Service Engineering

Homework 9: GazolCo's Call Center

Fourteen agents are busy answering calls at GazolCo's call center. Most calls are by customers calling to pay or inquire about their gas bills. Looking through recent ACD reports you see that the average handling time of each call is approximately 4 minutes. Methaney, the call center's manager, is sitting behind her desk playing with the screen saver's settings while awaiting the opening remarks of your analysis. As for you - your head is all clouded and you feel a bit queasy, but gradually you begin to recall a long forgotten assignment you once did for your Service Engineering course…

… calls are answered by 14 agents, the average handling time being 4 minutes. Normally the call volume is 180 calls per hour.

Start out with the 4CallCenter's *Performance Profiler*.

1. **(Solved)** Use the M/M/N model (no features) to answer the following questions:

   a. Use *Performance Profiler* to determine what are the average speed of answer, agents occupancy and P{Wait > 0} under the current call volume (180) ?
   b. Use *Advanced Profiling* to record the change in the average speed of answer and agent's occupancy as the call volume gradually increases from 180 to 210 calls per hour (test at least 4 values). Can you explain the phenomenon you encounter in terms of the underlying Markov process? (stability…)

2. **(Submit)** Continue your analysis using the M/M/N+M model (i.e. the Erlang-C model with the addition of exponential abandonment). (Press the *Settings* button and select the "*abandons*" feature).

   a. Set the average patience parameter to a value that seems reasonable (keep in mind that the average handling time is 4 minutes). What value have you selected?

   b. Repeat Question 1 and compare the results. What are the "positive" side-effects of abandonment?

   c. How do you expect the following performance indicators to change (increase/decrease) as the average patience parameter increases?
      I. % Abandoned
      II. Average Speed of Answer (which accounts *only* for served customers, excluding those who abandoned)
      III. Average queue length
      IV. Agent's occupancy
      Test this with values of average patience ranging over 30, 60, 90, 150, 300, 450, 600 seconds (with the "normal" call volume of 180 calls per hour).

d. How about the "fraction answered within 1.2 minutes (70 sec)"? Try and give a qualitative explanation to the phenomenon that you observe.
Hint: the customers that were not answered within 1.2 minutes fall into 2 separate categories. First determine those categories and then calculate the performance measures values for different values of patience (test at least 10 values between 10-600 seconds). Comment your findings.

e. The Average Speed of Answer (ASA) is a common "service measure", meaning that it is frequently regarded as a performance "score" given to the call center, which is constantly monitored. Staffing levels are planned so as to meet given "service goals", which include ASA. Use 2c to argue against the use of ASA as an exclusive "service goal". (In light of 2c, how could you improve your call center's ASA?).

For the purpose of this homework, assume from here on that average patience is 2 minutes. In practice, average patience is higher, typically about 1-2 average service time.

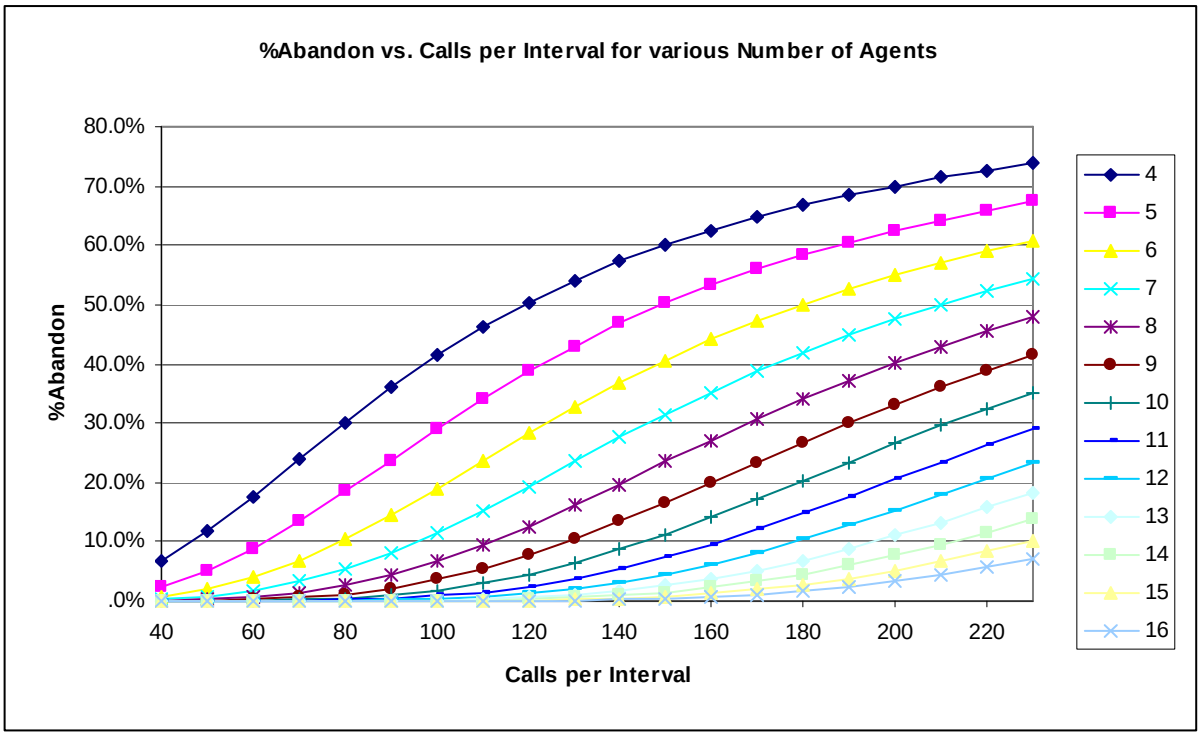
f. Repeat 2c but now vary the average handling time (use the same range 30-600 seconds as with patience). Variations of which parameter (patience or handling time) has a greater impact on performance?

