

試験科目名 Subject
科目名 地域・都市計画 (英文) Regional & Urban Planning

受験番号 Examinee's Number	M
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広島大学大学院先進理工系科学研究科（博士課程前期）入学試験問題（2026年4月入学）  
 Entrance Examination for Master's Course (April 2026 Enrollment),  
 Graduate School of Advanced Science and Engineering

<注意事項>

1) 日本語または英語のどちらで解答してもよい。

<Notice>

1) You can answer either in Japanese or English.

Answer all questions.

### Question 1.

Machine learning methods like neural networks have become increasingly popular in urban and transportation planning to analyze and predict people's decision-making. However, traditional theoretical models, such as random utility theory and relevant choice models, for decision-making analyses are considered equally useful for research. Explain the fundamental differences between the two methods. List several advantages and disadvantages for each of the two methods. Discuss the promising applications of the two methods by giving examples.

### Question 2.

Choice models are popularly applied to analyze individuals' preferences as represented by the estimated parameters. Normally, a linear utility function is specified by including a deterministic component and a random error term which follows certain distributions. Assuming a normal distribution for the error term, please answer the name of the model derived based on this assumption, and discuss what other models can be derived under different distributions (give at least one example).

### Question 3

In the case of mode choice analysis between car and bus, someone estimated the model parameters and obtained the following results,  $\beta_{car}(TT) = -0.175$ ,  $\beta_{car}(TC) = -0.02$ ,  $\beta_{PT}(TT) = -0.035$ , and  $\beta_{PT}(TC) = -0.01$ ,

$$V(car) = 0.256 - 0.175 * TT - 0.02 * TC$$

$$V(bus) = -0.035 * TT - 0.01 * TC$$

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TT: travel time, unit: minute

TC: travel cost, unit: JPY

V(): utility function

where  $\beta$  represents the marginal utility parameters associated with each attribute.

Explain the meaning of the constant in the car utility function. Calculate the value of time for both car users and public transport users using the unit of JPY/hour. Discuss the indications of the calculated value of time in combination with practice or society.

試験科目名 Subject
科目名 交通工学  (英文) Transportation Engineering

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Please choose two out of the following four questions.

Question 1:

(1) Explain the concept of negative externalities in the context of private car use, and provide examples relevant to urban transportation systems.

(2) Explain why providing car users with the shortest route based solely on individual travel time may lead to undesirable outcomes from a system-wide perspective.

Question 2:

Name one type of new mobility service and explain three advantages and three disadvantages. Your answer should consider efficiency, equity, and externalities.

Question 3:

Suppose that individuals choose among car, bus, and rail for commuting trips. Travel time, travel cost, and access distance differ across modes.

(1) Write down a discrete choice model for mode choice. You do not need to specify a likelihood function.

(2) Explain the role of the explanatory variables in your model. You may introduce additional variables if you consider them important.

(3) Briefly discuss one or two limitations of your model.

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Question 4:

Consider the road network shown in Figure 1. There are 36 commuters traveling from the Residential area (origin) to the Central Business District (CBD) (destination).

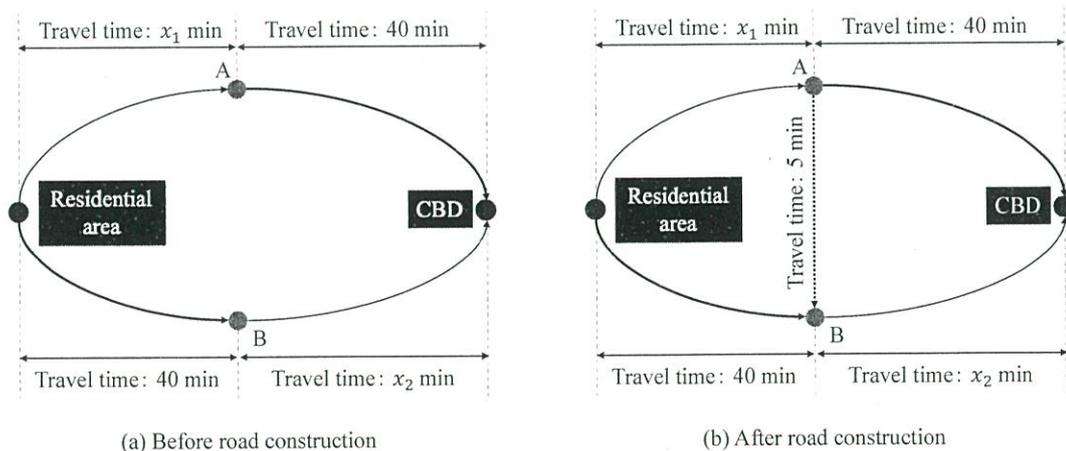
Travel times are defined as follows:

- The travel time on the link [Residential area  $\rightarrow$  A] is  $x_1$  minutes.
- The travel time on the link [B  $\rightarrow$  CBD] is  $x_2$  minutes.
- All other links have constant travel times (40 minutes).
- Here,  $x$  denotes the number of commuters using that link.

