

2018年8月27日 13時～16時
13:00-16:00, August 27, 2018

[C 計画・設計・論文]
[C Planning/Design/Essay]

C-1 計画・設計
(専攻分野：都市環境工学)

C-1 Planning and Design
(Major Field of Study: Urban Environmental Engineering)

受験番号

Examination I. D.

- (1) すべての答案用紙の所定の欄に、問題番号、受験番号を記入しなさい。氏名を記入してはならない。
Write the question number and your examination I. D. on all the answer sheets. Do not write your name.
- (2) 問題冊子に受験番号を記入しなさい。
Write your examination I. D. on this sheet.
- (3) 専攻分野として「都市環境工学」を希望するものは、C-1、C-2のいずれか1科目を解答しなさい。
If your major field of study is “Urban Environmental Engineering,” then answer either C-1 or C-2.

C – 1 Planning and Design (Urban Environmental Engineering)

Think of City A in Japan with features as follows.

- Residential population is 100,000 as of 2017.
- Daytime population has been regarded the same as the residential population since 1980.
- The city has commercial, residential, field farming and mountainous areas.
- No activities in industry and tourism. Agricultural activity is dry field farming only.
- All areas of the city belong to the catchment area of River B.
- River B flows through the city and eventually flows into Lake C.
- Coverage of municipal water supply system is 100 %, based on the residential population.
- Coverage of municipal wastewater treatment system is 75% based on the residential population, while 15 % and 10% of the population are using household wastewater treatment tank and septic tank, respectively.
- Municipal wastewater is managed by a separate sewer system, and the wastewater treatment plant is adopting a conventional activated sludge process.
- The wastewater treatment plant discharges treated wastewater to River B. The effluents from household wastewater treatment tanks and septic tanks pass through side ditches and drains, and eventually flow into River B.

Based on the background above, answer Q.1, Q.2 and Q.3. Refer to Figure 1 and Tables 1, 2, 3 and 4 when necessary.

Q.1

Table 1 and Figure 1 show the transition of annual municipal water supply in City A.

- (1) $S(t)$ indicates the annual water supply of year t in City A. Present a formula for calculating the 5-year simple moving average of annual municipal water supply, and explain the significance of examining moving average.
- (2) Answer two factors that define the annual municipal water supply, and explain how the changes of those factors are considered to have affected the transition of annual municipal water supply in City A.
- (3) Estimate the residential population in City A in 2000 based on the annual municipal water supply. Show the calculation process to support the estimation by defining values and conditions needed.

Q.2

Pollution load from City A to the water environment is to be analyzed.

- (1) Based on the fact that the domestic wastewater discharge in City A is 220 L per person per day in 2017, calculate the commercial wastewater discharge per person per day in City A in 2017.

- (2) Calculate the annual pollution load of BOD from each pollution source in City A. Categorize pollution sources into 4 groups as below. Note that all commercial wastewater is discharged to municipal wastewater treatment system, and the concentration of pollutants in commercial wastewater is the same as that in domestic wastewater.
 1. Wastewater treatment plant
 2. Household wastewater treatment tank
 3. Septic tank
 4. Non-point sources including mountainous, dry field farming, residential and commercial areas

- (3) Water quality monitoring station is located downstream of River B, and the monitoring point is classified as “A” with BOD standard value of 2.0 mg/L or lower in Environmental Quality Standards for Water Pollution. Answer if the monitoring point meets the standard value by showing the calculation process. Note that annual maximum BOD in River B upstream, before pollutants from City A flow into the stream, is 1.0 mg/L. The flow in River B downstream is as follows in the past 10 years.

Three months flow rate: 20 m³/sec, Six months flow rate: 12 m³/sec

Low flow rate: 8 m³/sec, Drought flow rate: 2 m³/sec

Note that pollutant runoff coefficient at the monitoring point is determined by the pollutant runoff coefficient to the river and the pollutant remaining ratio in the river. The pollutant remaining ratio in the flow of concern is 0.8. Assume the appropriate value of pollutant runoff coefficient to the river.

Q.3

Lake C is recently suffering from eutrophication which is causing difficulties at water treatment plants. Measures for controlling the eutrophication are necessary in Lake C watershed. Therefore, City A is considering the measures for point sources as follows.

