Operations Research, Spring 2015
Case Study 1

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In this case study, you revisit Mikasa's order allocation problem (and the given data) described in Homework 0.

1 Your task

Please work on the following problems. All the four problems are independent.

1. (10 points) Mikasa recently learned Linear Programming. Before she tries to apply Linear Programming to help her solve the problem, she wants to do a practice by solving Problem 1b in Homework 1. Please use AMPL to solve that problem and find an optimal solution. Do not forget to interpret your solution and make a managerial suggestion. Decouple the data from the model.

2. (30 points; 15 points each) Suppose that there is no order splitting cost. Moreover, the revenue of an order can be proportionally collected based on the ratio of total delivered quantity to the total demanded quantity. For example, if order 1 is allocated to Fab 1 for 2000 units of item 4 and to Fab 2 for 5000 units of item 10, then IEDO can collect $\$5500 \times \frac{2000+5000}{2000+3000+5000} = \$4400$ as the sales revenue.

    (a) Formulate a mathematical LP that solves the (modified) planning problem.

    (b) Solve the (modified) problem by AMPL. Decouple the data from the model.

3. (30 points; 15 points each) Suppose that Eren has determined the following order allocation:

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	Fab 1	Fab 2	Fab 3	Fab 4	Fab 5	Fab 6	Fab 7	Fab 8
Order 1	x	x						
Order 2		x	x					
Order 3			x	x	x		x	
Order 4				x	x		x	x
Order 6					x	x	x	
Order 10	x		x		x	x	x	x

That is, Order 1 is allocated to Fabs 1 and 2, Order 2 is allocated to Fabs 2 and 3, etc. He does not plan to work on orders 5, 7, 8, and 9. With the recently learned Linear Programming, Mikasa wants to know whether the allocation can really be done. If yes, Mikasa wants to minimize the total number of machine hours used (in all fabs) for finishing these orders.

(a) Formulate a mathematical LP that solves Mikasa's problem.

(b) Solve Mikasa's problem by AMPL. Decouple the data from the model.

4. (30 points) Design a method that embeds Linear Programming as its component to make a suggestion to Mikasa. Try to earn as much profit as possible.

   (a) (10 points) The points you earn in this problem is $10(\frac{z}{z^*})$, where z is your profit and $z^* = 50070$ is the maximum attainable profit.

   (b) (20 points) Describe the method you use. 20 points will be based on how logical your method is and how Linear Programming is embedded in your method. If you write a program to repeatedly invoke AMPL, clearly describe how that program works.

2 Submission rules

- **Things to submit.** Please put a hard copy of the work into the instructor's mailbox on the first floor of the Management Building 2. Limit your report to six pages, including everything. Please also send all your programs (including AMPL model/data files and other programs, if any) electronically to Amy Liu. Indicate the file names in the report.

- **Deadline.** The deadline of this homework (for both the report and files) is 2pm, April 7, 2015. Works submitted between 2pm and 3pm will get 10 points deducted as a penalty. Submissions later than 3pm will not be accepted.

- **Teams** Students may form teams to work on this case study. Each team can have at most three students. Each team should submit only one report. All team members must sign on the first page of the hard copy of the report. If one does not sign, she/he will get 10 points off as a penalty.