penalty is incurred if the criterion is not violated.

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> **Example**
>
> The ideal schedule for a department consists of series lasting four or five shifts each. One employee, Francis, has requested not to work on November 5th from 8:00 to 16:00. The priority weighting is 10 for series length and 100 for requests. However, the generated schedule includes deviations: a six-shift series (off by one shift) incurs a penalty of 10, while a single-shift series (three shifts short) incurs a penalty of 90 due to the squared deviation. Together, these violations result in a penalty of 100. Additionally, Francis was scheduled for a late shift on November 5th at 15:45, violating his request. This incurs a penalty of 100, totaling a penalty score of 200. If Francis's request were a requirement, the optimizer would have respected it by not assigning him a late shift.

2.5 Weightings

Weightings have a significant impact on optimizer output. The default weightings assigned by ORTEC Workforce Scheduling when creating a criterion are intended as suggestions. Vertical standards have a default weighting of 1000 because they relate to matters that most organizations consider very important. Requests are given a default weighting of 100 because users normally regard these requests as important as well. Scheduling criteria are given weightings ranging from 1 to 100. However, the only scheduling criteria with a weighting of 100 are 'No standalone shifts' and 'No shift or else minimum number of shifts': the importance of the first is self-evident, while the second is designed to control the number of weekend shifts, which will normally be a priority as well. The other scheduling criteria are given a weighting of either 1 or 10; those whose significance tends to be localized are weighted at 1, those with more general significance at 10. This is because the optimizer first needs to address more general matters (such as series and rest periods), and then local matters (such as individual and consecutive shifts).

We advise to initially leave the default weightings as they are. Once the schedule optimizer has been run a few times, it'll become clear whether insufficient importance is being given to particular criteria. The weightings of these criteria can then be increased. We suggest that each weighting increase should involve the addition of a zero. In most cases, there's scope for doing this a few times since the maximum weighting is 10,000. Remember that there's no point in increasing weightings across the board: the optimizer weighs up interests against one another, and if they're all the same, it makes no difference whether they're high or low.

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2.6 Schedule transitions

When producing a schedule, the optimizer takes account of the shifts on the preceding schedule. In other words, it seeks to complete series, weekends, etc. that were unfinished when the previous schedule ended. Indeed, each schedule actually passes on responsibility for such completion to the next schedule: penalties aren't incurred for half weekends, for example, if the Sunday is covered by the next schedule. When passing on responsibility, no check's made to see whether the next schedule can, in fact, resolve the problem.

So, you can have a situation where, for example, the previous schedule has started a series of night shifts, which, because of the rules now in place, can't be completed by the new schedule. Or where the previous schedule has started a series on a Friday, which is intended for completion on the present schedule but can't, in fact, be completed because the employee can't be scheduled to work during the weekend in question. It's therefore a good idea to pay particular attention to the end of a schedule when you work with ORTEC Workforce Scheduling. To prevent problems, try to end your schedules not on a Friday but, say, on a Monday.



If the schedule periods are months, this may not be possible.

2.7 No history

An issue that can arise is the lack of a prior schedule. Without a historical schedule, several regulations applicable to periods lasting three months or more won't affect the current schedule. These regulations, such as limitations on working hours, night shifts within a thirteen-week period, or the provision of free weekends, will only impact the scheduling process after the specified duration has passed. Additionally, while relevant laws and labor agreements might permit requesting someone to work four consecutive weekends or exceed the contractual hours by thirty-two hours in the first month, these practices are generally not well-received in reality. Thus, the quality of a schedule is typically improved by incorporating shorter, less rigid regulations.

For instance, the 'Labor-time and availability' rule can restrict the total work hours during a scheduling period. Another example is the 'Number of free weekends' rule in the collective labor agreement for regular hospitals, mandating that an employee should have a minimum of twenty-two free weekends within a fifty-two-week timeframe. It would be beneficial to introduce a rule mandating two free weekends out of every five, ensuring at least twenty free weekends within fifty-two weeks.

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3 Labor-time rules

Most of the available rules are specifically designed to reflect Dutch legislation or a particular Collective Labor Agreement. In most cases, the only possible parameters are:

- Number (shifts, weeks, hours: minutes)
- Types (Consignation, Picket, Attendance)

You can often select and define one of the following checkboxes:

- This rule applies only to employees for whom the employee property [None]...
- This rule applies only to employees in a salary group between [None] and [None].
- This rule applies only to employees aged over 18 years up to 100 years.
- This rule applies only to employees with contracthours from 0:00 up to 48:00 hours.

For some rules it's possible to define which shifts the rule must take into account, such as (all) shifts, night shifts semi-night shifts.

Use **Crtl+F** to search for a specific rule in this document.

Working hours per period (general)

The maximum labor-hours is average per week 40:00 hours in a period of 13 succeeding weeks.

Number of on call shifts

Maximum 26 shifts of type Consignation in each 13 weeks period.

A week runs from Monday to Sunday.

Number of on call shifts with exceptions

Shifts of type Consignation : maximal frequency is 3 per 1 weeks period
.
This maximum can be enlarged to 4 once during 6 weeks per 52 weeks period, provided that following these presence shifts the employee will have a rest period equal in length.

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A week runs from Monday to Sunday.

Number of duties that exceed the required amount

In a rotation, a duty may not be assigned more often than the number given by the demands.

Applicable only in connection with cyclic rosters.

Nof shifts in a period

At most 25 shifts per 13 weeks' period.

This rule counts all shifts, including free-time shifts. If you don't want free-time shifts included, it is better to use the rule 'Number of work shifts'. A week runs from Monday to Sunday.

Nof shifts on a day

The maximum number of shifts that begin on the same day is 1.

The rule counts only the number of work shifts; free-time shifts and consignation shifts are not counted.

Number of night shifts

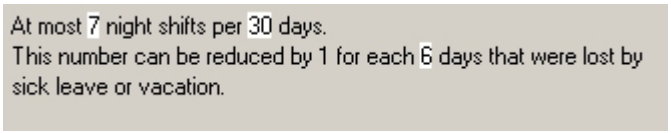
Whenever some night shifts end after 2:00, the maximal number of night shifts is 25 per period of 13 consecutive weeks.

☐ or the number of work hours between 0:00 and 6:00 hours does not exceed 20:00 hours per period of 2 weeks.

The rule 'Night shift definition' is used to define the nightshifts. A week runs from Monday to Sunday.

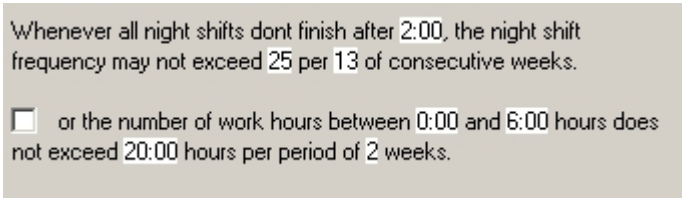
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Number of night shifts; deduction for lost days



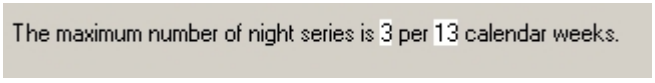
The rule 'Night shift definition' is used to define the nightshifts.

Number of semi night shifts



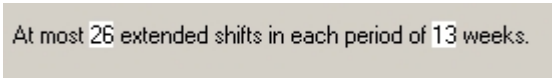
The rule 'Night shift definition' is used to define the night shifts; a semi night shift is a special night shift. A week runs from Monday to Sunday.

Number of night shifts series



The rule 'Night shift definition' is used to define the night shifts. An isolated night shift is treated as a series (i.e. minimum shift-series length is 1). A week runs from Monday to Sunday.

Number of extended shifts



The rule applies to shifts where the working time is more than the original working time. This rule is checked by the Optimizer. A week runs from Monday to Sunday.

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Number of relief day shifts

A master schedule of 4 weeks should contain at least 8 day-off days. This period should contain at least 2 series of at least 2 consecutive day-off days.

Counts the number of relief days. Only shifts of the type 'Free time' (or a variant) can be scheduled on a relief day. The amount of rest on a relief day has to be at least the amount defined in the rule 'Minimum rest time during relief day'. If this rule does not apply to an employee, the default number of hours is twenty-four.

Number of free days on a weekday

The number of days off on Sunday between 6:00 and 0:00 in a period of 13 is at least 4.

A week runs from Monday to Sunday.

Number of free weekends

At least 2 weekends off duty per 4 weeks period; a weekend off duty lasts 60:00 hours,
enclosing Saturday 0:00 to Monday 4:00.

☐ Also valid for on-call shifts

Number of working shifts

The maximum number of work shifts per 13 week(s) is 25.

A week runs from Monday to Sunday.

Labor time per period (night/on call)

The maximum labour-time per week is on average 45:00 hours per period of 13 consecutive weeks, if this period includes Consignation (excluding night).

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A week runs from Monday to Sunday.

Labor time per period (day)

The maximum labour-time per week is on average 40:00 hours per period of 13 consecutive weeks, if this period does not include work during night shifts.

A week runs from Monday to Sunday.

Labor time per period (night)

The maximum labour-time per week is on average 40:00 hours per period of 13 consecutive weeks, if this period includes work during night shifts.

A week runs from Monday to Sunday.

Availability for a shift

An employee has to be available for a shift.

Does not apply to cyclic rosters. This rule checks whether the employee is available to the department during the shift interval.

On call before or after a night shift

No shifts of type Consignation in any period between 8:00 before a night shift and 8:00 after this night shift.

On call before or after a work shift

No shifts of type Consignation in any period between 8:00 hour(s) before a shift and 8:00 hour(s) after a shift.

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Period without on call

For each period of 4 weeks at least 2 periods of at least 168:00 hours without shifts with type Consignation

A week runs from Monday to Sunday.

Period without on call, but with picket

In case of a picket duty:
For each period of 13 weeks at least 8 period(s) of at least 168:00 hour (s) without shifts of activity kind Consignation

This rule is applied if any shift involves picket duty. A week runs from Monday to Sunday.

Break per period

Between Monday 0:00 and Monday 0:00, there must be an uninterrupted break of at least 36:00 hours.

☐ In the event that the first or last day of the period is a day-off, this rule also takes into account the break time that falls outside of the period on the days either side of this day-off.