Option-1: At the current coverage of municipal wastewater treatment system, the wastewater treatment plant is upgraded from the conventional activated sludge process to an advanced wastewater treatment process that works for both nitrogen and phosphorus removal. At the same time, all septic tanks are replaced with household wastewater treatment tanks.

Option-2: Using the current wastewater treatment process, the coverage of municipal wastewater treatment system is elevated up to 90 % while the rest is treated by household wastewater treatment tanks.

- (1) What are the difficulties at water treatment plants when the water sources, such as Lake C, are in eutrophication? Answer two major difficulties and explain each concisely.
- (2) Answer one example of advanced wastewater treatment process that work for both nitrogen and phosphorus removal, and draw the process flow diagram. Then, concisely explain which pollutant is mostly removed from water in which process while referring to the removal principles.
- (3) As for measures for point sources, which would work better for the eutrophication control in Lake C, Option-1 or Option-2? Explain quantitatively. Remember to identify the advanced wastewater treatment process to be adopted in Option-1, and show the calculation process. Set the appropriate values if not given but necessary for calculation.
- (4) City A is also considering measures for non-point sources for the eutrophication control in Lake C, in addition to the measures for point sources. Answer one particular example of schemes as the measure for non-point sources, and explain the effectiveness and challenges of the scheme.

表 1 . A 市の水道の年間配水量

Table 1. Annual municipal water supply in City A

西暦 Year	年間配水量 (100 万 m ³) Annual water supply (Million m ³)	西暦 Year	年間配水量 (100 万 m ³) Annual water supply (Million m ³)	西暦 Year	年間配水量 (100 万 m ³) Annual water supply (Million m ³)
1980	14.70	1993	18.26	2006	13.87
1981	15.21	1994	18.40	2007	13.56
1982	15.05	1995	18.11	2008	13.81
1983	15.89	1996	18.60	2009	13.53
1984	15.39	1997	18.00	2010	13.33
1985	16.78	1998	17.60	2011	13.33
1986	16.80	1999	16.43	2012	12.75
1987	17.70	2000	17.19	2013	13.14
1988	17.56	2001	16.02	2014	12.15
1989	17.98	2002	15.78	2015	12.45
1990	18.30	2003	14.88	2016	12.13
1991	18.30	2004	15.16	2017	12.34
1992	18.56	2005	14.69		

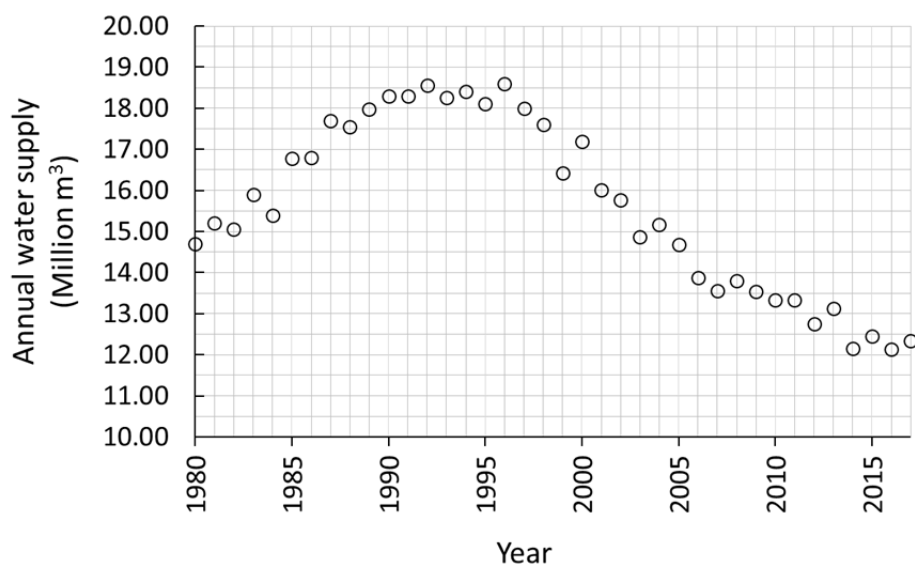


図 1 . A 市の水道の年間配水量の推移

Figure 1. Transition of annual municipal water supply in City A

表 2. A 市の汚濁負荷発生原単位

Table 2. Pollution load per unit sources in City A

	BOD	Total nitrogen	Total phosphorus	Unit
し尿 Human excreta	18	9	0.9	g/person/day
雑排水 Wastewater except human excreta	40	2	0.4	g/person/day
山林 Mountainous area	1	5	0.2	kg/ha/year
畑 Dry field farming area	3	30	0.4	kg/ha/year
住宅地・商業地 Residential and commercial areas	5	10	1.0	kg/ha/year

