SEEStat 3.0 Tutorial

June 2012

To become a regular user of SEEStat, please go to
http://seeserver.iem.technion.ac.il/see-terminal/
click on “Register” (left menu), and follow the registration procedure.
SEEStat 3.0 Tutorial

Introduction...................................................................................................................................... 2
Connecting to SEEStat on the Technion SEELab Server.............................................................. 3
SEEStat Tutorial..................................................................................................................................... 7
   Part 1 ................................................................................................................................................ 7
      Example 1.1: Distributions ........................................................................................................ 8
      Example 1.2: Intraday time series ............................................................................................. 15
      Example 1.3: Time series (Daily totals) .................................................................................... 20
   Part 2 .................................................................................................................................................. 24
      Example 2.1: Distribution fitting ................................................................................................. 24
      Example 2.2: Distribution mixture fitting .................................................................................. 26
      Example 2.3: Survival analysis with smoothing of hazard rates .............................................. 28
      Example 2.4: Smoothing of intraday time series ........................................................................ 30
   Part 3 .................................................................................................................................................. 32
      Example 3.1: Queue regulated by a protocol & announcements ............................................. 32
      Example 3.2: Queue length & state-space collapse ............................................................... 34
      Example 3.3: Change-of_Shifts phenomena ............................................................................. 36
      Example 3.4: Daily flow of calls ................................................................................................. 40
As a participant in the ServEng seminar/mini-course, you are able to connect (from your PC or laptop) to the SEELab Server at the Technion.

Once connected, you will be able to go through the self-taught SEE Tutorial that follows.

To start, you need a “User Name” and “Password”. Use the Number allocated to you in the seminar/mini-course (from 1-20):

On Page 3, you are asked to provide the following LogIn information:

Your User Name: visitor_1_20
Your Password: visitor_1_20

You will be needing the above also for the following step (Page 4):

Introduction: SEEStat is an environment for Exploratory Data Analysis (EDA) in real-time. It enables users to easily conduct statistical and performance analyses of massive datasets; in particular, datasets representing operational histories of large service operations (e.g. call centers, hospitals, internet sites), as available through the SEELab server. SEEStat can also automatically create sophisticated reports in Microsoft Excel, which support research and teaching.

Both SEEStat and the SEELab Server were developed at the Faculty of Industrial Engineering and Management, Technion, Israel Institute of Technology. More information on the SEELab can be found at its homepage http://ie.technion.ac.il/Labs/Serveng/
Connecting to SEEStat on the Technion SEELab Server

The standard way to connect to the SEE server is via the Microsoft Internet Explorer web browser, within any of the following operating systems: Windows XP, Windows 2003, Windows Vista and Windows 7.

1. From Internet Explorer visit this address: http://seeserver.iem.technion.ac.il/see-terminal. (You may wish to bookmark this URL for future use.) You will see the following:

2. Select “Log In”, type your User Name and Password, and then click button “Log In”.

If User Name and Password are valid, you will have access to the SEE terminal.

3. Click “To Terminal”

You might be prompted to install the Remote Desktop ActiveX control: click Install.
After installation, if you see the following window, then check “Drivers” (this enables you to save your SEE documents on your computer) and go to **Step 5**.

![Remote Desktop Connection window](image)

If you do not see the above window, than go back and click again “To Terminal”. If after this action you still do not see this window than proceed to **Step 4**.

4. Problems with *Remote Desktop ActiveX* control.

4.1. Add [http://seeserver.iem.technion.ac.il](http://seeserver.iem.technion.ac.il) to the Trusted Sites of Internet Explorer. This is performed as follows: From the Internet Explorer menu, click *Tools → Internet Options*, then visit the *Security Tab*. Select the *Trusted Sites Zone*. Now **uncheck** the box ("require server verification for all sites in this zone") which appears below the list of websites. Finally, click on *Sites* and add the above *URL* to the list of websites.