In scenario (a), the network is as shown in Figure 1(a) (before construction). In scenario (b), a new link connecting A and B is added as shown in Figure 1(b) (after construction), with a travel time of 5 minutes. Assume that commuters are identical and non-cooperative, and that each commuter chooses a route that minimizes his or her own travel time. A user equilibrium (Wardrop equilibrium) is a flow pattern in which all used routes have equal and minimal travel times, and no commuter can reduce travel time by unilaterally switching routes.

Answer the following:

- (1) Compute the user-equilibrium route flows and the equilibrium travel time under Scenario (a).
- (2) Compute the user-equilibrium route flows and the equilibrium travel time under Scenario (b).
- (3) Determine whether the road construction in scenario (b) improves social welfare. Explain your answer using an appropriate criterion (e.g., total system travel time).



Note:  $x_1$  and  $x_2$  denote the numbers of commuters using each link (i.e., travel time is equal to the number of road users). The road sections from the residential area to location A and from location B to the CBD become congested as the number of commuters increases, whereas the remaining road sections do not experience congestion.

Figure 1. Road network before and after road construction

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次の5問のうち4問を選び解答せよ。

Choose and answer four out of the following five questions.

問題1. 建築のパッシブクーリングに関する以下の問題に答えよ。

Question 1. Answer the following questions concerning passive cooling for buildings.

- (1) パッシブクーリングとアクティブクーリングの違いを説明せよ。  
Explain the differences between passive cooling and active cooling.
- (2) 放射冷却手法を建物内に導入する際、床に導入する場合と天井に導入する場合の熱的効果の違いを論ぜよ。  
Discuss the differences of thermal effects between the application of radiant cooling system for a ceiling and that for a floor.
- (3) 放射冷却手法における結露のリスクを論ぜよ。  
Discuss the mold risks in a radiant cooling system.

問題2. 住宅内のダンプネスとカビの発生に関する以下の問題に答えよ。

Question 2. Answer the following questions concerning dampness and mold growth in residential buildings.

- (1) 住宅内のダンプネスの主な発生要因を説明せよ。  
Explain main causes of dampness in residential buildings.
- (2) 住宅内のカビの発生によって生じる健康被害を説明せよ。  
Explain the possible health problems caused by the mold growth in residential buildings.
- (3) 住宅内の空気質に起因する健康被害と省エネとのトレードオフについて論ぜよ。  
Discuss the trade-off between the health problems caused by indoor air quality and energy-savings.

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問題 3. 標準年気象データ (TMY) に関する以下の問題に答えよ。  
Question 3. Answer the following questions concerning Typical Meteorological Year (TMY) data.

- (1) TMY とは何かを説明せよ。  
Explain what the TMY is.
- (2) TMY の具体的な利用方法を例示して説明せよ。  
Explain the specific usages of TMY by quoting some examples.
- (3) 2050 年などの将来の TMY を作成する方法を論ぜよ。  
Discuss the methods of developing a future TMY such as for 2050.

問題 4. 世帯エネルギー消費に関する以下の問題に答えよ。  
Question 4. Answer the following questions concerning household energy consumption.

- (1) Figure 1 を用いて、世帯エネルギー消費量の影響要因を考察せよ。  
Discuss the factors affecting household energy consumption using Figure 1.
- (2) Figure 1 中の(a) Shift, (b) Rebound について、それぞれ具体例を挙げて説明せよ。  
Explain about (a) Shift and (b) Rebound indicated in Figure 1, by quoting specific examples, respectively.
- (3) 以上の考察を基に、世帯エネルギー消費量の省エネ手法を論ぜよ。  
Based on the above considerations, discuss the energy-saving measures for household energy consumption.

