MGS411 Group Homework:

Generating an Optimal Car Design:

An automobile manufacturer has conducted a customer study for designing a new vehicle. Three issues were found to be most influential in determining which vehicle is purchased: fuel types, transmission types, and model type. Listed below is the part-worth for each level for each characteristic, as perceived by 7 potential vehicle buyer groups. Part- worth should be 50 or more for each customer group, in order to obtain the group purchasing preferences.

Use BIP to help select a winning vehicle (i.e. one that maximizes sales of the vehicle).

	Fuel Type			**Transmission**		**Model**	
Category	Gasoline	Diesel	Hybrid	Hand	Auto	Sedan	SUV
Taxi Drivers	5	26	20	18	11	17	10
Soccer Moms	18	11	5	12	16	15	26
Office Employ	4	16	22	7	13	11	19
Workers	12	8	4	18	9	22	14
Retirees	19	9	3	4	14	30	19
Younger	6	15	21	8	17	20	11
Upper Income	9	6	3	13	5	16	28

Include in the Objective Function the number of members represented by each category (i.e. you can assume there are 150 Taxi Drivers, 200 Soccer Moms, etc.). These may be used as coefficients of the BIP variables. You can also use percentages. Notice that an individual can belong to more than one category (e.g. an upper income and a retiree).

If you want to change the labels of the categories, this is fine. You can also exchange values within one group of columns to make the category more realistic (e.g. for the category of Upper Income you can use6, 3, 9 in lieu of 9, 6, 3, etc.)

Set up the equations for this BIP, following the examples in the PPT and pages 337+ and solve it using the software of your choice. Prepare a short report with your recommendations. BTW, all these ratings are fictitious. The actual application is not.

Results:

Group 4 Results 11/15/2012

Optimal Design

Category		# of members	Fuel Type			Transmission		Model	
			Gasoline	Diesel	Hybrid	Hand	Auto	Sedan	SUV
			y11	y21	y31	y12	y22	y13	y23
Taxi Drivers	X1	100	5	26	20	18	11	17	10
Soccer Moms	X2	225	18	11	5	12	16	15	26
Office Employ	X3	125	4	16	22	7	13	11	19
Workers	X4	150	12	8	4	18	9	22	14
Retirees	X5	200	19	9	3	4	14	30	19
Younger	X6	175	6	15	21	8	17	20	11
Upper Income	X7	250	9	6	3	13	5	16	28
	Tot	1225							

Let yij= 1 if level I is chosen for attribute j, 0 otherwise
Let Xk= 1 if customer group k favors the design, 0 otherwise

Objective Function: Maximize Customer Support
max 100X1+ 225X2 + 125X3 + 150X4 + 200X5 + 175X6 + 250X7

Value 475

X1	X2	X3	X4	X5	X6	X7	y11	y21	y31	y12
1	0	0	0	1	1	0	0	1	0	0

S.T.	5y11 + 26y21 + 20y31 + 18y12 + 11y22 + 17y13 + 10y23 - 50X1	>=	1
Constraints:	18y11 + 11y21 + 5y31 + 12y12 + 16y22 + 15y13 + 26y23 - 50X2	>=	1
	4y11 + 16y21 + 22y31 + 7y12 + 13y22 + 11y13 + 19y23 - 50X3	>=	1
	12y11 + 8y21 + 4y31 + 18y12 + 9y22 + 22y13 + 14y23 - 50X4	>=	1
	19y11 + 9y21 + 3y31 + 4y12 + 14y22 + 30y13 + 19y23 - 50X5	>=	1
	6y11 + 15y21 + 21y31 + 8y12 + 17y22 + 20y13 + 11y23 - 50X6	>=	1
	9y11 + 6y21 + 3y31 + 13y12 + 5y22 + 16y13 + 28y23 - 50X7	>=	1
	y11 + y21 + y31	=	1
	y12 + y22	=	1
	y13 + y23	=	1

X1, X2, X3, X4, X5, X6, X7	=	0,1
y11, y21, y31, y12, y22, y13, y23	=	0,1

4	>=	1
42	>=	1
40	>=	1
39	>=	1
3	>=	1
2	>=	1
27	>=	1
1	=	1
1	=	1
1	=	1

The optimal solution has X1= X5= X6= 1. This indicates that customer categories 1, 5, and 6 will support this design.

Total Customers: 475 **Percent:** 38.78

The optimal solution has y21= y22= y13= 1. This indicates that such vehicle design: diesel, automatic transmission and sedan, will maximize customer group purchases.