Exercises - Section 1: Lecture 3 – Binary Modeling with Truth Tables - Questions

For each of the following constraints, write the truth table to either demonstrate that the math and gurobipy match the English, or show where the math and gurobipy don't match the English. The variables for these constraints are defined as follows:

English	Math	gurobipy

For each of the features in the data set, is the feature used in a logistic regression model? (1=yes, 0=no)	x_j	`import gurobipy as gp`
		`from gurobipy import GRB`
		
		`m = gp.Model()`
		`x = m.addVars(J, type=GRB.BINARY)`

1.

English	Math	Gurobipy
Either feature 6 or feature 11 (or both) must be used.	$x_6 + x_{11} \geq 1$	`m.addConstr(x[6] + x[11] >= 1)`

Truth table:

2.

English	Math	gurobipy
At least two of features 4, 6, and 11 must be used.	$x_4 + x_6 + x_{11} \geq 2$	`m.addConstr(x[4] + x[6] + x[11] >= 2)`

Truth table:

3.

English	Math	gurobipy
Feature 4, and either feature 6 or feature 11 (or both), must be used.	$x_4 + x_6 + x_{11} \geq 2$	`m.addConstr(x[4] + x[6] + x[11] >= 2)`

Truth table:

4.

English	Math	gurobipy
Feature 4, and either feature 6 or feature 11 (or both), must be used.	$2x_4 + x_6 + x_{11} \geq 3$	`m.addConstr(2 * x[4] + x[6] + x[11] >= 3)`

Truth table:

5.

English	Math	gurobipy
Feature 4, and either feature 6 or feature 11 (or both), must be used.	$2x_4 + x_6 + x_{11} \geq 4$	`m.addConstr(2 * x[4] + x[6] + x[11] >= 4)`

Truth table:

6.

English	Math	gurobipy
If feature 4 is not used, then either feature 6 or feature 11 (or both), must be used.	$x_4 + x_6 + x_{11} \geq 1$	`m.addConstr(x[4] + x[6] + x[11] >= 1)`

For each of the following truth tables, write the corresponding constraint in English, math, and gurobipy. The variables for these constraints are defined as follows:

English	Math	gurobipy
For each of the features in the data set, is the feature used in a logistic regression model? (1=yes, 0=no)	x_j	`x = m.addVars(J, vtype=GRB.BINARY)`

7. **Truth table:**

x_2	x_3	$x_2 + x_3$	Outcome
0	0	0	True
0	1	1	True
1	0	1	True
1	1	2	False

English	Math	gurobipy

8. **Truth table:**

x_1	x_2	x_3	$-x_1 + 2x_2 - x_3$	**Outcome**
0	0	0	0	False
0	0	1	-1	False
0	1	0	2	True
0	1	1	1	True
1	0	0	-1	False
1	0	1	-2	False
1	1	0	1	True
1	1	1	0	False

English	**Math**	**gurobipy**

9. **Truth table:**

x_1	x_2	x_3	$-x_1 + 2x_2 - x_3$	**Outcome**
0	0	0	0	True
0	0	1	-1	False
0	1	0	2	False
0	1	1	1	False
1	0	0	-1	False
1	0	1	-2	False
1	1	0	1	False
1	1	1	0	True

English	**Math**	**gurobipy**

10. **Truth table:**

x_2	x_3	**Outcome**
0	0	False
0	1	True
1	0	True
1	1	False

English	Math	gurobipy

11. **Truth table:**

x_1	x_2	x_3	Outcome
0	0	0	False
0	0	1	False
0	1	0	False
0	1	1	True
1	0	0	False
1	0	1	True
1	1	0	True
1	1	1	True

English	Math	gurobipy

12. **Truth table:**

x_1	x_2	x_3	Outcome
0	0	0	False
0	0	1	True
0	1	0	True
0	1	1	True
1	0	0	False
1	0	1	False
1	1	0	False
1	1	1	True

English	Math	gurobipy

NOTES: