Course manual

Rostering I

Version 22

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General

About this document

This document contains course overheads and exercises.

About the Rostering I course

The Rostering I course addresses experienced planners with no or little knowledge of the Jeppesen Crew Rostering system. Beginners not familiar with Crew Rostering concepts should begin with the course ***Rostering Introduction***.

The course gives you a thorough introduction Jeppesen Crew Rostering. After completing the course you will be able to:

- produce production rosters using Jeppesen Crew Rostering
- perform simple simulations and scenario analysis
- use manual and automatic tools.

Slides

Exercises

Basic functionality

Purpose

- get familiar with the working screen and menus
- change settings
- work with and create different scenarios (sub-plans).

Documentation reference

You also find a general description of Studio in the Help. Go via the table of contents **Planning> Crew Planning User Guide> Studio**

There is an exercise on how to use the help further down.

Exercise 1 Overview

1. Start the system.
2. Compile a rule set.
3. Explore menus and toolbar buttons.
4. Load a prepared sub-plan.
5. View and zoom.
6. Change number of rows shown and window size.
7. Run reports.
8. Create new scenarios (different sub-plans).

Exercise 1.1 Starting the system

How the system is started varies from client to client. Here you will learn how to start the course system.

Step 1 Double-click the Academy Desktop button. You are then logged in as student## to a Citrix server.

Step 2 Start Exceed. Double click on the EoD passive button.

Step 3 Click the Launcher button for your course. A login form is displayed.

Step 4 Log in as: student## / password.

Step 5 Click the Studio button in Launcher to start the system.

Exercise 1.2 Compiling a rule set

The system needs a compiled rule set. A warning will be shown if the default rule set is not compiled.

Step 6 Read the warning and then click **Close**.

Step 7 Compile the `default_ccr` rule set.
Select the command **Admin Tools> Rule Source Manager**.
In the Rule Source Manager form, select `Top Source Files` and `default_ccr`.
Click **Build**.

Close the form, and wait for the compilation to finish.

Step 8 Load the compiled rule set.
Select the command **File> Load> Load Rule Set**
Select `default_ccr` from the submenu.

The name of the loaded rule set is displayed in the title bar.

Exercise 1.3 Exploring menus and toolbar buttons

In this exercise you will look at the basic menu structure to find out what is what.

Step 9 Examine the main menus and try to figure out the main purpose of each menu.

Step 10 Examine the window menu buttons.
With these commands you define what to show in a window, number of rows, redraw and clear screen.

Step 11 Examine the toolbar buttons.
Commands that are used frequently are available via toolbar buttons.

Step 12 Look at the available plans.
Click the **Plan Manager** toolbar button.

Note You can also use the command **File> Open> Open Plan**, what is the difference?

Exercise 1.4 Loading a prepared sub-plan

In this exercise you will open an already created solution.

Step 13 Open a prepared sub-plan.

Click the **Plan Manager** toolbar button. The Plan Manager form is shown.
Select: `Course / RosteringI / Dated / Rostering_ex_1`.
Click **Open Plan**. The timetable (local plan) and the trips, crew and rosters for the planning period (sub-plan) are loaded.
Click **Close** to close the Plan Manager form.

Step 14 Show rosters in window 1 (upper working window).
Select the command **Window (1): Show Rosters** (keyboard shortcut F9).

How many crew members are there?

> Hint: The bottom line in the left margin shows the number of rows shown in the working window.

Step 15 Show trips in window 2 (lower working window).
Select the command **Window (2): Show Trips** (keyboard shortcut F8).

How many trips are there?

> Hint: There is a toolbar button that shows rosters and trips in one go.

Exercise 1.5 Viewing and zooming

Sometimes it is necessary to take a closer look at planning objects.

- Zoom horizontally
  Use Ctrl+roll the mouse wheel or
  Alt+left or right arrow.
- Zoom vertically
  Use Alt+roll the mouse wheel or
  Alt+up or down arrow.
- Zoom horizontally and vertically
  Use Ctrl+Alt+roll the mouse wheel.
- Diagonal scroll

  Use Ctrl+Shift+roll the mouse wheel. This can be useful in the trip view where the trips are sorted on departure time.
- Zoom As Is
  Middle-click on the lower time scale will give you the same zoom as you have in the other window.
- Cancel
  Right-click on the lower time scale will zoom out completely.

Zoom in as much as you need to count the following.

Step 16 Manually count the flight duty trips for BARBER, URSULA.

> Hint: You find BARBER, URSULA by scrolling to the end of all rosters and search for crew name by looking for the name in the Info area.

Step 17 How many legs are there in the first trip? What are the flight numbers?

Step 18 Point at a leg and look in the information area.
What is the aircraft type of flight 129 departing on September 18?

Step 19 Align the zoom view in the trip window with the zoom you have in the rosters to by placing the pointer on the lower time scale in the trips window and middle-click.

You may also use the time scales for zooming.

Step 20 Click in the lower time scale at the start and end time of the desired period, like you mark the start and end of a period.

Step 21 Try the diagonal scroll in the trip window (window 2). Zoom in on the first trip. Then press Ctrl+Shift and use the mouse wheel to scroll diagonally down/right.

Exercise 1.6 Number of rows and window sizes

Sometimes you wish to change the size of the working windows or the number of rows shown in each window.

Step 22 Try to show more crew in window 1.
Use the command **Window (1): Rows> Set Rows.**
Also try pressing `Alt` while rolling the mouse wheel.

Step 23 Resize Studio window to fit half screen size.
Grab the corners or sides of the window (the cursor will change shape).

Step 24 Make window 1 larger than window 2.
Between the two scroll bars of the working windows, there is a separation handle that moves the separation line up and down. Try it out.

Exercise 1.7 Running reports

An important function in the system is the ability to show detailed information in reports.

Step 25 Generate a detailed Roster report for one crew member.
Click to select an activity assigned to any crew member.
Select the command **Assignment Object: Generate Report**.
Select the report `crew_roster.py` from the pick-list.
Click **Generate & View**.

Step 26 Generate the same report, `crew_roster.py`, for all crew members in the window.
Use Ctrl+A to select all activities in the rosters window.
Select the command **Assignment Object: Generate Report**.

Step 27 Generate a Crew Info report for one crew member.
Select the command **Crew Object: Properties**.

> Hint: The **Crew Object** menu can be found in the left margin of the Rosters window.

Exercise 1.8 Creating a new scenario

It is possible to save a plan under a new name (to create a new scenario).
You will create your own scenario for the rest of Exercise 1.

Step 28 Save the sub-plan as `Rostering_ex_1_<your_name>`.
Use the command **File> Save> Save Sub-plan As…**.
Edit the sub-plan name in the Sub-plan Properties form.
Click **OK**.

Step 29 Verify that your plan may be found in the **Plan Manager**.
Click the **Plan Manager** toolbar button.

Note The name of the currently open sub-plan is shown in the title bar.

Extra exercises

Exercise 1.9 Using Airport Manager

You may use **Airport Manager** to investigate airports. It answers questions like "What airport is that?" "Where is it?" "What time zone do they have?" etc.

Hint: Countries have a two-letter code. The country code used in **Airport Manager** is the same as used for mail, not cars.

Step 30 Open the **Airport Manager.**
Use the command **Planning Tools> Airport Manager.**

Step 31 Look up the airports FLF and ACB. Where are they located?

Step 32 How many airports are there in Finland, country code FI?

Step 33 How many airports are there in the city GOT?

Exercise 1.10 Use the Help

In this exercise you shall explore the possibilities of the Help.

Step 34 Read the help text for a few commands. Open the **File** menu and put the mouse over a command and press F1 to display the help section. Try for example the following commands on the **File** menu:

- **File> Save> Save Plans**
- **File> Open> Open Plan**
- **File> Load> Load Rule Set.**

Step 35 Read about Studio "Main Window". Use the search function to find it. The topics that are most likely to contain the information you want are at the top of the list. The number next to the topics indicates how well it matches the search criteria.

Step 36 Click on any of links in the picture for further information.

Step 37 Move page by page by clicking the **Next** and **Previous** toolbar buttons.

Step 38 Click the toolbar button **Show in Contents** to locate the topic in the Contents tab. Explore the table of contents to find out how the Help is structured.

Step 39 Open the Glossary using the table of contents. Look up the term rudob.

Exercise 1.11 Changing a table by using Table Editor

Normally the Crew Rostering system is fed automatically with all needed input, but sometimes the data has to be corrected manually. In this exercise you will change the contents of a table.

Step 40 Look at the first crew member, crew id 749265, and note the name.

Step 41 Open the table manager.
Click the **External Tables Manager** toolbar button.

Step 42 Open the crew table for editing. This table holds all data for crew.
Select the directory **Crew Tables**.
Select `crew75.etab`.
Click **Edit**.

Step 43 Change the first name of crew member 749265 to URSULA.

Step 44 Save the table and reload external tables.
Click the **Refresh** toolbar button.

What happened?

Step 45 The Table Editor has its own User Guide. Find it in the Help using the table of contents **Planning> Table editors User Guide> Table Editor for text file tables**

Exercise 1.12 Preferences

With the **Preferences** command you may set presentation time base, visualisation period, how to present parameters, what printer to use, access level to your scenarios etc.

Step 46 Show the time on the legs in Kuala Lumpur time.
Select the command **Options> Preferences**.
Set **Leg Time Presentation** to `Reference`.
Set **Reference Airport** to `KUL`.
Click **OK**.
Redraw the window. Click the **Refresh** toolbar button.

What happened? Zoom in on the legs. Compare the times on the legs, with the time in the time scale ruler and in the dynamic info report.

Step 47 Show also the time in the time scale in Kuala Lumpur time.
Select the command **Options> Preferences**.
Set **Scale Time Presentation** to `Reference`.
Click **OK**.
Redraw the window. Click the **Refresh** toolbar button.
Zoom in close on a leg and look at the time shown on the leg and compare it with the time shown in the information area and time scale

What differences do you notice?

Step 48 Set **Reference Airport** to `LHR`. Look at the different times again.

Step 49 Change the settings of all time presentations back to UTC.

Note These settings are your personal preferences and are saved for the next Studio session.

Manual planning

Purpose

To learn the most common commands useful for manual planning.

Documentation reference

If you want more information about a specific command, use F1.

You also find a general description of how to work in Studio in the Help. Find it using the table of contents **Planning> Crew Planning User Guide> Studio> Working in Studio**

Exercise 2 Overview

1. Sort crew and trips.
2. Filter crew.
3. Filter trips.
4. Select crew and trips.
5. Deassign and move trips between crew members.
6. Assign trips.

Exercise 2.1 Sorting

You may wish to sort objects on different properties, for example crew on name or seniority, trips on departure date or length etc.

In Studio you may set different sorting criteria in the working window. The chosen sorting criteria is active until you chose a new sorting criteria.

Step 1 Open the original plan.
`Course/RosteringI/Dated/Rostering_ex_1`

Do **not** save the current sub-plan.

Step 2 Show rosters in the window 1 and trips in the window 2.

Step 3 Sort crew on seniority.
Assignment General: Sort> Crew Seniority Order.

Hint: The seniority number is shown in the information area.

Step 4 Sort crew on number of duty days in the planning period.
Assignment General: Sort> Rule Values
Type `pp.duty_days`
Click **OK**.

Is the sorting in descending or ascending number of duty days?

Step 5 Sort trips on arrival time.
Trip General: Sort> Arrival Time
Scroll to see the difference in sorting between arrival and departure time.

Step 6 Reset the settings to sort on **Crew Alias** in Rosters window and **Departure Time** in Trips window.
Assignment General: Sort> Crew Alias
Trip General: Sort> Departure Time

Exercise 2.2 Filtering crew

You may make complex filters by using the filter form containing all available filtering values. It is possible to create pre-defined filter to filter on often used criteria. These filters are also called fast filters.

Note When using the filter form you must remember to click **Default** to reset the values before you make a new filter.

Step 7 Filter all pursers.
Assignment General: Filter
Select **Purser** from the submenu.

How many crew members are shown?

Step 8 Filter all **First Officers**.

How many crew members are shown?

Step 9 Filter all crew members who have a leg touching MEX.
Assignment General: Filter> by.
Set the parameter **Airport** (under heading **Leg Values, Touched**) to `MEX`.
Click **OK.**

How many crew members are shown?

Step 10 With the filter above you show crew members that have a MEX leg assigned anywhere in the roster. Now you will filter only the crew members with a trip starting after September 15.
Assignment General: Filter> by.
Set the parameter **Airport** (under heading **Leg Values, Touched**) to `MEX`.
Set the parameter **Departure Date** to `>15Sep2004`.
Click **OK**.

How many crew members are shown now?

Step 11 Filter all crew members with a surname starting with the letter B.

How many crew members are shown?

> Hint: Click **Default** to reset the selection form.
> An asterisk (`*`) matches anything (for example, `B*`).

Step 12 Filter the crew members with the following crew id: `642179`, `705012` and `741286`.

Step 13 Filter the flight attendant (FA) from the above group of 3 crew members.
Set **Filter Method** to `SUBFILTER` and **Current Function** (under heading **Crew Values**, **Functions)** to `FA`.

Exercise 2.3 Filtering trips

In the same way as you filtered crew members above, you may wish to filter unassigned trips.

Notice the difference between Trip Filter Values form compared to Crew Filter Values form.

Step 14 Filter trips with more than two duties in the trip window.
Trip General: Filter> by.
Find the parameter **Trip Values** and **Duties**.
Enter the value `>2` and click **OK**.

How many trips are shown?

Step 15 Filter trips with deadhead touching LHR.
Trip General: Filter> by.
Set the parameter **Airport** (under heading **Leg Values, Touched**) to `LHR` and **Deadhead** (under heading **Leg Values-Others**) to `YES`.

How many trips are shown?

Exercise 2.4 Selecting

You select one or several planning objects in order to perform an operation on them (for example deassign, delete or lock). When you select an object it gets a black frame. A selection is normally done with a click. You can also use Ctrl+click, and the rubber-band method to make selections.

Step 16 Try out the different ways to select objects in the working window.
A single object, click.
Multiple objects, Ctrl+click.
Multiple objects, rubber-band.
All objects, Ctrl+A.

Step 17 Display the **Assignment Object** menu by right-clicking on a selection of objects or by pressing 1 on the keyboard. Display the **Assignment General** menu by right-clicking outside of any objects or by pressing 2 on the keyboard.

Step 18 Select all crew members flying to MEX.
Make sure you show all crew in the working window.
Crew General: Select > by

How many crew members are selected?

> Hint: The **Crew** menu can be found in the left margin in the Rosters window.

> Hint: You may find useful information in the message area in the working screen. For example, after running the **Select> by** command the message area shows the number of filtered crew members.

Step 19 Select the assigned trips that have a deadhead leg touching KWI.
Assignment General: Select> by.

Set the parameter **Airport** (under heading **Leg Values, Touched**) to `KWI` and **Deadhead** (under heading **Leg Values-Others**) to `YES`.

How many trips are selected?

Step 20 Lock the selected KWI trips. Make sure that you are pointing on one of the selected trips when locking.
Assignment Object: Lock/Unlock.

How can you see that the trip is locked to the roster?

Step 21 Select all open (unassigned) trips that have a leg touching YYZ.
Make sure you have all trips in the working window.
Trip General: Select> by
Set the parameter **Airport** (under heading **Leg Values, Touched**) to `YYZ`.

How many trips are selected?

Step 22 Filter the selected trips.
Trip General: Filter> Selected Trips

Step 23 Hide the selected YYZ trips.
Trip Object: Hide

Step 24 Try the **Undo** command.

Exercise 2.5 Selecting while filtering

Instead of first filter and then select within your filtered objects you may combine the two operations.

Step 25 Filter all assigned trips touching MEX after the 15th.
Assignment General: Filter> by.
Set the parameter **Airport** (under heading **Leg Values, Touched**) to `MEX`.
Set the parameter **Departure Date** to `>15Sep2004`.
Click **OK**.

Step 26 Repeat the filtering and now make sure the assigned MEX legs are selected when you filter. In the top of the filter form you find the field **Select** with a pick-list of what you wish to select (LEG).

Exercise 2.6 Deassigning and moving trips

The **Move** command moves a trip or other activity from one crew member to another.

The **Deassign** command deassigns a trip or other activity from the roster. The trip will appear in the first line of the trip window (if you have no trip window open, the system will open one).

Step 27 Show the rosters in window 1 and trips in window 2.

Step 28 Deassign some trips one by one from any roster.
Assignment Object: Deassign

Step 29 Select a number of trips and deassign them in one operation.
Assignment Object: Deassign

Step 30 Deassign some trips by dragging them from the Rosters to the Trips window.

Step 31 Move (drag) the first trip from ARCHER, NICHOLAS to AULT, MATTHEW.

Step 32 Undo the move. Move again but use right-drag this time instead.

Step 33 Try to move a trip from BALL, MARK to BARKER, NICOLA.

What message do you get? Why?

Exercise 2.7 Assigning trips

There are a number of commands available for assigning trips to a roster:

- **Assign** assigns a trip in the trip window to a crew member. The command is available both for main position and for other positions (for example to fly below rank).
- **Find Assignable Crew** presents all crew members that legally can have the trip.
- **Find Assignable Crew In Other Window** makes it possible to use the command only on crew members shown in the Rosters window.
- **Find Assignable Trip** presents trips legal to assign to the given crew member.
- **Find Assignable Trip In Other Window** makes it possible to use the command only on trips shown in the Trips window.

Step 34 Show all rosters in window 1 and trips in window 2.

Step 35 Deassign all activities for all crew members.
Use Ctrl+A to select all activities. Drag them to the Trips window or use the command **Assignment Object: Deassign**.

Note Locked activities will not be deassigned. Unlock these and try again **Assignment Object: Lock/Unlock**.

Step 36 Show all trips again to update the contents of window 2.
What happened to the personal activities?

Step 37 When the trips are deassigned they remain individual trips. Group them together with by pressing Ctrl+A to select all trips and select **Trip Object: Merge Identical**.
Notice the difference in crew complement and number of rows shown in the Trips window, before and after the command..

Step 38 Assign a trip to a crew member.
Trip Object: Assign> Main Position.
Click on the crew member that should have the trip.

Step 39 Are there any positions left to assign to this trip?
Repeat the assignment procedure.
After this operation the trip should have disappeared from the trip window.

Step 40 Assign some trips by dragging them from the Trips to the Rosters window.

Step 41 Filter all crew members with a first name starting with A.

Step 42 Filter all trips with a leg touching MEX.

Step 43 Create a complete roster for crew member ASHBURNER, ALLAN.
Crew Object: Find> Find Assignable Trips in other Window> Main Position.

Step 44 Try to assign as much as possible using the "A*" crew and the remaining MEX trips in window 2.

Step 45 Read about **Assign**. Mark the command **Trip Object: Assign> Main Position** and press F1.

Extra exercises

Exercise 2.8 Finding colleagues

Sometimes you search for the other crew members on the same flight, or other trips with the same leg.

Step 46 Open the original plan in order to get the personal activities back..
`Course/RosteringI/Dated/Rostering_ex_1`

Do **not** save the current sub-plan.

Step 47 Show rosters in the window 1 and trips in the window 2.

Step 48 Find an assigned trip that has been assigned to more than one crew member.
Assignment Object: Leg> Show> Rosters

Step 49 Find an unassigned trip that has been assigned to at least one crew member.
Trip Object: Leg> Show> Rosters

Step 50 Change your preferences for how the rosters are presented.
Use the command **Options> Preferences.**
Set the parameter **Open new Window** to `YES` (heading **Show Leg and Find Change Possibilities**).
Click **OK**.

Step 51 Run again the command **Assignment Object: Leg> Show> Rosters.**

What happened? What display do you prefer?

Step 52 Run again the command **Trip Object: Leg> Show> Rosters.**

Exercise 2.9 Changing ground duty codes

You may change the ground duty code on a single, personal ground duty.

Step 53 Find the row of SEL for BALL, MARK. Change one to parental leave instead.
Assignment Object: Lock/Unlock
Assignment Object: Properties
Set parameter **Activity Code** to `PL`
Click **OK**.

What happens?

Step 54 Find the MBT for ANDERSON, DAVID.
Change the code to R1 instead.

What happens?

Step 55 Some ground duties are coloured grey and others are brown.
Can you figure out the difference between them?

Exercise 2.10 Adding Ground Activities

You may create assignments that are personal ground activities, such as medical check or vacation.

Step 56 Show all crew in window 1 and trips in window 2.

Step 57 ANDREWS, DIANE falls ill. Deassign all trips during the first 14 days and replace with illness.
Assignment Object: Deassign
Crew Object: Create Activities
Set parameter **Activity Code** to `SK`.
Start date `01Sep2004`
End date `14Sep2004`.
Click **OK**.

Step 58 Create fire training activity.
Assignment General: Create Activities
Set parameter **Activity Code** to `FIR`
Click **OK**.
Click on empty days where crew should take the course.
Right-click to end the command.

Exercise 2.11 Tagging

Crew members and activities are often tagged as a reminder of some interesting criteria. By tagging a crew member you may later filter or select all tagged crew members.

Step 59 Open the original plan.
`Course/RosteringI/Dated/Rostering_ex_1`

Do **not** save the current sub-plan.

Step 60 Show rosters in window 1 and trips in window 2. Click the **Show Rosters and Trips** toolbar button.

Step 61 Tag crew members AULT, STEPHEN and ATKINSON, JILL.
Crew Object: Tags> USER_TAG_0> Set

> Hint: The **Crew Object** menu can be found in the left margin in the Rosters window.

Step 62 Tag all crew members flying to MEX.
Crew Object: Select> by
Crew Object: Tags> USER_TAG_0> Set

How many crew members were tagged?

Step 63 Clear the tag from the crew members.

Step 64 Tag a number of assigned trips.
Assignment Object: Tags> USER_TAG_0> Set.

Step 65 Tag all open (unassigned) trips that have a leg touching YYZ.
Trip General: Select> by
Set the parameter **Airport** (under heading **Leg Values, Touched**) to `YYZ`.
Trip Object: Tags> USER_TAG_0> Set

Step 66 Filter the tagged trips.
Trip General: Filter> Tagged> USER_TAG_0

Step 67 Select the previously tagged crew members AULT, STEPHEN and ATKINSON, JILL.
Crew General: Select> Tagged> USER_TAG_0

Step 68 Clear the tag from these two crew members.
Crew Object: Tags> USER_TAG_0> Clear

Step 69 Read about Tagging objects in the Help. Search for "tagging objects" or go via the table of contents. **Planning> Crew Planning User Guide> Studio> Working in Studio> Tagging objects**

Step 70 Click on the link to get to the Tags command description.

Rules and parameters

Purpose

To use rules and parameters, to become familiar with the Rule Parameter form.

The Rule Parameter form controls the behaviour of rules, quality calculations in the optimizer, report behaviour, calculated objects (rudobs) such as minimum rest or debriefing time.

Documentation reference

In addition to the command descriptions, you find a general description of Rule exception in the Help. Use the search function to find it or go via the table of contents **Planning> Crew Planning User Guide> Planning functions> Rostering functions> Rule exception**

Exercise 3 Overview

1. Control the rules through the Rule Parameter form.
2. Make rule exceptions.
3. Break rules on purpose.
4. Compare two parameter settings

Exercise 3.1 Controlling rules

The rules are controlled, turned on or off, via the Rule Parameter form.

Step 1 Open the plan `Course/RosteringI/Dated/Rostering_ex_3`.

Do **not** save the current sub-plan.

Step 2 Show all illegal crew members.
Window (1): Show Legal/Illegal> Show Illegal Rosters

How many illegal crew do you have?

How do you recognize that a crew member is illegal?

Step 3 What is illegal in the rosters?
Crew Object: Check legality

Step 4 Change rules that fail.
Click the **Rule Parameters** toolbar button.
Select the tab **ROSTER RULES** and **change Max credit time in month** to `120:00`.
Click **OK**.

What happens?

Step 5 Show illegal crew again

What happens?

Exercise 3.2 Making rule exceptions

In the previous exercise you changed the rule limit for all crew members, also crew that had less credit time will now work according to the higher limit. Sometimes you want to do a rule exception only for one specific crew member regarding one specific rule.

Exceptions may be used to accept something that is illegal according to the rules. The exception is only valid for a specific crew member and for one specific time period.

Step 6 Show illegal crew members.

Step 7 Create a rule exception for AMBRUOSI, URSULA.
Crew Object: Rule exceptions> Create.

What happens?

How is it indicated in the roster?

Step 8 Create rule exceptions for all remaining crew members.

What happens?

Do you think this is OK

Step 9 Read about Rule exception in the Help. Use the search function to find it or go via the table of contents **Planning> Crew Planning User Guide> Planning functions> Rostering functions> Rule exception**

Exercise 3.3 Breaking rules on purpose

The optimizer will never return a solution not complying with the rules. But when you do manual planning you may break the rules.

Step 10 Show all rosters in window 1 and trips in window 2.

Step 11 Find the 4-leg trip beginning with BA247 on September 3. Assign this trip to ATKINSON, PATRICIA.

What messages do you get?

Step 12 Click **Yes**.

What happens?

Exercise 3.4 Comparing parameter settings

It is possible to compare the currently loaded parameter setting with another sub-plan or a saved parameter set.

Step 13 Compare the difference between the current setting and the parameters in the original plan.
Select the command **File> Load> Load Parameters> from Sub-plan.**

Select the plan `Course/RosteringI/Dated/Rostering_ex_1`.
Click **View Settings Diff**.

How many rules have a different setting?

How many parameters have a different setting?

Using optimization

Purpose

To start and monitor optimization jobs and to learn how to use the optimization module.

Documentation reference

If you want more information about a specific command, use F1.

The Crew Rostering Optimizer has its own Reference. Find it using the table of contents **Planning> Crew Rostering Optimizer Reference**

Exercise 4 Overview

1. Start an optimization job.
2. Monitor the job.
3. Verify the solution.

Exercise 4.1 Starting an optimization job

In this exercise you will send a job to the optimizer.

Step 1 Open the plan `ourse/RosteringI/Dated/Rostering_ex_4`.

Step 2 Show the rosters in window 1 and trips in window 2.

Step 3 Start a job with the name `..ex_4_<your_name> .`
Click the **Start Optimization Job** toolbar button.
Sub-plan name: `…ex_4…`
Comment: `What has changed, what do you expect?`
Input legs/rotations: `Window 2`
Crew Assignments: `Window 1`
Optimizer: `Crew Rostering Optimizer`
Batch options: `Default`
Helper Jobs: `0`

Exercise 4.2 Monitoring the optimization job

You can monitor a running optimization job to make sure it develops as intended.

To monitor the job you can use **Batch Job Manager** and **Plan Manager**.

Step 4 Start **Batch Job Manager**.
Click the **Batch Job Manager** toolbar button.

Step 5 Find your job in **Batch Job Manager** and take a look at the optimization report.

Hint: Use the command **Show> My Jobs** in the **Batch Jo Manager**.
Position the pointer on the job, right-click and select **Status**.

- Look at the Run information. What is the job doing currently?
- Look at the **Solution details** in the **Solution information** tab. How many crew members and trips did you send to the optimizer?

Step 6 Look also in **Plan Manager**.

- How many solutions have been produced?
- Select the best solution and click **View Opt. Report**. Look at the **Solution details** in the **Solution information** tab. How many slots are assigned? What is the total block time assigned?
- Plot a graph showing how the unassigned trips are varying. Highlight the line in the report and click **Plot Graph**.
- Plot a graph of how the cost (total cost of the plan) is varying. Try to explain what you see.

Exercise 4.3 Verifying the solution

When the optimizer is finished and returns a solution, the solution is usually verified by using different reports.

Step 7 Open the best solution and take a look at the result.

What gives you the best understanding of the quality of the solution, viewing the Optimizer Report or really seeing the rosters on the screen?

Influence the solution

Purpose

In this exercise you will change the objective of the cost function to priorities between different types of production and from assigning production to increase quality and verify the differences. The purpose is to get acquainted with tuning the penalty function to get the wished results from the optimizer.

Documentation reference

You find a general description of the Cost Function in the Help. Find it using the table of contents **Planning> Crew Planning User Guide> Planning functions> Rostering functions> Cost function for rostering weighted fair share**

For details about customizable functions, see your client-specific documentation

Exercise 5 Overview

1. Improve the quality of the solution.
2. Add ground duties.
3. Change priority to assign more reserves.

Exercise 5.1 Improving quality

Until now the quality cost parameters have been turned off. In this exercise you will introduce the quality aspect to the solution.

Step 1 Open the best solution generated in Exercise 4.1.

Step 2 Generate the Roster Cost report for all crew.
Use Ctrl+A to select all roster activities.
Assignment Object: Generate Report
Select the report `crew_roster_cost.py`.
Verify that penalty of quality is 0.

Step 3 Change relation between the penalty weights.
Open the Rule Parameter form. Click the **Rule Parameters** toolbar button
You find the cost parameters in the **ROSTER COST** tab.
Change all five penalty weights to 10.
Click **OK**.

Step 4 Generate the `crew_roster_cost.py` report again.
Print the report for later comparison. It shows the reference plan when only the penalty of unassigned trips was considered by the optimizer.

Step 5 Open the Rule Parameter form and **ROSTER COST** tab again.
Change the penalty weights to `1000,800,800,0,0`.
Click OK.

Step 6 Start a new optimization job, `ex_5.1_01`, with the quality penalties turned on.

Step 7 When the job is finished open the best solution.

Step 8 To be able to compare with the previous optimization run, reset all penalty weights to 10.

Step 9 Generate the `crew_roster_cost.py` report for all crew and compare the result with the printed report of Exercise 4.1.

Exercise 5.2 Balance quality and unassigned trips

When the objective function also considers quality and stability not all trips get assigned. We need to find a better balance between open time and quality aspects.

Step 10 Increase the weight of unassigned trips to 1500.
Change the penalty weights to `1500,800,800,0,0`, and start a new optimization job (named `ex_5.2)`. Do not forget to write a comment about what you change. Analyze the result as in step 7-9.

Step 11 Continue to increase the weight of unassigned trips until you manage to assign all trips. Analyze the result as in step 7-9.

Exercise 5.3 Adding ground duties

Ground duties can be regarded as non-flight trips. They have a crew complement and should match legs in the timetable.

Ground duty external table provides an easy integration of ground duty objects into the local plan (timetable). From here, they can be extracted and turned into trips.

In our scenario we only have one type of ground duties: reserves.

Step 12 Open the best solution from exercise 5.2.

