外国語科目 (数理・計算科学専攻)　　21　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

次の英文を読んで，下の設問に日本語で答えよ．

As early as 1738 Daniel Bernoulli advanced the idea that gases are formed of elastic molecules rushing hither and thither at large speeds, colliding and rebounding according to the laws of elementary mechanics. Of course, this was not a completely new idea, because several Greek philosophers asserted that the molecules of all bodies are in motion even when the body itself appears to be at rest. The new idea was that the mechanical effect of the impact of these moving molecules when they strike against a solid is what is commonly called the pressure of the gas. In fact if we were guided solely by the atomic hypothesis, we might suppose that the pressure would be produced by the repulsions of the molecules. Although Bernoulli's scheme was able to account for the elementary properties of gases (compressibility, tendency to expand, rise of temperature in a compression and fall in an expansion, trend toward uniformity), no definite opinion could be passed on it until it was investigated quantitatively. The actual development of the kinetic theory of gases was, accordingly, accomplished much later, in the nineteenth century.

Within the scope of this book, the molecules of a gas will be assumed to be perfectly elastic spheres that move according to the laws of classical mechanics. Thus, e. g., if no external forces, such as gravity, are assumed to act on the molecules, each of them will move in a straight line unless it happens to strike another sphere or a solid wall. Systems of this kind are usually called billiards, for obvious reasons.

(出典 "The Mathematical Theory of Dilute Gases" by C. Cercignani, R. Illner, M. Pulvirenti, 1994)

- Daniel Bernoulli (1700-1782): スイスの数学・物理学者
- molecule: 分子
- hither and thither: あちらこちらに
- elastic: 弾性のある
- sphere: 球，球体
- billiards: ビリヤード

(1) Bernoulliが1738年にどのようなアイデアを提案したと述べられているか．また，それとギリシャ哲学者の主張との違いが何であると述べられているか．

(2) 最終行でビリヤードと表現されている理由を述べよ．

問 2

次の英文を読んで，下の設問に日本語で答えよ．

Thomas Bayes, one of the leading mathematical lights in computing today, differs from most of his colleagues: He has argued that the existence of God can be derived from equations. His most important paper was published by someone else. And he's been dead for 241 years.

Yet the 18th-century clergyman's theories on probability have become a major part of the mathematical foundations of application development.

Search giant Google and Autonomy, a company that sells information retrieval tools, both employ Bayesian principles to provide likely (but technically never exact) results to data searches. Researchers are also using Bayesian models to determine correlations between specific symptoms and diseases, create personal robots, and develop artificially intelligent devices that "think" by doing what data and experience tell them to do.

One of the more vocal Bayesian advocates is Microsoft. The company is employing ideas based on probability—or "probabilistic" principles—in its Notification Platform. The technology(1) will be embedded in future Microsoft software and is intended to let computers and cell phones automatically filter messages, schedule meetings without their owners' help and derive strategies for getting in touch with other people.

If successful, the technology will give rise to "context servers"(2)—electronic butlers that will interpret people's daily habits and organize their lives under constantly shifting circumstances.

"Bayesian research is used to make the best gambles on where I should flow with computation and bandwidth," said Eric Horvitz(3), senior researcher and group manager of the Adaptive Systems & Interaction Group at Microsoft Research. "I personally believe that probability is at the foundation of any intelligence in an uncertain world where you can't know everything."

(出典 "18th-century theory is new force in computing" by Michael Kanellos, CNET News.com February 18, 2003, 4:00 AM PT, `http://www.news.com/2009-1001-984695.html`)

- Thomas Bayes (1702–1761): 数学者，確率論におけるベイズの公式で有名
- Bayesian: ベイズの公式 (理論) に基づく，ベイズ理論の
- clergyman: 聖職者
- butler: 執事
- bandwidth: 帯域幅

(1) 下線部 The technology はどのようなことを可能にすると述べられているか．

(2) 下線部 "context servers" はどのようなものを指すと述べられているか．

(3) 下線部 Eric Horvitz 氏の言葉をすべて和訳せよ．

問 3

次の英文を読んで下の設問に日本語で答えよ.

Prior to Windows NT 4, the window manager and graphics services were part of the user-mode Windows subsystem process. In Windows NT 4, the bulk of the windowing and graphics code was moved (a) from running in the context of the Windows subsystem process to a set of callable services running in kernel mode (in the file Win32k.sys). The primary reason for this shift was to improve overall system performance. Having a separate server process that contains the Windows graphics subsystem required multiple thread and process context switches, which consumed considerable CPU cycles and memory resources even though the original design was highly optimized.

(中略)

Is Windows Less Stable with USER and GDI in Kernel Mode?

Some people wondered whether moving this much code into kernel mode would substantially affect system stability. The reason the impact on system stability has been minimal is that prior to Windows NT 4 (and this is still true today), a bug (such as an access violation) in the user-mode Windows subsystem process (Csrss.exe) results in a system crash because the Windows subsystem process was (and still is) a vital process to the running of the system. Because it was the process that contained the data structures that described the windows on the display, the death of that process would kill the user interface. However, even a Windows system operating as a server, with no interactive processes, can't run without this process, because server processes might be using window messaging to drive the internal state of the application. With Windows, an access violation in the same code now running in kernel mode simply crashes the system more quickly, because exceptions in kernel mode result in a system crash.

There is, however, one additional theoretical danger (b) that didn't exist prior to moving the windowing and graphics system into kernel mode. Because this body of code is now running in kernel mode, a bug (such as the use of a bad pointer) could result in corrupting kernel-mode protected data structures. Prior to Windows NT 4, such references would have caused an access violation because kernel-mode pages aren't writable from user mode. But a system crash would have then resulted, as described earlier. With the code now running in kernel mode, a bad pointer reference that caused a write operation to some kernel-mode page might not immediately cause a system crash, but if it corrupted some data structure, a crash would likely result soon after. There is a small chance, however, that such a reference could corrupt a memory buffer (rather than a data structure), possibly resulting in returning corrupt data to a user program or writing bad data to the disk.

(出典 M. E. Russinovich and D. A. Solomon, Microsoft Windows Internals, 4th Ed., pp.56-58, 2005)

- Windows NT 4: 1996 年出荷の Microsoft 社のオペレーティング・システム．Windows 2000, XP の前身.
- the Windows subsystem process: Windows の主要機能を実現するアプリケーション・プロセス．サーバ・プロセスともいう．非カーネルモードで動作する.
- context switch: コンテキスト切り替え.
- CPU cycles: CPU サイクル，CPU 時間.

(1) Windows NT 4 について、下線 (a) のように変更しなければどんな問題があると述べられているか.

(2) 下線 (b) の danger とは例えば何であると述べられているか.