Daily rest time

Resting time is at least 11:00 consecutive hours during a period of at least 24 consecutive hours.
An exception is permitted: once in a period of 7 times 24 consecutive hours this resting time may be reduced to at least 8:00 hours.

Night shift definition

A shift is a night shift only if a part of it will be between 0:00 and 6:00.

A night shift is a shift that involves work during the night interval. The default definition of the night interval is from 0:00 hours to 6:00 hours, but this rule can be used to apply an alternative definition. Only one night shift definition can be introduced for each employee (otherwise it

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would not be clear which should be followed).

Day-off definition

If on a day there is a shift which completely exist of the activity kind Day-off, WTR the following rules apply:
There starts no other shift on or after 0:00 hours of this day and before 0:00 hours the next day. The consecutive rest time counts at least 24:00 hours.

☑ In case of a night shift the consecutive rest time counts at least 32:00 hours.

Definition vacation day

If on one day there is a shift which completely consists of activity kind leave-of-absence (no labour), Special leave the following rules apply:
The consecutive rest time counts at least 32:00. This rest time falls for minimum 16:00 hours on one day. The minimum total rest time for each of the following shifts consisting of the same activity types is increased by 24:00 hours.

☐ The employee finishes work not later than 0:00 o'clock on the previous day and starts not earlier than 0:00 o'clock on this day.

Duration of a day shift

Labour-time per shift is at most 8:00 hours.

This rule can be used in the context of a work agreement, so that employees who only work four hours a day are not assigned to eight-hour shifts.

Duration of a night shift

Labour-time per night shift is at most 8:00 hours.

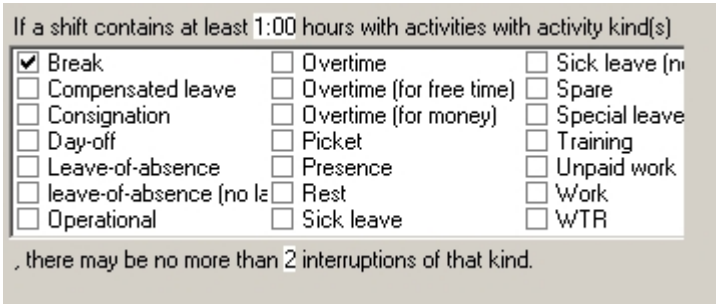
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No shift during leave

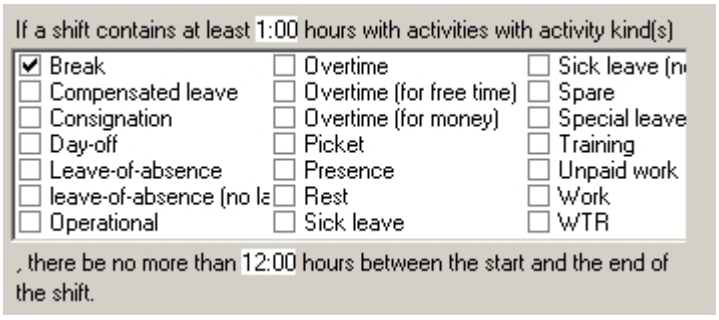
A day of leave should at least include a minimum of 24:00 hours between 0:00 hours before the begin and 0:00 hours after the end of that day of leave.

This rule ensures that no non-leave shifts are scheduled on either side of a leave shift, for at least the specified minimum numbers of hours within the specified interval.

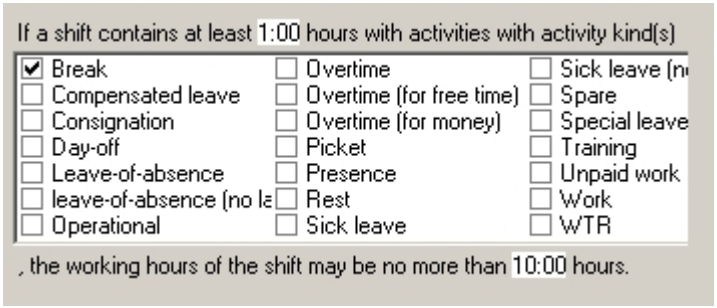
Broken duty: Number of interruptions



Broken duty: Maximum length

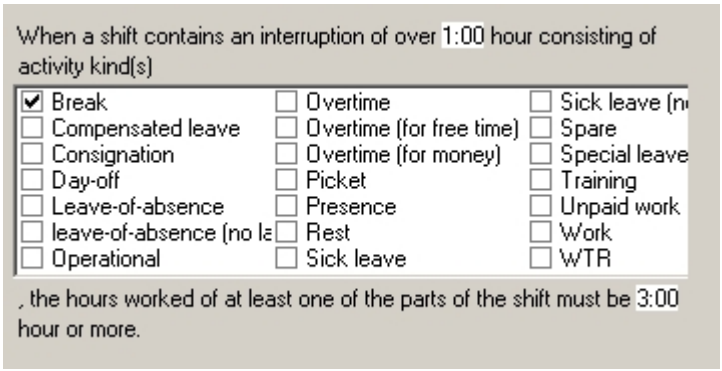


Broken duty: Maximum working hours

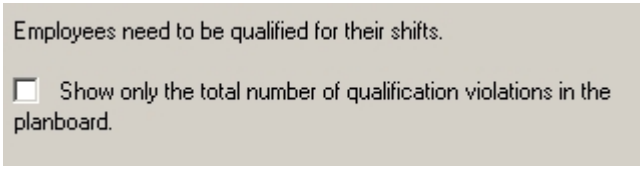


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Broken duty: Minimum working hours

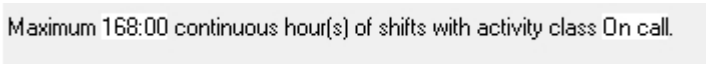


Skills



This rule is checked by the Optimizer, whether the rule has been activated or not.

Duration of on call period



Maximum number of hours work per day



The total number of Labour-time per calendar day is computed.

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Maximum labor time of shifts

Maximum working time per day shift is 8:30 hours.
Maximum working time per night shift is 8:00 hours.
However, shifts that begin between 4:00 and 5:00, should not exceed 7:30 hours.
These rules are allowed to be ignored for 12 times per calendar year: in these cases the maximal working time is 9:00 hours.

Maximum labor time based on account balance

The total labour-time can not be higher than the balance on account (None), category (All).

Maximum labor time per shift with exceptions

The maximum number of working hours per day shift is 10:00 hours.
The maximum number of working hours per night shift is 9:00 hours.
On Saturdays, Sundays and Public holidays the maximum is 12:00 for day shifts and 12:00 for night shifts.

Minimum labor time of shifts

Minimum working time per day shift is 5:00 hours.
Minimum working time per night shift is 5:00 hours.
However, the minimum wokring time for shifts that begin between 0:00 and 0:00 is 24:00 hours.
These rules may be ignored for 12 hours per calendar year: then the minimum working time is 4:00 hours.

Minimum rest time during relief day

A relief day that has been planned in a schedule between two shifts requires a resting time of at least 24:00 hours.

This rule provides a definition for a relief day (also known as a free day) in the context of the rule 'Number of free days'.

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Minimum period of rest after working period

The minimum period of rest after working period of either 6 days or 60:00 hours of labor, needs to be 36:00 hours
☐ , unless followed by a break of 0 days

☐ A working day is a day which contains a minimum of 0:00 hours of labor (no rest).

☐ A working period consists of a series of shifts where the period of rest between the shifts is less than 24:00 hours.

Maximum labor time based on account balance

The total labour-time can not be higher than the balance on account (None), category (All).

Maximum labor time per shift with exceptions

The maximum number of working hours per day shift is 10:00 hours.
The maximum number of working hours per night shift is 9:00 hours.
On Saturdays, Sundays and Public holidays the maximum is 12:00 for day shifts and 12:00 for night shifts.

Minimum labor time of shifts

Minimum working time per day shift is 5:00 hours.
Minimum working time per night shift is 5:00 hours.
However, the minimum wokring time for shifts that begin between 0:00 and 0:00 is 24:00 hours.
These rules may be ignored for 12 hours per calendar year: then the minimum working time is 4:00 hours.

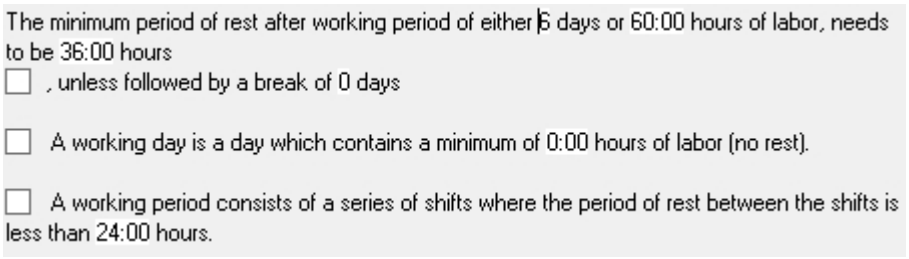
Minimum rest time during relief day

A relief day that has been planned in a schedule between two shifts requires a resting time of at least 24:00 hours.

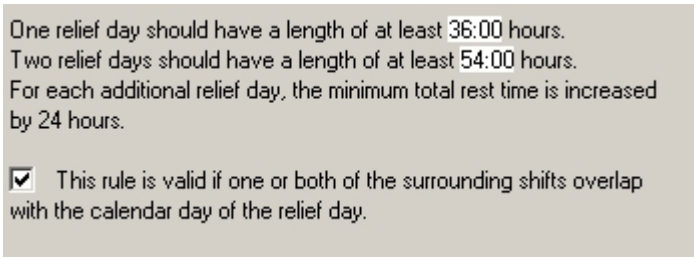
This rule provides a definition for a relief day (also known as a free day) in the context of the rule 'Number of free days'.

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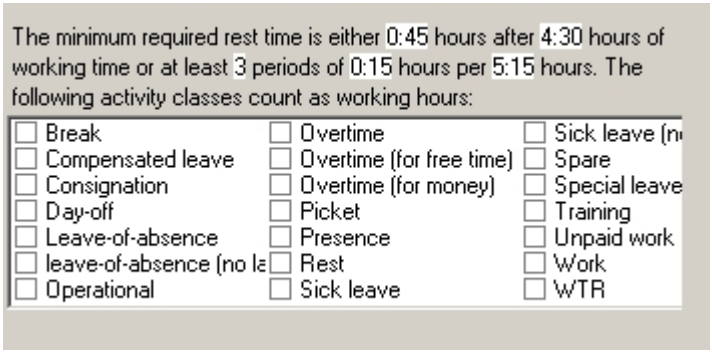
Minimum period of rest after working period



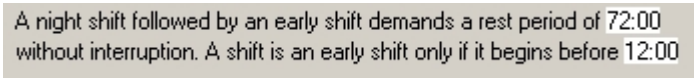
Minimum rest time for a series of relief day shifts



Minimum rest time



Early shift after night shift



Can usually be covered using ‘Rest after a night shift series’.