g. Check what happens at the call center when there is a surge of calls which is double or triple the normal call volume (i.e. 360 or 540 calls per hour). Give a description of how "bad" things get, based on your results.

h. To maintain the original (i.e. with the "normal" call volume) fraction of abandoned calls even when these surges occur, do you need more or less than double/triple the original number of agents? (use the *Staffing Query*). What could be the reason for this?

3. (Submit) Let us assume now that employing every agent costs $12 per hour of work. Also, the marketing department claims that each abandonment costs 1.5$. What is the optimal number of agents, assuming that the call volume is 500 per hour? Repeat this question for call volume varying between 800-2600 (use jumps of 300). Plot the optimal staffing and the corresponding probability to abandon as a function of the call volume. Do you see any patterns? Assume that average patience is 2 minutes.

4. **(Submit)** In our lecture on the Erlang-A Queue, we present the following example of Congestion Curves. (See the figure below.) We assume the average handling time is 4 minutes and average patience is 6:00 minutes. The basic interval is equal to 1 hour.



Reproduce these curves (via the *Advanced Profiling* and *Graph* options). Then, produce 4 additional congestion curves where you change only the Y-axis to be: Agents' Availability, Average Speed of Answer (ASA), Average Time in Queue and, finally, the Fraction of Calls that were Answered Immediately.

Submit the 5 congestion curves with your assignment. In addition, use them to answer the following 2 questions:

- How many agents are needed to ensure less than 30% waits (call volume is 180 calls per hour)?
- What is then ASA and what fraction of time do you expect the agents to be idle?

Technicalities:

Here are some technical instructions and information concerning the assignment.

1. Software:

   To perform the analysis and various calculations required in this assignment you will use the **4CallCenters** software. You will be using tools that determine a call centers performance ("Performance Profiler", "Advanced Profiling"), determine system parameters required to meet certain goals ("Advanced Queries") and help set the staffing levels needed to meet performance goals ("Staffing Query"). Also, you will be able to perform "What-If Analysis" on various parameters and create graphs to display these results. 4CallCenters tools support various queueing models from the basic Erlang-C to models including abandons, blocking and overflows.

   Here's how you get started:

   a.1 If you are working on a computer that allows software installation then just go to:
   http://iew3.technion.ac.il/serveng/4CallCenters/Downloads.htm
   and follow the installation instruction there.

   a.2 If installation is blocked, you can still work with 4CallCenters having done the following:
   1. Create a folder named 4CC and download the zip file into it.
   2. Extract the zip file into the folder 4CC. You will see a list of 3 files, one of which is called CCC.CAB.
   3. CCC.CAB is also an extractable file. Extract it to the folder 4CC using WinZip.
   4. The folder 4CC should now contain a file named CCC.exe. Double click on this file to activate the software.

   b. 4CallCenters has basic instructions appearing in the header of each tool and additional more detailed "Help." 4CallCenters can export results to Excel or Access files and plot various types of graphs. Note that 4CallCenters has an "Indicators" setting (under *Settings->Indicators*) determining which performance indicators are visible - you might need to change these settings for the assignment.

2. General:

   a. Keep your answers short and clear.
   b. Unless stated otherwise, you should present your analysis results in either tables or graphs - try selecting only the more important/interesting performance indicators. In most cases, you have the freedom to choose the format that seems clearest to you. Using a spreadsheet is necessary.
   c. While working on the assignments, any questions or problems should be addressed to

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