CASE STUDY 2: RESOURCE OPTIMISATION IN SERVICE DESK

The Service Helpdesk, which I am a part of, plays a very crucial role in keeping the business IT systems up and running 24x7 by helping resolve any IT issues faced or attending to any requests raised by the employees. The Service Helpdesk Team is a group of IT Analysts who attend to the varying levels of demands within the business throughout the day.

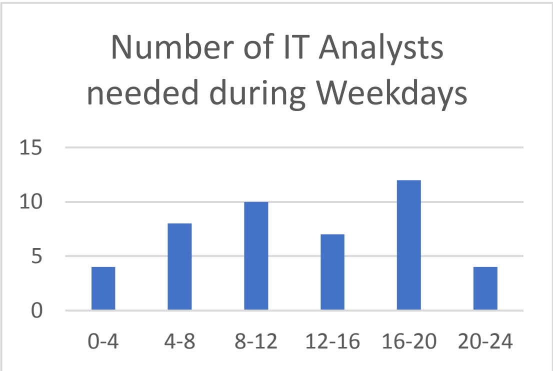
Each IT Analyst has an average capability to attend to 10 Service Helpdesk calls every 4 hours.

The number of IT analysts needed to keep the Service Helpdesk running varies from hour to hour and between weekdays and weekends. This case study is vaguely based on a bus station (Jensen, 2018) scheduling problem.

REQUIREMENT

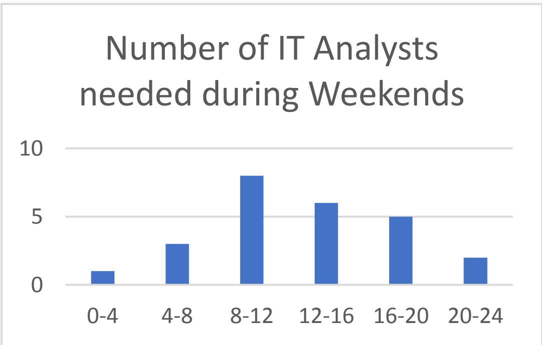
The table below lists calls raised during each time slot along with the number of analysts required (assuming every analyst can attend to an average of 10 calls in a 4-hour slot).

The requirements are different on weekdays and weekends. Tables and graphs showing both are given below.



Time Slot	Calls Raised	Number of IT Analysts needed
0-4	40	4
4-8	80	8
8-12	100	10
12-16	70	7
16-20	120	12
20-24	40	4

Figure 7: ServiceDesk Requirements during Weekdays



Time Slot	Calls Raised	Number of IT Analysts needed
0-4	10	1
4-8	30	3
8-12	80	8
12-16	60	6
16-20	50	5
20-24	20	2

Figure 8: ServiceDesk Requirements during Weekends

Time 0 represents midnight, and times are shown with a 24-hour clock format starting at midnight. For example, during weekdays, four IT analysts are required from midnight to 4 a.m., while eight analysts must be there from 4 a.m. until 8 a.m. To transform this into functional format for the constraints, analysts available in each timeslot will be a sum of analysts allocated for the current and previous timeslots. The assumption is that the requirements do not change within weekdays and within weekends.

Resource utilisation optimisation needs to be done along with reducing the cost to the business—which is determined by the pay for the analysts required during the 24-hour period. The IT analysts are paid according to the time slot when they start work on a day. Pay rates are the same irrespective of whether weekday or weekend. The table with the pay for the analysts are shown below.

Works starts at slot	Pay for next 8 hours work
0-4	£120
4-8	£105
8-12	£80
12-16	£90
16-20	£100
20-24	£110

Figure 9: IT analysts' pay rates

The problem is to determine how many analysts must be scheduled for each timeslot to cover the requirements for Service Help Desk during weekdays and weekends. IT Analysts work eight-hour shifts that start at times: 0, 4, 8, 12, 16 or 20. For example, an analyst starting at time 0 can attend to calls from time 0 to 8. An analyst scheduled to start at time 20 works for the final four hours of the day and the first four hours of the next day. The goal is to minimize the number of analysts needed. Note that, although an analyst may be scheduled to work for an eight-hour period, there is no requirement that he/she will be needed for the entire period. He/she might be idle for a four-hour interval within the period.