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Violation of duty times based on duty properties

If a shift with property (None) is assigned at publication of the schedule or later on, this shift cannot be extended outside originally scheduled times.

Day-off after availability shift

An rest day should be followed by a relief day

A rest shift is a shift whose type is defined as ‘rest’. The times specified in the rule ‘Minimum rest time during relief day’ are used for the day off.

Rest after shift

During 24 consecutive hours at least 11:00 hours of rest is required without interruption.
A night shift that ends after 2:00 has to be followed by at least 14:00 hours' rest without interruption.
An exception to this minimum rest requirement is permitted: once in a period of 7 times 24 consecutive hours the resting time may be reduced to at least 8:00 hours.

Rest after shift, two exceptions

During 24 consecutive hours at least 11:00 hours of rest is required without interruption. A night shift that ends after 2:00 has to be followed by at least 14:00 hours rest without interruption.
Two exceptions to this minimal rest requirement are permitted:
(1) once in a period of 7 times 24 consecutive hours the resting time may be reduced to at least 8:00 hours
(2) once in the same period the resting time is allowed to be reduced to 10:00 hours.

Rest after shift series

Following a series of at least 3 consecutive shifts a 48:00 hours' rest is required without interruption.

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Rest after night shift series

Following a series of at least 3 consecutive night shifts a 48:00 hours' rest is required without interruption.

Rest on days off

A relief day planned in a schedule between two shifts requires at least 30:00 hours of rest without interruption. Two or more days off in succession count for 24:00 hours each.

Work relation

A student has to cooperate with their instructor.

For each student or trainee, the entire roster period is checked to establish whether the minimum overlap percentage exists between his/her Labor-time and those of one or more of his/her supervisors. If the minimum is not reached, a violation is generated. This rule is not checked by the schedule Optimizer.

Shift series

The number of consecutive shifts is at most 6.

Shifts belong to a series if the start times of two consecutive shifts are not more than 32 hour apart. This rule is concerned only with work shifts.

Night shift series

If some night shifts end after 2:00, then the maximal number of night shifts in succession is 6.

The rule 'Nightshift definition' is used to define the nightshifts.

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Semi night shift series

If all night shifts do not finish after 2:00, then the number of night shifts in succession has to be at most 6.

The rule 'Night shift definition' is used to define the semi night shifts.

Series of leave days

A series of day of leave is always preceded by at least 1 day-off days and is always followed by a at least 1 day-off days.
A series of days of leave consist of at least 5 days of leave.

A relief day (rest day) is defined on the basis of the rule 'Minimum rest time during relief day'.

Rest day after night shift series

No work should be planned after a series of night shifts for 0:00 hours.

☑ On this day a recovery day has to be planned.

If the box in the above window is ticked, at the end of the generation process the Optimizer rosters a rest shift after each nightshift series.

Activity classes not allowed

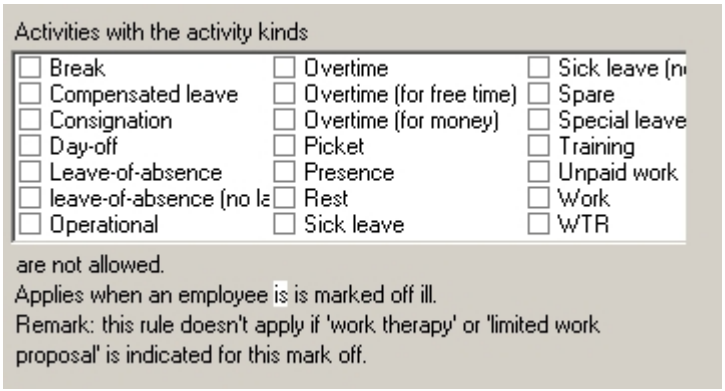
Activities with the activity kinds

☐ Break	☐ Overtime	☐ Sick leave (n
☐ Compensated leave	☐ Overtime (for free time)	☐ Spare
☐ Consignation	☐ Overtime (for money)	☐ Special leave
☐ Day-off	☐ Picket	☐ Training
☐ Leave-of-absence	☐ Presence	☐ Unpaid work
☐ leave-of-absence (no la	☐ Rest	☐ Work
☐ Operational	☐ Sick leave	☐ WTR

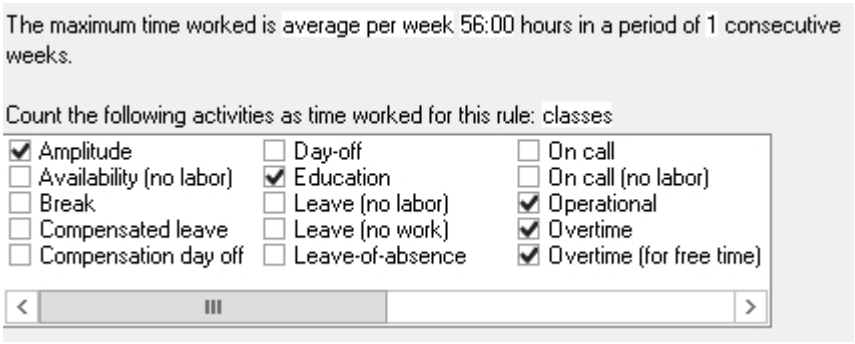
are not allowed.

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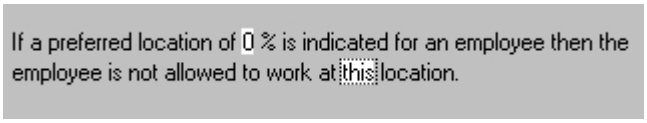
Activity classes not allowed during sick leave



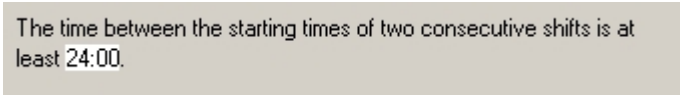
Time worked per period



Preferred workstations and locations with percentage



Forward rotation



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Weekly rest

Weekly rest is at least:
Either 36:00 hours of rest per period of 7 times 24 hours, or 60:00 hours of rest per period of 9 times 24 hours.

An exception is permitted: the last mentioned rest may be reduced to 32:00 hours, once per period of 5 hours.

Working hours and availability

An employee is not allowed to exceed the number of hours for which he/she is available for her/his department during any schedule period by 0:00 hours.

☑ Complete full weeks based on previous schedule.

An employee's availability to the department (reference date: first day of the roster period) is calculated for the entire roster period, unfortunately as yet without correction for weekends. The amount of working time spent in the relevant department must not exceed the availability by more than the specified number of hours.

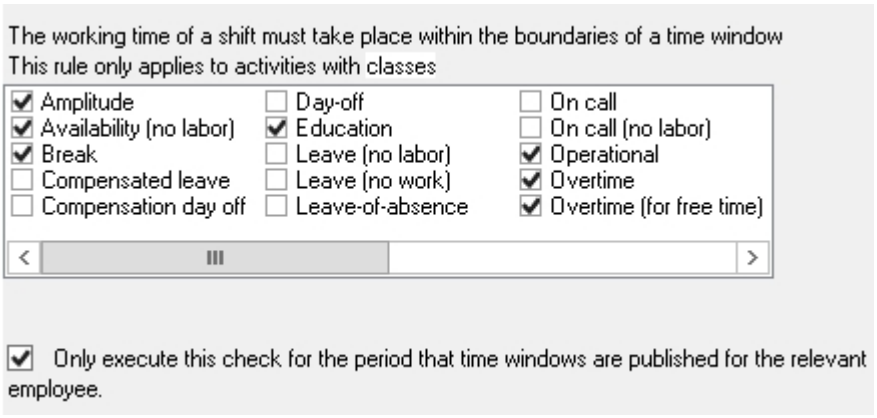
NB:. Suppose that the roster period is a month, and the employee works 36 hours a week. The employee is therefore available 31 * 36/7 = 159.4 hours, or for 19.92 eight-hour shifts. If it were not possible to exceed the employee's availability, he or she would be assigned shifts totaling more than seven hours a month too few. It is therefore necessary to define a permissible excess of, say, four hours.

Check on workstation validity period

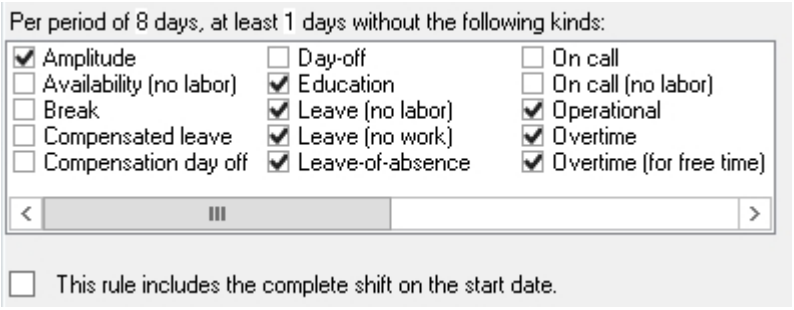
An employee may not be scheduled on a workstation outside the effective period of the workstation.

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Check shift times with time window



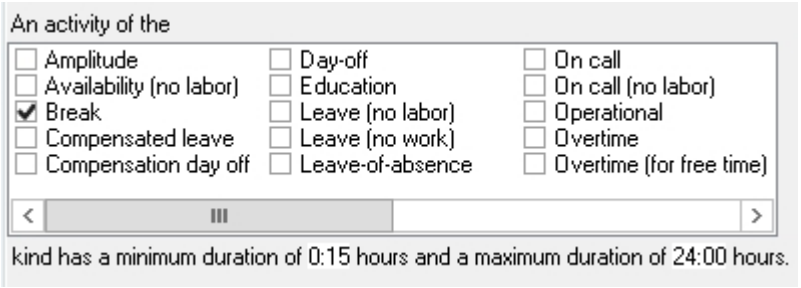
Days without kind in period



Disturbance type not permitted



Duration of activity



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Duty properties of consecutive shifts equal

The value of duty property (None) for a shift must be equal to the value of duty property (None) for the previous shift.
This rule is only valid if the two shifts are less than 12:00 hours apart.