Step 13 Save the sub-plan under a new name, `ex_5.3`.

Step 14 Look at external table `Reserves.etab` containing ground duties.
Planning Tools> Local Plan> Ground Duties
Select the file and click **View**.

Step 15 Load the reserve ground duties into the local plan and sub-plan and turn them into trips.
Planning Tools> Local Plan> Ground Duties
Click **Load into Local Plan and Sub-Plan**.
Create legs with departure date in September.
General, Time Base: `UDOR`
Date, Departure Date: `1SEP2004/30SEP2004`.

Click **OK**.
Click **Add to Sub-Plan**.

Step 16 Verify that the ground duties have been imported into the sub-plan by showing the trips. Note that all reserves have a booked value 0/0/0//1/1/1//0, defined by the assign value in the toolbar.

Step 17 In Crew Rostering, crew need value uses an external table which need to be updated.
Planning Tools> Sub-plan> Create tables> Leg need table [Yes]

Click the **Refresh** toolbar button 

Step 18 Open the Rule Parameter form and **ROSTER COST** tab again.
Change the penalty weights to `2000,800,800,0,0.`
Click OK.

Step 19 Start optimization (with all rosters and all trips as input) with the name `ex_5.3_01.`

What happens?

Step 20 Since the added ground duty legs belong to the local plan, you need to save it before starting a new job.
File> Save> Save Local Plan.
Try to start the optimization job again.

Step 21 Monitor the job and wait for the optimizer to finish. Open the best solution and analyze the result.

How many reserve positions are open (unassigned)?

Exercise 5.4 Changing priorities

It is clearly impossible to assign all reserves as well as all flights, so you have to prioritize.

Suppose that you are not satisfied with the distribution between assigned reserves and assigned flight duties in the previous exercise. You wish to increase the number of assigned reserves.

Step 22 Force the optimizer to assign more reserves by raising the cost for an unassigned reserve. Continue with your current solution.
Open the Rule Parameter form and **ROSTER COST** tab again.
Raise the cost substantially for `1.3 Reserve pairing daily`, maybe to 1000 to make it possible to really notice the difference.

Step 23 Restart the optimizer with the name `ex_5.4`.

Step 24 Compare the results with last job.

What was the consequence of the decision to prioritize reserves?

Step 25 Make some new jobs with better parameters.
Run the `crew_roster_cost.py` report to compare your results (remember to reset the cost parameters to 10 before running the report).

Fairness

Purpose

To learn how to use the fairness concept in the planning and how the rosters are influenced by fairness.

Documentation reference

You find a general description of Fairness in the Help. Find it using the table of contents **Planning> Crew Planning User Guide> Planning functions> Rostering functions> Fairness**

For details about customizable functions, see your client-specific documentation.

Exercise 6 Overview

1. Calculate fairness targets and store the result in a table.
2. Analyze the fairness distribution in a previous job (without fairness included in the cost function).
3. Include fairness in the cost function.
4. Run the optimizer with fairness enabled.
5. Analyze the result of the job.
6. Improve the distribution by giving higher priority to fairness.

Exercise 6.1 Calculate fairness targets

When using fairness the goal is to distribute roster properties in a fair manner between crew members. One common property to distribute evenly is block hours. Other properties could be, for example, layovers at certain popular stations, night duties, mail flights, and reserve duties.

In this exercise you will run the command that calculates the target values for the fairness distribution.

Step 1 Open the best solution from Exercise 5.4.

Step 2 Create fairness tables.
To be able to distribute properties evenly the optimizer needs to know the fairness target values, what to aim for. A number of values are calculated and stored in two tables. These values are used to calculate the personal target for each person.
Planning Tools> Sub-plan> Create tables> Fairness tables [OK]

Step 3 Take a look at the created tables.
Click the **External Table Manager** toolbar button.
The tables are placed in directory `Sub-plan External Tables` and are

called `FairnessCrewFactors.etab` and `FairnessTargetValues.etab`.
What properties will be distributed fair and what are the full time targets?

Exercise 6.2 Analyze fairness reports

In this exercise you will look at the spontaneous fairness distribution in the current solution. The fairness targets were not considered by the optimizer when the solution was created.

Step 4 Make sure that the new tables are in effect, use the **Refresh** command.

Step 5 Generate the Fairness Statistics and Fairness Details reports for all crew.
Use Ctrl+A to select all roster activities.
Assignment Object: Generate report
Select `crew_fairness_statistics.py` and `crew_fairness_details.py`.

A fairness element presented here is the block time distribution among crew members. In block time column the number in parenthesis is block time target value and the value to the left is actual block time for this crew member.

Why does target value differ between crew members?

Step 6 Skim through the crew members to get a feeling for how well actual block times agree with target block times.

Step 7 Print or keep the fairness reports on the screen for later comparison.

Exercise 6.3 Including fairness in the cost function

You will now force the optimizer to actually consider the fairness target values.

Step 8 Enable **Weight of FAIRNESS** in the cost function.
Open the Rule Parameter form and **ROSTER COST** tab.
Change the penalty weights to `3000,800,800,300,0`.
Click **OK.**

Step 9 Verify the cost by generating a `crew_roster_cost.py` report. Keep it for later comparison.
Assignment Object: Generate report
Select `crew_roster_cost.py`.

Step 10 Make sure that all rosters and all trips are shown.

Step 11 Start the optimizer, `ex_6.3_01`, monitor the job and wait for it to finish.

Exercise 6.4 Analyzing the result

In this exercise you will analyze the result of the job and compare it with the fairness distribution you kept from Exercise 6.2.

Step 12 Open the best solution.

Step 13 Generate the `crew_fairness_statistics.py` and `crew_fairness_details.py` reports again.

Is the block time more fair distributed?

Step 14 How did considering fairness impact the costs for quality and stability? Compare the `crew_roster_cost.py` report for exercise 5.4 and 6.3. To be able to compare with the previous optimization run, remember to reset all cost parameters to 10 before you generate the report.

Extra exercise

Exercise 6.5 Improving the distribution

In this exercise you will try to improve the distribution of the fairness elements by raising priority for fairness.

Step 15 Read the input to the sub-plan in from Exercise 6.3.

Step 16 Open the Rule Parameter form and **ROSTER COST** tab and increase the weight of fairness.

