受験される方は、必ず受験される前に志望先の教員に連絡をとって下さい。

外国語科目 (数理・計算科学専攻)　　19　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，問いに答えよ．

William Sealy Gosset (June 13, 1876 – October 16, 1937) was a chemist and statistician, better known by his pen name Student. Born Canterbury, England to Agnes Sealy Vidal and Colonel Frederic Gosset, Gosset attended Winchester College, the famous private school, before reading chemistry and mathematics at New College, Oxford. On graduating in 1899, he joined the Dublin brewery of Arthur Guinness & Son.

Guinness was a progressive agro-chemical business and Gosset would apply his statistical knowledge both in the brewery and on the farm–to the selection of the best yielding varieties of barley. Gosset acquired that knowledge by study, trial and error and by spending two terms in 1906–7 in the biometric laboratory of Karl Pearson. Gosset and Pearson had a good relationship and Pearson helped Gosset with the mathematics of his papers. Pearson helped with the 1908 papers but he had little appreciation of their importance. The papers addressed the brewer's concern with small samples, while the biometrician typically had hundreds of observations and saw no urgency in developing small-sample methods.

Another researcher at Guinness had previously published a paper containing trade secrets of the Guinness brewery. To prevent further disclosure of confidential information, Guinness prohibited its employees from publishing any papers regardless of the contained information. This meant that Gosset was unable to publish his works under his own name. Therefore he used the pseudonym Student for his publications to avoid detection of his publications by his employer. Therefore his most famous achievement is now referred to as the Student t-distribution, which may otherwise have been the Gosset t-distribution.

Using this pseudonym Pearson published "*The probable error of a mean*" and almost all of Gosset's papers in his journal *Biometrika*. However, it was R.A. Fisher who appreciated the importance of Gosset's small-sample work, after Gosset had written to him to say "I am sending you a copy of Student's Tables as you are the only man that's ever likely to use them!". Fisher believed that Gosset had effected a logical revolution.

Ironically the t-statistic for which Gosset is famous was actually Fisher's creation. Gosset's statistic was $z = t/\sqrt{n-1}$. Fisher introduced the t-form because it fitted in with his theory of degrees of freedom. Fisher was also responsible for the applications of the t-distribution to regression.

(Wikipedia, the free encyclopedia (2006.6.28) より引用．一部出題者により編集
URL `http://en.wikipedia.org/wiki/William_Sealy_Gosset`)

注： Guinness: ビール会社．agro-chemical: 農業化学．W.A. Gosset, Karl Pearson, R.A. Fisher はいずれも統計家．biometrics: 計量生物学．Biometrika: Pearson が創始した統計雑誌．pseudonym: ペンネーム．Student's Tables: Student の (t-分布) 表．small-sample work: 小標本理論．Student t-distribution: Student の t 分布．statistic: 統計量．regression: 回帰分析．degree of freedom: 自由度．

(1) Gosset がペンネームで論文を書いた理由を，本文の内容に即して述べよ．
(2) 枠で囲まれた部分を和訳せよ．固有名詞，論文名は英語のままで良い．

問 2

カオス (chaos) について書かれた次の英文を読んで，下の (1)，(2) に答えよ．

"Chaos," as a standard term for nonperiodic behavior, seems to have received its big boost in 1975 with the appearance of a now widely quoted paper by Tien Yien Li and James Yorke of the University of Maryland, bearing the terse title "Period Three Implies Chaos." In a mapping, a sequence of *period three* is one in which each state is identical with the state that occurred three steps earlier, but not with the state that occurred one step or two steps earlier; sequences with other periods are defined analogously. The authors showed that, for a certain class of difference equations, the existence of a single solution of period three implies the existence of an infinite collection of periodic solutions, in which every possible period—periods 1, 2, 3, 4, . . . —is represented, and also an infinite collection of nonperiodic solutions. This situation, in which virtually any type of behavior may develop, seems to fit the nontechnical definition of chaos, and it is not obvious that Li and Yorke intended to introduce a new technical term.

They might as well have done so. In the ensuing years the term has appeared with increasing frequency, and when, in 1987, it became the key word in the title of James Gleick's popular book, its permanence was virtually assured.

In the process of establishing itself as a scientific term, "chaos" also picked up a somewhat different meaning. Li and Yorke had used the term when referring to systems of equations that possess at least a few nonperiodic solutions, even when most solutions may be periodic. In systems that are now called chaotic, most initial states are followed by nonperiodic behavior, and only a special few lead to periodicity. I shall refer to chaos in the sense of Li and Yorke as *limited chaos*, calling chaos *full chaos* when it is necessary to distinguish it from the limited type.