Duty property equals employee property

The value of duty property (None) for a shift must be equal to the value of employee property (None).

☐ This rule is only valid for shifts starting more than 12:00 hours after the previous shift.

☐ This rule is only valid in case the duty property of the shift does not have the default value.

This rule is not supported in cyclical schedules.

Forbidden department

An employee may not work a shift for a forbidden department.

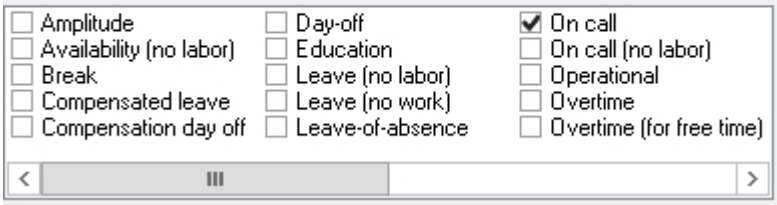
Labor time in salary period

The maximum labor time per salary period is 152:00 hours.

☐ This rule includes the complete shift on the start date.

Labor time per day for specified kind

The labor time in every continuous period of 1 x 24 consecutive hours amounts to a maximum of 13:00 hours if this period contains one of the following shift kinds:



Labor time per period (day/on call)

The maximum labor time per week is on average 45:00 hours per period of 13 consecutive weeks, if this period includes On call (not during the night).

☐ This rule includes attendance shifts.

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Maximum difference between start and end time for a day

The difference between the start time for the first shift on a day and the end time for the last shift on the same day is a maximum 10:30.

☐ This rule is only valid when the shifts on a day contain between 0:01 and 24:00 hours of classes:

☑ Amplitude	☐ Day-off	☐ On call
☐ Availability (no labor)	☑ Education	☐ On call (no labor)
☐ Break	☐ Leave (no labor)	☑ Operational
☐ Compensated leave	☑ Leave (no work)	☑ Overtime
☐ Compensation day off	☑ Leave-of-absence	☑ Overtime (for free time)

This rule does not apply to availability assignments.

Maximum duration of shift with certain activity kind

The duration of a shift of which the spent time contains activities with activity kind

☐ Amplitude	☐ Day-off	☐ On call
☐ Availability (no labor)	☐ Education	☐ On call (no labor)
☐ Break	☐ Leave (no labor)	☐ Operational
☐ Compensated leave	☐ Leave (no work)	☐ Overtime
☐ Compensation day off	☐ Leave-of-absence	☐ Overtime (for free time)

is at most 24:00 hours.

Maximum number of shifts with labor time per period

In a period of 3 weeks a maximum number of 9 shifts are allowed with more than 8:00 hours of labor time.

Maximum working time on an around public holidays

In the period between 0:00 for the start of the holiday and 0:00 after the end of the holiday, the working time amounts to a maximum 0:00 hours.

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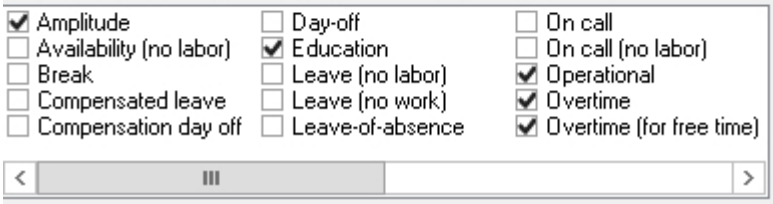
Minimum break time

The minimum break period within a shift is 0:45 hours after 4:30 hours of the selected activities. This break period may be split into a period of at least 0:15 hours followed by a period of at least 0:30 hours.

After meeting the break time demands, the remainder of the shift must also meet the break requirements.

Two consecutive shifts will be treated as one shift if the gap between them is no more than 0:45 hours. In this case the gap will be treated as break.

Take activities into account that contain classes



Minimum of rest after shift

A shift that contains 12:00 continuous hours of working time needs to be followed by at least 10:00 hours of rest.

This rule does not apply to availability assignments.

Minimum rest time after work at weekend

The minimum uninterrupted rest time following the end of working in the period between Friday 0:00 and Monday 0:00 is 0:00 hours.

Minimum rest time after work on public holidays

The minimum uninterrupted rest time following the end of working in the period between 0:00 hours before the start of the holiday and 0:00 hours after the end of the holiday is 0:00 hours.

Minimum time of activity class during shift

A minumum of 4:00 continuous hours of activity class Rest is required if the duration of a shift is 12:00 hours or more.

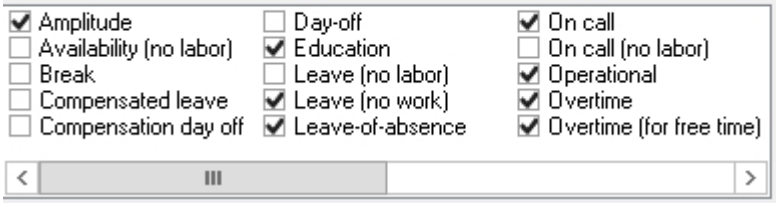
Minimum working hours of a shift

The hours worked of a shift must be at least 8:00 hour(s).

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No kind in period

Per period of 28 x24 consecutive hours, at least 2 periods of 48:00 hours without the following kinds:



Non acceptable (combination of) duties

It is not allowed to assign shifts with duty type(s) (None) and shifts with duty type(s) (None) in the same schedule.

Remark 1: Use a semicolon (';') to enter multiple duty types
Remark 2: If one of the parameters is blank, all duty types entered for the other parameter will be not acceptable in the schedule.

Number of free weekends based on days

At least 2 weekends off of 60:00 hours per 4 weeks,
including Saturday 0:00 until Monday 4:00.

☐ The rule is reset to zero after 3 consecutive weekends without shifts (no shifts start or end in the period concerned).

☐ Also valid for on-call shifts

Only work in registered provinces

An employee is only allowed to work in a registered province.(Provincie 1, Provincie 2 of Provincie 3)

Position intersection

If the position of an activity equals (calculated), the intersection of the employee's positions and the positions of the activity's workstation should be exactly 1 position.

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Rest after labor on Sunday

When working more than 4:00 hours on Sunday, there should be at least 35:00 hours of consecutive rest time within 155:00 hours after the last shift on the Sunday.
When working 04:00 hours or less on Sunday, there should be at least 12:00 consecutive hours of rest time within 144:00 hours after the last shift on the Sunday. This rest time should be completely before or after 13:00 hours. It is not allowed to work more than 5:00 hours on the day of the rest period.

Rest after series of days with starting shifts

After the last shift with labor in a period of at least 6 and at most 14 consecutive days with labor shifts starting on each day there should be at least 24:00 hours of rest.

☐ This rule applies only if a night shift starts on at least 1 of these days.

Rest after series of days with starting shifts

After the last shift with labor in a period of at least 6 and at most 14 consecutive days with labor shifts starting on each day there should be at least 24:00 hours of rest.

☐ This rule applies only if a night shift starts on at least 1 of these days.

Rest days without starting shifts

After 14 days there should be at least 2 days without starting shifts with labor.

This does not apply when this period contains 2 days without a starting shift with labor and at least 1 of these days overlaps with a continuous period of rest of at least 24:00 hours.

Rest per number of hours

The minimum rest time is 11:00 consecutive hours in a period of 24:00 consecutive hours.

The minimum rest time in a period of 168:00 consecutive hours can be shortened:
- ☑ once to 8:00 hours
- ☐ once to 9:00 hours
- ☐ once to 10:00 hours

This rule does not apply to availability assignments.

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Rest per number of hours labor period

This rule uses 'shifts' according to the labor period defintion.

The minimum rest time is 11:00 consecutive hours in a period of 24:00 consecutive hours.

The minimum rest time in a period of 168:00 consecutive hours can be shortened:

- [x] once to 8:00 hours
- [ ] once to 9:00 hours
- [ ] once to 10:00 hours
- [ ] This rule also applies to attendance shifts.

Rest per week for shift with certain activity kind

The minimum rest time in a consecutive time period of 7 times(multiplied by) 24 hours is at least 90:00 hours, if this period contains Presence.

The rest time needs include 1 period of at least 24:00 consecutive hours rest, as well as 6 periods of at least 11:00 consecutive hours rest. 6 rest times in each consecutive time period of 7 times 24 hours can be shortened to 8:00 hours once and to 10:00 hours once.

Shifts with property in period

Between Sunday 0:00 and Sunday 0:00, there must be at least 1 shifts with property (None) value (None) or 2 shifts with property (None) value (None).

Note: The automatic planner is not able to assign shifts to resources for whom this rule is valid.

- [ ] This rule includes the complete shift on the start date.

Time worked in between two rest periods

The maximum time worked is 9:00 hours in between two rest periods of at least 9:00 hours. This maximum can be increased to 10:00 hours at most 2 times a week.
Check up to 2 days of history to search for the preceding rest period.

Count the following activities as time worked for this rule: classes

[x] Amplitude	[ ] Day-off	[ ] On call
[ ] Availability (no labor)	[x] Education	[ ] On call (no labor)
[ ] Break	[ ] Leave (no labor)	[x] Operational
[ ] Compensated leave	[ ] Leave (no work)	[x] Overtime
[ ] Compensation day off	[ ] Leave-of-absence	[x] Overtime (for free time)

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Week definition

The week starts on Monday at 0:00.

Weekly rest based on days

The minimum weekly rest time amounts to 36:00 consecutive hours in a period of 7 days starting on Monday.

☐ It is allowed to use the first 6:00 hours of the following period to reach the required amount in this week. These hours can, however, only count as rest time in 1 period, not in both. Check this for a maximum of 4 weeks in the past.

☐ The minimum weekly rest time must include a full calendar day. Note that it is not allowed to use a full calendar day of rest from the following period.

Rest day after labor on Sunday or public holiday

Each Sunday or public holiday is a day off. Whenever a Sunday is not a day off, a compensation day off must be had within 2 weeks. Whenever a public holiday is not a day off, a compensation day off must be had within 8 weeks.

