外国語科目 (数理・計算科学専攻)　　20　大修

英語　　時間　午後2時 – 午後3時

注意事項

1. つぎの3問中2問を選択し解答せよ.
2. 解答は1問ごとに別々の解答用紙に記入せよ.
3. 解答用紙ごとに必ず問題の番号および受験番号を記入せよ.
4. 2問を超えて解答した場合は採点されない可能性がある.

問 1

次の文章を読み，枠(a)，枠(b)で囲まれた部分を和訳せよ．

The act of counting is undoubtedly one of the oldest of human activities. Men probably learned to count in a crude way at about the same time as they began to develop articulate speech. The earliest men who lived in communities and domesticated animals must have found it necessary to record the number of goats in the village herd by means of a pile of stones or some similar device. If the herd was counted in each night by removing one stone from the pile for each goat accounted for, then stones left over would have indicated strays, and herdsmen would have gone out to search for them. Names for numbers and symbols for them, like our 1, 2, 3, . . . , would have been superfluous. The simple and yet profound idea of a one-to-one correspondence between the stones and the goats would have fully met the needs of the situation. (a)

In a manner of speaking, we ourselves use the infinite set

$$N = \{1, 2, 3, . . .\}$$

of all positive integers as a "pile of stones." We carry this set around with us as part of our intellectual equipment. Whenever we want to count a set, say, a stack of dollar bills, we start through the set N and tally off one bill against each positive integer as we come to it. The last number we reach, corresponding to the last bill, is what we call the number of bills in the stack. If this last number happens to be 10, then "10" is our symbol for the number of bills in the stack, as it also is for the number of our fingers, and for the number of our toes, and for the number of elements in any set which can be put into one-to-one correspondence with the finite set {1, 2, . . . , 10}.

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The positive integers are adequate for the purpose of counting any non-empty finite set, and since outside of mathematics all sets appear to be of this kind, they suffice for all non-mathematical counting. But in the world of mathematics we are obliged to consider many infinite sets, such as the set of all positive integers itself, the set of all integers, the set of all rational numbers, the set of all real numbers, the set of all points in a plane, and so on. It is often important to be able to count such sets, and it was Cantor's idea to do this, and to develop a theory of infinite cardinal numbers, by means of one-to-one correspondences. (b)

(G. F. Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill Book Company Inc., 1963 より)

注： cardinal number： 濃度

問 2

次の英文は，知識の論理についての教科書中の演習問題 1.1 と 1.2 である（1.2 の直前の ＊という印はこの問題が難問であることを示している）．これを読んで下の設問 (1),(2),(3) に答えよ．

1.1 The *aces and eights* game is a simple game that involves some sophisticated reasoning about knowledge. It is played with a deck consisting of just four aces and four eights. There are three players. Six cards are dealt out, two to each player. The remaining two cards are left face down. Without looking at the cards, each of the players raises them up to his or her forehead, so that the other two players can see them but he or she cannot. Then all of the players take turns trying to determine which cards they're holding (they do not have to name the suits). If a player does not know which cards he or she is holding, the player must say so. Suppose Alice, Bob, and you are playing the game. Of course, it is common knowledge that none of you would ever lie, and that you are all perfect reasoners.

(a) In the first game, Alice, who goes first, holds two aces, and Bob, who goes second, holds two eights. Both Alice and Bob say that they cannot determine what cards they are holding. What cards are you holding? (Hint: consider what would have happened if you held two aces or two eights.)

(b) In the second game, you go first. Alice, who goes second, holds two eights. Bob, who goes third, holds an ace and an eight. No one is able to determine what he or she holds at his or her first turn. What do you hold? (Hint: by using part (a), consider what would have happened if you held two aces.)

(c) In the third game, you go second. Alice, who goes first, holds an ace and an eight. Bob, who goes third, also holds an ace and an eight. No one is able to determine what he or she holds at his or her first turn; Alice cannot determine her cards at her second turn either. What do you hold?

* **1.2** Show that in the aces and eights game of Exercise 1.1, someone will always be able to determine what cards he or she holds. Then show that there exists a situation where only one of the players will be able to determine what cards he or she holds, and the other two will never be able to determine what cards they hold, no matter how many rounds are played.

(R. Fagin, J. Y. Halpern, Y. Moses, and M. Y. Vardi, Reasoning about Knowledge, MIT Press, 1995 より)

(1) トランプを用いた「aces and eights」とよばれるゲームでは，それぞれのプレーヤーに何枚のカードが配られ，各プレーヤーはそれをどのように持っているか，日本語で説明せよ．

(2) 演習問題 1.1(a)（枠で囲まれた部分）に対する正解を書け．

(3) 下線部を和訳せよ．

問 3

以下の「Reject or Do Not Reject」と題する統計的仮説検定に関する文章を読み，全文を和訳せよ．

If it had happened that the observed $|t|$ value had been smaller than the critical value, we would have said that we *could not reject* the hypothesis. Note carefully that we do not use the word "accept," since we normally cannot accept a hypothesis. The most we can say is that on the basis of certain observed data we cannot reject it. It may well happen, however, that in another set of data we can find evidence that is contrary to our hypothesis and so reject it.

For example, if we see a man who is poorly dressed we may hypothesize, H_0: "This man is poor." If the man walks to save bus fare or avoids lunch to save lunch money, we have no reason to reject this hypothesis. Further observations of this kind may make us feel H_0 is true, but we still cannot accept it unless we know all the true facts about the man. However, a single observation against H_0, such as finding that the man owns a bank account containing $500,000, will be sufficient to reject the hypothesis.

(N. R. Draper and H. Smith, Applied Regression Analysis, Third Edition, John Wiley & Sons, 1998 より)

注：

reject: 棄却する
$|t|$ value: t 統計量の絶対値
critical value: 棄却限界値
accept: 受容する
hypothesis: 仮説