4.2. Make sure that Internet Explorer has the SEEStat *ActiveX control* enabled. This is performed as follows: From the Internet Explorer menu, click *Tools → Internet Options*, then visit the *Programs Tab*. Select the *Manage add-ons*. Lookup the Microsoft RDP Server Client and enable it.

4.3. If **Step 4.1** and **Step 4.2** do not help, and you can wait a day or so, send e-mail to adminsee@tx.technion.ac.il. Your e-mail must contain the following information:
   a. Your operating system (Windows,…)
   b. Your Web Browser and version.
   c. Your problem.
If you can NOT wait for the administrator’s response: connect directly via

d. At the Windows Start tab (bottom left of the desktop): Run to Open mstsc
e. Remote Desktop Connection to Computer: seeserver.iem.technion.ac.il

5. Click Connect.
6. When the Log On to Windows dialog box appears, type your User Name and Password
   (as before – using the Terminal requires an additional permission) and then click OK.

![Log On to Windows dialog box]

7. Finally, the Remote Desktop window will open. You will see the desktop settings, files,
   and programs that are on the SEELab server.

8. **Run SEEStat**: Click the SEESTAT 3.0 icon to open the program.
    Then go to Page 6 to start the SEEStat tutorial, after reading the following paragraph on
    your interaction with Excel.

9. **Interaction with Excel**: SEEStat interacts with Excel to display data. You might then
    discover that the Excel chart size does not fit your screen size. If this happens, read
    further on how to overcome the problem.

10. **Excel chart-size set to fit screen-size**:
    **If the Excel chart does not display in full screen**:
    Click Output->Options. Select option **Chart_Size**. Click Apply and OK.
**Important:** For the above change of chart-size to apply, one must exit SEEStat and re-enter it again. (You exit SEEStat either via the usual “x” on the top-right, or by clicking “Close SEESTAT” in the Main menu.)

**Comment:** This option is used in order to reset the chart size into a full screen chart. Typically, such a problem does not arise: users will encounter chart size in Excel that does fit their physical screen size. But sometimes, for example due to a changed resolution, the chart size will not fit the screen size. Then, one should implement the above option.

11. **Disconnecting from the SEELab Server:**

   1. To end your Remote Desktop session: From the Start Menu, click **Log Off**.

   ![Log Off Windows](image)

   **Are you sure you want to log off?**

   - **Log Off**
   - **Cancel**

   2. Click **Log Off** to exit the SEELab server.
SEEStat Tutorial

Part 1

After connecting to the server, click the SEEStat 3.0 icon to open the program. On the top of the screen you see the main menu. Click "Main". We shall work with "Statistical Models (Summaries)". Click it.

A list-box with names of SEEStat studies appears (two databases in our case). Select USBank (the database we shall be working with), click "OK" and wait for a few seconds.

Background: The source of this example database is a large call center of a U.S. Bank. This call center has sites in 4 states, which are integrated to form a single virtual call center: Calls are queued up, when appropriate, in a central queue; they are then served by agents across sites, by fitting service types to agent skills using SBR (Skills-Based Routing) algorithms. The virtual call center has about 900-1200 agent positions on weekdays, and 200-500 agent positions on weekends. Agents process up to 300,000 calls per day (about 20% reach the agent-queue, and the rest complete their service process within the VRU = Voice Response Unit).
Now you see the “Model” panel.

Example 1.1: Distributions

*We shall now create a histogram of the distribution of service time (duration), at 1-second resolution.*

Click the "Distributions" button. Three available distribution- models appear. Select "Estimates".
You see the tab control, that has 4 tabs: “Variables”, ”Options”, ”Select Categories” and ”X Properties”.

The first one "Variables" is active. This tab is mandatory, which means you must select variable(s) before moving forward. The three other tabs are optional, which means that they already have default values.

NOTE: You can select (click) several variables simultaneously by pressing the Ctrl button and, in parallel, clicking on the variables one by one.

Select "Agent service time"(the last entry in the list).
Now click tab "Select Categories". You see a list box with all the service types that are offered by USBank. Select "Retail", which is the Bank’s main service.

