Business Case Study Report Staff Planning

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Problem Statement

• An insurance company InsurePlus wants help with finding the optimal number of staff that they need for their insurance application approval process for the calendar year 2021.

• The company operates in three locations and employs both internal and outsourcing to fulfil the demands

• Certain constraints and parameter data are provided for the case study.

• The pyomo library in python is used to find optimal solution for the problem of the case study to find the optimal number of Full Time Equivalent and the number of applications to be outsourced.

Actual Scenario

Staff availability

States	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
A	81%	76%	75%	80%	78%	73%	68%	76%	81%	73%	68%	65%
B	81%	76%	75%	80%	78%	73%	68%	76%	81%	73%	68%	65%
C	81%	76%	75%	80%	78%	73%	68%	76%	81%	73%	68%	65%

Results obtained upon optimisation:

Total cost for the company for processing the application = **17.96 million $**
Average FTE and outsourced applications per Month for each Location:

State	Average FTE per month	Average applications outsourced per Month
A	122.39	370
B	88.97	905
C	45.77	454
Total	85.71	576

Percentage of outsourced applications = **18.31 %**

Average cost per Application = **158.55 $**

Worst Scenario (Minimum staff availability)

Minimum & Maximum bounds of Staff availability:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lower Bound	70%	65%	70%	75%	70%	65%	60%	65%	70%	65%	60%	60%
Upper Bound	90%	85%	80%	85%	85%	85%	80%	75%	85%	90%	75%	70%

Results obtained upon optimisation:

Total cost for the company for processing the application = **19.59 million $**

Average FTE and outsourced applications per Month for each Location:

State	Average FTE per month	Average applications outsourced per Month
A	124.29	721
B	81.64	1432
C	24.17	1165
Total	76.17	1106

Percentage of outsourced applications = **35.14 %**

Average cost per Application = **173 $**

As we see here, due to low staff availability, the number of applications outsourced is almost double compared to the actual scenario. This increases the costs by around **1.6 million $**

Average Cost per application increased by **15 $**

Best Scenario (Maximum staff availability)

Minimum & Maximum bounds of Staff availability:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lower Bound	70%	65%	70%	75%	70%	65%	60%	65%	70%	65%	60%	60%
Upper Bound	90%	85%	80%	85%	85%	85%	80%	75%	85%	90%	75%	70%

Results obtained upon optimisation

Total cost for the company for processing the application = **16.52 million** $

Average FTE and outsourced applications per Month for each Location:

Percentage of outsourced applications = **4.11** %

Average cost per Application = **145.88** $

State	Average FTE per month	Average applications outsourced per Month
A	124.29	0
B	96.97	388
C	57.34	0
Total	92.87	129

As we see here, due to high staff availability, the number of applications outsourced is very less (**4** % only) compared to the actual scenario. This decreases the costs by around **1.4 million** $

Average Cost per application decreased by **13** $

Question 1

The company wants to know the optimised staffing recommendations for the business case described. Write the mathematical model for the deterministic optimisation problem. Define and explain your decision variables, objective function and the constraint. (Hint: Use months of the year as the model timeline).
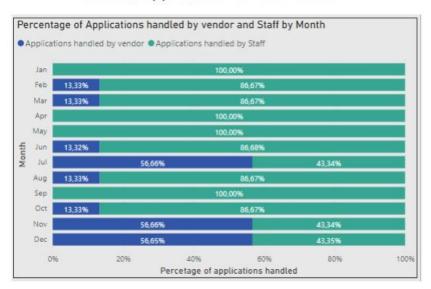
Answer:

- Indexes- Indexes for the optimisation problem are Location and Months. Let us name it as i,j respectively.
- Parameters- Following variables are the parameters in this optimisation problem:
  - Demand for insurance for the year per Location per Month - $D(i,j)$
  - Staff Availability per location per month - $S(i,j)$
  - Full Time Equivalent (FTE) salary per month for 2021 - $F(i,j)$
  - Outsourcing cost per application per location - $O(i,j)$
  - FTE application serving rate per month for 100% working, $F\_app\_serv = 40$
- Decision Variable
  - FTE per location per month, $X(i,j)$
  - Number of application outsourced per location per month, $Y(i,j)$