A day off is defined as a full calendar day without activities, or only activities with class(es)

☐ Amplitude	☑ Consignation (no labor)
☑ Availability (no labor)	☑ Day-off
☑ Break	☐ Education
☑ Compensated leave	☑ Leave (no labor)
☑ Compensation day off	☑ Leave (no work)

Note: when looking for compensation days off, the rule looks back no further than 16 weeks. This rule cannot be calculated in a cyclical schedule.

☐ The day off on a Sunday or public holiday must either follow a rest of at least 11 hours or be followed by a rest of at least 11 hours. For the compensation day off the same must hold. In the rest of at least 11 hours no activity should be planned or only one or more activities with class(es)

☐ Amplitude	☑ Consignation (no labor)
☑ Availability (no labor)	☑ Day-off
☑ Break	☐ Education
☑ Compensated leave	☑ Leave (no labor)
☑ Compensation day off	☑ Leave (no work)

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Daily rest after a shift (labor period)

This rule uses 'shifts' according to the labor period definition.

The minimum rest time is 11 consecutive hours after every shift.

☐ The minimum rest can be shortened to at least 10 hours, when this is compensated by a rest of at least 12 hours within 4 weeks.

☐ Different conditions for 'on call (no labor)' or 'work (stand by)':
- Activities of the kind work (stand by) are not considered rest.
- The minimum rest time of 11 consecutive hours can only be shortened when the total time for work (stand by) is not more than the total time for on call (no labor). In this case the missed rest should be compensated by a daily rest of at least 11 hours plus the missed rest within 8 weeks.

☐ This rule applies only to employees for whom the employee property (None)...
☐ This rule applies only to employees in a salary group between (None) and (None).
☐ This rule applies only to employees aged over 18 years up to 100 years.

Maximum number of on call periods per month

This rule uses the definitions for labor period and on call period.
A presence period is a labor period where the activity 'Presence' is used.

The maximum number of on call periods per calendar month is 12.

This rule is only valid when there is no presence period.

☐ This rule applies only to employees for whom the employee property (None)...
☐ This rule applies only to employees in a salary group between (None) and (None).
☐ This rule applies only to employees aged over 18 years up to 100 years.

Maximum number of special periods per month

This rule uses the definitions for labor period, on call period and consignation period.
A presence period is a labor period where the activity kind 'Presence' is used.
Special periods are on call periods, presence periods and consignation periods.

Maximum 5 special periods per 3 weeks.

This rule is only valid when there is at least one on call period.
This rule is only valid when there is at least one presence period or one consignation period.

☐ This rule applies only to employees for whom the employee property (None)...
☐ This rule applies only to employees in a salary group between (None) and (None).
☐ This rule applies only to employees aged over 18 years up to 100 years.

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Minimal rest after work stand by (labor period)

This rule uses 'shifts' according to the labor period definition.

A shift may not start within 5:30 hours after an activity with kind work (stand by).

- [ ] This rule applies only to employees for whom the employee property (None)...
- [ ] This rule applies only to employees in a salary group between (None) and (None).
- [ ] This rule applies only to employees aged over 18 years up to 100 years.

Minimum time between attendance shift and long shift

This rule uses 'shifts' according to the labor period definition.

There should be at least 72 hours between the end time of an attendance shift and the begin time of a shift containing more than 10 hours of the following classes:

- [x] Amplitude
- [x] Education
- [x] Operational
- [x] Overtime
- [x] Overtime (for free time)
- [x] Overtime (for money)
- [x] Presence
- [x] Spare
- [x] Training
- [x] Unpaid work
- [x] Work

- [ ] This rule applies only to employees for whom the employee property (None)...
- [ ] This rule applies only to employees in a salary group between (None) and (None).
- [ ] This rule applies only to employees aged over 18 years up to 100 years.

Maximum labor time of shifts (labor period)

This rule uses 'shifts' according to the labor period definition.

The labor time in a shift should be at most 12 hours.

No more than 4 shifts with more than 10 hours of labor time each may be worked in sequence. Two consecutive shifts are in the same sequence if there is less than 35 hours in between.

In every 2 calendar weeks, no more than 8 shifts with more than 10 hours of labor time each may be worked.

This rule does not include attendance shifts.

- [ ] This rule applies only to employees for whom the employee property (None)...
- [ ] This rule applies only to employees in a salary group between (None) and (None).
- [ ] This rule applies only to employees aged over 18 years up to 100 years.

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4 Scheduling criteria

First, we'll explain some key points about Scheduling criteria. Then, we'll present a list of most criteria, along with specific notes when needed.

4.1 Weighting

Each criterion is rated on a scale from 0 to 10,000. A rating of 0 means the criterion is ignored. The optimizer uses these ratings to prioritize tasks: for example, if criterion A has a rating of 5 and criterion B has a rating of 100, the optimizer will prioritize fixing 21 violations of criterion A over one violation of criterion B.

4.2 Availability

To simplify the setting of Scheduling criteria, every Scheduling criterion ends with:

> Example
>
> This criterion is valid tor employees with an availability of at least **0:00** and at most **48:00** hours per week.

This implies that scheduling criteria, like shift-series length, can be adjusted to have different parameters for part-time workers compared to full-time staff. Consequently, users can instruct the system to exempt certain employees from applying the standard (departmental) criteria.

4.3 Cost type

Costs stem from the number of violations and a set cost per violation. For instance, consider the 'Shift-series length' criteria. Having two series of seven shifts each is preferable to one series of six and another of eight. Costs follow a 'quadratic' principle: a violation by two incurs a cost of four (two times two). So, pairing a six-shift series with an eight-shift series equals a total cost of four, whereas two seven-shift series result in a total cost of two. The cost type is predefined by the system and isn't adjustable by the user.

> In relation to criteria, it's crucial to grasp the meaning of these four terms:
>
> - **Penalty**: This represents the visible final outcome in calculations, used by the optimizers for scheduling decisions.

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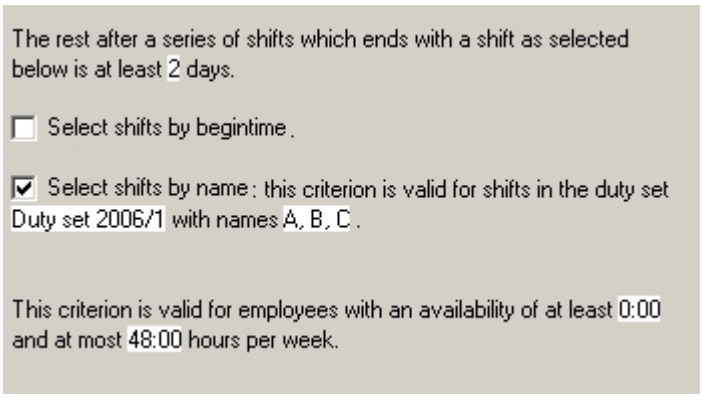
- **Basic cost**: It's the penalty divided by the specified weighting.
- **Violation**: A criterion sets parameters for the scheduling process. If an arrangement breaches these parameters, the extent of that breach can be determined. For example, if the maximum specified shift-series length is five and a series runs for seven shifts, it violates by two. The associated basic cost of this violation depends on the cost type: if it's linear, the basic cost is two; if it's quadratic, it's four (i.e., two times two).
- **Number**: It denotes how many times a violation occurs. For a rule, any violation incurs a penalty. Hence, 'number' signifies the count of penalties. Concerning a criterion, the penalty depends on the severity of the violation, which relates to a basic cost. This basic cost, when multiplied by the weighting, results in the penalty.

4.4 Series

If a scheduling criterion involves a series, it's possible to define which shifts are 'relevant' within that criterion's context. Two shifts are relevant to a series if the time between them is within twenty-four hours or if they fall on the same day or across two consecutive days. The presence or absence of non-relevant shifts between the relevant ones doesn't matter. For instance, a night shift starting on a Monday and ending at 07:00 hours the next day (Tuesday), paired with an early shift on Wednesday beginning at 07:00 hours, are part of a series (provided both are relevant). It's important to note, however, that such a combination would typically be prohibited by the rules.

4.5 Criteria

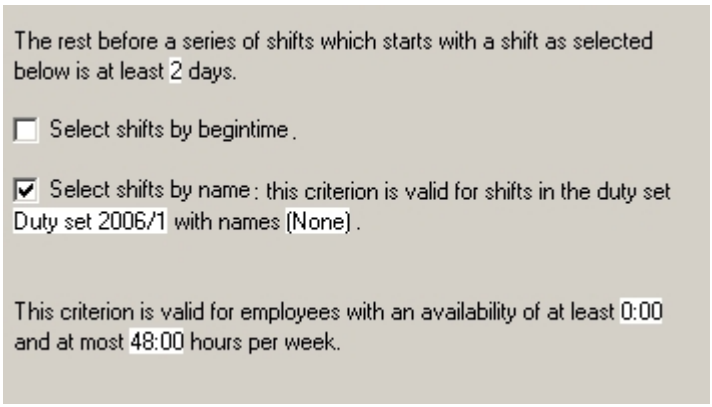
Number of days rest after a shift



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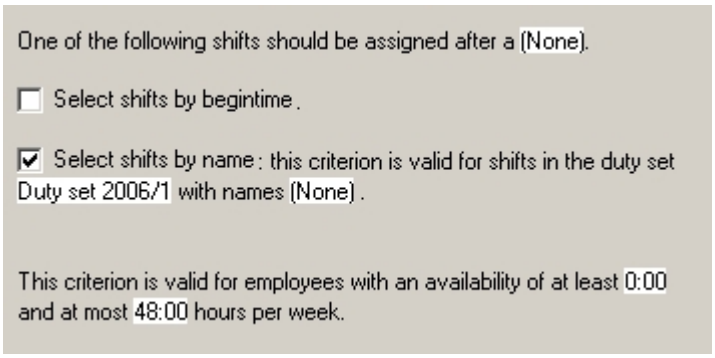
The cost type is quadratic. The Scheduling criterion is concerned with the number of calendar days on which no shift is scheduled. So, if provision is made for two days rest after a nightshift, the day on which the nightshift ends cannot be counted as one of the necessary rest days.

Number of days rest before a shift

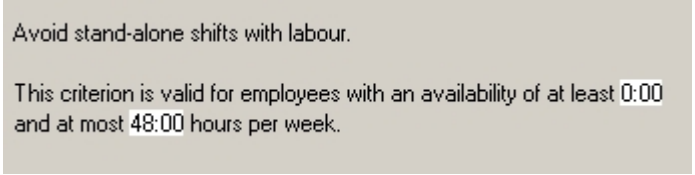


The cost type is quadratic. The Scheduling criterion is concerned with the number of calendar days on which no shift is scheduled.

Combinations of consecutive shifts



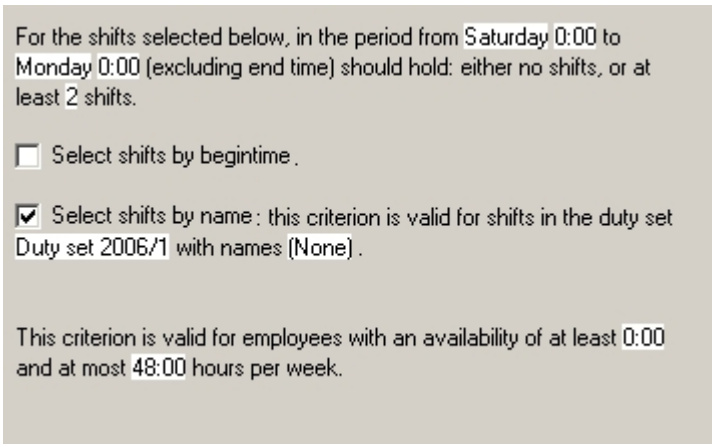
No standalone shifts



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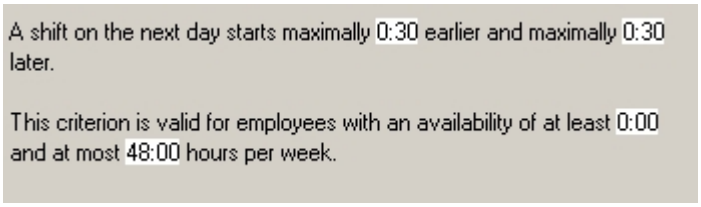
Applies to all shifts that involve work.

No shift or else minimum number of shifts



This Scheduling criterion can be used to specify that either no shifts at all, or otherwise at least two shifts, should be scheduled at the weekend.

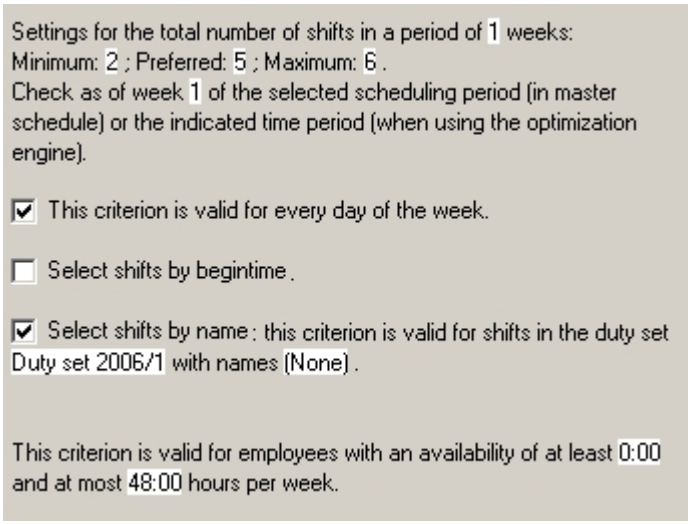
Maximum difference in start times



This criterion can also be used to prevent forward rotation (increasingly late shift start times) and/or backwards rotation (increasingly late shift start times).

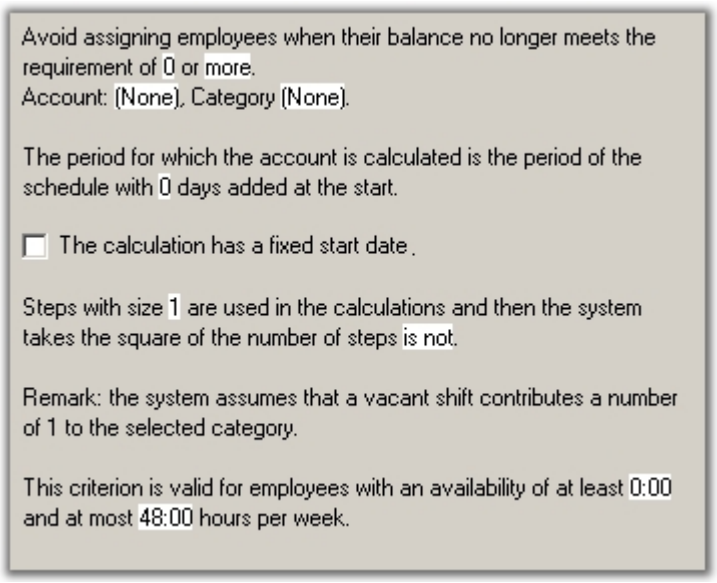
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Minimum/Maximum number of shifts



The cost type is quadratic. The specified weeks run from Monday to Sunday. The user has the option of selecting a particular part of the week (e.g. working days only; see window).

Minimum/maximum balance of an account category

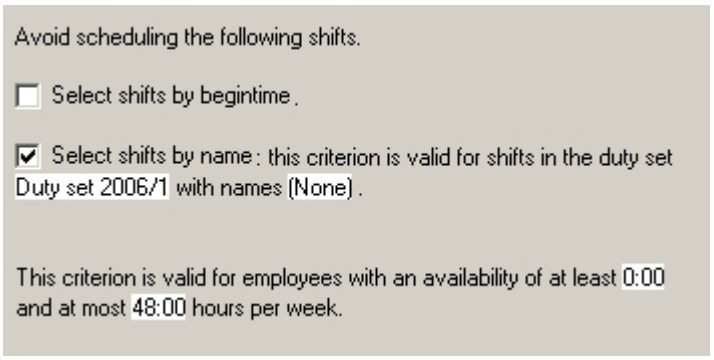


An experimental variant of this criterion has been developed for use in Belgium, which features a user-definable period (from a specified start date to the end of the schedule); this variant uses historical statistics,

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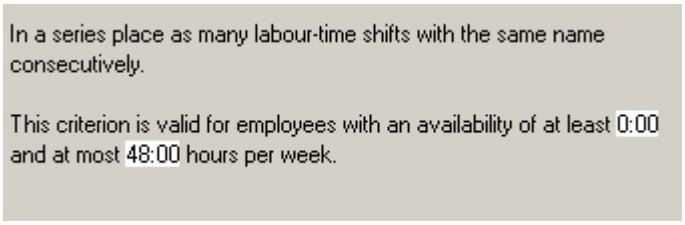
which are updated every hour.

Unwanted shifts



This Scheduling criterion is useful only in the context of work agreements. If an employee is definitely not allowed to work particular shifts, it is better to use a requirement preventing his/her assignment to those shifts.

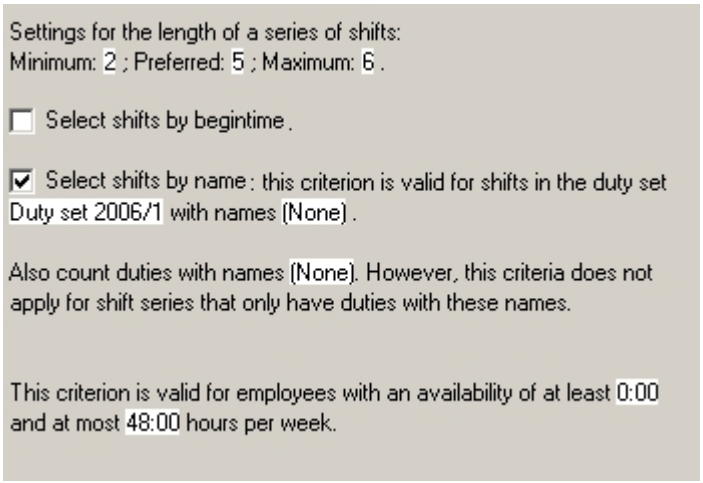
Consecutive shifts are the same



Shifts are regarded as 'the same' if they share the same name.

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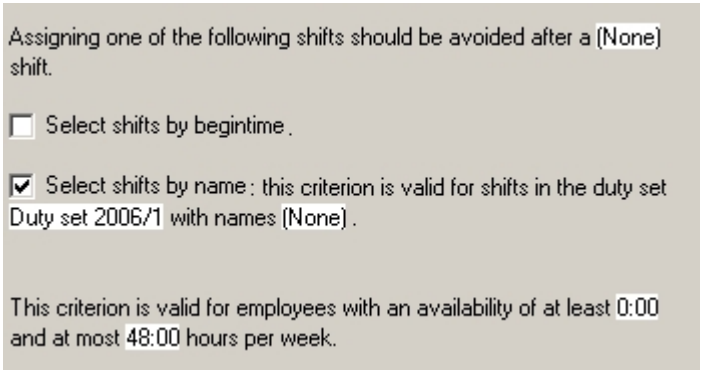
Shift-series length



> The cost type is quadratic, so if a series contains 1, 2, 3 etc. too many or too few shifts (on the basis of the specified minimum and maximum), the resulting cost will be 1, 4, 9, etc.

The criterion defines the ideal series length, but deviation from this ideal does not incur a penalty. Consequently, the specified minimum and maximum should reflect the preferred range, not the tolerable range

Forbidden combinations of shifts



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Avoid shifts situated far away

Avoid assignments of shifts with a large distance between home and work. This rule is relevant for duties in the duty set Duty set 2006/1 with the following names:
(None)
Apply a threshhold value of 0 units.

This criterion is valid for employees with an availability of at least 0:00 and at most 48:00 hours per week.

Only useful if x and y coordinates are in use.

Preferred workstations and locations

Schedule workstations and locations according to the preferred jobs and locations of an employee.

If an employee has a preferred or location at 100%, the automatic planner tries to assign this employee to that workstation or location in every shift.
If there are no preferred workstations or locations at 100%, the realised percentages are calculated over the period of the schedule, including the 0 days before.

☐ Don't use the realized percentage, but use the percentages as a measure. The higher the preferred location's percentage, the higher the chance that this location is assigned to the employee.

This criterion is valid for employees with an availability of at least 0:00 and at most 48:00 hours per week.