Open the tab "X Properties". It is used to set properties of charts and tables. At the left side there is a list box "Resolution". The default resolution (bin-size of the histogram) of 5 seconds is marked. Select the minimal resolution \(00:01\) = 1 second, in order to not miss any details of the histogram.

Now you must select the dates we focus on. Click button "Dates ->" at the right side.
You see the list of months for which the requested data are available. Select "April 2001". Below the list of months, you see two options for date-selection (Date type): "Aggregated days" and "Individual days". "Aggregated days" is a chosen-default, which we now follow.

Click "Days" to make the selection of days, and select "Week days" – an aggregation of all 5 working days of the week. (Holidays and some special days, such as system failure, are excluded).
All selections are have now been completed: click "OK" at the bottom right.

**Wait for a few seconds** – SEEStat is processing your request: you now see the chart/histogram, produced as "Chart 1" within an Excel spreadsheet. 

**NOTE:** All the examples in this tutorial, from now on, will be accumulated in this Excel file. DO NOT modify or close this Excel file.

Looking at the chart, you see some irregularities at the left (near the origin). We shall look at these more carefully later.
In fact, two sheets have been created: The first is the chart, in “Chart1”; the second is "Table1", which includes Table(s) that are associated with the chart, with the default one being the "Statistics" table. Click Table1 to see the contents of this table (N=619,096 is the number of observations), skim through the summary data and then return to Chart1.

<table>
<thead>
<tr>
<th>Statistics</th>
<th>Agent service time</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>619096</td>
</tr>
<tr>
<td>N (average per day)</td>
<td>30954.8</td>
</tr>
<tr>
<td>Mean</td>
<td>4 min 19 sec</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>4 min 35 sec</td>
</tr>
<tr>
<td>Variance</td>
<td>21 min^2</td>
</tr>
<tr>
<td>Median</td>
<td>2 min 57 sec</td>
</tr>
<tr>
<td>Minimum</td>
<td>0</td>
</tr>
<tr>
<td>Maximum</td>
<td>59 min 53 sec</td>
</tr>
<tr>
<td>Skewness</td>
<td>3.062</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>15.38</td>
</tr>
<tr>
<td>Standard Error Mean</td>
<td>0 sec</td>
</tr>
<tr>
<td>Interquartile Range</td>
<td>3 min 53 sec</td>
</tr>
<tr>
<td>Mean Absolute Deviation</td>
<td>3 min 2 sec</td>
</tr>
<tr>
<td>Median Absolute Deviation(MAD)</td>
<td>1 min 42 sec</td>
</tr>
<tr>
<td>Coefficient of Variation (CV) (%)</td>
<td>106.17</td>
</tr>
<tr>
<td>L-moment 2 (half of Gini's Mean Difference)</td>
<td>2 min 6 sec</td>
</tr>
<tr>
<td>L-Skewness</td>
<td>0.383</td>
</tr>
<tr>
<td>L-Kurtosis</td>
<td>0.245</td>
</tr>
<tr>
<td>Coefficient of L-variation (L-CV) (%) (Gini's Coefficient)</td>
<td>48.57</td>
</tr>
</tbody>
</table>

You can easily make modifications to charts and tables, as long as they do not require the loading of new data from the database. You will now go through an example of such a modification.
First, return to the SEESTAT main menu by clicking the SEESTAT USBank button, on the task bar at the lower-left side of the screen – this is a click that you will be exercising each time that you wish to transfer from Excel to SEEStat.

Click "Output" on the top main menu at the right; after this click "Modify Tables and Charts”

Two tabs are available: "Options" and "Properties". Open "Properties" and change the resolution to **00:10 = 10 seconds**.

Click "OK".
The chart is becoming smoother, but at the cost of losing some details at the left, near the origin.

**Example 1.2: Intraday time series**

We now create a chart for arrival-counts to the call center(s) of USBank, during several days in a September.

