LUMS ATM Optimization

DISC 212-S1
GROUP 5

Problem

Students complain about inefficcient ATM's in LUMS:

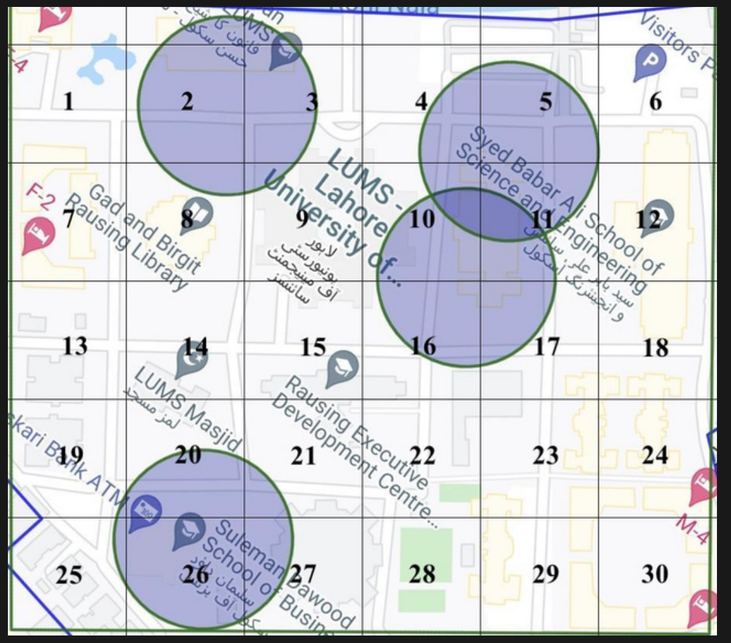
- Superstore ATM fixed timings
- Frequent traffic at PDC ATM
- SDSB and SAHSOL ATM's often underused and inconvinient.

Our model aims to place a new ATM in LUMS that would maximise utility while being optimally distant from existing ATM's

Data

1) MCLP model
2) Survey

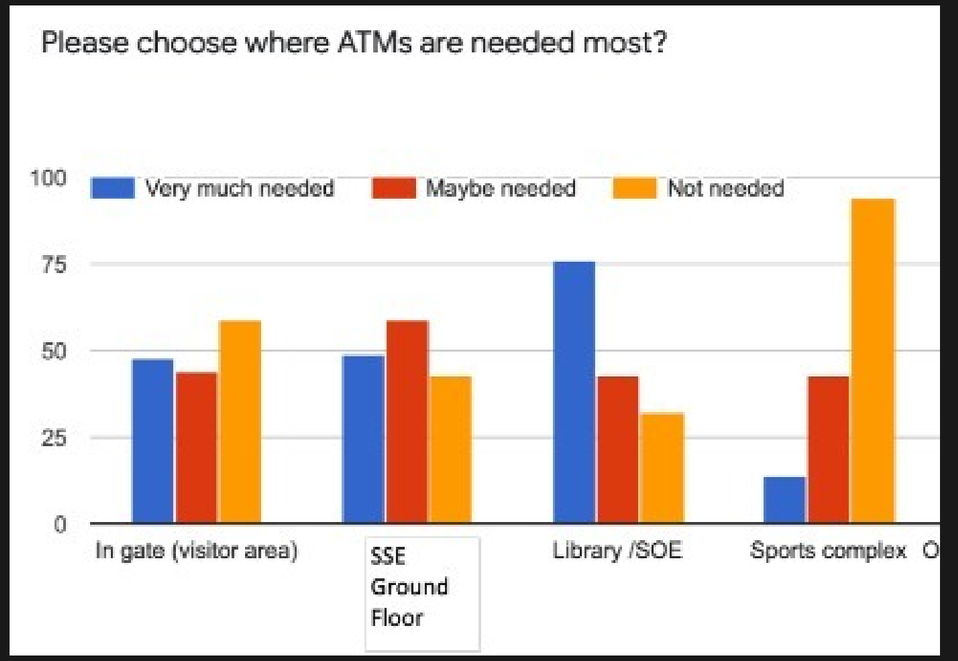
- 13 hotspots were identified where ATMs at LUMS did not exist, through an extensive survey
- With google maps, dimensions of the selected area were determined. It measures 460m x 420m
- A simplified grid of 30 boxes was created, which measures 84m x 76m respectively