The functionality of the preferred locations feature is described below. This criterion uses historical statistics, which are updated every hour.

Preferred location of 0%: this should always be avoided: the basic cost of the violation will be increased by 100 if the employee is actually assigned to a shift with at such a workstation or location. See also the rule ‘Preferred workstations and locations with percentage’.

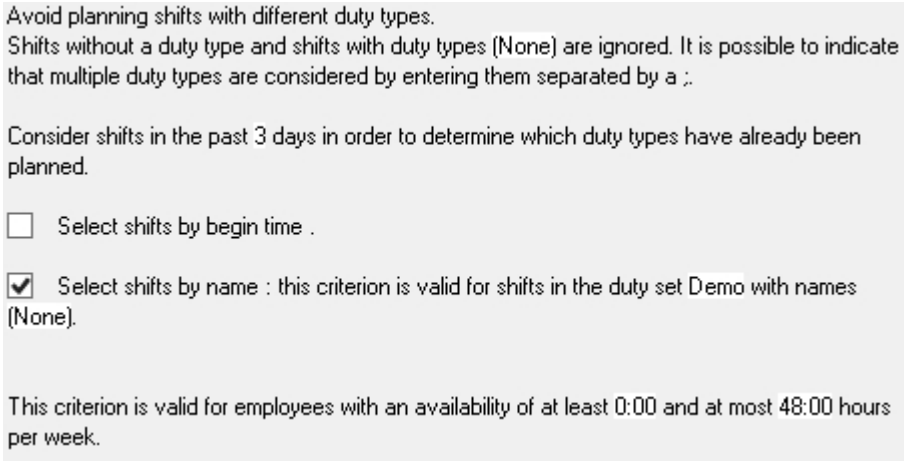
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Case 1: the employee has one or more 100% preferred locations. These will be treated as his/her principal workstations. The optimizer will penalize any assignment to another workstation by imposing a basic cost of 100, plus 1 for every percentage point that the scheduled workstation has a preference of less than 100%. So, if the employee is assigned to a workstation with a preference of 30%, the basic cost of the violation will be 170. So, if any 100% preferred locations are defined, the percentage ceases to have any proportional significance; any assignment to a workstation with a percentage other than 100% will result in a penalty for every shift, but the lower the preference percentage, the higher the penalty.

Case 2: the employee has no 100% preferred locations. The specified location percentages are therefore treated as indicative of the proportion of his/her time that the employee should spend at the various locations. If the percentages total more than 100%, a penalty will always result. If the total is less than 100%, there will not be a problem: the optimizer will treat the shortfall percentage as the proportion of the employee's time that may be allocated to any workstations.

Example. Workstation A is a 40% preferred location for Mr. Janssen, while workstation B is a 50% preferred location. The optimizer will seek to assign at least 40% of the time that Mr. Janssen spends working during the schedule period and the specified number of days prior to the schedule period to workstation A, and at least 50% to workstation B. The remaining 10% of his time may be assigned to any workstation (under the terms of this criterion).

Duty type



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Limit time between shifts

Avoid time between shifts. Multiply the number of minutes between a shift and the previous shift with the weight of this criterion.

This is only valid in case the two shifts are less than 12:00 hours apart.

The difference is not squared.

This criterion is valid for employees with an availability of at least 0:00 and at most 48:00 hours per week.

Maximum number of days without selected shift

The number of days without a shift as selected below can amount to a maximum of 5.

☐ Select shifts by begin time .

☑ Select shifts by name : this criterion is valid for shifts in the duty set Demo with names (None).

This criterion is valid for employees with an availability of at least 0:00 and at most 48:00 hours per week.

Minimum / Maximum number of workstations

The number of different Workstations in a period of 1 weeks is:
Minimum: 0 ; Preferred: 1 ; Maximum: 1 .
Check as of week 1 of the selected scheduling period (in master schedule) or the indicated time period (when using the optimization engine).

☐ Select shifts by begin time .

☑ Select shifts by name : this criterion is valid for shifts in the duty set Demo with names (None).

The difference is squared.

This criterion is valid for employees with an availability of at least 0:00 and at most 48:00 hours per week.

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Preferred department

Avoid planning shifts from a preferred department that does not have the highest priority.

☐ The departments the employee is assigned to, also count as preferred departments with a priority of 100.

The score will be calculated as follows:
Calculate the difference between the priority of the most preferred department and the priority of the shift department. When the shift department is not a preferred department, the priority is 0.
Multiply this difference with the weight of this criterion.
The difference is not squared.

This criterion is valid for employees with an availability of at least 0:00 and at most 48:00 hours per week.

Remaining work times

Give employees with higher remaining work times precedence

The difference is not squared.

This criterion is valid for employees with an availability of at least 0:00 and at most 48:00 hours per week.

Shift feature

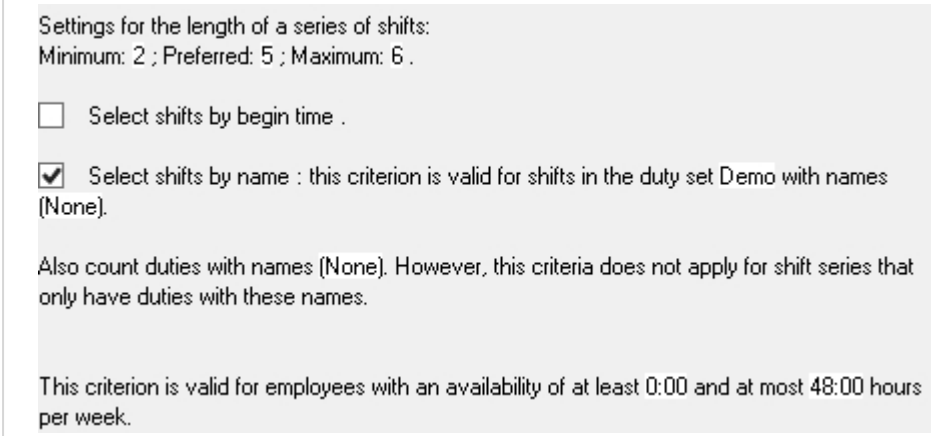
When scheduling avoid having employees get a balance of more for 0.
Shift feature: (None)

The difference is not squared.

This criterion is valid for employees with an availability of at least 0:00 and at most 48:00 hours per week.

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Shift series length

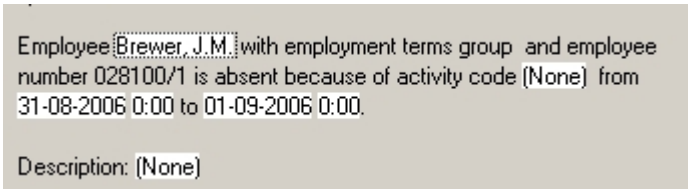


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5 Requests

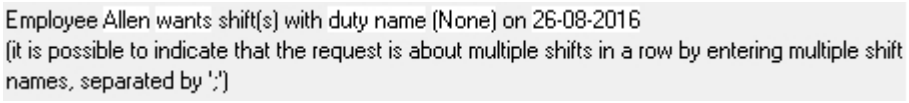
A request can be seen as either a rule or a criterion. To treat it as a rule, you need to check the 'Required' box. When a request is considered a requirement, assigning a weight becomes unnecessary. Some requests aren't considered by the optimizers, so weightings cannot be assigned to them or set as requirements.

Absence type

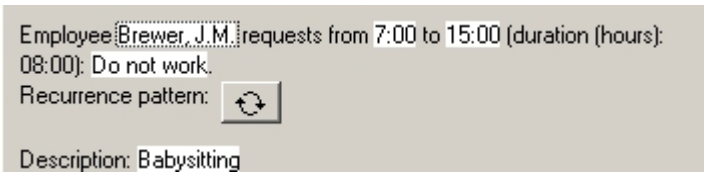


The optimizers do not take this type of request into account.

Duty Request



Recurring request



This is a yes/no criterion: if the defined interval does/doesn't overlap with a shift, a basic cost of 1 is imposed, regardless of the duration of the overlap. The shifts considered are work shifts, or shifts whose type is defined as ‘consignation’, ‘picket’ or ‘attendance’.

NB: If, for example, an employee should not work late shifts (from 15:00 to 23:00 hours), the interval of the request needs to be set to, say, 21:00 to 22:00 hours. If the full period from 15:00 to 23:00 hours were set as the interval, this would preclude the employee being assigned a dayshift from 08:00 to 16:30 hours.

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Leave request

Employee Brewer, J.M. requests to be on leave type (None) from 02-02-2006 to 03-02-2006

(No) working during a period

Employee Brewer, J.M. requests from 31-08-2006 7:00 to 31-08-2006 14:00: Do not work

This is a yes/no criterion: if the defined interval does/does not overlap with a shift, a basic cost of 1 is imposed, regardless of the duration of the overlap. The shifts considered are work shifts, or shifts whose type is defined as 'consignation', 'picket' or 'attendance'.

NB: If, for example, an employee should not work late shifts (from 15:00 to 23:00 hours), the interval of the request needs to be set to, say, 21:00 to 22:00 hours. If the full period from 15:00 to 23:00 hours were set as the interval, this would preclude the employee being assigned a dayshift from 08:00 to 16:30 hours.

Request with description

Employee Brewer, J.M. has a request described below in the period from 31-08-2006 7:00 to 31-08-2006 14:00 as follows:
Workshop

Optimizers do not take account of this type of request.