First you must return to the "Statistical Models (Summaries)" window. Click the SEESTAT button on the task bar (left-bottom), next click "Windows" on the main menu (at the top) and select "Statistical Models (Summaries)"
We are now changing models. To this end, select the "**New Model**" button (bottom-right).

Select now "**Time Series**" and then select "**Intraday**".

As in [Example 1.1](#), four tabs appear. In tab "**Variable**", select "**Arrivals to queue**".
Now select dates: Click "Dates ->"; Select from "Months" the month of **September 2001**; Mark "Individual days", and click the "Days" tab.

The list of days contains the date, the name of week-day and comments if any. For example, **Monday, September 3rd**, was Labor Day.

*It is expected that the Tuesday following a holiday will be a busy day. We thus compare all Tuesdays of the month: September 4, September 11, September 18 and September 25.*

Hold down the **“Ctrl”** key on the keyboard, and in parallel click, one after one, on the **four Tuesdays** of September 2001.

Then click **"OK"** (bottom right).
Note: The graphs appear in “Chart2” of Excel. As before,” Table2” contains the corresponding numerical data.

You see a sharp drop in the number of calls around 09:00 AM on September 11, 2001 – this is of course not surprising, given that one of the call centers of US Bank was in NYC, and the others located on the U.S. East Coast.

You also see that the Tuesday after Labor Day is indeed a heavily-loaded Tuesday, as anticipated.

The chart is noisy, due to its 5 minute resolution. We shall momentarily increase the resolution to 1 hour (60 minutes). We also note the following:

On the two Tuesdays after September 11, the number of calls is low, relative to the Tuesday after Labor Day. A natural question now arises: Is there a "shape of a Tuesday"? To seek a common pattern for (the shape of) a Tuesday, if there is any, we change the graphs from absolute counts to "percent to mean" (mean = average number of calls per resolution period).
Go back to the main menu via the SEESTAT tab (bottom-left). In the main menu select "Output" then "Modify Tables and Charts". In the "Options" tab, in the "Convert to" table on the left, select "Percent to mean", and on the "Properties" tab set resolution to \(60:00 = 1\) hour,

Click "OK".

The "Shape of a Tuesday" is clearly manifested: the distribution of calls over the day is almost the same for the three Tuesdays, both normal and heavily-loaded. (Surprisingly, September 11 also catches up from around 13:00 or so.) For example, the arrival rate during the peak hour – from 10:00-11:00 – is about 2.5 times that of an average hour.

Instead of "Percent to mean", you can plot according to "Proportion to column totals" which, in simple words, means the "hourly fraction of load":

Going via the “SEESTAT tab”, "Output", "Modify Tables and Charts" “Proportions to column totals”, then “OK”.

19
You see that the arrivals during the peak hour 10:00-11:00 constitute 10% of the daily total. (Such observations make load-predictions much easier: indeed, only the daily total must be predicted. Once the daily total is determined, the number of arrivals per hour is allocated according to the shape of the day; e.g. 10% allocated to 10:00-11:00.)

**Example 1.3: Time series (Daily totals)**

There are two types of daily-totals time-series: individual days during a specific month and aggregated days by months. We now demonstrate these concepts.

Return to the "Statistical Models (Summaries)" window, via SEESTAT and using "Windows" on the main menu. Press the "New Model" button. Select "Time Series", then "Daily totals".
From the variables list select "Arrivals to offered" (around the middle of the list – it counts arrivals to the phone queue).
Press the "Dates->" button.

Mark "Days for one month" and select (after scrolling down) February 2003.

Open tab "Days" (there is no need for you to select anything, but note the Comments). Click "OK".
Two comments are worth making: On February 12, the system stopped working at 4:00 PM, and February 17 was a holiday - Washington's birthday. This is manifested on the chart, where these special days are marked as Abnormal (green) and Holiday (red). Note that weekends are also marked (blue).

Return again to the "Statistical Models (Summaries)" window via the SEESTAT tab. Press button "<-Tables"(top right)

From the variables list select "Number of agents". Open the "Select Categories" tab. Select the following three services: select "Premier" (priority Retail service), press “Ctrl”, and select "Subanco" (Spanish language), "Quick&Reilly" (brokerage).
Now press the "Dates->" button. Mark "Aggregated days by months" and click "Select all".