One feasible solution to this problem is to schedule maximum analysts required during each 8-hour time period. For example, during weekdays, 8 analysts at time 0, 10 analysts at time 8, and 12 analysts at time 16. This solution will cover all the requirements and use a total of 30 analysts with a total cost of *£2960*. The actual problem is to find the smallest number of analysts which will bring down the expense (their pay) to the minimum by taking into consideration the differing pay rates throughout the day as well.

METHOD

Linear Programming lends itself very well to this situation and helps to optimise the number of analysts needed also while maintaining the costs to the business at the minimum.

We need constraints that assure that the analysts scheduled at the times that cover the requirements of a specific interval sum to the number required. For the interval from time 0 to 4, analysts starting at time 20 of the previous day and time 0 of the current day cover the needs from time 0 to time 4 as they are running on 8-hour shifts.

a. Weekday Resource Optimisation:

Time	0	4	8	12	16	20			
Constraints									
Analysts starting at 0 + Analysts starting at 4	1	1					0.00	>=	8
Analysts starting at 4 + Analysts starting at 8		1	1				0.00	>=	10
Analysts starting at 8 + Analysts starting at 12			1	1			0.00	>=	7
Analysts starting at 12 + Analysts starting at 16				1	1		0.00	>=	12
Analysts starting at 16 + Analysts starting at 20					1	1	0.00	>=	4
Analysts starting at 20 + Analysts starting at 0	1					1	0.00	>=	4

Figure 10: Excel Table with Constraints

Transform the constraints into linear functions:

Add the pay rates to the table:

Time	0	4	8	12	16	20			
Pay (daily)	120	105	80	90	100	110			
Analysts Required	0	0	0	0	0	0			
Constraints									
Analysts starting at 0 + Analysts starting at 4	1	1					0.00	>=	8
Analysts starting at 4 + Analysts starting at 8		1	1				0.00	>=	10
Analysts starting at 8 + Analysts starting at 12			1	1			0.00	>=	7
Analysts starting at 12 + Analysts starting at 16				1	1		0.00	>=	12
Analysts starting at 16 + Analysts starting at 20					1	1	0.00	>=	4
Analysts starting at 20 + Analysts starting at 0	1					1	0.00	>=	4

Figure 11: Excel Table with Variables and Constraints

Set the objective as expense minimisation, variable cells as the analysts required at the different timeslots and add the constraints.

