

Service Engineering - Recitation 11

4CallCenters Software

Download and Install

- [setup.exe](#) and [help](#) document available from <http://ie.technion.ac.il/serveng/4CallCenters/Downloads.htm>

4CallCenters™

Personal Optimization Tools for Call Centers

Downloads:

1. [4CallCenters v2.23](#)(setup.exe file- 3 MB)
 - **For installation:** Open setup.exe and follow the instructions.
 - **To uninstall the installed software:** Go to Start/Programs/4CallCenters v2.23/Uninstall 4CallCenters v2.23
2. 4CallCenters - Help Document ([PDF-824KB](#)), ([Doc-123KB](#))
Document containing the 4CallCenters application's help pages.

Tools

- **Performance Profiler**
 - Anticipating your call center's performance for long and short term decision making
 - can profile the performance using a wide variety of performance indicators
- **Staffing Query**
 - determine the staffing level required during a given interval in order to meet your call center's performance goal
 - If more than one performance goal, should use the "Advanced Queries" tool
- **Advanced Profiler**
 - an enhanced profiling tool, allows multiple-value input parameters.
 - especially useful for creating large performance tables or for preparing graphs.
- **Advanced Queries**
 - Can use if you have multiple performance goals or if you want to determine the value of one of your input parameters, for which your goal (or goals) is achieved,
 - Allows multi-value input (for both input parameters and goals)
- **What-if Analysis**
 - test various what-if scenarios which arise from the possible variations in your call center's parameters
 - see the impact of such variations on your performance.

Performance Profiler

- **Example:** T = 60 min / N = 10 / AHT = 01:00 / Arrival rate = 550
 - Case 1: Set **Target Time to Answer** = 00:10
 - Case 2: Set **Target Time to Answer** = 00:00 to compute P(delay)
 - Case 3: Increase the **arrival rate** up to 600: the system **explodes**

4CallCenters v2.23

File Table Settings Help

Performance Profiler | Staffing Query | Advanced Profiling | Advanced Queries | What-if Analysis

Performance Profiler Performance Profiler allows you to determine and optimize the Performance Level of your Call Center. Enter y

Your Call Center's Parameters

- ◆ Number of Agents Answering Calls: 10
- ◆ Average Time to Handle One Call (mm:ss): 01:00
- ◆ Calls per 60 minute Interval: 600

Settings

- ◆ Features: None Selected
- ◆ Basic Interval: 60 minutes
- ◆ Target Time: 00:00 (mm:ss)

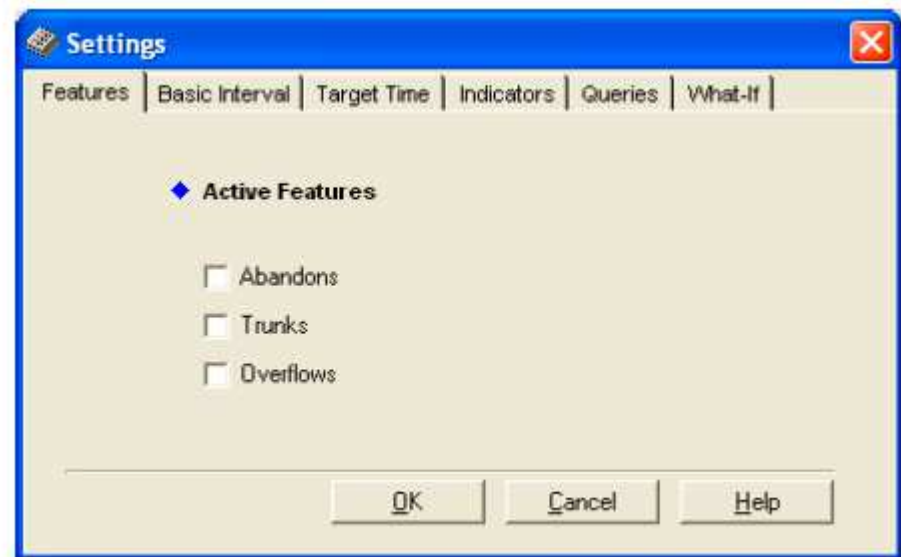
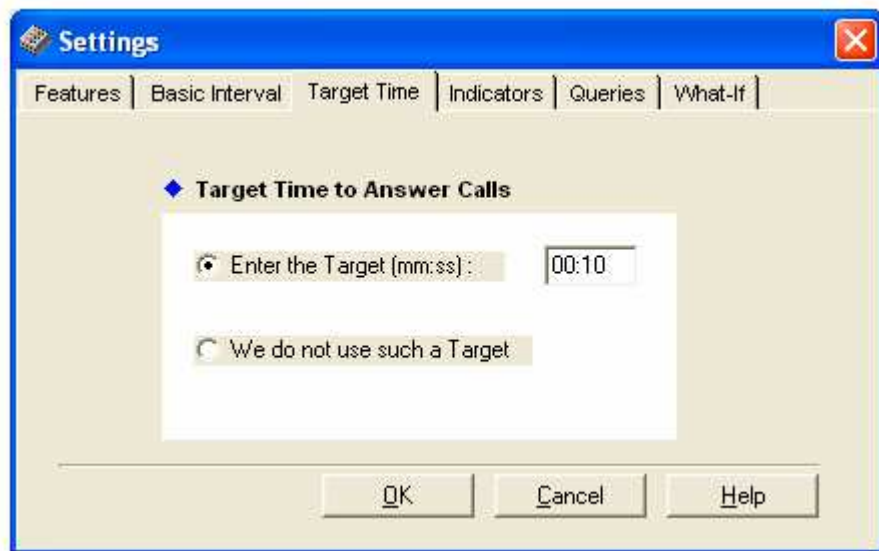
Change Settings

