

筑波大学情報学群情報科学類

平成30年度推薦入試

小論文問題

【注意事項】

1. 試験開始の合図があるまで、この問題冊子の中を見てはいけません。
2. この問題冊子は、全部で6ページ（表紙、白紙を除く）です。
3. 解答用紙は、罫紙1枚とマス目紙1枚の計2枚です。
4. 解答用紙と下書き用紙の定められた欄に、学群・学類、氏名、受験番号を記入してください。
5. 問題は **1** と **2** の2題で、問題 **1** には設問(1)～(7)が含まれます。問題 **1** の解答を罫紙、問題 **2** の解答をマス目紙に記入してください。
6. 解答用紙上部の 欄には、問題番号をそれぞれ「 **1** 」、「 **2** 」と記入してください。

1 Cardinality (集合の要素数) に関する英語の本の一部を読んで、設問(1)から(7)に答えなさい。

【設問】

- (1) 下線部(ア)を和訳しなさい。
- (2) Example 3では、なぜ下線部(イ)にある ingenuity が必要となるのか。Example 2の集合 A と Example 3の集合 Z のそれぞれの特徴を比較して理由を説明しなさい。
- (3) 下線部(ウ)を和訳しなさい。
- (4) 下線部(エ)の問いかけに対してあなたならどう答えるか、100～200字程度で述べなさい。
- (5) 下線部(オ)の問題を解きなさい。
- (6) 下線部(カ)の問題を解きなさい。
- (7) 集合 A_1, A_2, A_3, \dots はいずれも countably infinite な集合であり、これらの集合を要素とする集合 $G = \{A_1, A_2, A_3, \dots\}$ も countably infinite であるとする。このとき、 A_1, A_2, A_3, \dots の和集合も countable であることを下式の記号を用いて説明しなさい。なお、下式は A_1, A_2, A_3, \dots を表しており、 $a_{i,j}$ は i 番目の集合 A_i の j 番目の要素を表している。

$$A_1 = \{a_{1,1}, a_{1,2}, a_{1,3}, \dots\}$$

$$A_2 = \{a_{2,1}, a_{2,2}, a_{2,3}, \dots\}$$

$$A_3 = \{a_{3,1}, a_{3,2}, a_{3,3}, \dots\}$$

⋮

専門用語などの単語に関しては次の表を参考にしなさい。

alternate	交互にする	negative	負の
cardinality	基数, 集合の要素数	nonempty	空でない
consistently	一貫して	nonnegative	非負の, 負でない
correspondence	対応	one-to-one	一対一の
countable	可算の, 数えられる	positive	正の
countably infinite	可算無限	procedure	手順
definite	明確な	set	集合
definition	定義	solution	解
denote	示す	subscript	下付き文字
duplicate	重複	suffice	十分である
finite	有限	symbolically	記号を使って
glimpse	ちらっと見る	theorem	定理
infinite	無限	union	和集合
ingenuity	工夫	vice versa	逆に, 反対に
integer	整数		

Cardinality

Ex.

The **cardinality** of a set is the number of elements in the set. The cardinality of a set is denoted by $|S|$. The cardinality of a set is the number of elements in the set. The cardinality of a set is the number of elements in the set.

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Countable Sets

A set is **countable** if it is finite or countably infinite. A set is **countably infinite** if it is infinite and its elements can be put in a one-to-one correspondence with the natural numbers \mathbb{N} .

Ex.

The set of natural numbers \mathbb{N} is countably infinite. The set of integers \mathbb{Z} is countably infinite. The set of rational numbers \mathbb{Q} is countably infinite.

The set of real numbers \mathbb{R} is not countable. The set of irrational numbers \mathbb{I} is not countable. The set of complex numbers \mathbb{C} is not countable.

Definition: A set is **countable** if it is finite or countably infinite. A set is **uncountable** if it is infinite and its elements cannot be put in a one-to-one correspondence with the natural numbers.

Example: The set of real numbers \mathbb{R} is uncountable. The set of irrational numbers \mathbb{I} is uncountable. The set of complex numbers \mathbb{C} is uncountable.



The set of real numbers \mathbb{R} is uncountable. The set of irrational numbers \mathbb{I} is uncountable. The set of complex numbers \mathbb{C} is uncountable. The set of natural numbers \mathbb{N} is countable. The set of integers \mathbb{Z} is countable. The set of rational numbers \mathbb{Q} is countable.

The set of real numbers \mathbb{R} is uncountable. The set of irrational numbers \mathbb{I} is uncountable. The set of complex numbers \mathbb{C} is uncountable. The set of natural numbers \mathbb{N} is countable. The set of integers \mathbb{Z} is countable. The set of rational numbers \mathbb{Q} is countable.

The advantage of having a single set of data is that it is easier to manage. It is also easier to compare the results of the two sets of data. The disadvantage is that the data is not as detailed as the data in the two separate sets.