(E. N. Lorenz: "The essence of chaos," University of Washington Press, 1993 より)

注 1) difference equation: 差分方程式
注 2) periodic solution: 周期解

(1) Li と Yorke が論文 "Period Three Implies Chaos" で示したことを，本文に即して具体的に述べよ．

(2) 枠内の部分を和訳せよ．固有名詞は英語のままで良い．

問 3

以下の文章は，西洋で古来知られている，指で勘定する方法を説明している．これを読み，それに続く設問に答えよ．

As Bede described them, the signs for all the numbers from 1 to 99 could be made with only the left hand, the right hand being reserved for representing numbers from 100 to 9900. This fits in very well with some of the earlier literary references; for example, Juvenal (60-130 A.D.) writes, "Happy is he who had delayed the hour of his death so long and finally numbered his years on his right hand." If that was Juvenal's only criterion for happiness, he must have died with a sorrowful heart, for he could easily have numbered his years on his left hand. (ア)

The numbers were expressed by the hand being held upward, the palm flat, the fingers together and the thumb, unless otherwise noted, being held out to one side. By comparing the following description with the diagram by Pacioli, it should be obvious how the different numbers were represented. The system is quite cunning in that it only uses the third, fourth, and fifth fingers, either bent at the middle joint or fully closed upon the palm, to represent all digits from 1 to 9. This leaves the thumb and index finger free to represent the multiples of 10 (10, 20, 30, . . . 90), so that two sets of finger positions can be used in any combination to represent the numbers from 1 to 99. In some descriptions, for example the one by Bede, there were signs for numbers between 10,000 and 1,000,000 which were made by the hands touching various parts of the body, but these were evidently known only to a few people and not part of the regularly used system.

	Left Hand
1	5th finger bent at the middle joint
2	4th and 5th fingers bent at the middle joint
3	3rd, 4th, and 5th fingers bent at the middle joint
4	3rd and 4th fingers bent at the middle joint
5	3rd finger bent at the middle joint
6	4th finger bent at the middle joint
7	5th finger closed on the palm
8	4th and 5th fingers closed on the palm
9	3rd, 4th, and 5th fingers closed on the palm
10	tip of the index finger touching the middle joint of the thumb
11–19	represented by the sign for 10 and the signs for 1 to 9 being made at the same time
20	thumb touching the base of the third finger
30	thumb and index finger form a circle
40	thumb and index finger held vertical and close together
50	thumb bent at both joints and held flat against the palm
60	thumb set as for 50 with the index finger bent over it
70	first joint of the index finger held on the first joint of the thumb, which is held vertical
80	tip of index finger held on the first joint of the thumb
90	thumb bent over the first joint of the index finger

(Michael R. Williams: "History of Computing Technology," 2nd ed., IEEE Computer Society, 1997 より．作題の都合上，Pacioli による指使いの図，及び，右手の形の説明は省略した．)

注 1) Bede 中世キリスト教の修道士・学者 (672?-735).

注 2) Juvenal ローマを代表する風刺詩人.

注 3) index finger/3rd finger/4th finger/5th finger 人差し指／中指／薬指／小指.

(1) 枠線内 (ア) で，著者はユーモアを交えて 70 歳で死んだ Juvenal の死は不幸であったであろうと述べている．その根拠をわかりやすく説明せよ.

(2) 以下の図 A，図 B はそれぞれ Bede の記述した方式を用いて数を表したものである．それぞれが表す数を答えよ.

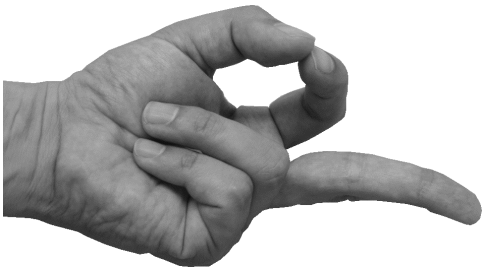

図 A

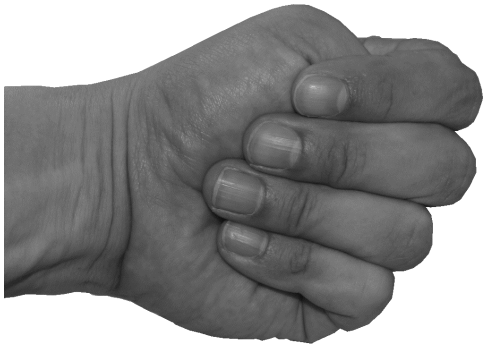

図 B