表 3. A 市の土地利用と流出係数

Table 3. Land use and runoff coefficient in City A

	山林 Mountainous area	畑 Dry field farming area	住宅地 Residential area	商業地 Commercial area
利用面積 (ha) Area (ha)	2000	900	2200	1700
流出係数 Runoff coefficient	0.2	0.1	0.5	0.6

表 4. 汚濁物質除去率 (%)

Table 4. Removal ratio of pollutants (%)

	BOD	Total nitrogen	Total phosphorus
下水処理場 (標準活性汚泥法) Wastewater treatment plant (conventional activated sludge process)	92	40	30
合併浄化槽 Household wastewater treatment tank	90	35	20
単独浄化槽 Septic tank	80	25	15

2018年8月27日 13時～16時
13:00-16:00, August 27, 2018

[C 計画・設計・論文]
[C Planning/Design/Essay]

C-2 論文
(専攻分野：都市環境工学)

C-2 Essay

(Major Field of Study: Urban Environmental Engineering)

受験番号

Examination I. D.

- (1) すべての答案用紙の所定の欄に、問題番号、受験番号を記入しなさい。氏名を記入してはならない。
Write the question number and your examination I. D. on all the answer sheets. Do not write your name.
- (2) 問題冊子に受験番号を記入しなさい。
Write your examination I. D. on this sheet.
- (3) 専攻分野として「都市環境工学」を希望するものは、C-1、C-2のいずれか1科目を解答しなさい。
If your major field of study is “Urban Environmental Engineering,” then answer either C-1 or C-2.

C – 2 Essay (Urban Environmental Engineering)

The fifth Basic Environment Plan (hereafter, abbreviated as BEP) and the fourth Fundamental Plan for Establishing a Sound Material-Cycle Society (hereafter, abbreviated as FPSMCS) were adopted by cabinet decision in Japan in 2018. Answer the following questions, by referring the timeline for about half a century preceded to these Plans.

[Timeline]

- 1967 Enactment of the Basic Law for Environmental Pollution Control
- 1992 United Nations Conference on Environment and Development
- 1993 The Basic Environment Law replaced the Basic Law for Environmental Pollution Control
- 1994 Adoption of the first BEP
- 2000 Enactment of the Fundamental Law for Establishing a Sound Material-Cycle Society
- 2003 Adoption of the first FPSMCS
- 2011 The Great East Japan Earthquake
- 2015 Adoption of the 2030 Agenda for Sustainable Development by the United Nations
- 2018 Adoption of the fifth BEP and the fourth FPSMCS

Q.1 Explain differences in the scope of the issues covered by the Basic Law for Environmental Pollution Control and by the Basic Environment Law, taking into account international background behind the replacement of the Basic Law.

Q.2 The fifth BEP set 6 priority strategies, by referring to the SDGs adopted with the 2030 Agenda for Sustainable Development in 2015. Explain briefly about SDGs, then explain relationships among the scope of the issues covered by SDGs and the scope of the issues covered by the two Basic Laws, questioned by Q.1.

Q.3 The fifth BEP refers to “sustainable regional development by utilizing local resources” as one of the priority strategies, and the fourth FPSMCS adopts “regional revitalization by forming Regional Circular and Ecological Sphere” (“Chiiki-Junkan-Kyosei-Ken” in Japanese) as one of the mid-to-long term directions toward a Sound Material-Cycle Society. By taking two examples of technologies for utilizing local renewable resources, present your thoughts how utilization of these technologies taking advantage of the region-specific natural and social conditions could effectively contribute to regional revitalization.

Q.4 The fourth FPSMCS refers to “secure preparedness for disaster waste management” as one of the mid-to-long-term priority actions. Preparedness for disasters such as huge earthquakes and natural disasters caused by climate change is a new priority issue for environmental engineers. By taking a concrete example of public facility or public service in the field of urban environmental engineering, list up at least two types of natural disasters for which we should be prepared, and discuss possible institutional and technical measures to be taken in advance.

2018年8月27日 13時～16時
13:00-16:00, August 27, 2018

[C 計画・設計・論文]
[C Planning/Design/Essay]

C-3 計画・設計
(専攻分野：都市計画)
C-3 Planning and Design
(Major Field of Study: Urban Planning)

受験番号

Examination I. D.