Compute ◆ Add to Table Delete Rows Clear All Export Import Graph

	Basic Interval (minutes)	Target Time to Answer	Number of Agents	Average Handling Time	Calls per Interval	Agent's Occupancy	Average Speed of Answer	%Answer within Target	Average Queue Length
Results									
1	60.0	00:10.0	10.0	01:00.0	550.0	91.7%	00:51.8	37.4%	7.9
2	60.0	00:00.0	10.0	01:00.0	550.0	91.7%	00:51.8	28.1%	7.9
3	60.0	00:00.0	10.0	01:00.0	600.0	n/a	n/a	n/a	n/a
4									

Performance Profiler (2)

- Add either **Trunks** or **Overflows** feature to keep your system stable
 - **Trunks**: maximum number of calls which can be in the system simultaneously
 - **Overflows**: a technical limit on the time a call can spend waiting in queue



Performance Profiler (3)

- Add the **abandonment** feature - the system **does not** explode.

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File Table Settings Help

Performance Profiler Staffing Query Advanced Profiling Advanced Queries What-if Analysis

Performance Profiler Performance Profiler allows you to determine and optimize the Performance Level of your Call Center. Enter your call center's parameters below, then press 'Compute'.

Your Call Center's Parameters

- Number of Agents Answering Calls: 10
- Average Time to Handle One Call (mm:ss): 01:00
- Calls per 60 minute Interval: 600
- Average Callers' Patience (mm:ss): 03:00

Settings

- Features: Abandons
- Basic Interval: 60 minutes
- Target Time: 00:00 (mm:ss)

Change Settings

compute Add to Table Delete Rows Clear All Export Import Graph

	Number of Agents	Average Handling Time	Calls per Interval	Average Patience	Agent's Occupancy	%Answer	%Abandon	Average Speed of Answer	Average Time in Queue	%Answer within Target	%Abandon within Target	Average Queue Length
Results	10.0	01:00.0	600.0	03:00.0	90.8%	90.8%	9.2%	00:16.1	00:16.5	33.6%	0.0%	2.8
1	10.0	01:00.0	600.0	01:00.0	87.5%	87.5%	12.5%	00:06.9	00:07.5	45.6%	0.0%	1.3
2	10.0	01:00.0	600.0	03:00.0	90.8%	90.8%	9.2%	00:16.1	00:16.5	33.6%	0.0%	2.8
3												
4												
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7												
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9												
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12												
13												
14												
15												
16												

Settings Parameters Indicators

Ready 00:01/2007 10:14

Start Tera Term - iet... Rec10 4CC_recitation... 4CallCenters... Lecture10 Adobe Acrobat... EN 19:14

Operational Performance Measures

The most prevalent performance measure is $P\{W_q \leq T; \text{Sr}\}$ (or “worse” $P\{W_q \leq T \mid \text{Sr}\}$).

We recommend:

- $P\{W_q \leq T; \text{Sr}\}$ - fraction of **well-served**;
- $P\{\text{Ab}\}$ - fraction of **poorly-served**.

with **T** determined via “*Waiting less than T is Well-Served*”.