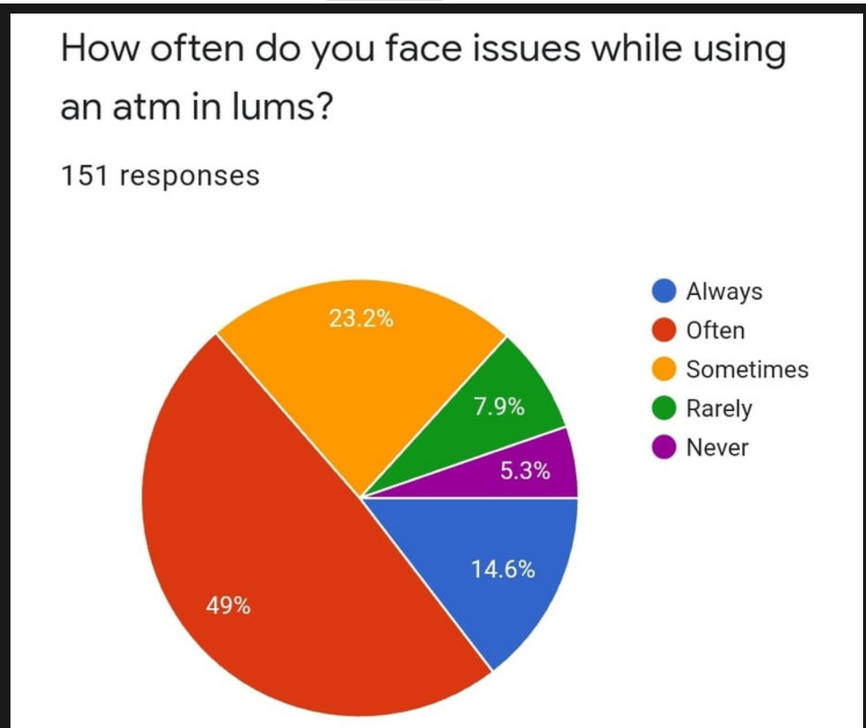


Data Analysis

Demand Criteria	
0.75	ATM Needed
0.25	Maybe Need
0	Not needed

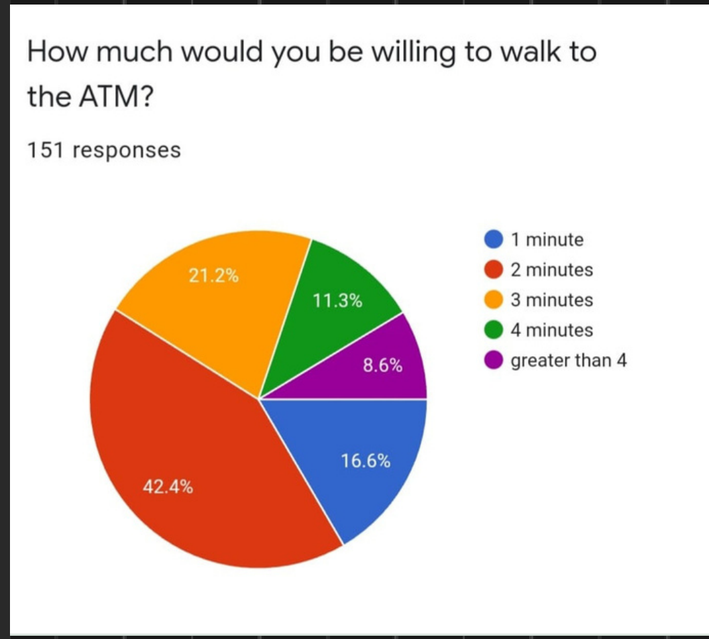
Demand from the surveys	
Female Hostel Enclosure	64.25
Out-gate	31.25
In-gate	47
Academic Blocl-Main Exit	30.25
Library	67.75
Academic Blocl-Library Exit	43.5
Academic Blocl-PDC Exit	33.25
SSE	51.5
Academic Blocl-REDC Exit	25.5
REDC	29
Sports Complex	21.25
Male Hostel Enclosure	61.5
M7	40.75





Assumptions

- LUMS and the Vendor equally bear the initial and monthly costs
- The additional cost of setting up an ATM outside building(s) is negligible
- The radius for a single atm to be 150m, considering the preferred walking time of 2 mins
- Hotspot spread in different nodes (grid boxes) - Demand is the same for such nodes (grid boxes)
- Demad is aggregated at the centre of each node (grid box)