Open the "Days" tab and select "Week days".

Click "OK".

You see that one of the selected services (Quick&Reilly) was integrated into the Call Center of USBank only in November 2002.
Part 2

Example 2.1: Distribution fitting

We now fit a parametric service-time distribution to the service-time data from Example 1.1.

Open window "Statistical Models (Summaries)". Click "New Model" and select "Distributions" and "Fitting".

From the variables list select "Agent service time". Open tab "Options". You see the list of distributions available for fitting. Mark simultaneously 3 of them: Lognormal, Lognormal (Shifted) and Exponential. Set chart type to "Polygon".

On the tab "Select Categories" select Retail. Open the “X Properties” tab and set resolution to 00:01 = 1 second. Click the "Dates->" button. Select April 2001 and “Aggregated days”, open tab "Days" and select "Week days". Click "OK".
Observe again the irregularities near the origin. It looks as though there are at least three distributions involved: very short calls, abnormally short calls and, after around 30 seconds, the pattern looks rather regular. The best fit is produced by the Lognormal (Shifted) distribution. But clearly, close to the origin from the right, the fit is inadequate.

You could use the Tables on the previous Sheet (the one accompanying the graph-sheet) to statistically validate the fit: scroll down until reaching the tables "Parameter-Estimates" and "Goodness-of-Fit tests".

<table>
<thead>
<tr>
<th>Distribution</th>
<th>Residuals Std</th>
<th>Kolmogorov-Smirnov Statistic</th>
<th>p Value</th>
<th>Cramer-von Mises Statistic</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exponential</td>
<td>0.0333587</td>
<td>0.0648108</td>
<td>&lt;.0001</td>
<td>688.93</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Lognormal</td>
<td>0.0504286</td>
<td>0.0878369</td>
<td>&lt;.0001</td>
<td>1574.38</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Lognormal (Shifted)</td>
<td>0.0070429</td>
<td>0.0211677</td>
<td>&lt;.0001</td>
<td>30.71</td>
<td>&lt;.0001</td>
</tr>
</tbody>
</table>
**Example 2.2: Distribution mixture fitting**

We now try to accommodate the behavior to the right of the origin by a mixture of distributions for “Agent service time”.

Via SEESTAT return to the "Statistical Models (Summaries)" window, click "New Model", select “Distributions” and "Mixture fitting".

Open the "Options" tab. You can select a homogeneous or heterogeneous (mixture of various distributions) option. The former is the default. Select "Lognormal". Set the number of mixture components to 6, select chart type Polygon.

Click "OK".
You observe an excellent fit (Red line). In particular, on the left side (near the origina), there are two components, accommodating the very short and short calls.

Going to the previous Excel Sheet, to view the corresponding Tables (by scrolling it down), one notes that the main component has weight 87 % in the mixture – its role in the chart is to fit the part beyond 30 seconds, which it does very well.

<table>
<thead>
<tr>
<th>Components</th>
<th>Mixing Proportions (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Lognormal</td>
<td>3.77</td>
</tr>
<tr>
<td>2. Lognormal</td>
<td>3.39</td>
</tr>
<tr>
<td>3. Lognormal</td>
<td><strong>88.66</strong></td>
</tr>
<tr>
<td>4. Lognormal</td>
<td>2.91</td>
</tr>
<tr>
<td>5. Lognormal</td>
<td>1.00</td>
</tr>
<tr>
<td>6. Lognormal</td>
<td>0.27</td>
</tr>
</tbody>
</table>
**Example 2.3: Survival analysis with smoothing of hazard rates**

**SEEStat** supports several survival models. These are required, for example, in order to get insight into customers' **(im)patience**, namely the time customers are willing to wait prior to hanging up. Indeed, for those customers who got served, their waiting time provides only a lower bound on how long they are willing to wait - their (im)patience constitutes **censored** observations. One must thus "uncensor" the data to produce adequate estimates. To this end, we now use simple tools from survival analysis. These will produce hazard-rate functions, which provide natural statistical summaries of (im)patience.

