

Please state all your assumptions and show all your work. Define your decision variables clearly. Briefly explain your constraints and objective functions. Define all units of measure (e.g., hours, \$, \$/hour, etc.) Explain what software package you used (e.g., LINDO, LINGO, EXCEL solver, etc.) For EXCEL solver, be sure to give a separate statement of the formulation /input. Use an equation editor for the equations. If you cannot get one, then use subscripts to indicate indexing. Graphs should be detailed and easy to read.

Question

A University of China professor will be spending a short sabbatical leave at the University of Iceland. She wishes to bring all needed items with her on the airplane. After collecting the professional items that she must have, she finds that airline regulations on space and weight for checked luggage will severely limit the clothes she can take. (She plans to carry on a warm coat and then purchase a warm Icelandic sweater upon arriving in Iceland). Clothes under consideration for checked luggage include 3 skirts, 3 slacks, 4 tops and 3 dresses. The professor wants to maximize the number of outfits she will have in Iceland (including the special dress she will wear on the airplane). Each dress constitutes an outfit. Other outfit consists of a combination of a top and either a skirt or slacks. However, certain combinations are not fashionable and so will not qualify as an outfit.

In the following table, the combinations that will make an outfit are marked with an x.

	Top 1	Top 2	Top 3	Top 4	Iceland Sweater
Skirt 1	x	x			x
Skirt 2	x			x	
Skirt 3		x	x	x	x
Slacks 1	x		x		
Slacks 2	x	x		x	x
Slacks 3			x	x	x

The weight (in grams) and volume (in cubic centimeters) of each item are shown in the following table:

	Weight (grams)	Volume (cm ³)
Skirt 1	600	5,000
Skirt 2	450	3,500
Skirt 3	700	3,000
Slacks 1	600	3,500
Slacks 2	550	6,000
Slacks 3	500	4,000
Top 1	350	4,000
Top 2	300	3,500
Top 3	300	3,000
Top 4	450	5,000
Dress 1	600	6,000
Dress 2	700	5,000
Dress 3	800	4,000
Total allowed	4,000	32,000

Formulate a BIP model that would help her choose which items of clothing to take. (Hint: After using binary decision variables to represent the individual items, you should introduce auxiliary binary variables to represent outfits involving combinations of items. Then use constraints and the objective function to ensure that these auxiliary variables have the correct values, given the values of the decision variables.)