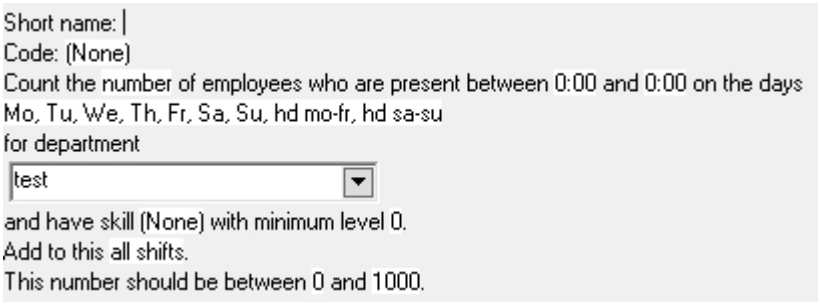
Recurring shift request

Employee Allen wants shift(s) duty name (None)
(it is possible to indicate that the request is about multiple shifts in a row by entering multiple shift names, separated by ';')
Recurrence pattern 

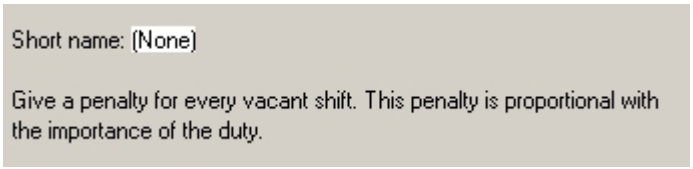
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6 Daily requirements

Number of skills present

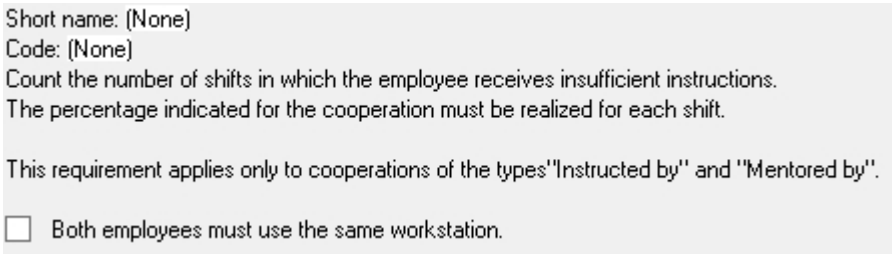


Importance of vacant shifts



Optimizers always seek to schedule all shifts. However, in case not all shifts can be accommodated, this criterion creates a priority structure by varying the penalties for omission.

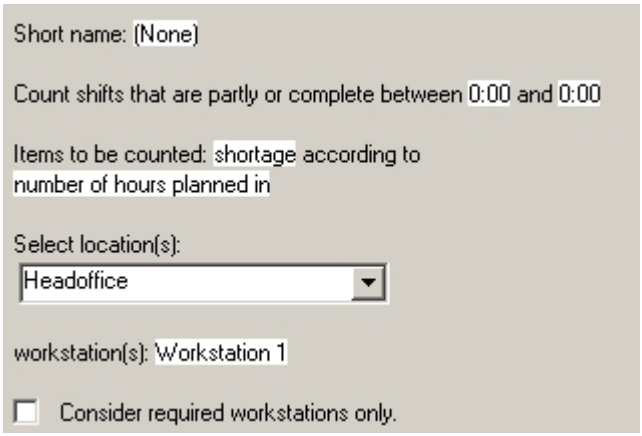
Work relations per shift



Each shift that a student or trainee is scheduled to work is checked to establish whether the minimum overlap percentage exists between his/her Labour-time and those of one or more of his/her supervisors. If the minimum is not reached, a basic cost of 1 is imposed. The criterion is therefore a yes/no criterion.

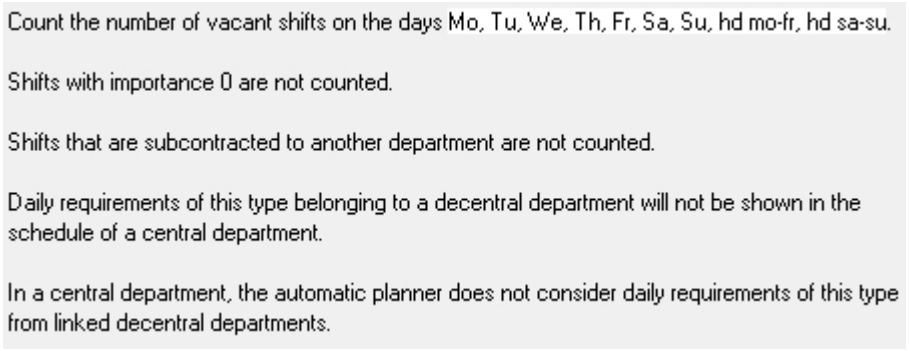
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Workstation demand



Optimizers do not take account of this type of request, since it does not make any difference which employee mans a given workstation, and the optimizer will seek to schedule all shifts anyway.

Number of vacant Shifts



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7 Frequently asked questions

7.1 Question 1 (defining weightings)

How do I decide what weightings to use?

When you create a criterion, ORTEC Workforce Scheduling will suggest a weighting for it, which depends on the type of criterion concerned. It's advisable to use this default weighting, at least to begin with. If you then find that one or more criteria are being violated more often than you would like, you can always increase their weightings. We suggest that when you increase a weighting, you do so by adding an extra zero to the existing weighting (e.g. increase 10 to 100).

If you reach the point where all your weightings end in a zero, you might as well remove the last zero from every weighting, because the zeros will simply be making all penalties ten times higher, without influencing the scheduling priorities.

7.2 Question 2 (quadratic costs)

The costs associated with some Scheduling criteria are quadratic (i.e. squared)? At what point are the costs squared, and why?

The basic cost of a violation is sometimes squared. 'Quadratic costs' as they are known, are associated with scheduling criteria that relate to several shifts, or to the lengths of shift series or rest series. The reason being that, in such cases, two single violations is preferable to one double violation. Consider the following example. Suppose that there are twelve shifts in a week, and two employees, A and B. A criterion has been defined, stating that they should work a maximum of five shifts a week (weighting 10). ORTEC Workforce Scheduling's first priority, however, is to ensure that all shifts are scheduled. So, providing there are no rules to prevent it, A and B are assigned twelve shifts between them. The optimizer has a choice between assigning six to each of them, or five to one and seven to the other. The first option would mean two single violations, so that the basic cost would be 1 + 1. After applying the weighting of 10, the penalty would work out at 10 + 10 = 20.

The second option would mean no violation in respect of the one employee (and therefore no cost), but a double violation in respect of the other. Application of the quadratic principle would mean that the basic cost in the latter case was 2 x 2 = 4. Hence the penalty would be 10 x 4 = 40. Consequently, the optimizer would regard the first option (six shifts each) as preferable.

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7.3 Question 3 (no late shifts)

In the work agreements, I have specified that a particular employee should not work any late shifts; I have set the weighting for this criterion at 1000. Nevertheless, late shifts are sometimes assigned to the employee. How can I stop this happening?

> The optimizer has been unable to come up with a better solution than a schedule that included late shifts for the employee in question. This can sometimes happen, but it shouldn't happen often. If even an occasional late shift is unacceptable, what you need is not really a criterion, but a rule. The simplest way of ensuring that the employee gets no late shifts at all is to define a recurring request that the employee should not work between 20:00 hours and 22:00 hours, and mark it as a requirement. The employee will then not be assigned any shifts that fall (even partially) in the period 20:00 hours to 22:00 hours.

7.4 Question 4 (minimum numbers)

Do I have to specify a minimum under 'minimum and maximum number of shifts'?

> In many cases, a minimum isn't needed, since if a maximum is specified for every employee in the group, the shifts will inevitably be fairly well distributed amongst them. However, under certain circumstances, the maximums may be high enough to allow the optimizer to schedule all the shifts without giving any to certain employees in the relevant group. If this happens, and is considered undesirable, you need to specify minimums as well as maximums.

7.5 Question 5 (shift sequences)

I have defined all the rules and criteria carefully, but the schedules produced by the schedule optimizer are not very good. The scheduling of the nightshifts is particularly poor. What should I do?

> It can sometimes happen that a specific situation throws up problems that the schedule optimizer is not able to resolve satisfactorily. This may involve the organization of nightshifts, for example. Even defining very high weightings and allowing a long computation period does not always resolve such problems. Under such circumstances, it can help to separately address the problem area of the schedule first. If it is the nightshifts that are the sticking point, begin by using the shift sequence optimizer to work out your nightshift sequences, and assign them to appropriate employees. Then check the planner's output. If the distribution still isn't to your liking, define an appropriate rule ('Maximum number of nightshifts in a period') or scheduling criterion to ensure better performance. Once the nightshift sequences are more in line with your

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expectations, any remaining nightshifts can be scheduled manually. Then you should fix the nightshifts before running the schedule optimizer.

7.6 Question 6 (subsequent schedule)

Why doesn't the optimizer take any account of the schedule for the next period?

The penalty calculations for each schedule take account of the previous schedule. If, for example, the previous schedule ends with three shifts for employee A (and the minimum shift-series length is five), this will not attract a penalty in the previous schedule. The rationale being that the series will be completed in the current schedule. This makes sense, because otherwise, if the current schedule didn't yet have any shifts assigned to employee A, 'short series' penalties be would incurred. So it is the responsibility of the current schedule to tie up the loose ends left by the previous schedule.

However, it may be that some shifts have already been entered onto the next schedule. The calculations made for the previous schedule do not take these shifts into account. The reason for this is the same as the reason that account is taken of the previous schedule; the alternative is to accept that, if nothing has yet been entered onto the next schedule, the current schedule will incur short-series penalties. One might suggest that the optimizer should look only at what is actually scheduled. However, this would merely shift the problem along, because the schedule has to end somewhere. Do the series have to end where the schedule ends, or can it continue?

Consider the following example: on the second day of the next schedule, a shift is planned. Does that mean that the previous day is free (possibly providing a short rest), or can work be scheduled for this day?

The approach adopted is clear. Each optimizer is responsible for tying up the loose ends left by its predecessor as efficiently as possible; the user is responsible for the future. If the user wishes the optimizer to take account of the future, he needs to make this possible by, for example, scheduling and fixing shifts (possibly rest shifts) in advance.

7.7 Question 7 (revised lists)

How does the optimizer cope with revised rules and criteria?

Before the optimizer begins the generation process, it needs to determine which rules and criteria apply. The user defines this applicability by specifying the period for which the list of rules or criteria is valid. If these lists remain unchanged during the schedule period, there's no issue. However, introducing a

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new set of rules or criteria during this time can create complications. Typically, rules and criteria have extended validity periods. Consider the rule 'Number of nightshifts per four-week period,' for instance. Suppose an employee is scheduled for four nightshifts in the first two weeks but none thereafter. If the user specifies that, starting from the third week, the employee shouldn't work more than three nightshifts per four-week period, there's uncertainty about allowing the initially scheduled nightshifts. To avoid this, the decision is made to disregard changes. The rules and criteria applicable at the start of the schedule period remain valid throughout. However, work agreements are an exception; multiple agreements can apply simultaneously. Regarding work agreements, if an agreement is valid at any point in the schedule period, it's considered valid for the entire duration.

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Contact information

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