OMM500N - Assignment 1 – Problem 1

Upgrading a Fleet of School Buses

Part One. Background

St.Louis city wants to upgrade their school bus with some constraints, and we're gonna maximize the result under this circumanstance.

Part Two. Problem Statement

0)   Assumptions

One driver per car -> maximum 450 drivers -> 450 cars

best use of the allocation' -> maximize seating capacity with new type buses

1)   Variables

X_a – new type A's amount

X_c – new type C's amount

X_{old} – old buses

2)   Objective Function

Max $50*X_c + 25*X_a + 0*X_{old}$

3)   Constriants

Money: $70000*X_c + 50000*X_a <= 10$ millions

AFE: $(8*X_c + 10*X_a + 5*X_{old}) >= 6*(X_c+X_a+X_{old})$

Driver amounts: $X_a + X_c + X_{old} <= 450$

Old buses amount: $X_{old} <= 400$

Total seating capacity: $50*X_c + 25*X_a + 50*X_{old} >= 20000$

Non-negativity

4) Solver:

Linear or Nonlinear solver can both complete the work.

Part Three. Result and Recommendation

1) Result

			Type C	Type A	Old bus	
1	Upgrading Buses					
2						
3	**PARAMETERS**					
4			*Type C*	*Type A*	Old bus	
5		**Purchase Cost**	70,000	50,000	0	
6		MPG	8	10	5	
7		**Seating Capacity**	50	25	50	
8						
9	**DECISION VARIABLES**					
10			*TypeC*	*Type A*	*old bus*	
11		Purchase Amounts[cars]	143	0	257	
12						
13	**OBJECTIVE**					
14		Seating capacity by new buses	7,142.857143	*maximize*		
15						
16						
17	**CONSTRAINTS**					
18			**LHS**		**RHS**	
19		Driver Amounts	400	<=	450	
20		Total Seating Capacity	20,000	>=	20,000	
21		money	10,000,000	<=	10,000,000	
22		AFE(with computation transform)	2,429	>=	2,400	
23		Old Bus amount	257	<=	400	
24		Non-negativity				
25						

Buying 143 new type C, and retain 257 old buses, this can provide 7142 seats under upgraded buses and satisfying all constraints.

2) Recommendation:

Budget is not enough for all students to have themselves in new buses.

Under this circumstance, new Type C bus is much preferred than new Type A bus.