

**INTERNATIONAL UNIVERSITY OF JAPAN**  
Public Management and Policy Analysis Program  
Graduate School of International Relations

**PHDC3501 (2 Credits)**  
**Advanced Public Policy Modeling**  
Spring 2018

**Midterm Exam (100 points)**

**Instruction:** Download the exam template from the course Web page. You **MUST ALWAYS** show necessary computation and your reasoning as clearly as possible. This is an open-book and open-notebook exam. However, you may not communicate (including written, verbal, gestural, any other communication) with others during the exam. Submit your answer by email by 17:00; you are given four hours for this exam.

**1. Policy Modeling (30 points)** An imaginary city hosts the annual Naked Couple Festival, which is similar to the Naked Man Festival of Minami Uonuma City (two cities are very similar in various respects). But only couples older than 15 are allowed to participate in this event. Couples should be neither husband and wife nor close relatives. Voluntary participants are clad in (wear) big and colorful nappies to hide their hips and breasts, of course. Due to the decent tradition and culture of the city, there has not been any gender crime or similar problem in the event for the past 1,000 years. The city has been famous for its lowest divorce rate and crime rate in the country. The 70 percent of the local economy depends on tourism including hot spring, sky resort, unique food, and cultural properties.

Recently, the mayor of the city found that (1) the number of couple participants has declined by 40 percent; (2) the number of tourists has declined by 30 percent; (3) the amount of sales during the event has decreased by 35 percent, but the portion of liquor and cigarette of the total sales has increased by 20 percent. As a special policy analyst invited by the mayor, you had to analyze recent festival issues and submit a memorandum to the mayor (decision maker). You found that many visitors are not pure tourists but those who are looking for something interesting regardless of the event. Not only female participants but ordinary visitors also felt appalling by the lustful gazes of such “unwelcome visitors,” who were oftentimes drinking and smoking heavily on the street. Some of them were arrested for drug use and/or violent behavior during the festival.

**1.1 (10 points)** What is your (mayor’s) public problem? How would you define it? You need to pick the most important factor (aspect) that can be the pinpoint of a policy problem.

**1.2 (10 points)** List at least four decision variables including their units of measurement. Explain how they influence outcomes (likely causal relationship).

**1.3 (5 points)** List at least four environment variables and outcome variables.

**1.4 (5 points)** List at least two criterion variables.

**2. LP Formulation (30 points).** An organization wants to maximize its profit by optimizing the number of four products (A-D) to be produced per day. Labor, metal, and wood are jointly used to product each product as shown in the following table. The company has 400 employees who are allowed to work up to 8 hours per day for 300 full-time workers and 6 hours per day for 100 part-time workers. Company’s daily availability of metal is 168 Kg and

84 Kg for wood (1 ounce = .028 Kg). Hourly wage is 880 yen for both full-time and part-time workers, unit cost of metal per ounce (oz) is 110 yen, and unit cost of wood per ounce is 220 yen (1 dollar = 110 Yen). The competitive market prices of product A through D are \$15, \$15, \$20, and \$30 as shown in the following table (all products are assumed to be sold at that price in the market). Market demand says that each product should not be produced more than 1,000 (EA). Formulate this LP problem algebraically. You must show your reasoning step by step to make it clear. You don't need to solve this LP problem and interpret the result.

	Product A	Product B	Product C	Product D
Labor (hour)	2	1	3	2
Metal (oz)	4	2	1	2
Wood (oz)	6	2	1	2
Unit price	\$15.00	\$15.00	\$20.00	\$30.00

**3. Read Q5.S1 on pages 180-181 (40 points).** As a special policy analyst, you report this LP result to the CEO of Stickley Furniture and are about to answer to following questions.

**3.1 (5 points)** Suppose the CEO really wants to produce 1 chair. How would you like to explain consequences of CEO's preference without running new LP? Include two types of interpretation of this sensitivity.

**3.2 (10 points)** The CEO asks, "What if I increase assemble resource by 900 minutes and finishing by 360 minutes at the same time?" Explain the consequence of such simultaneous changes without running new LP.

**3.3 (15 points)** The CEO considers three options to improve company's profit. Option 1 is to increase assembly resource by 900 minutes; option 2 is to increase finishing by 360 minutes; and option 3 is to reduce wood by 900 ounces (sell or not to purchase 900 ounces of wood in the market). The marginal cost of assembly minute is known to be \$2.00 and \$1.00 for finishing minute. The market price of wood is \$3.00 per ounce. Conduct a cost-benefit analysis and explain your suggestion to the CEO. The baseline is the current optimal solution.

**3.4 (10 points)** Evaluate the extent that each LP assumption is satisfied in this LP problem. Which one do you think most problematic? Is this LP formulation unrealistic?

*End of the midterm exam.*