- (1) すべての答案用紙の所定の欄に、受験番号を記入しなさい。氏名を記入してはならない。
Write your examination I. D. on all the answer sheets.
Do not write your name.
- (2) 問題冊子に受験番号を記入しなさい。
Write your examination I. D. on this sheet.
- (3) 専攻分野として「都市計画」を希望するものは、C-3、C-4のいずれか1科目を解答しなさい。
If your major field of study is “Urban Planning,” then answer either C-3 or C-4.

C – 3 Planning and Design

Propose a development plan for Site X, approximately 6.5ha, by referring to the following descriptions and maps in the answer sheets 1 and 2.

1. About City A

City A is a city in the Tokyo Region with a population of approximately 43000. Major industries of City A are pelagic fishery, seafood processing and agriculture. City A is located 50 minutes away from the prefectural capital city and 70 minutes away from Tokyo Wards Area by rapid train services on Private Railway Line B. However, Private Railway Line B doesn't reach the central district located at the southern end of City A. Most parts of City A are covered only by local bus services departing from Terminal Station C of Private Railway Line B, which is located at the geographical center of City A.

City A is known as a scenic city where its three sides except north are facing towards the ocean. It has many tourist spots including the central district with a fish market, beaches, natural green areas as well as many vacation cottages. On the other hand, City A has many inconveniently located residential areas, and thus the population has been decreasing since early 1990s. However, migration of young families, who are attracted by rich natural and agricultural environment, is observed as a new movement.

Although Private Railway Line B had been trying to extend the line to the central district, the plan was finally given up last year due to the declining population. As a consequence, City A now has to replace the former development plan by a new development and conservation plan for the area around Station C.

Climate of City A is warm with a scarce chance of snow, so there is no need to consider snow cover in the development concept and the development plan.

2. About the site and the surroundings

- Site X, approximately 6.5 ha, next to Station C, is framed by National Highway D, Road E designated by the city planning, Road F and Feeder Road G. Site X was formerly used for agriculture but currently vacant.
- Site X and the surrounding areas are located on a plateau dissected by valleys. Site X is mainly on a flat plateau but partly dissected by a valley.

- Station C opened in 1970s as a terminal station. The traffic plaza of Station C is a hub of local and sightseeing bus services. The east side of Station C was developed as a residential area during 1980s.
- National Highway D between Station C and Site X is a two-lane two-way traffic, which is now in the process of expansion to 15m width, along with a 2.5m side walk on each side. National Highway D is an arterial road of City A connecting Station C with the central district located at the southern end of City A.
- Road E designated by the city planning, following the same standard with National Highway D, will be framing the western edge of Site X. Road E will be reaching the central district as a bypass of National Highway D in the future. Road E will overpass the valley by a bridge (maximum clearance 8m) in Site X.
- Traffic on Road F, connecting prime agriculture lands in the western part of City A, is not heavy because the road doesn't reach the central district. An agricultural land improvement project is conducted in the area framed by Road E on the west and Road F on the south.
- Improved prime agriculture lands, owned and managed mainly by active vegetable farmers, cover the flat plateau on the western periphery of Site X. Contrary, lands in the valley formerly used as paddy fields are now mostly fallowed and abandoned. Forests cover the slopes between plateaus and valleys.
- Beach H, 1.5 km west from Site X, is a popular bathing place mainly for local residents during summer. Old coastal villages, vacation cottages and restaurants are scattered on the lowland around Beach H.
- A Cluster of Public Facilities I, including an elementary school, a junior high school, a sports park, a fire station and a police station, is located on the eastern periphery of Site X.
- There are no shopping streets and supermarkets within 1km distance from Site X.

3. Planning requirements and required planning documents

Propose both “Development and conservation concept for the area including Site X” and “Development plan for Site X “.

1) Development and conservation concept for the area including Site X

《Planning requirements》

- Long-term Concept, approximately 20 years, for the land use plan, transportation plan and open space plan of an area between National Highway D and Beach H is required.
- Site X, approximately 6.5 ha, will be positioned as a hub for local communities in the city planning masterplan now in the process of revision. In Site X, a mixed-use development including housing areas featuring the enchanting character of City A and a hub facility for local communities will be developed. Detailed planning requirements for Site X are explained in the next section 2).
- In the area, a 10ha development for vacation cottages, with the maximum floor area ratio of 30%, is planned as a second stage project following the Site X development.
- In the area, a strong favor should be given to the development and conservation of open spaces, parks, greens, pedestrian paths and related facilities, not only for local residents but for all visitors to City A.
- Development and conservation ideas, policies and measures for making the best use of existing resources should also be proposed.

