INTERNATIONAL UNIVERSITY OF JAPAN

Public Management and Policy Analysis Program
Graduate School of International Relations

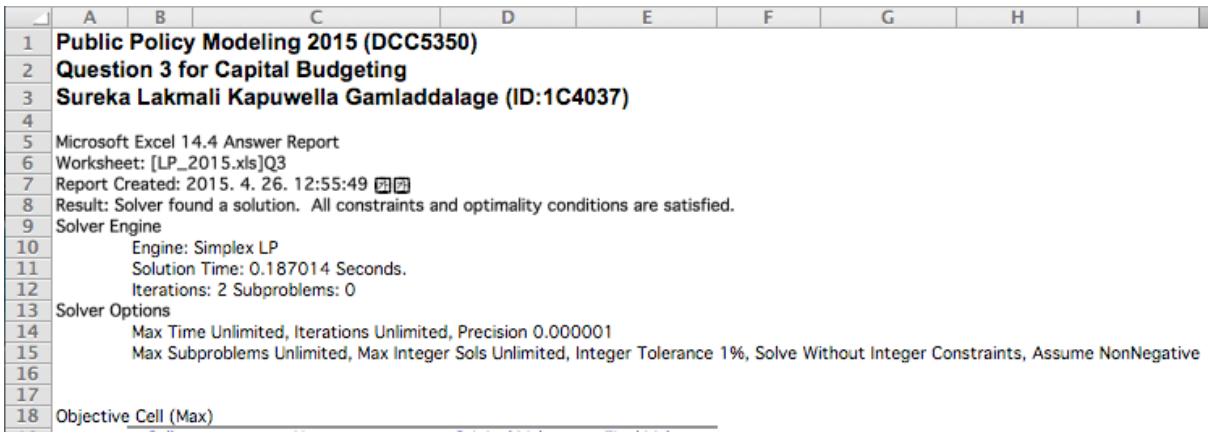
DCC5350 (2 Credits)
Public Policy Modeling
Spring 2016

Homework 3: Linear Programming (150 points)

Instruction: Please write down your student ID and name at the top of your answer. PLEASE handwrite. Submit your answer and hardcopies of your Excel worksheets to TA by 17:00 on Friday, May 6th. Pay special attention to the followings.

- When you are asked to report numbers (e.g., optimal solution, reduced costs, and shadow prices), you MUST MARK (circle) them on the printout of Excel worksheets and then HANDWRITE them DOWN on your answer sheet explicitly. Don't say, "Look at the printout or Excel worksheet." Your boss will hate this manner!
- When you report numbers, check and interpret the unit of measurement and scale you are using. For example, if you are using a unit of billion dollars and get the optimal solution of 2.5, you must say "2.5 billion dollars," not just "2.5."
- Substantive interpretation means that your interpretation should be sufficient and acceptable to those who don't know policy modeling concept and other jargons.
- Organize your answer in the ascending order (1, 2, …) and use single column. Show your calculation clearly; otherwise, you may not get full credits.
- You may not communicate (including written, verbal, gestural, any other communication) with others except for TAs and the instructor to do this homework. Collaboration (cheating) is NOT tolerable. Of course, you may ask TAs or other students for "technical help" for using Excel solver, not for solving questions.
- Do not wait until the last minute to do this homework.

Excel Worksheet Printing: When printing out your Excel worksheet, add four rows to the top of the worksheet and provide course title, question to be answered, student name, and id as shown in the following screenshot. Apply this rule to every worksheet (i.e., LP formulation worksheet, Answer Report worksheet, and Sensitivity Report worksheet). Then change Page Setup (check the option for row and column headings) so that row and column headings are also printed out.



	A	B	C	D	E	F	G	H	I
1	**Public Policy Modeling 2015 (DCC5350)**								
2	**Question 3 for Capital Budgeting**								
3	**Sureka Lakmali Kapuwella Gamladdalage (ID:1C4037)**								
4									
5	Microsoft Excel 14.4 Answer Report								
6	Worksheet: [LP_2015.xls]Q3								
7	Report Created: 2015. 4. 26. 12:55:49								
8	Result: Solver found a solution. All constraints and optimality conditions are satisfied.								
9	Solver Engine								
10		Engine: Simplex LP							
11		Solution Time: 0.187014 Seconds.							
12		Iterations: 2 Subproblems: 0							
13	Solver Options								
14		Max Time Unlimited, Iterations Unlimited, Precision 0.000001							
15		Max Subproblems Unlimited, Max Integer Sols Unlimited, Integer Tolerance 1%, Solve Without Integer Constraints, Assume NonNegative							
16									
17									
18	Objective Cell (Max)								

Question 1 (35 points). Read Question 2.20 on page 57-58 and solve *a* and *c* (not b).

Q 1.1 (10 Points) Solve *c*. You must define decision variables clearly.
Q 1.2 (10 Points) Check the unit of measurement in the objective function and constraints.
Q 1.3 (10 Points) Draw a feasible region and indicate the optimal solution as shown in Figure 2.7 on p.36. The figure should be large enough; do not draw a tiny one.
Q 1.4 (5 Points) Solve *a*. Print out the LP formulation worksheet and Answer Report and then report optimal solution and value (of objective function at the optimal solution). Don't forget to mark these figures on the Answer Report.

Question 2 (25 points). Read Question E*3.28 on page 112. Retail outlets are labeled as Tokyo (1), Nagano (2), Niigata (3), and Kumamoto (4), respectively.

Q 2.1 (15 Points) Formulate this LP problem. You must define decision variables clearly.
Q 2.2 (10 Points) Solve this problem using Excel Solver and attach the LP formulation worksheet and Answer Report. Report the optimal solution and optimal value.

Question 3 (90 points). Read Question 3.6 on page 106-107. The unit profit of product 3 turns out $10, not $25. The maximum hour of milling machine was changed from 500 to 550.

Q 3.1 (15 Points) Formulate this LP problem. You must define decision variables clearly.
Q 3.2 (5 Points) Check the unit of measurement in the objective function and constraints.
Q 3.3 (10 Points) Solve this problem using Excel Solver and attach the LP formulation worksheet, Answer Report, and Sensitivity Report.
Q 3.4 (5 Points) Report the optimal solution and optimal value. Again, don't forget to mark these figures on the Answer Report.
Q 3.5 (10 Points) Report allowable increase and decrease of the coefficient of product 2. Explain their meaning substantively.
Q 3.6 (10 Points) Report non-zero reduced cost and explain its meaning substantively.
Q 3.7 (5 Points) Report non-binding constraints and show how their slacks (or surplus) are calculated.
Q 3.8 (10 Points) Report the largest shadow price and explain its meaning substantively. Don't forget to use its allowable range in the explanation.
Q 3.9 (15 Points) Suppose the cost of increasing one milling machine hour per week is $2 and unit costs of lathe and grinder are $3 and $7, respectively. The company decided to invest up to $15 to increase available time. Given the result in 3.3, what would you suggest to the company? What is the maximum marginal profit that the company can get from investing $15? Show your calculation clearly (Ignore the digits below the decimal point in sensitivity analysis).
Q 3.10 (5 Points) Among certainty, divisibility, proportionality, additivity, and homogeneity, which assumption do you think is most problematic in this LP formulation? And why?

End of homework assignment 3.