Return again, via **SEESTAT**, to the "Statistical Models (Summaries)" window, click "New Model".

Select "**Survival analysis**" and "**Survival Curve Estimate**".
There are two variable tabs. The first tab "Censored time" is open. Select "Wait time (handled)"; this corresponds to the waiting time of the customers who received service. Open the "Failure time" and select "Wait time (unhandled)"; this corresponds to the waiting of customers who joined the queue but did not receive service (mainly due to abandonment, though there are sometimes other reasons such as system malfunction).

Open the "Options" tab. SEEStat supports several methods of smoothing, which are applicable to hazard rates and beyond. Select “Default” smoothing (which, this time, happens to be the method of HEFT).

From the tab "Select categories" select "Telesales". Click "Dates". Select "April 2001" and on the tab "Days" select "Week days". Click "OK".
A noticeable peak in the hazard rate indicates that there is a trigger for customers to abandon after about 50 seconds of waiting (which, based on our experience, could be the result of a voice-announcement at that time: such announcements, regardless of their contents, “reminds” customers of their wait and thus increases their likelihood of abandonment).

**Example 2.4: Smoothing of intraday time series**

Smoothing algorithms are available for several statistical models. We now demonstrate the application of smoothing to the data used in Example 1.2.

Return as usual to "Statistical Models (Summaries)" , click "New Model" , select "Time Series" and "Intraday". Select "Arrivals to queue". In "Options" tab select “Default” smoothing (this time, the default is the method of Cubic Splines).
Select "Scatter" as chart type.
In tab "X Properties", set resolution to \textbf{02:00} = 2 minutes.
Click "Dates", mark "Individual days" and select "September 2001".
On the "Days" tab select (with "Ctrl" and click) all four \textbf{Tuesdays} of September.
Press "\textbf{OK}".

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{usbank_arrivals.png}
\caption{USBank Arrivals to queue}
\end{figure}

\textit{For this small resolution of 2 minutes, there is plenty of noise, but the smoothed data clearly identifies the regular pattern that was discovered before. (Note that the smoothed curves are computed with the minimal resolution for this variable, which is 30 seconds; the 2-minute resolution is only for display.)}

Click "\textbf{Output}" on the main menu, then click "\textbf{Modify Tables and Charts}".
Open the "\textbf{Properties}" tab, set resolution to \textbf{15 min}. and click "\textbf{OK}".
The Averaged Data (over 15 minutes) are now much closer to the smoothed curves, as expected.

**Part 3**

Some additional interesting examples.

**Example 3.1: Queue regulated by a protocol & announcements**

Via SEESTAT return to the "Statistical Models (Summaries)" window, click "New Model", then click the "Distributions" button. Three available distribution models appear. Select "Estimates". In tab “Variables” select (using Ctrl) both “Wait time (unhandled)” and “Wait time (handled)”.

In tab “Options” select chart type Polygon. Click “Dates->”, select December 2002, make sure the "Aggregated days" option is selected, and in "Days" select Week days. Click “<-Tables”. In “Select Categories” select “Quick&Reilly”. Press "OK".
Both lines are periodical. To get a better focus, you will cut the chart at the left side.

Click "Output" on the main menu and then "Modify Tables and Charts". Open "Properties", set the low limit 5 seconds.

Click "OK".
As you see, the Wait time (unhandled), in blue, peaks every 65 sec. The Wait time (handled), in red, peaks every 130 seconds. These interesting observations are yet to find their explanations. (Our experience suggests that peaks in the "Wait-time (unhandled)" are "psychological", for example a reaction of a customer to an announcement; and peaks in the "Wait-time (handled)" are "protocol-driven", for example a result of a priority upgrade.)

**Example 3.2: Queue length & state-space collapse**

Via SEESTAT return to the "Statistical Models (Summaries)" window, click "New Model". Click the "Time Series" button.