Or even a four-dimensional refinement:

- $P\{W_q \leq T; \text{Sr}\}$ - fraction of **well-served**;
- $P\{W_q > T; \text{Sr}\}$ - fraction of **served**, with **potential for improvement** (say, a higher priority on next visit);
- $P\{W_q > \epsilon; \text{Ab}\}$ - fraction of **poorly-served**;
- $P\{W_q \leq \epsilon; \text{Ab}\}$ - fraction of those whose **service-level** is **undetermined**.

with **ε**: “*Abandoning before ε is Harmless*”.

Operational Performance Measures (2)

- With abandonment – changing Target Times

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File Table Settings Help

Performance Profiler | Staffing Query | Advanced Profiling | Advanced Queries | What-if Analysis

Performance Profiler Performance Profiler allows you to determine and optimize the Performance Level of your Call Center. Enter your call center's parameters below, then p

Your Call Center's Parameters

- ◆ Number of Agents Answering Calls
- ◆ Average Time to Handle One Call (mm:ss)
- ◆ Calls per 60 minute Interval
- ◆ Average Callers' Patience (mm:ss)

Settings

- ◆ Features: Abandons
- ◆ Basic Interval: 60 minutes
- ◆ Target Time: 00:30 (mm:ss)

[Change Settings](#)

[Compute](#) ◆ [Add to Table](#) [Delete Rows](#) [Clear All](#) [Export](#) [Import](#) [Graph](#)

	Basic Interval (minutes)	Target Time to Answer	Number of Agents	Average Handling Time	Calls per Interval	Average Patience	Agent's Occupancy	%Answer	%Abandon	Average Speed of Answer	%Answer within Target	%Abandon within Target	Average Queue Length
Results													
1	60.0	00:00.0	10.0	02:00.0	300.0	02:00.0	87.5%	87.5%	12.5%	00:13.8	45.8%	0.0%	1.3
2	60.0	00:10.0	10.0	02:00.0	300.0	02:00.0	87.5%	87.5%	12.5%	00:13.8	55.7%	3.9%	1.3
3	60.0	00:30.0	10.0	02:00.0	300.0	02:00.0	87.5%	87.5%	12.5%	00:13.8	71.1%	8.8%	1.3
4													

Operational Performance Measures (3)

Erlang-A parameters:

$\lambda = 300$ calls/hour, $1/\mu = 2$ min, $n = 10$, $1/\theta = 2$ min.

Target times $T = 30$ sec, $\epsilon = 10$ sec.

- $P\{W_q \leq T; \text{Sr}\} = 71.1\%$;
- $P\{W_q > T; \text{Sr}\} = 87.5\% - 71.1\% = 16.4\%$;
- $P\{W_q > \epsilon; \text{Ab}\} = 12.5\% - 3.9\% = 8.6\%$;
- $P\{W_q \leq \epsilon; \text{Ab}\} = 3.9\%$.
- Delay probability $P\{W_q > 0\} = 100\% - 45.8\% = 54.2\%$.

- Choose a performance goal to receive recommendation for staffing
 - $P(\text{abandonment})=5\%$
 - Avg time in Queue = 1min
 - 80% of customers wait less than 20 seconds

C

Advanced Profiling

- Can enter multiple values for input parameters
 - Especially useful for creating graphs or performance tables
 - EX) Change staffing from 3 to 20

The screenshot shows the 4CallCenters v2.23 application window. The 'Advanced Profiling' tab is selected. The main window displays a table of input parameters and their corresponding performance metrics. A dialog box titled 'Multi-Value Input (Number of Agents)' is open, allowing the user to specify a range of values for the 'Number of Agents' parameter.

Advanced Profiling
The **Advanced Profiling** tool allows you to enter multiple values for each of the input parameters, and produces a performance profile for each combination of parameters.