Step 17 Start a new optimization job, `ex_6.5_01`, monitor the job and wait for it to finish.

Step 18 Open the best solution when the job has finished.

Generate the `crew_fairness_statistics.py` and `crew_fairness_details.py` reports. Did you get a better distribution? What is the price in lost quality?

Before you compare the `crew_roster_cost.py` report for exercise 6.3 and 6.5, remember to reset all cost parameters to 10 before you generate the report.

Step 19 Run several jobs with various weight parameters.

Bidding

Purpose

The purpose of this exercise is to get familiar with bids and use bid ratio.

In this exercise you will start from the plan used in exercise 4, before any reserves were added.

Documentation reference

You find a general description of Preferential bidding in the Help. Find it using the table of contents **Planning> Crew Planning User Guide> Planning functions> Rostering functions> Preferential bidding**

For details about customizable functions, see your client-specific documentation.

Exercise 7 Overview

The major steps in the process of producing a solution accounting for bids are:

1. Investigate given bids and bid points.
2. Create a reference roster solution with the optimizer.
3. Save the data from the reference roster in an external table.
4. Import the reference roster external table to your sub-plan.
5. Include bid ratio in the cost function.
6. Run the optimizer with bid ratio costs enabled.
7. Analyze the result of the job.
8. Improve the result.

Exercise 7.1 Investigating bids and bid points

In this exercise you will look at the bid points of one crew member.

Bid ratio strives to give each crew as high ratio as possible between his/her bid points in the production roster and his/her so called reference roster.

A reference roster is the best possible roster that a crew can get in theory according to his/her bids. But in practise it is impossible to grant all bids of all crew members, therefore the bid ratio for a particular crew member will be between 0 and 100 percent.

Step 1 Start by opening the best solution of exercise 4.1.

Step 2 Show all rosters and trips.

Step 3 Find crew member 771078, Nicholas Archer.

Step 4 Generate a Bid Details report for his bids and print it.
Assignment Object: Generate Report.
Select `crew_bid_details.py`.

What kind of bids does he have and what is the number of granted bid points in the current solution?

Step 5 Change his roster, and predict how the bid points are going to change.

Step 6 Calculate the new total bid points.

Step 7 Run the `crew_bid_details.py` report again.
Did you calculate the correct sum of bid points?

You will now produce a solution, where you take the bids into account.

Exercise 7.2 Reference roster solution

Step 8 Show all rosters and trips.

Step 9 Deassign all unlocked activities.

Step 10 Set parameters for a reference roster job.
Open the Rule Parameter form and **BIDS** tab. Under **Bid Parameters** change **Use reference roster generation** to `True`.

Step 11 In the **ROSTER COST** tab, set weight of PBS to 100, all others weights to 10.

Step 12 Start the optimizer with the name `ex_7.2_RefRoster`.

Exercise 7.3 Saving the data

The result of the reference roster job with the maximum possible bid points needs to be stored as a separate table.

Step 13 Open the best solution.

How can you see that this was a reference roster job?

Step 14 Generate (and save) the reference roster table.
Planning Tools> Sub-plan> Create tables> Bid reference tables

Exercise 7.4 Optimize with bid ratio costs enabled

To calculate the bid ratio you have to have information about the maximum possible points available in your sub-plan. The maximum number of bid points were calculated in the optimization job of the reference roster (Exercise 7.2) and saved in a table (Exercise 7.3). You will now use that information.

Step 15 Open the *input* solution from Exercise 7.2.

Step 16 Show rosters and trips. Make sure you opened the input and not the best solution by assuring you have no overbooked flights assigned.

Step 17 Turn off the use of max roster.
In **BIDS** tab under Bid Parameters change **Use reference roster generation** to `False`.

Step 18 Make sure that PBS is considered. Use for example the penalty weights `3000,100,100,0,500`.

Step 19 Start the optimizer, `ex_7.4_01`, monitor the job and wait for it to finish.

Exercise 7.5 Analyzing the result

In this exercise you will analyze the result of the job.

Step 20 Open the best solution of exercise 7.4.

Step 21 Generate the `crew_bid_statistics.py` report and print it. Look at the Bid Ratio graph.

Explain what you see in the graph.

If there are crew members to the right in the graph that have low bid ratio, what can have caused that?

Extra exercises

Exercise 7.6 Compare solution with reference plan

In this exercise you will compare two sub-plans.

Step 22 Open the best solution of exercise 7.4, unless already open.

Step 23 Load the best solution of the reference roster run as reference plan.
Click the **Plan Manager** toolbar button.
Select the best solution of the reference roster run. Click **Load as Ref**.

Step 24 Show rosters in window 1. Now two rosters per crew member are shown. For crew with a low bid ration you can investigate what trips they had in the reference roster and compare with the solution of exercise 7.5.

Step 25 Read about Reference plan in the Help. Use the search function to find it or go via the table of contents **Planning> Crew Planning User Guide> Planning functions> Rostering functions> Reference plan**

Exercise 7.7 Adding one more dimension: fairness

In the two previous runs the solution objective was to get all tasks assigned while granting as many crew bids as possible. Thus, there was a trade-off between assigning activities and granting bids.

In this exercise you will also consider fairness, which is yet another trade-off parameter. Adding fairness is a big change to the optimization problem. Therefore, we will let the optimizer “start from scratch”, with all trips deassigned.

Step 26 Open the *input* solution of exercise 7.4. Make sure that all unlocked trips are deassigned.

Step 27 Create fairness tables.
Planning Tools> Sub-plan> Create tables> Fairness tables [Ok]

Step 28 Raise the fairness weight in the penalty weights.
Use for example `3000,100,100,300,500`.

Step 29 Start the optimizer, `ex_7.7_01`, monitor the job and wait for it to finish.

Step 30 Analyze the result.

Plot the cost for violating fairness and for violating bid satisfaction from the job status information about the job.

Generate some reports, for example `crew_bid_statistics.py` and `crew_fairness_statistics.py`.

Do you notice a difference between the bid ratio in the solutions? Can you explain why?

Exercise 7.8 Improve the assignment rate

Now you will try to get more trips assigned to the rosters.

Step 31 Open the best solution of exercise 7.7.

Step 32 Show rosters in window 1 and trips in window 2.
Verify that there are both flight-duty trips and ground duties (reserves) in the window.

Step 33 Raise the weight for unassigned trips.
Use for example `100000,100,100,300,500`

Step 34 Start the optimizer and analyze the solution.

Can you explain the difference between the previous and this solution's bid ratio graph?

Exercise 7.9 Raising the bid weight

In this exercise you will increase the priority of granting bids and evaluate the effect on other objectives.

Step 35 Increase the bid ratio weight and restart the optimizer.

Step 36 Generate the `crew_bid_statistics.py`.

How does the bid ratio graph differ from the previous one?

The complete planning process

Purpose

To get an understanding of the basic steps in a Jeppesen Crew Rostering process, and to repeat the most important parts of the course.

Documentation reference

In addition to the individual commands, there is a description of the high level workflow in the Help. Find it using the table of contents **Planning> Crew Planning User Guide> Planning workflows> Rostering workflow**

Exercise 8 Overview

In this exercise you will go through a generic planning process. In a real planning situation there will be more details to consider, but the basic steps in the system will be the same:

1. Load data into the system.
2. Load rule set and parameter.
3. Create tables.
4. Perform manual planning.
5. Run automatic planning.
6. Analyze the solution.
7. Publish the rosters.

Exercise 8.1 Loading data

This step will create the scenario (local plan, sub-plan and environment). To accomplish this, the following data is needed:

- Timetable
  Typically converted from an SSIM file into a local plan.
- Duties to be assigned
  For example, flight-duty trips and reserve duties. Typically from a so-called *CTF file*.
- Crew data
  Information about the crew, whose rosters should be created. Typically imported from a database into external tables.
- Roster data
  For example pre-assignments imported via the CTF format or external table and converted into sub-plan and/or environment plan.

- Rule set
  Defines the agreements and planning objectives (cost and quality).

Import the time table to create the local plan

Assume that you already have the timetable in the form of a local plan. Prepared by the pairing planners.

Import Trip data to create the sub-plan

Import trip data into Jeppesen Crew Rostering plan format, create a new sub-plan from a CTF file.

Step 1 Open the Create Sub-plan form
File> New> New Sub-plan> from CTF File.

Step 2 Select data to import.
CTF File: `CTF_trips.ctf`
Crew Plan: `crew75.etab`
Local Plan: `Course/RosteringI/Dated`
Base Definitions File: `DefaultBaseDefinitions`
Sub-plan: `ex_8_`<your_name>
Environment Sub-plan: `<leave blank>`

Step 3 Click **OK**.
When the creation is finished a form with information is shown.

Note This only creates the new sub-plan.

Step 4 Open the new sub-plan when generation is completed.

Exercise 8.2 Load rules and set parameters

It is important to load rules and to set appropriate parameters and rules to reflect the scenario that is going to be planned. Normally you will already have the correct rule set because it is the default one (the one that is always loaded).

Step 5 Load the Rule set `default_ccr`.
File> Load> Load Rule Set

Step 6 Load the parameter file.
File> Load> Load parameters> from File.
Select `RosteringI/PlanningProcess`.
Click **Load Settings**.

Step 7 Set the assign value to 1 for the crew positions you want to assign.
In the toolbar: 0/0/0//1/1/1//0

Exercise 8.3 Load data to the sub-plan

Load crew data to the sub-plan

Step 8 Load the crew plan, `crew75.etab`.
File> Load> Load crew plan.
Show rosters in window 1.

Load pre-assigned trips

Step 9 Load pre-assigned trips.
File> Import> Preassignments (trips).
Scroll to find a crew member with a pre-assigned trip.

Load pre-assignments

Step 10 Load pre-assignments.
File> Import> Preassignments (personal activities)

Load ground duties

Step 11 Load reserves for September into the sub-plan.
Planning Tools> Local Plan> Ground duties
Select `Reserves.etab`.
Click **Load into local plan and sub-plan**.
Set parameters:
Time Base: `UDOR`
Departure date: `1Sep2004/30Sep2004.`
Click **OK**.
Click **Add to sub-plan**.

Recalculate crew need

Step 12 The new ground duties have no need yet. Recalculate crew need on each leg.
Planning Tools> Sub-plan> Create tables> Leg need table [Yes]

Click the **Refresh** toolbar button 

Create tables

Step 13 Create the fairness tables.
Planning Tools> Sub-plan> Create tables> Fairness Tables

Save the sub-plan

Exercise 8.4 Perform manual planning

Before using the optimizer to generate a solution, you may wish to assign some activities manually, for example training activities to instructors and trainees, personal rosters for union members and management staff.

Step 14 Filter the following two crew members with days off bids and produce their rosters manually. Try to grant the days off bids.
103240, ANDERSON, DAVID and 870077, ANAND, NISHA.

> Hint: You see when they want their days off by looking at the rudobs.

Step 15 Make sure to lock the pre-assigned activities.
Use Ctrl+A to select all assigned activities.
Assignment Object: Lock/Unlock

Why?

Exercise 8.5 Run automatic planning

When manual planning has been performed and you have locked the assigned activities, the rest of the problem will be solved by the optimizer.

Step 16 Show all rosters in window 1 and all trips in window 2.

Step 17 Make sure the assign value in the toolbar is set to include cabin crew (`0/0/0//1/1/1//0`).

What would the value of the assign value be if you only wished to optimize pursers?

Step 18 Start the optimizer, `ex_8_opt01`, monitor the job and wait for it to finish.

Step 19 Monitor the progress of the job.
Plot the graph for the total cost.

Exercise 8.6 Analyzing the solution

To evaluate a solution and get a good overview by simply scrolling through the rosters is not very easy. The perfect tool for this is the reports, which can show statistics for the complete solution.

The reports should also be used to compare different solutions.

Step 20 Open the best solution and show the rosters in window 1.

Step 21 Generate the `crew_roster_cost.py` report.

This report shows how cost components are triggered in the complete solution. This could be used to compare different scenarios. What is the total cost of plan?

Step 22 Generate the `crew_fairness_statistics.py` report.
This report shows how well some properties have been distributed among crew, for example block hours.

Exercise 8.7 Publishing

Publishing includes supplying information to crew and other systems about the planned rosters.

Step 23 Generate a `crew_roster.py` report.
This is a report that will be sent to individual crew members when the rosters are published.