Objective Function

MAX 64.25Y1 + 0Y2 + 30.25Y3 +30.25 Y4 +0Y5 . . . . + 61.5Y30

Y= NODE IDENTIFIED ON THE MAP

Decision Variables

Yi = 1 if grid box has an existing ATM

Yi = 0 if not

Xi = 1 if grid box is covered

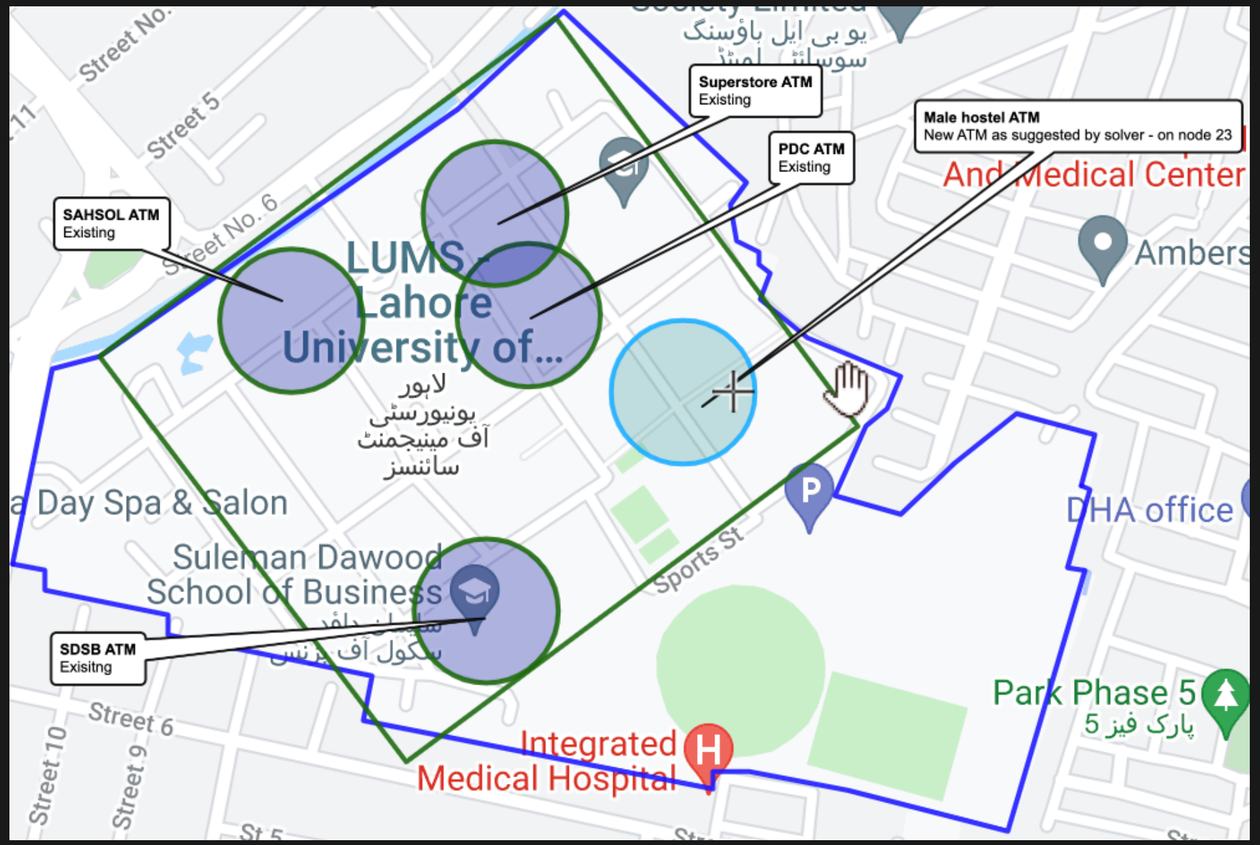
Xi = 0 if not

Constraints

- CONSTRAINTS FOR THE LOCATION OF ATM- NOT EQUIVALENT TO ZERO WITH EXISTING ATM'S
- MCLP CONSTRAINTS
- THE TOTAL NO. OF ATMS IS 5