《Required planning documents》

By using “解答用紙 1 : 地区 X を含む広域エリアの開発・保全構想 (図面) (Answer Sheet 1: Development and Conservation Concept for the Area including Site X (Map))”, propose a development and conservation concept for the area including Site X, which includes the following items, with a 1/5000 map and concise texts. If necessary, you may illustrate diagrams and sketches with the texts.

- (1) Development and conservation concept for the area including Site X
- (2) Land use planning polices (land use, building type, arrangement of various facilities, etc.)
- (3) Transportation policies (flows of vehicles, bicycles and pedestrians, etc.)
- (4) Open space development policies (arrangements of parks, greens and open spaces, etc.)

2) Development plan for Site X

《Planning requirements》

- Provide approximately 200 housing units for families, and approximately 50 housing

units for singles or couples. Abundant car parking lots with an 80% coverage of households should be provided. Parking lots can be on the surface, multi-story or integrated with buildings.

- Provide a hub facility with approximately 3000 m² floor area for local communities by including concrete ideas of the type and contents of the facility. Car parking lots for visitors with the capacity of 200 should be provided. Parking lots can be on the surface, multi-story or integrated with buildings.
- Provide park(s) with the total area of more than 20000m²
- Provide facilities including small retail(s), bicycle parking(s), garbage collection site(s), and community meeting room(s) that are necessary for the residents.

《Required planning documents》

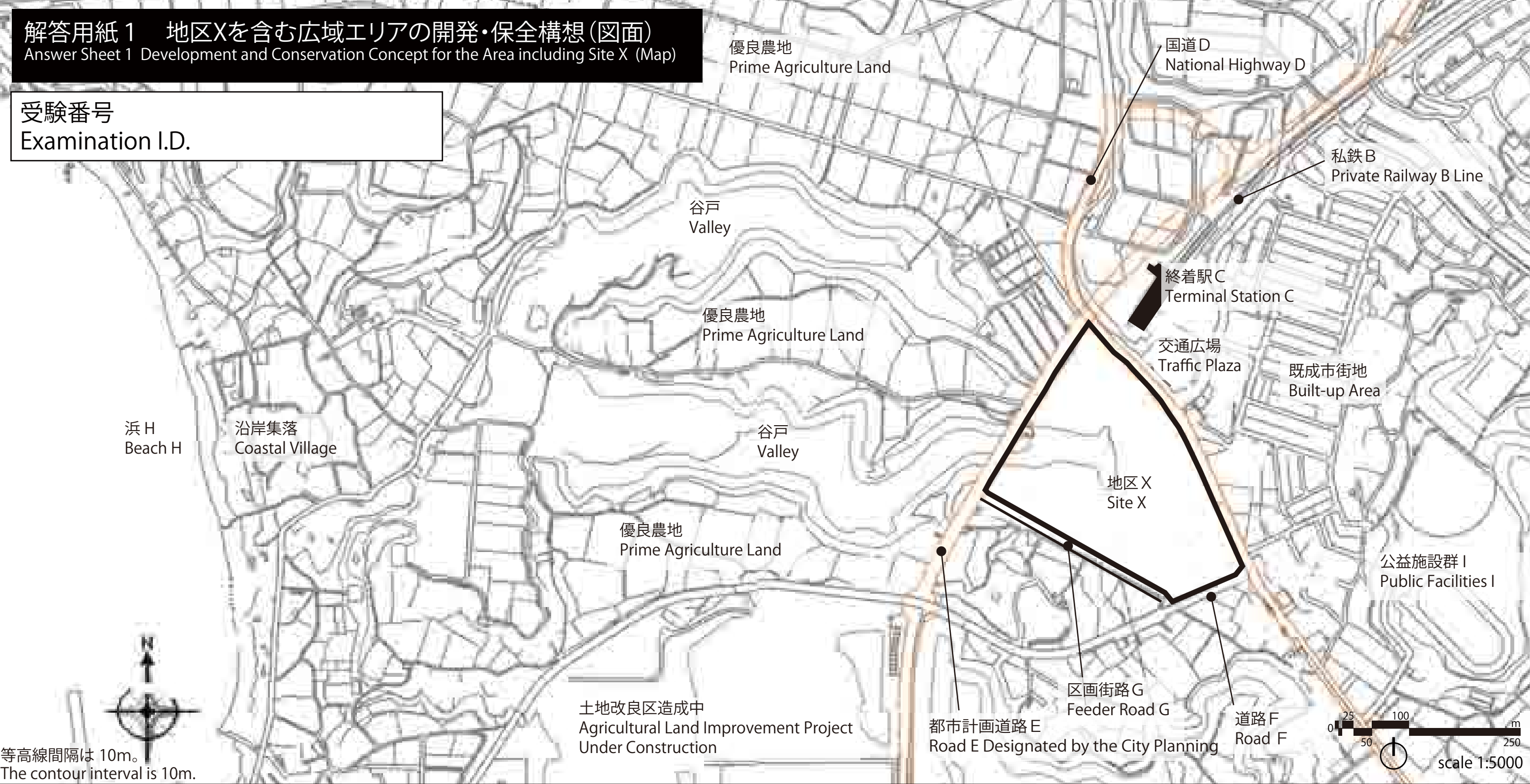
Using “解答用紙 2 : 地区 X の開発計画 (図面) (Answer Sheet 2: Development Plan for Site X (Map))” and 「解答用紙 3 : 地区 X の開発計画 (文章) (Answer Sheet 3 : Development Plan for Site X (Texts))” , propose a development plan for Site X, which includes the following items, with a 1/1000 map and texts. If necessary, you may illustrate diagrams and sketches with the texts.

