Exercises - Section 4: Lecture 11 - Notation Subscripts Summations – Part 1

Traditionally, optimization experts use letters at the beginning of the alphabet to denote data – things that the optimization model can't suggest changes to, like the cost of purchasing a raw material or the forecasted demand for a product. The tradition for variables is to start with *x*, *y*, and *z*, and then go back to *w* and work backwards.

I'm not sure exactly where the tradition came from, but by now this is what we're stuck with – so let's go ahead and embrace it!

[Note, though, that there are exceptions. For example, some modelers use letters that match what's being modeled – for example, P for price, C for cost, T for temperature, etc. You can use whatever you want, as long as you clearly define the terms.]

Suppose we have the following notation for a rental car fleet planning model:

DESCRIPTION	MATH	GUROBIPY
Forecasted rental demand for small cars (forecasted data)	A	A (typically declared with a value, e.g., A = 10, or read from a file)
Forecasted rental demand for midsize cars (forecasted data)	B	B
Forecasted rental demand for luxury cars (forecasted data)	C	C
Forecasted rental demand for SUVs (forecasted data)	D	D
Forecasted rental demand for minivans (forecasted data)	E	E
Cost per small car (known data)	F	F
Cost per midsize car (known data)	G	G
Cost per luxury car (known data)	H	H
Cost per SUV (known data)	I	I
Cost per minivan (known data)	J	J
Number of small cars to purchase (variable)	X	X = model.addVar(name = 'X')
Number of midsize cars to purchase (variable)	Y	Y = model.addVar(name = 'Y')
Number of luxury cars to purchase (variable)	Z	Z = model.addVar(name = 'Z')
Number of SUVs to purchase (variable)	W	W = model.addVar(name = 'W')
Number of minivans to purchase (variable)	V	V = model.addVar(name = 'V')

Fill in the table below, using the notation above to describe each of the following quantities mathematically and in Python.

QUESTION	MATH	GUROBIPY
1. Forecasted rental demand for luxury cars		
2. Forecasted rental demand for SUVs		
3. Cost per SUV		
4. Number of small cars to purchase		
5. Forecasted demand for midsize cars and minivans		
6. Forecasted rental demand for cars (not SUVs or minivans)		
7. Total cars to purchase above midsize		
8. Total vehicles to purchase		
9. Cost of midsize cars purchased		
10. Cost of SUVs purchased		
11. Cost of midsize cars and minivans purchased		
12. Cost of SUVs and minivans		
13. Cost of all cars (not SUVs or minivans) purchased		
14. Cost of all vehicles purchased		
15. Forecasted purchase cost per rental of SUVs		
16. Forecasted purchase cost per rental of minivans		
17. Average purchase cost over all SUVs and minivans		
18. Average purchase cost of all cars (not SUVs or minivans)		
19. Forecasted purchase cost per rental over all cars (not SUVs or minivans)		
20. Forecasted purchase cost per rental over all vehicles		

NOTES: