平成 26 年度実施

東北大学大学院情報科学研究科

博士課程前期・入学試験問題(2015 年 3 月 3 日)

専門試験科目群第 7・社会科学群

専門科目　問題冊子

注意(Notices)

1. 設問から 3 問題を選択し、解答用紙に解答すること。
   Choose 3 from the 5 questions and write your answer on the answer sheet.
2. 1 つの問題につき 1 枚の解答用紙を使用すること(解答が複数枚にわたってもかまわないが、その場合には問題毎に用紙をかえること)。その際、各解答用紙の上部にある問題番号欄に、対応する問題番号を記入すること。
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Problem E–1 Let the utility function of consumers be $U(x_1, x_2) = 1 - e^{-x_1} - e^{-x_2}$, the price of good 1 be p and the price of good 2 be 1.

(1) Given income of I, derive the Marshallian demands (ordinary demends) for two goods and the indirect utility function $V(p, I)$.

(2) Given utility level u, derive the Hicksian demand function (compensated demand function). Find the expenditure function $M(p, u)$.

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Problem E–2 (1) Explain Zipf's law (or rank-size rule) and its application in the context of regional science.

(2) Explain the distinction between the "marketing" and "transport" principles in Christaller's central place theory. Drawing figures might be of help.

Problem E–3 Consider a closed economy that is completed with two countries and produces a single (composite) good. Then the system of output equations in physical units (e.g. tons or litters) for the inter-regional *physical* table can be written as follows:

$$\left.\begin{aligned} a_{11}x_1 + a_{12}x_2 + y_{11} + y_{12} &= x_1 \\ a_{21}x_1 + a_{22}x_2 + y_{21} + y_{22} &= x_2, \end{aligned}\right\}$$

where x_s and y_{rs} denote the output of country s and the amount of country r's product that is finally consumed in country s, respectively. a_{rs} represents the amount of country r's product that is required to produce one unit of good in country s, and let A denote the matrix composed from those physical input coefficients $\begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix}$.

(1) Given a_{rs} and y_{rs}, calculate the output x_1 of country 1. For the output system being economically meaningful, what characteristics the input coefficient matrix A should possess?

(2) Let p_r denote the price of good produced in country r. Then write the system of output equations in *monetary* terms by assuming that the transport costs between countries are negligible.

(3) For convenience, we call the currency of country 1 as "dollar", and that of country 2 as "Euro". Note that we have $p_1 = \mu p_2$ when 1 Euro is equivalent to μ dollars. Then provide the formula for the trade balance TB of country 1.

(4) When the exchange rate μ is determined so as to keep the balance of payments to zero, what terms should be added to TB obtained above?

Problem E–4 For function $f(x)$, let

$$\hat{f}(x) \equiv \frac{d \ln f(x)}{dx} = \frac{f'(x)}{f(x)}.$$

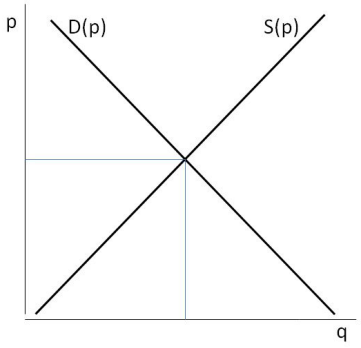
Given functions $f_1(x)$, $f_2(x)$,

(1) derive $\widehat{f_1 + f_2}$, $\widehat{f_1 f_2}$, $\widehat{\left(\frac{f_1}{f_2}\right)}$;

(2) calculate $\hat{g}(x)$, where $g(x)$ is the following determinant:

$$g(x) = \begin{vmatrix} f_1(x) & 6 & f_2(x) - f_1(x) \\ f_1(x) & -1 & 2f_2(x) - f_1(x) \\ f_1(x) & 3 & 3f_2(x) - f_1(x) \end{vmatrix}.$$

Problem E–5 The demand curve D and the supply curve S are generally depicted as the functions of price p as shown in the figure. Consider the following system of linear models:



$$\left.\begin{aligned} D &= \alpha_0 - \alpha_1 p + u \\ S &= \beta_0 + \beta_1 p + v, \end{aligned}\right\} \quad \ldots \quad \text{(a)}$$

where u and v are the disturbances in respective equations.

(1) Suppose the parameters in $q_t = \alpha_0 - \alpha_1 p_t + u_t$ are estimated from the time series data of demands q and prices p. The result can be called neither demand function nor supply function. Draw a figure to explain the reason.

(2) Regarding (a) as the simultaneous equations, and discuss their identification problem. Let g denote the number of endogenous variables in an equation, and k denote the number of system variables (both endogenous and exogenous) that are not appearing in that equation. Examine the order condition (= the necessary condition for the parameters being able to be estimated) for (a).

(Hint) When $k = g - 1$, an equation is called "just-identified".

(3) How the equations in (a) should be modified in order to properly estimate the demand and supply functions? Propose the modification that includes addition of appropriate variables.

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専門試験科目群第 7・社会科学群

問題 S-1

「役割」概念の社会学的意義について説明しなさい。

問題 S-2

現代の不平等に関する社会学的議論の例を挙げなさい。

問題 S-3

都市化の社会病理と指摘されている現象について例を挙げて説明しなさい。

問題 S-4

日本の高度経済成長期における農村の過疎問題について説明しなさい。

問題 S-5

近代家族と性別役割の関連について説明しなさい。