Two available models for time series appear. Select "Intraday". On tab “Variables” select “Customers in queue (average)”. On tab “Options” select smoothing “None” and chart type Polygon. On tab “X Properties” select resolution 1 minute.

In “Select Categories” tab select (with Ctrl and click) Business and Platinum. Click “Dates->”, select “Dates totals only”, select the 8 months from May 2002 to December 2002 and select Week days on the "Days" tab. Click “OK”.
Platinum is a small-scale service. You will now normalize the chart in order to identify patterns.

Click "Output" on the main menu and then "Modify Tables and Charts". Open the "Options" tab and select Percent to mean. Click "OK".

Note the essentially overlapping patterns of the queue lengths of the two customer types. (This phenomenon is predicted by asymptotic analysis of queues in heavy traffic, where it is referred to as State-Space-Collapse.)
Example 3.3: Change-of-Shifts phenomena

Via SEESTAT return to the "Statistical Models (Summaries)" window, click "<-Tables". On tab "Variables" select "Un handled proportion". On tab "X Properties" select resolution 5 minutes. In "Select Categories" tab select "Retail". Click "Dates->", select "April 2001", and select Week days. Click "OK".

You observe a lot of noise before 8:00 AM. There are only few agents working then, and few customers are calling. We now cut this noisy (possibly irrelevant) part of the chart, until 8:00 AM.

Click "Output" on the main menu and then "Modify Tables and Charts". Open the "Properties" tab and change low limit to 08:00.

Click "OK".
Via SEESTAT return to the "Statistical Models (Summaries)" window. Click "<-Tables". On tab “Variables” select “Average wait time (all)”. Click "OK"
We observe that the patterns for the two variables ("Unhandle proportion" and "Average wait time (all)" are rather similar. We now compare them more closely.

Via SEESTAT return to the "Statistical Models (Summaries)" window. On tab "Variables" select “Unhandled proportion” and “Average wait time (all)”. Click OK.

Observe an increase in "unhandled proportion" and "average wait time" from 17:00 to 20:00 – this is a time period of shift-change, or shift-overlap. Indeed, we shall verify, momentarily, that during this period, many agents were leaving their shifts. The number of arrivals is also going down, but the schedule of agent exits is not well-synchronized with arrivals – agents here are leaving prematurely.

The management of shift-change is prevalent chronic problem for call centers. We identify such problems via the SEEStat functions that display entries and exists of agents:

Via SEESTAT return to the "Statistical Models (Summaries)" window. On tab "Variables" select “Agent entries” and “Agent exits”. In the "Select Categories" tab select “Retail”. Open the "Properties" tab and change the low limit to 17:00 and upper limit to 20:00. Click OK.
Note that times of entries immediately follow time of exists (some overlap would have been desirable). In addition, more are leaving (in red) than are joining (blue) which, as noted, was not matched well with the decline rate of customer calls. Both “arrival rate” and “# of agents online” are easy to plot, which we do now for you:
Example 3.4: Daily flow of calls

Via SEESTAT return to the "Main" menu. Select “Daily Report”.

Click “Dates->” select April 2002, ”Individual days”, click “Days” and select “2 April 2002 Tuesday”. Click OK. (Note; VRU = Voice Response Unit, or simply an Answering Machine.)

We have chosen a typical day – Tuesday, April 2, 2002 – since this day has virtually no problematic calls. There is a total of 261,143 calls on that day. The PowerPoint slide describes the process-flow of calls. There are 4 significant entry points to the system: through the VRU ~227054 calls (87%), Announcement ~18777 calls, Message ~4517 calls and Direct group (callers that directly connect to an agent) 2179 calls. 196143 calls (about 79% of all calls) exit from the system through the VRU, Announcement, Message and Others groups; while another 21% of callers entering the system seek service by an agent (Offered Volume).

The served callers include those who will request other services (6951 calls, or about 13% of the handled calls), while 46445 calls (86% of callers) exit the system after receiving service by a single agent.