Final Recommendation

Male-Hostel -1
Y23
61.5
1



Placement of new ATM Outside Male hostel enclosure

= New ATM

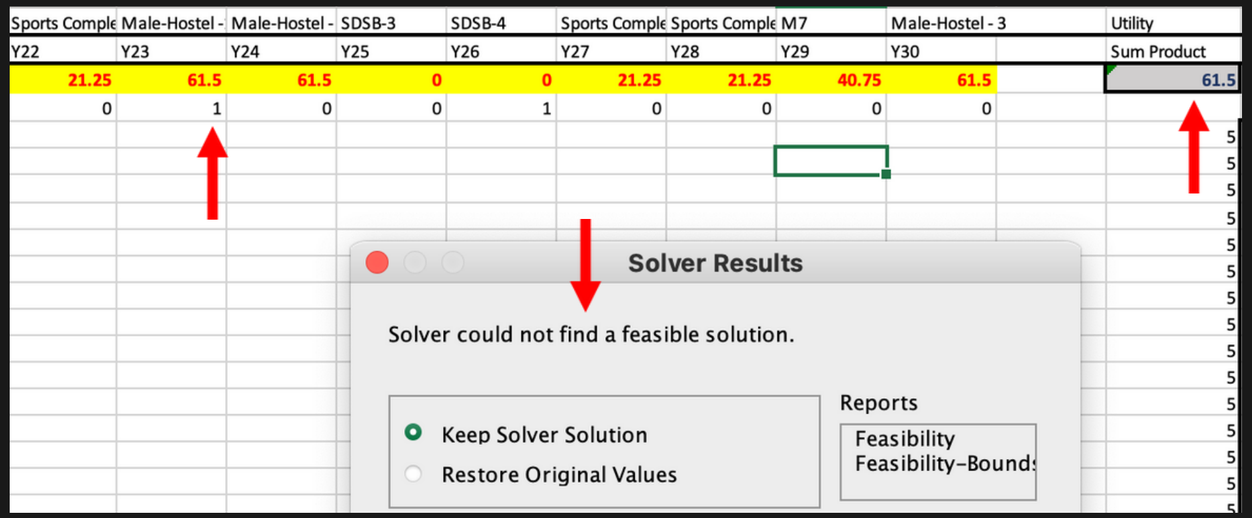
Insights

The solver initially gives us an unfeasible solution because the objective is to maximise utility while also taking into account the distance constraints put forth by the MCLP constraints.

This not only places it at a distance not overlapping with the existing ATMS, but also takes into account the maximisation of utilitly.

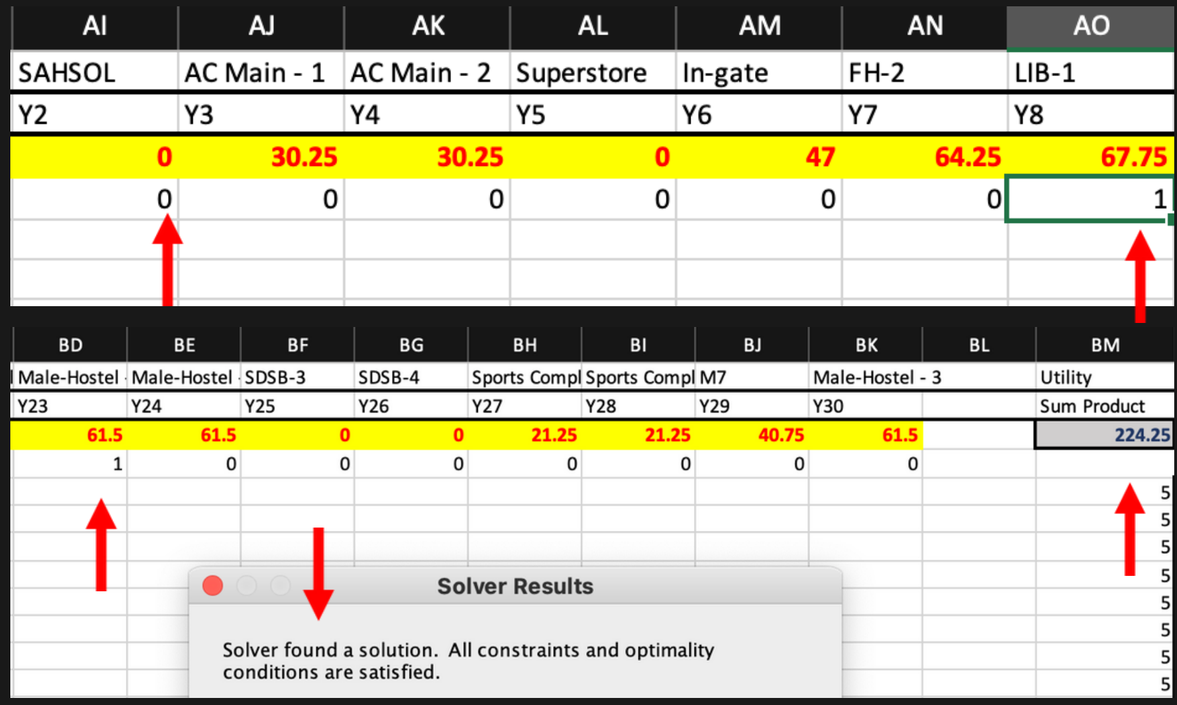
Solver then gives us the recommendation to place it in one of the boxes around the male hostel area.

Original Solution



The original answer in which solver displays infeasible solution since the existing units (ATM's) are fixed in the MCLP model. Investment is fixed with cost of one additional ATM. (Solver adds additional ATM to Male Hostel node)

Alternate Solution



The alternate answer in which solver displays feasible solution in which existing units (ATM's) can be moved around to maximise demand and coverage as shown in the optimal solution. Investment is not fixed with additional costs of relocating existing ATM's. (Solver relocates SAHSOL ATM to Library node and adds additional ATM to Male Hostel node)