Compute | **Add to Table** | **Delete Rows** | **Clear All** | **Export** | **Import** | **Graph** | **Settings**

Input Multi-Value	Basic Interval (minutes)	Target Time to Answer	Number of Agents	Average Handling Time	Calls per Interval	Average Patience	Agent's Occupancy	%Answer	%Abandon	Average Speed of Answer	Average Time in Queue	%Answer within Target	%Abandon within Target	Average Queue Length
Results														
1	60.0	00:20.0	3.0	01:00.0	600.0	01:00.0	99.9%	30.0%	70.0%	01:02.9	00:42.0	2.2%	28.0%	7.0
2	60.0	00:40.0	4.0	01:00.0	600.0	01:00.0	99.9%	30.0%	70.0%	01:02.9	00:42.0	2.2%	28.0%	7.0
3	60.0	01:00.0	5.0	01:00.0	600.0	01:00.0	99.9%	30.0%	70.0%	01:02.9	00:42.0	2.2%	28.0%	7.0
4	60.0	01:20.0	6.0	01:00.0	600.0	01:00.0	99.9%	30.0%	70.0%	01:02.9	00:42.0	2.2%	28.0%	7.0
5	60.0	01:40.0	7.0	01:00.0	600.0	01:00.0	99.9%	30.0%	70.0%	01:02.9	00:42.0	2.2%	28.0%	7.0
6	60.0	02:00.0	8.0	01:00.0	600.0	01:00.0	99.9%	30.0%	70.0%	01:02.9	00:42.0	2.2%	28.0%	7.0
7	60.0	02:20.0	9.0	01:00.0	600.0	01:00.0	99.9%	30.0%	70.0%	01:02.9	00:42.0	2.2%	28.0%	7.0
8	60.0	02:40.0	10.0	01:00.0	600.0	01:00.0	99.9%	30.0%	70.0%	01:02.9	00:42.0	2.2%	28.0%	7.0
9	60.0	03:00.0	11.0	01:00.0	600.0	01:00.0	99.9%	30.0%	70.0%	01:02.9	00:42.0	2.2%	28.0%	7.0
10	60.0	03:20.0	12.0	01:00.0	600.0	01:00.0	99.9%	30.0%	70.0%	01:02.9	00:42.0	2.2%	28.0%	7.0
11	60.0	03:40.0	13.0	01:00.0	600.0	01:00.0	99.9%	30.0%	70.0%	01:02.9	00:42.0	2.2%	28.0%	7.0
12	60.0	04:00.0	14.0	01:00.0	600.0	01:00.0	99.9%	30.0%	70.0%	01:02.9	00:42.0	2.2%	28.0%	7.0
13	60.0	04:20.0	15.0	01:00.0	600.0	01:00.0	99.9%	30.0%	70.0%	01:02.9	00:42.0	2.2%	28.0%	7.0
14	60.0	04:40.0	16.0	01:00.0	600.0	01:00.0	99.9%	30.0%	70.0%	01:02.9	00:42.0	2.2%	28.0%	7.0
15	60.0	05:00.0	17.0	01:00.0	600.0	01:00.0	99.9%	30.0%	70.0%	01:02.9	00:42.0	2.2%	28.0%	7.0
16	60.0	05:20.0	18.0	01:00.0	600.0	01:00.0	99.9%	30.0%	70.0%	01:02.9	00:42.0	2.2%	28.0%	7.0
17	60.0	05:40.0	19.0	01:00.0	600.0	01:00.0	99.9%	30.0%	70.0%	01:02.9	00:42.0	2.2%	28.0%	7.0
18	60.0	06:00.0	20.0	01:00.0	600.0	01:00.0	99.9%	30.0%	70.0%	01:02.9	00:42.0	2.2%	28.0%	7.0

Multi-Value Input (Number of Agents)

