(Bangalore) Your hometown is Bangalore, India. And you applied for graduate course in Business Analytics at Arizona State University recently and got admit for Fall 2020. The course starts on Aug 22, 2020, so you have booked your flight tickets and started packing your bags with excitement. You are very thrilled about moving to the US. But are also worried that you might not get your favorite food items and snacks in the US. Your mom suggests that you should carry a lot of home-made snacks so you will have enough Indian food during your stay in the US. And she also cooked 5 different food items for you. One of the ASU MSBA Alumni told you that Data Science and Analytics Books are usually costly in the US and that you must buy them from India and take it to the US. Meanwhile, you also shopped a lot of new clothes as you are moving to the US. You also must carry your electronics such as laptop, iPad, hard disk, power bank, mobile phone, etc. which are mandatory for the course. But you realized that the airlines allow only bag of 23 kg weight per passenger. So, you must fit everything you want to carry into this 45kg bag.

You are wondering how to prioritize what items should you carry with you to the US and what to leave behind. Interestingly, you come up with a strategy to categorize all the items into 3 categories.

1. Things that are not available in the US and must be carried from India only.
2. Things that are available in the US, but they are very costly. So, you would prefer carrying them from India.
3. Any other things that are available in the US for the same price or cheaper than in India

Every category has an importance factor assigned to it. Category 1 items have higher importance than category 2 items, and category 2 items have higher importance than category 3 items.

Weight of each item in kilograms and importance level of each item are available in the file P06\_41.xlsx



**Discussion: -**

Our objective is to decide which items should be carried in the bag which gives you more benefit. There are two decision variables that are binary. One is to decide whether we pack that item or not, and second is to decide how many of those items to pack. 1 means we are packing the item, 0 means we are not packing the item. When we decide whether we are carrying the item or not, we can calculate the total value of the items you are considering packing. Here, our objective is to maximize the value and make sure you the weight of the items which you are carrying fits in the bag.

**Mathematical Model: -**

*Parameters (Inputs):*

$i ϵ 1,2,3,4 \left( i: Index for items\right), iϵ \{Books, Snacks, Electronics, Clothes\}$

$C\_{i} : Importance level of each item \{ C\_{1} :2, C\_{2} :3, C\_{3} :1, C\_{4} :1\} $

$$W\_{i} : Weight of item i \{ W\_{1} 0.8, W\_{2} :1.5,W\_{3} 1.3, W\_{2} :0.8\}$$

$$W : Maximum Weight an airline allows;W=45 Kgs$$

*Min i : Minimum number of each item to pack*

*Max i : Maximum number of each item to pack*

*Decision Variables:*

$$x\_{i} :Decision on whether carrying item i or not$$

$$y\_{i} :Number of items of item i$$

*Objective:*

$$Maximize total value=\sum\_{i=1}^{4}\left(x\_{i}\*y\_{i}\*C\_{i}\*W\_{i}\right)$$

*Constraints:*

$$\sum\_{i=1}^{4}\left(x\_{i}\*y\_{i}\*W\_{i}\right)\leq W ; \left(1\right) Max weight an airline allows$$

*Min i <=* $(x\_{i}\*y\_{i})$ *<= Max i for all i (2) Number of items constraint*

$$ x\_{i}ϵ\left\{0,1\right\} \left(3\right) Binary Constraint$$

*yi* $ϵ$ *Integer (4) Integer Constraint*

*Excel Implementation:* Please find the attached spreadsheet for solution.