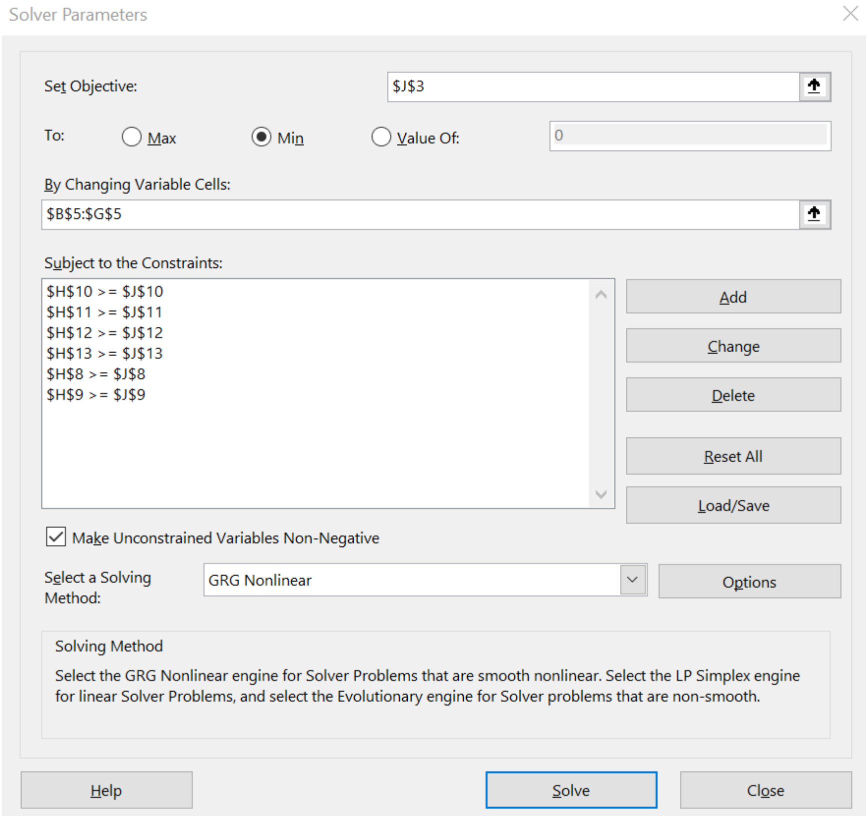


Figure 12: Solver Dialog Box with Variables, Constraints and Objectives

Run solver to get the optimised number of analysts required during the 4-hour timeslots in weekdays. This provides the following Total Expense.

									Total Expense
Time	0	4	8	12	16	20			2500.00
Pay (daily)	120	105	80	90	100	110			
Analysts Required	4	4	6	8	4	0			
Constraints									
Analysts starting at 0 + Analysts starting at 4	1	1					8.00	>=	8
Analysts starting at 4 + Analysts starting at 8		1	1				10.00	>=	10
Analysts starting at 8 + Analysts starting at 12			1	1			14.00	>=	7
Analysts starting at 12 + Analysts starting at 16				1	1		12.00	>=	12
Analysts starting at 16 + Analysts starting at 20					1	1	4.00	>=	4
Analysts starting at 20 + Analysts starting at 0	1					1	4.00	>=	4

Figure 13: Excel Table with Optimised Scheduling with Minimum Expense

This shows no analysts are required to start work at 20:00 because it's more efficient (cheaper) to allow the analysts at 16:00 to cover those four hours.

b. **Weekend Resource Optimisation:**

Transform the constraints into linear functions:

Time	0	4	8	12	16	20			
Analysts starting at 0 + Analysts starting at 4	1	1					0.00	>=	3
Analysts starting at 4 + Analysts starting at 8		1	1				0.00	>=	8
Analysts starting at 8 + Analysts starting at 12			1	1			0.00	>=	6
Analysts starting at 12 + Analysts starting at 16				1	1		0.00	>=	5
Analysts starting at 16 + Analysts starting at 20					1	1	0.00	>=	2
Analysts starting at 20 + Analysts starting at 0	1					1	0.00	>=	1

Figure 14: Excel Table with Constraints

Add the pay rates to the table:

Time	0	4	8	12	16	20			
Pay (daily)	120	105	80	90	100	110			
Analysts Required	0	0	0	0	0	0			
Constraints									
Analysts starting at 0 + Analysts starting at 4	1	1					0.00	>=	3
Analysts starting at 4 + Analysts starting at 8		1	1				0.00	>=	8
Analysts starting at 8 + Analysts starting at 12			1	1			0.00	>=	6
Analysts starting at 12 + Analysts starting at 16				1	1		0.00	>=	5
Analysts starting at 16 + Analysts starting at 20					1	1	0.00	>=	2
Analysts starting at 20 + Analysts starting at 0	1					1	0.00	>=	1

Figure 15: Excel Table with Variables and Constraints

Set the objective as expense minimisation, variable cells as the analysts required at the different timeslots and add the constraints.