☒ Range ☐ Sensitivity ☐ List

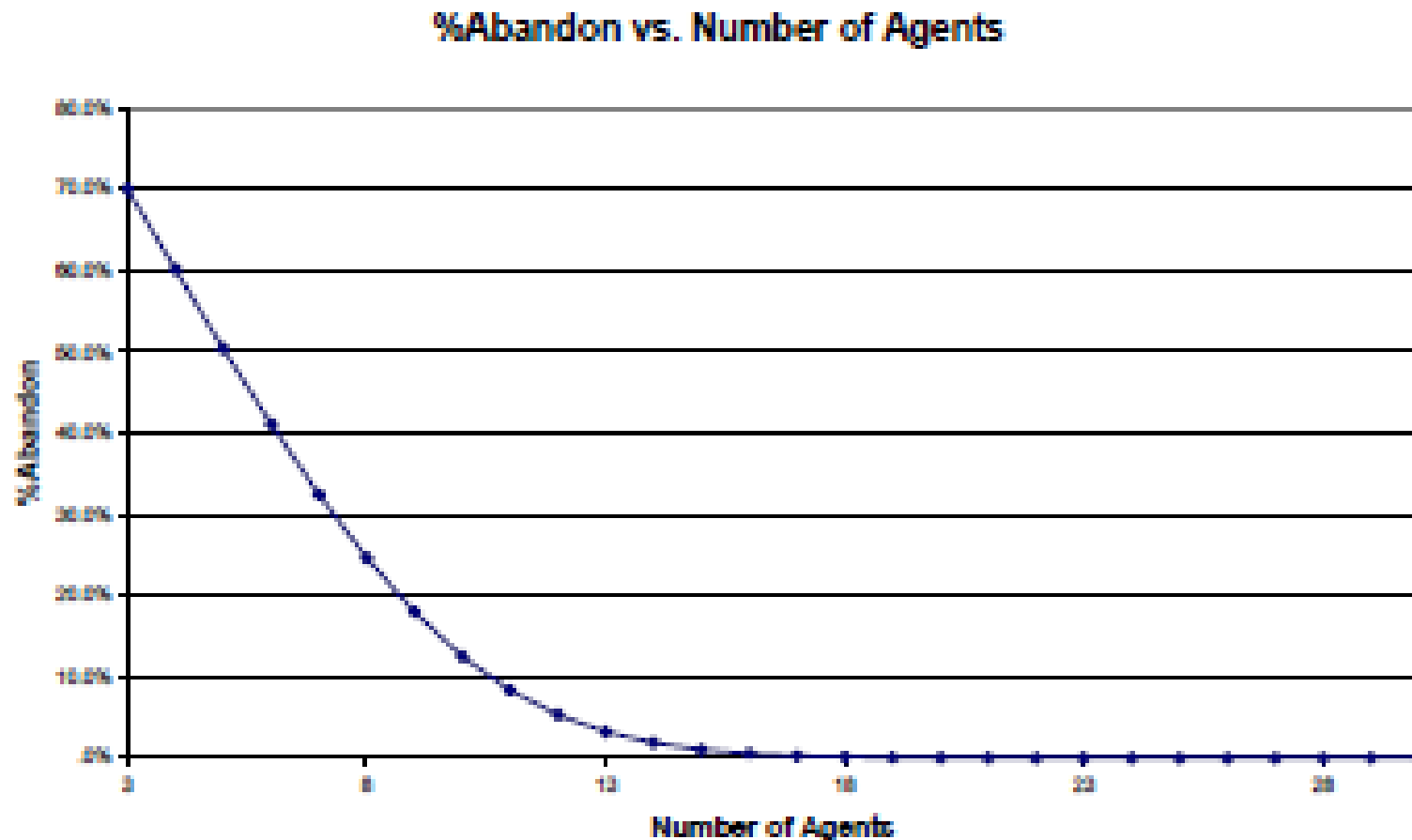
Min Value: 3
Max Value: 20
Step Size: 1

Base Value: 3
Increment?: 5%
Range?: 20%

OK Cancel Help

Advanced Profiling (2)

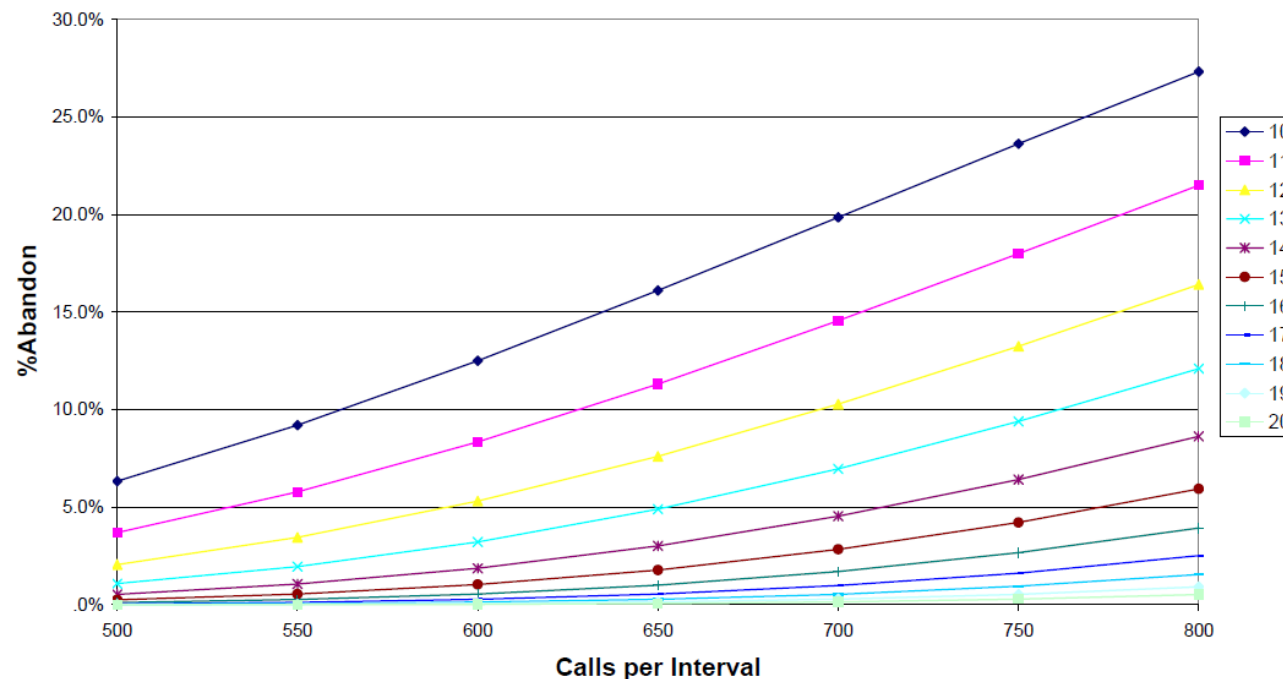
- Try using Table > Export to File features. Export the table to Excel.
- Create a graph of probability to abandon against staffing.



Advanced Profiling (3)

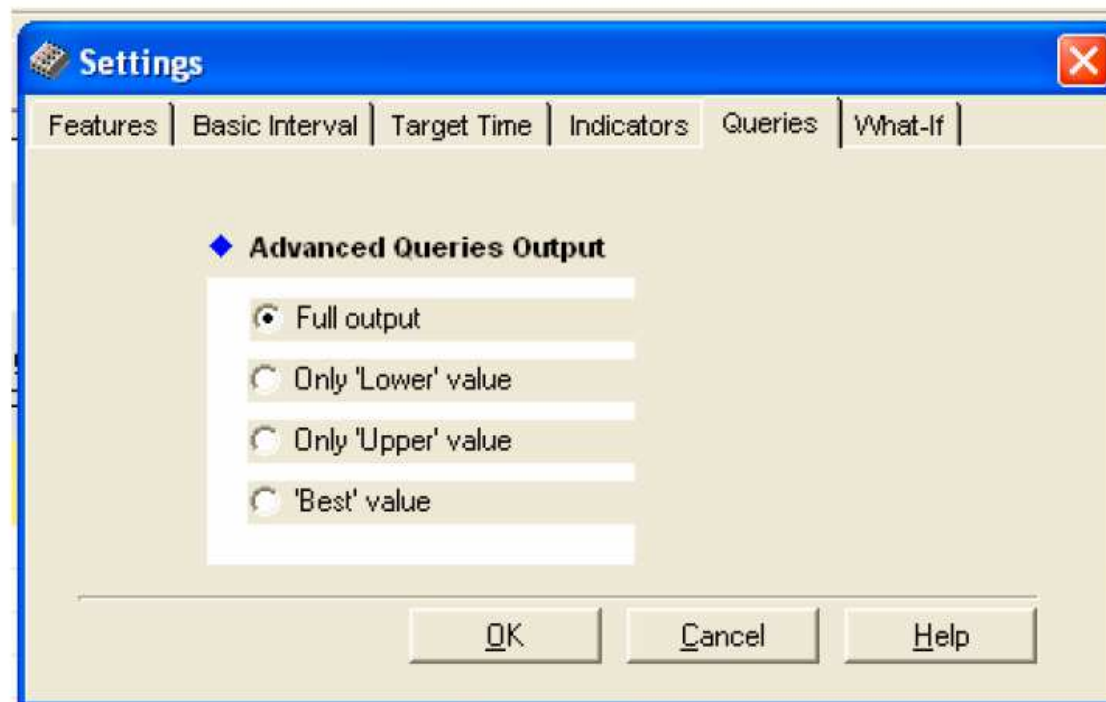
- Try **multiple parameters** options.
- Create multi-parameter graph of probability to abandon against arrivals, depending on different staffing levels.
 - Change number of agents from 10 to 20 by step 1.
 - Change arrival rate from 500 to 800 by step 50.

%Abandon vs. Calls per Interval for various Number of Agents



Advanced Queries

- You choose performance goal(s) and a certain system parameter. 4CallCenters determines which value of this parameter will lead to the desired performance goal.
- In Settings choose if you need "Lower", "Upper" or "Best" value of the parameter.



Advanced Queries (2)

EXAMPLE 1)

- Set the number of agents as a parameter to query and set two target goals: 5% of abandon and 80% served within 20 seconds.
- You can also choose multiple arrival rate: from 500 to 1,000 by step 100.
- NOTE: When there are multiple goals, it is usually impossible to meet all goal values simultaneously, therefore achieving the goals is in the sense that the values of the performance indicators set as goals is at least (or no more then, depending on the indicator) the value set as their goal.

4CallCenters v2.23

File Table Settings Help

Performance Profiler Staffing Query Advanced Profiling **Advanced Queries** What-if Analysis

Advanced Queries With this **Advanced** tool you can set multiple performance goals. Check the **Query** row of any one of your call center's parameters - pressing 'Compute' will find the value(s) of this parameter for which all your goals are met.

Compute Add to Table Delete Rows Clear All Export Import Graph Settings

Goals												
Query	▼						▼			▼		
Input		01:00	Range	01:00			5%			80%		
Multi-Value			▼									
	Number of Agents	Average Handling Time	Calls per Interval	Average Patience	Agent's Occupancy	%Answer	%Abandon	Average Speed of Answer	Average Time in Queue	%Answer within Target	%Abandon within Target	Average Queue Length
Upper												
1	11.0	01:00.0	500.0	01:00.0	73.0%	96.3%	3.7%	00:02.0	00:02.2	93.7%	3.3%	0.3
2	13.0	01:00.0	600.0	01:00.0	74.4%	96.8%	3.2%	00:01.7	00:01.9	94.8%	3.0%	0.3
3	14.0	01:00.0	700.0	01:00.0	79.6%	95.5%	4.5%	00:02.4	00:02.7	92.6%	4.1%	0.5
4	16.0	01:00.0	800.0	01:00.0	80.1%	96.1%	3.9%	00:02.1	00:02.4	93.8%	3.7%	0.5
5	18.0	01:00.0	900.0	01:00.0	80.5%	96.5%	3.5%	00:01.9	00:02.1	94.8%	3.3%	0.5
6	19.0	01:00.0	1,000.0	01:00.0	83.8%	95.5%	4.5%	00:02.5	00:02.7	93.2%	4.2%	0.7
7												

4CallCenters v2.23

File Table Settings Help

Performance Profiler Staffing Query Advanced Profiling Advanced Queries What-if Analysis

Advanced Queries

With this **Advanced** tool you can set multiple performance goals. Check the **Query** row of any one of your call center's parameters - press

♦

 ♦

Goals Query Input Multi-Value	Basic Interval (minutes)	Target Time to Answer	Number of Agents	Average Handling Time	Calls per Interval	Average Patience	Agent's Occupancy	%Answer	%Abandon	Average Speed of Answer	%Answer within Target	Average Queue Length
Lower	60.0	00:20.0	12.0	04:00.0	145.0	04:30.0	77.1%	95.7%	4.3%	00:10.4	80.4%	0.5
Upper	60.0	00:20.0	12.0	04:00.0	146.0	04:30.0	77.5%	95.6%	4.4%	00:10.8	79.8%	0.5

What if Analysis

- Tests the sensitivity of the Call Center performance to variations in parameter's value.
- Assume number of agents=200, average handling time 5 minutes and 2,500 calls per hour.
- Take the basis of average patience to be 8:00 and perform the analysis.
- **Setting → What-if → number of test values and value increments → compute**

What if Analysis (2)

The screenshot displays the 4CallCenters v2.23 application window. The 'What-if Analysis' tab is active, showing a table for input parameters and a 'Settings' dialog box.

What-if Analysis
To test the **sensitivity** of your call center's performance to variations in a parameter's value enter your basic scenario in the **Input** row, and check the parameter you wish to **Vary**. To control the values tested advise your 'Settings'.