The data is shown in the following table:

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Example 1: The data for the first set of data is shown in the following table:

$$x = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$$

The data for the second set of data is shown in the following table:

$$y = \begin{pmatrix} 4 \\ 5 \\ 6 \end{pmatrix}$$

Below is the matrix that contains the data for both sets of data:

$$\begin{pmatrix} 1 & 4 \\ 2 & 5 \\ 3 & 6 \end{pmatrix}$$

The matrix is shown in the following table:

Definition: If the data for the first set of data is shown in the following table:

$$x = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$$

then the data for the second set of data is shown in the following table:

Definition: If the data for the first set of data is shown in the following table:

Example 2: The data for the first set of data is shown in the following table:

$$x = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$$

is shown in the following table:

Definition: If the data for the first set of data is shown in the following table:

6.1.1. The first step is to find the 2×2 matrix A such that $A \cdot \begin{pmatrix} 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$. This is the identity matrix I .

6.1.2. The second step is to find the 2×2 matrix B such that $B \cdot \begin{pmatrix} 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$.

$$\begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix} \cdot \begin{pmatrix} 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 1+1 \\ 1+1 \end{pmatrix} = \begin{pmatrix} 2 \\ 2 \end{pmatrix} \neq \begin{pmatrix} 1 \\ 1 \end{pmatrix}$$

6.1.3. The third step is to find the 2×2 matrix C such that $C \cdot \begin{pmatrix} 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$. This is the identity matrix I . The fourth step is to find the 2×2 matrix D such that $D \cdot \begin{pmatrix} 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$. This is the identity matrix I . The fifth step is to find the 2×2 matrix E such that $E \cdot \begin{pmatrix} 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$. This is the identity matrix I .

6.1.4. The sixth step is to find the 2×2 matrix F such that $F \cdot \begin{pmatrix} 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$. This is the identity matrix I . The seventh step is to find the 2×2 matrix G such that $G \cdot \begin{pmatrix} 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$. This is the identity matrix I .

$$I = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$

6.1.5. The eighth step is to find the 2×2 matrix H such that $H \cdot \begin{pmatrix} 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$.

6.1.6. The ninth step is to find the 2×2 matrix I such that $I \cdot \begin{pmatrix} 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$. This is the identity matrix I . The tenth step is to find the 2×2 matrix J such that $J \cdot \begin{pmatrix} 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$. This is the identity matrix I .

6.1.7. The eleventh step is to find the 2×2 matrix K such that $K \cdot \begin{pmatrix} 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$.

$$I = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$

6.1.8.

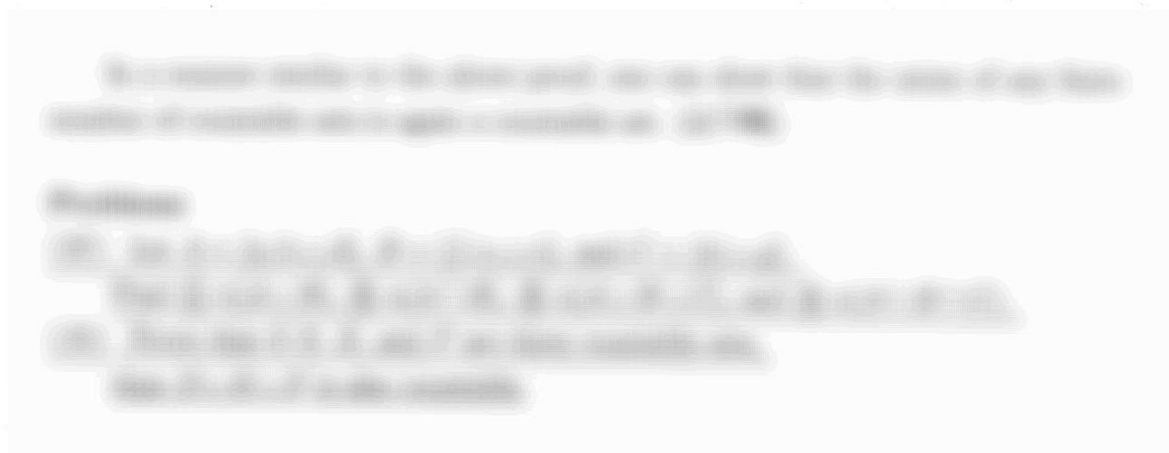
$$I = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$

6.1.9. The twelfth step is to find the 2×2 matrix L such that $L \cdot \begin{pmatrix} 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$.

$$I = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$

6.1.10. The thirteenth step is to find the 2×2 matrix M such that $M \cdot \begin{pmatrix} 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$. This is the identity matrix I . The fourteenth step is to find the 2×2 matrix N such that $N \cdot \begin{pmatrix} 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$. This is the identity matrix I .

6.1.11. The fifteenth step is to find the 2×2 matrix O such that $O \cdot \begin{pmatrix} 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$. This is the identity matrix I . The sixteenth step is to find the 2×2 matrix P such that $P \cdot \begin{pmatrix} 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$. This is the identity matrix I .



(出典 R. D. Driver 著 「Why Math?」 Springer-Verlag (1984) より一部改編して引用)

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インターネットや小型通信機器の発展に伴い、多様かつ膨大なデジタルデータが収集・蓄積され、従来知り得なかった新しい情報を抽出できるようになりました。このようなビッグデータの活用事例を一つ取り上げ、どのような情報を抽出し、それをどのように活用しているのかを具体的に述べてください。また、その活用事例において、あなたが特に重要であると考えer情報技術は何かを、その理由と共に説明してください。