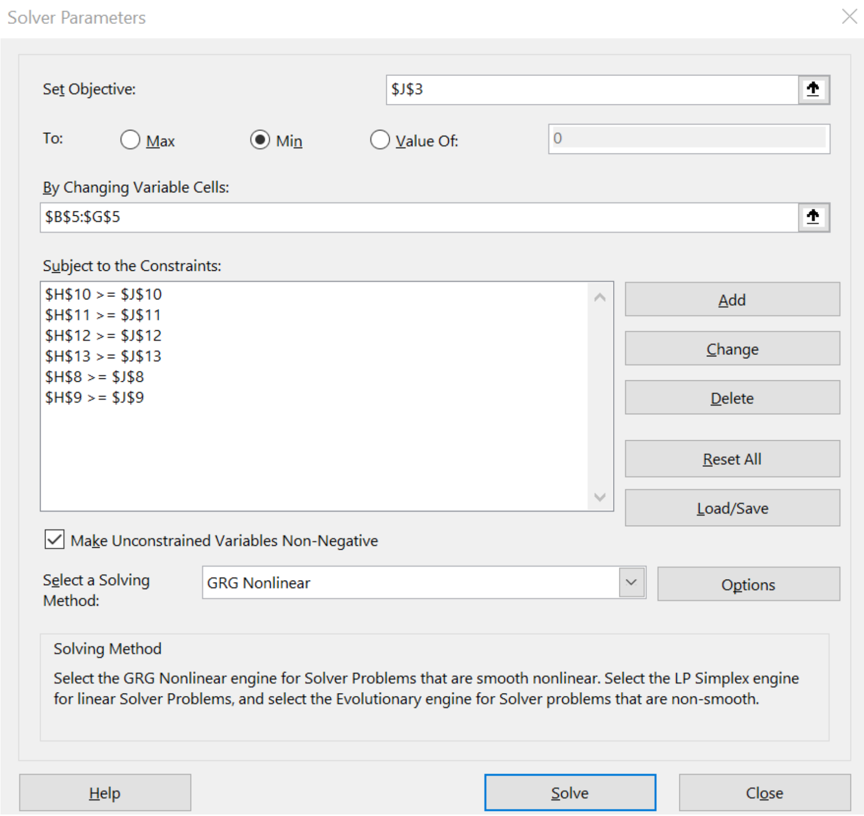


Figure 16: Solver Dialog Box with Variables, Constraints and Objectives

Run solver to get the optimised number of analysts required during the 4-hour timeslots in the weekends.

This provides the following Total Expense:

									Total Expense
Time	0	4	8	12	16	20			1280.00
Pay (daily)	120	105	80	90	100	110			
Analysts Required	1	2	6	3	2	0			
Constraints									
Analysts starting at 0 + Analysts starting at 4	1	1					3.00	>=	3
Analysts starting at 4 + Analysts starting at 8		1	1				8.00	>=	8
Analysts starting at 8 + Analysts starting at 12			1	1			9.00	>=	6
Analysts starting at 12 + Analysts starting at 16				1	1		5.00	>=	5
Analysts starting at 16 + Analysts starting at 20					1	1	2.00	>=	2
Analysts starting at 20 + Analysts starting at 0	1					1	1.00	>=	1

Figure 17: Excel Table with Optimised Scheduling with Minimum Expense

This shows no analysts are required to start work at 20:00 because it's more efficient (cheaper) to allow the analysts at 16:00 to cover those four hours.

RESULT

Using solver, the resource optimisation in the ServiceDesk gives the following numbers:

- Number of Analysts required on weekdays:
    - 0-4 hours : 4
    - 4-8 hours : 4
    - 8-12hours : 6
    - 12-16 hours : 8
    - 16-20 hours : 4
    - 20-24 hours : 0
- Number of Analysts required on weekends:
    - 0-4 hours : 1
    - 4-8 hours : 2
    - 8-12hours : 6
    - 12-16 hours : 3
    - 16-20 hours : 2
    - 20-24 hours : 0

This scheduling pattern brings the cost to the business down to **£2500 per day** during weekdays and **£1280 per day** during weekends.