Buttons: Compute, Add to Table, Delete Rows, Clear All, Export, Import, Graph, Settings

Vary	Input	60	00:20	200	05:00	2500	08:00				
		Basic Interval (minutes)	Target Time to Answer	Number of Agents	Average Handling Time	Calls per Interval	Average Patience	Agent's Occupancy	%Answer	%Abandon	Aver Spec Ans
- 20%											
- 15%											
- 10%											
- 5%											
0%											
+ 5%											
+ 10%											
+ 15%											
+ 20%											
1											
2											
3											
4											
5											
6											
7											
8											
9											
0											

Settings dialog box:

- Features | Basic Interval | Target Time | Indicators | Queries | What-If
- What-if Analysis Settings
- Select the number of Test Values : 18
- Select the Test Value Increments : 5%
- Buttons: OK, Cancel, Help

Legend:

- Settings (Orange box)
- Parameters (Yellow box)
- Indicators (White box)

What if Analysis (3)

4CallCenters v2.23

File Table Settings Help

Performance Profiler | Staffing Query | Advanced Profiling | Advanced Queries | What-if Analysis

What-if Analysis To test the **sensitivity** of your call center's performance to variations in a parameter's value enter your basic scenario in the **Input** row, and check the parameter you wish to **Vary**. To control the values tested advise your 'Settings'.

Compute Add to Table Delete Rows Clear All Export Import Graph Settings

Vary Input	Basic Interval (minutes)	Target Time to Answer	Number of Agents	Average Handling Time	Calls per Interval	Average Patience	Agent's Occupancy	%Answer	%Abandon	Average Speed of Answer	%Answer within Target	Average Queue Length
	60	00:20	200	05:00	2500	08:00						
- 45%	60.0	00:20.0	200.0	05:00.0	2,500.0	04:24.0	98.7%	94.7%	5.3%	00:13.9	65.8%	9.7
- 40%	60.0	00:20.0	200.0	05:00.0	2,500.0	04:48.0	98.7%	94.8%	5.2%	00:15.0	63.3%	10.4
- 35%	60.0	00:20.0	200.0	05:00.0	2,500.0	05:12.0	98.8%	94.8%	5.2%	00:16.1	61.0%	11.2
- 30%	60.0	00:20.0	200.0	05:00.0	2,500.0	05:36.0	98.8%	94.9%	5.1%	00:17.2	58.7%	11.9
- 25%	60.0	00:20.0	200.0	05:00.0	2,500.0	06:00.0	98.9%	94.9%	5.1%	00:18.3	56.6%	12.7
- 20%	60.0	00:20.0	200.0	05:00.0	2,500.0	06:24.0	98.9%	95.0%	5.0%	00:19.3	54.6%	13.4
- 15%	60.0	00:20.0	200.0	05:00.0	2,500.0	06:48.0	99.0%	95.0%	5.0%	00:20.4	52.7%	14.1
- 10%	60.0	00:20.0	200.0	05:00.0	2,500.0	07:12.0	99.0%	95.1%	4.9%	00:21.4	51.0%	14.8
- 5%	60.0	00:20.0	200.0	05:00.0	2,500.0	07:36.0	99.0%	95.1%	4.9%	00:22.5	49.3%	15.6
0%	60.0	00:20.0	200.0	05:00.0	2,500.0	08:00.0	99.1%	95.1%	4.9%	00:23.5	47.7%	16.3
+ 5%	60.0	00:20.0	200.0	05:00.0	2,500.0	08:24.0	99.1%	95.1%	4.9%	00:24.6	46.1%	17.0
+ 10%	60.0	00:20.0	200.0	05:00.0	2,500.0	08:48.0	99.1%	95.2%	4.8%	00:25.6	44.7%	17.7
+ 15%	60.0	00:20.0	200.0	05:00.0	2,500.0	09:12.0	99.2%	95.2%	4.8%	00:26.6	43.3%	18.4
+ 20%	60.0	00:20.0	200.0	05:00.0	2,500.0	09:36.0	99.2%	95.2%	4.8%	00:27.6	42.0%	19.1
+ 25%	60.0	00:20.0	200.0	05:00.0	2,500.0	10:00.0	99.2%	95.3%	4.7%	00:28.6	40.7%	19.8
+ 30%	60.0	00:20.0	200.0	05:00.0	2,500.0	10:24.0	99.3%	95.3%	4.7%	00:29.6	39.5%	20.4
+ 35%	60.0	00:20.0	200.0	05:00.0	2,500.0	10:48.0	99.3%	95.3%	4.7%	00:30.7	38.4%	21.1
+ 40%	60.0	00:20.0	200.0	05:00.0	2,500.0	11:12.0	99.3%	95.3%	4.7%	00:31.7	37.3%	21.8
+ 45%	60.0	00:20.0	200.0	05:00.0	2,500.0	11:36.0	99.3%	95.3%	4.7%	00:32.6	36.2%	22.5

Settings Parameters Indicators