- Objective function:
  - The objective is to minimize the annual cost spent on full time employees + annual cost of outsourcing applications.
- Cost function = $\sum_i \sum_j X(i,j) \times F(i,j) + \sum_i \sum_j Y(i,j) \times O(i,j)$
- Constraints:
  - Total quantity of applications combining full time employees and outsourced ones should be equal to the demand for each location X(i,j) * S(i,j)* F_app_serv + Y(i,j) = D(i,j)
  - Regulatory constraints - Location A & B has regulatory constraints that the outsourced insurance applications cannot be more than 30% and 40% of the total number of applications for each month, respectively
    - Y(i, j) <= D(i,j) * 0.3 , $\forall$ i ='A' , j ∈ Months
    - Y(i, j) <= D(i,j) * 0.4 , $\forall$ i ='B' , j ∈ Months
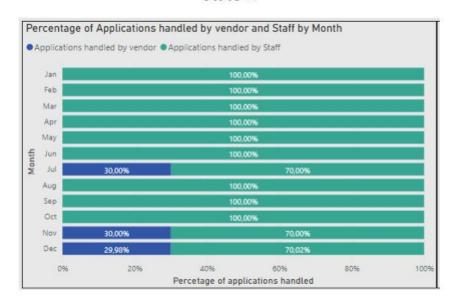 - Y(i,j) integer constraint
  - X(i,j)>0

Question 4

Use the solution of Q2 to create a stacked column chart that shows the percentage of applications processed by the staff and by the vendor for each month (%staff processed applications + %vendor processed applications should add up to 100%).
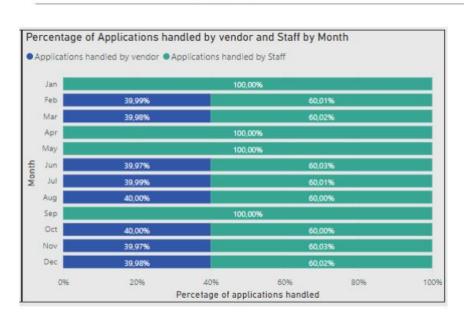
Overall- Applications of all 3 states

Percentage of Applications handled by vendor and Staff by Month

● Applications handled by vendor ● Applications handled by Staff

Month	Vendor	Staff
Jan		100,00%
Feb	13,33%	86,67%
Mar	13,33%	86,67%
Apr		100,00%
May		100,00%
Jun	13,32%	86,68%
Jul	56,66%	43,34%
Aug	13,33%	86,67%
Sep		100,00%
Oct	13,33%	86,67%
Nov	56,66%	43,34%
Dec	56,65%	43,35%

Percetage of applications handled

State A

Percentage of Applications handled by vendor and Staff by Month

● Applications handled by vendor ● Applications handled by Staff

Month	Vendor	Staff
Jan		100,00%
Feb		100,00%
Mar		100,00%
Apr		100,00%
May		100,00%
Jun		100,00%
Jul	30,00%	70,00%
Aug		100,00%
Sep		100,00%
Oct		100,00%
Nov	30,00%	70,00%
Dec	29,98%	70,02%

Percetage of applications handled

State B

State C

Percentage of Applications handled by vendor and Staff by Month

● Applications handled by vendor ● Applications handled by Staff

State B:

Month	Applications handled by vendor	Applications handled by Staff
Jan		100,00%
Feb	39,99%	60,01%
Mar	39,98%	60,02%
Apr		100,00%
May		100,00%
Jun	39,97%	60,03%
Jul	39,99%	60,01%
Aug	40,00%	60,00%
Sep		100,00%
Oct	40,00%	60,00%
Nov	39,97%	60,03%
Dec	39,98%	60,02%

Percetage of applications handled

Percentage of Applications handled by vendor and Staff by Month

● Applications handled by vendor ● Applications handled by Staff

State C:

Month	Applications handled
Jan	100,00%
Feb	100,00%
Mar	100,00%
Apr	100,00%
May	100,00%
Jun	100,00%
Jul	100,00%
Aug	100,00%
Sep	100,00%
Oct	100,00%
Nov	100,00%
Dec	100,00%

Percetage of applications handled

Month and Statewise comparison of FTE applications percentage v/s Outsourced applications percentage

Cost per Application with change in staff availability

Scenario	Cost per Application
Worst Scenario	173,00
Actual Scenario	158,55
Best Scenario	145,88

Total costs for application approval process with change in staff availability

100%

Scenario	Total Cost
Worst Scenario	$19,60M
Actual Scenario	$17,96M
Best Scenario	$16,53M

84,3%

Insight

- From the Best case and Worst case analysis we can conclude that, less the availability of staff which means more the percentage of outsourced applications, the company has to incur more cost.
- In Best case scenario the total cost decreased by **1.44 million** dollars while for worst case it increased by **1.63 million** dollars
- From the state wise analysis we see state A has the highest cost per application while state C has the lowest cost per application
- Also, we see that state A has the lowest percentage of outsourced applications as compared to other states