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# Server Allocation in a Call Centre


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One of the most crucial tasks for running a call centre is to decide the right level of staffing. This is because if a call centre is understaffed, it will lead to a bad customer experience, and if a call centre is overstaffed, it will not be as profitable. However, deciding the right level of staffing is difficult because the number of calls that will be received is uncertain, as is how long each call will take. Our objective is to find the most efficient method of assigning these calls to the available agents such that the service level targets are achieved while keeping the staffing requirement to a minimum.


## Introduction

In many call centres, customer queries are of different levels of complexity and each one needs to be assigned to an agent with the appropriate skill level. When a call arrives, based on the caller's initial input (determined by the Interactive Voice Response (IVR) unit), they are directed to a suitable agent. Some agents are multi-skilled and can solve more than one type of query. In such cases, there are multiple ways of allocating incoming calls to the available agents which can lead to a difference in the performance level of a call centre.

We consider a scenario where the complexity of the calls can be divided into four levels - 1, 2, 3 and 4. We have a fixed number of agents available to take these calls. The agent skill sets are also divided into four levels. An agent at level $i$ can take any call at a level less than or equal to $i$. Figure 1 shows a flowchart of the model.

## Procedure

We assume Poisson arrivals, exponentially distributed service time and exponentially distributed customer patience for incoming calls. We run simulations of call arrivals over a 45 minute interval, which includes the arrival and service times for each call, the patience time of each caller, and the complexity level of each call. We model three different methods of assigning calls to the available agent. For each of the three methods we, using our simulated data set, assign the calls to a fixed number of agents with two agents at level 1, 2 and 3 each and one agent at level 4 and calculate some performance measures of interest to find which method works the best.

The performance measures we compute include proportion of callers who abandon the call, proportion of callers who wait more than 30 seconds to get served and average speed of answer (ASA). These quantities are important as call centres have to meet certain service standards such as serving at least 90% of the calls within 30 seconds.

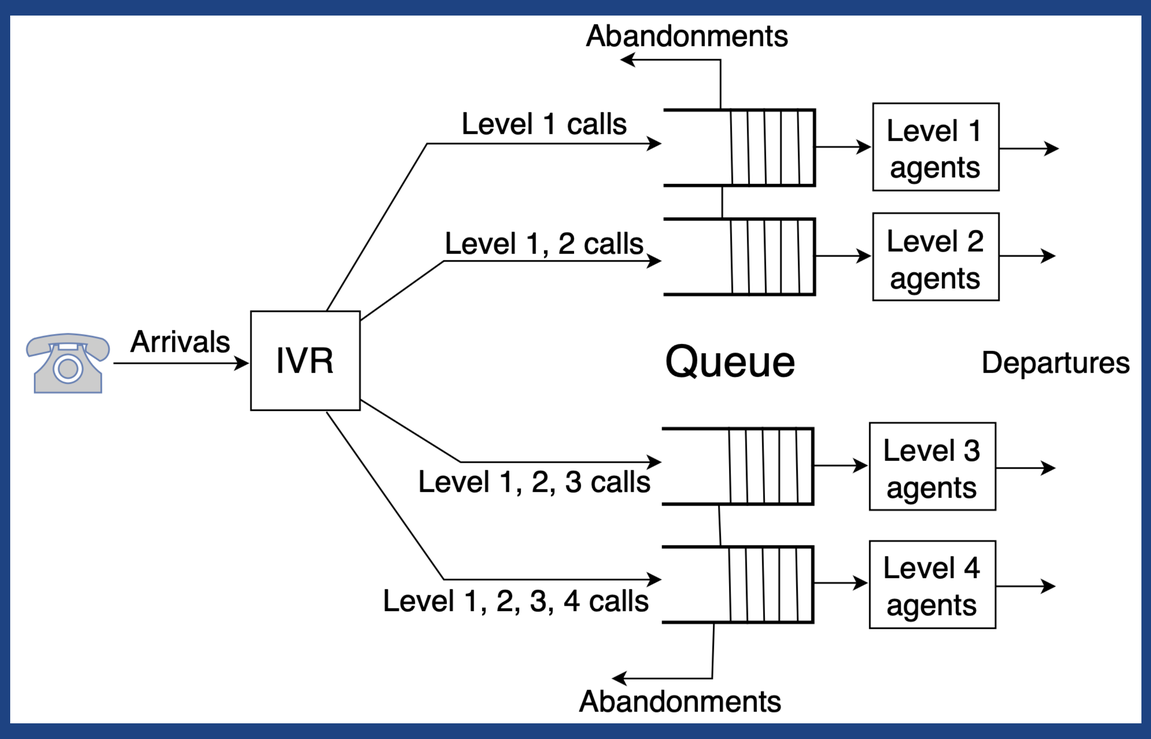


**Figure 1:** Queueing model for the call centre system.

## Methods of Allocation

- **Strict Assign** - When a call arrives, we only assign it to one of the free agents at the same level as the call. If a call is in waiting, it is assigned to the agent who becomes free the earliest and is at the same level as the call (given that the caller has not abandoned by then). For example, a level 2 call can only be assigned to a level 2 agent whether arriving or waiting.
- **Call Priority Assign** - When a call arrives, we assign it to an agent who is at the minimum level out of those available and capable of taking the call. For example, if a level 2 call arrives and level 3 and 4 agents are available, then the call is assigned to a level 3 agent. If a call is in waiting, it is assigned to the agent who becomes free the earliest and is capable of taking the call (given that the caller has not abandoned by then).
- **Agent Priority Assign** - When a call arrives, we assign it to an agent who is at the minimum level out of those available and capable of taking the call. If calls are in waiting and an agent becomes free, the agent is given the highest level call he is capable of attending to out of those who are in waiting (irrespective of the order they arrived in, that is, not first-come-first-served (FCFS)). For example, say three calls at levels 2, 4 and 3, (which arrived in this order), are waiting, and that an agent of level 4 became free, then the level 4 call will be assigned to the agent; if the level 4 caller has already abandoned, then the level 3 call will be assigned and so on.

## Results

We observe in Table 1 that on average 29.7% of callers abandoned the queue in the case of the Strict Assign method reflecting its poor performance when compared to the other two methods with 18.9% and 18.7% of average call abandonment. In terms of ASA, the Agent Priority method performed the best with an average speed of 14.49 seconds. It also has the lowest average proportion of people who waited for more than 30 seconds reflecting the consistency of the method. The Call Priority method has similar performance and is also FCFS which is often a requirement for call centres. As expected the Strict Assign policy performs the worst because it does not take advantage of multi-skilled agents and works like four separate call centres.

| | Stric Assign | Call Priority | Agent Priority |
|---|---|---|---|
| Abandonment proportion | 0.297 | 0.189 | 0.187 |
| Proportion waited > 30s | 0.139 | 0.125 | 0.121 |
| ASA (in seconds) | 22.06 | 14.775 | 14.493 |

**Table 1:** Performance measures for the three methods averaged over 500 runs.

## Further research

The project has various other prospects such as improving the prediction accuracy of the number of calls in any given interval, finding suitable distributions for the above model that better fits the actual data, deriving optimisation results addressing a trade-off between cost and customer service, and preparing the allocation algorithm for a sudden surge in the call numbers on any given day.

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