

Practice Exercises: **Optimization Models (I)**

For each exercise below, create a model in Excel and use Solver to find solutions. The data for some of the exercises are available in the accompanying Excel file.

1. Product Mix / Production Planning

Samson Electronics manufactures three types of personal devices: the Smartphone, the TabletPro, and the Tablet. The wholesale price and manufacturing costs for each item are given below:

Wholesale Manufacturing		
<i>Product</i>	<i>Price</i>	<i>Cost</i>
Smartphone	\$300	\$150
TabletPro	\$180	\$80
Tablet	\$150	\$70

Each Smartphone requires three hours of assembly; each TabletPro requires two hours of assembly; and a Tablet requires one hour of assembly. The marketing department has indicated that it can sell no more than 150,000 Smartphones, 100,000 TabletPros, and 90,000 Tablets. However, the demand is expected to be at least 50,000 units of each item, and Samson wants to meet this demand. The company has 400,000 hours of assembly time available.

- a) Build a model to help decide what the company should produce to maximize profits.
- b) In addition to maximizing profits, the company would like to keep total manufacturing cost to a minimum for budgetary reasons. Can you modify your model to address this concern?

2. Transportation and Logistics

A small winery can produce an exclusive wine at its two vineyards: it can produce 3500 bottles at a cost of 23 F per bottle at the Malpas vineyard, and 3100 bottles for 25 F each at the Peyrous vineyard. (Editors' note: as of this writing, our wine grower remains stubborn about reasoning in French Francs.)

Four fine restaurants around the country are interested in purchasing this wine. Because the wine is exclusive, they all want to buy as much as they need but will take whatever they can get. The maximum amounts required by the restaurants and the prices they are willing to pay are summarized below:

Restaurant	Maximum demand	Price
l'Ardoise Salée	1,800 bottles	69 F
chez Bogusse	2,300 bottles	67 F
la Cour d'Argent	1,250 bottles	70 F
Deumaigres	1,750 bottles	66 F

The costs of shipping a bottle from the vineyards to the restaurants are summarized below:

Vineyard	Restaurant			
	A	B	C	D
Malpas	7 F	8 F	13 F	9 F
Peyrous	12 F	6 F	8 F	7 F

The winery needs to determine the production and shipping plan that allows it to maximize its profit.

3. Scheduling

Maintenance at a major theme park is an on-going process that occurs 24 hours a day. Because it is a long commute from most residential areas to the park, employees do not like to work shifts of fewer than eight hours. These 8-hour shifts start every four hours throughout the day. The number of maintenance workers needed at different times throughout the day varies. The following table summarizes the minimum number of employees needed in each 4-hour period.

Time Period	Employees needed
12am - 4am	90
4am - 8am	215
8am - 12pm	250
12pm - 4pm	165
4pm - 8pm	300
8pm - 12am	125

The maintenance supervisor wants to determine the minimum number of employees to schedule that meets the minimum staffing requirements. Create a spreadsheet model for this problem and solve it using Solver.

4. Pairs Matching (aka the “Assignment Problem”)

As a manager at Information & Decision Systems (IDS) Consulting, Vijay must staff five new projects. He has identified five consultants, Ahmed, Bruno, Christelle, Diego, and Eric, that could lead any of the jobs.

There are advantages and disadvantages to various assignments of the consultants to the projects. Among the issues to consider are:

- matching the consultants’ areas of expertise with specific issues in a project;
- the time the project will require and the other demands on each consultant during this time;
- the preferences of each consultant for the different projects.

After exploring alternative pairings of individuals and projects, Vijay feels that he is running in circles. So, he decides to be more systematic in his approach, and starts by estimating a relative cost to the organization of assigning each consultant to each project, attempting to keep all the above factors in mind. After a few iterations, Vijay comes up with a table of costs and he feels satisfied that these numbers properly reflect the essential considerations.

Using the cost data shown in the following table, formulate an optimization model to determine the best matching of individuals with the projects.

Assignment costs for each consultant/project combination

<i>Consultant</i>	<i>Project</i>				
	I	II	III	IV	V
Ahmed	24	10	21	11	16
Bruno	14	22	10	15	15
Christelle	15	17	12	20	14
Diego	11	19	14	13	13
Eric	23	13	13	18	12