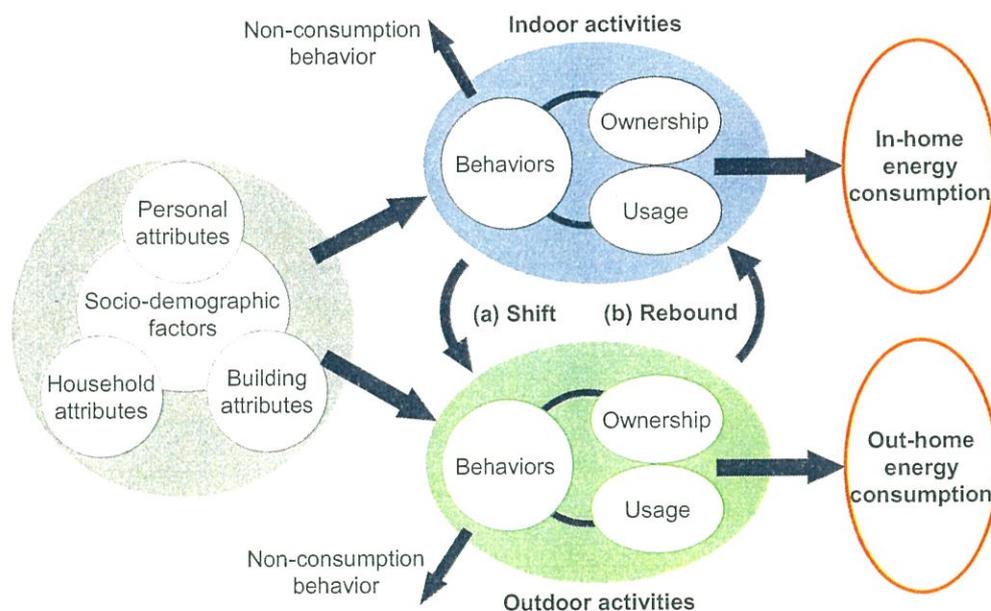


Figure 1. Overall structure of in-home and out-home energy consumption.

Source: Takata, Y., Kubota, T., Pratiwi, S.N., Sani, H.A. (2025) Classification of daily lifestyle patterns and their relationships with household energy consumption in apartment buildings: A case study of Indonesia, *Journal of Asian Architecture and Building Engineering*, 1-22.

問題5. 建築内の熱的快適性に関する以下の問題に答えよ。

Question 5. Answer the following questions concerning thermal comfort in buildings.

- (1) Standard Effective Temperature (SET\*)と作用温度の違いを説明せよ。  
Explain the differences between Standard Effective Temperature (SET\*) and operative temperature.
- (2) Figure 2は、各作用温度別の相対湿度ごとの室内風速とSET\*の関係を示している。この図を用いて、室内風速が熱的快適性に与える影響について論ぜよ。  
Figure 2 shows the relationship between indoor wind speed and SET\* across a range of relative humidity levels for various operative temperature levels. Discuss the effects of indoor wind speed on thermal comfort using this figure.

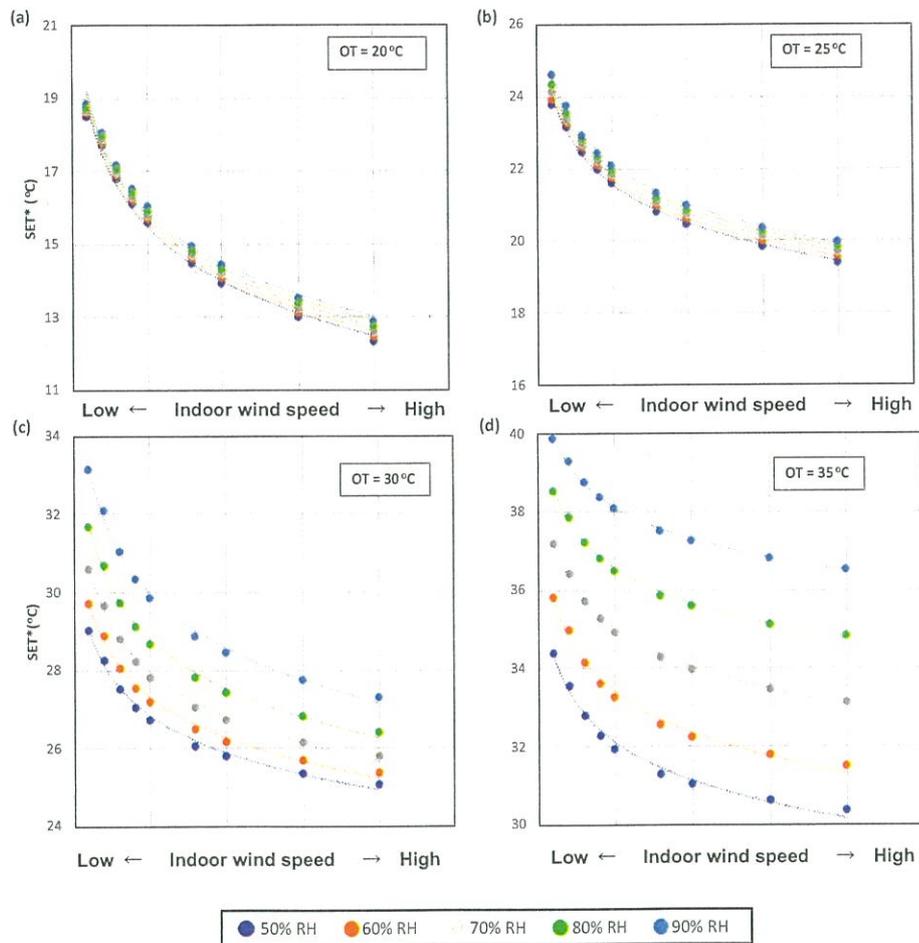


Figure 2. Relationship between the SET\* and indoor wind speed (m/s) at various RH levels (50-90%) when Operative Temperature (OT) is (a) 20°C (b) 25°C (c) 30°C and (d) 35°C (clo: 0.5, Metabolic Rate: 1 met).