- (1) Collective housings (form of housing buildings, location of entrances, number of floors, number of units for each housing type)
- (2) Hub facility(s) for local communities
- (3) Car parking lots (distinguish between parking lots for residents and for visitors)
- (4) Park(s) and open space(s)
- (5) Facilities including small retail(s), bicycle parking(s), garbage collection site(s), community meeting room(s) and others necessary facilities for the collective housing area
- (6) Paths on the site (for vehicles, bicycles and pedestrians)
- (7) Other open spaces
- (8) Vegetation (trees, shrubs, lawns, etc.)

End of the document

解答用紙 1 地区Xを含む広域エリアの開発・保全構想(図面)
Answer Sheet 1 Development and Conservation Concept for the Area including Site X (Map)

受験番号
Examination I.D.



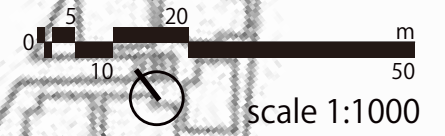
等高線間隔は 10m。
The contour interval is 10m.

0 25 50 100 250 m
scale 1:5000

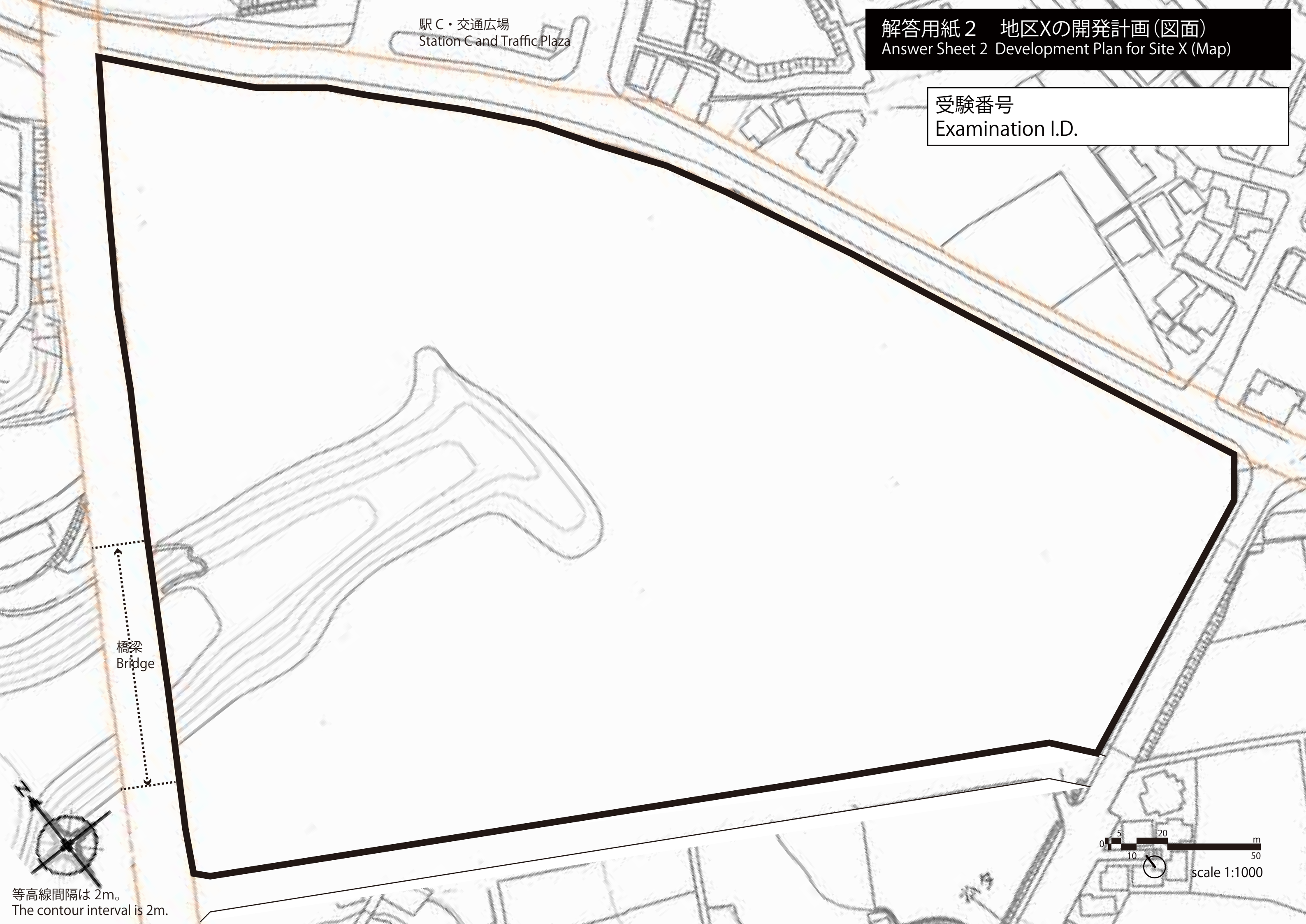
受験番号
Examination I.D.

駅 C・交通広場
Station C and Traffic Plaza

橋梁
Bridge



等高線間隔は 2m。
The contour interval is 2m.



2018年8月27日 13時～16時
13:00-16:00, August 27, 2018

[C 計画・設計・論文]
[C Planning/Design/Essay]

C-4 論文
(専攻分野：都市計画)
C-4 Essay
(Major Field of Study: Urban Planning)

受験番号

Examination I. D.

- (1) すべての答案用紙の所定の欄に、問題番号、受験番号を記入しなさい。氏名を記入してはならない。
Write the question number and your examination I. D. on all the answer sheets. Do not write your name.
- (2) 問題冊子に受験番号を記入しなさい。
Write your examination I. D. on this sheet.
- (3) 専攻分野として「都市計画」を希望するものは、C-3、C-4のいずれか1科目を解答しなさい。
If your major field of study is “Urban Planning,” then answer either C-3 or C-4.

C – 4 Essay

In the Tokyo Region, which is defined here as the area of Tokyo Metropolis along with Saitama, Chiba and Kanagawa Prefectures, it is one of the important policy issues to improve the child-rearing-friendliness through urban planning. Answer the following questions regarding this topic.

Q.1 Answer the following questions on urban and regional planning and policy aspects of this topic.

- (1) Nominate physical, economic and social factors which may facilitate and impede child-rearing-friendliness in the Tokyo Region and other factors influencing them, and structurally organize relationships among those factors by considering the relationships as extensive as possible. Use auxiliary diagrams or tables, if necessary.
- (2) Based on the factors and their structural relationships answered in (1), discuss measures in urban and regional planning and policy that should be taken to realize child-rearing-friendly society in the Tokyo Region by structurally referring to the reason why those measures should be taken, and also discuss the limitations of those measures. Note the relationships with relevant and important policy issues.

Q.2 Various research approaches can be taken to discuss child-rearing-friendly society in Tokyo Region from physical perspectives. Take two research methodologies, concretely explain the two by discussing advantages and disadvantages of them, and describe appropriate methodologies that should be taken to discuss the issue.