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※机上の受験番号を記入してください。

( 1 / 3 )

(注) 解答はすべて解答欄に記入すること。

I. 次の英文を読んで、設問に答えなさい。なお、文中\*印の付いた語句には注がある。

#### Part I

That flock of pigeons flying overhead may look like a chaotic cloud of birds, but it's more like an \*airborne hierarchy. By strapping tiny global positioning system (GPS) backpacks onto the birds, researchers have found that a flock follows several leaders at any given time in flight. But the flock's leadership can change so that even low-ranking birds sometimes get a chance to command. The findings could shed light on how other groups of animals behave \*en masse, such as herds of wildebeest, schools of fish, and even crowds of humans.

Flocks of birds are one of the most common sights in everyday life, but many aspects of the animals' behavior remain poorly understood. Why, for example, do flocks suddenly change directions and then change directions again within a few seconds? Why do birds in flight suddenly stop to rest on a certain stretch of telephone wire? And lacking any threat or sudden disturbance, why do flocks on the ground spontaneously take to the air?

#### Part II

To find some of the answers, researchers exploited a bit of 21st century technology. A team lead by \*statistical physicist Tamás Vicsek of Eötvös University in Hungary outfitted a trained flock of 13 homing pigeons with tiny GPS receivers that could determine each individual bird's position every 0.2 seconds. Then they sent as many as 10 members of the flock out on 15 test flights. The journeys included four flights of about 15 kilometers back to the birds' \*roost and 11 flights roaming freely around their home base outside Budapest. The researchers tracked each bird's directional changes and how often those changes either followed or were copied by its flockmates.

In today's issue of *Nature*, the team reports that the flight patterns showed a definite hierarchy, with most or all of the birds consistently copying changes in direction by the flock's leaders, which almost always flew in front. If, for example, a leading bird suddenly swerved to the right, its followers copied its move within about 0.4 seconds—an amount of time considered too long to be reflexive.

However, the data also revealed that the leaders weren't always the same, even within a single flight. And sometimes, even the birds at the bottom of the pecking order would lead the flock for brief periods. The arrangement made each flight more \*egalitarian, but the researchers think the reason might be more evolutionarily than politically driven. It's possible that this type of group decision-making is more accurate or beneficial than others, says zoologist and co-author Dora Biro of the University of Oxford in the United Kingdom. Perhaps the individuals in the flocks stand a better chance of survival if they sometimes participate in guiding the group rather than constantly submitting to a single leader, she says.

#### Part III

Another curiosity was that the lower-ranking birds most often flew behind and to the right of the leaders. The researchers think this relates to the structure of the birds' brains, in which the left side handles spatial tasks and the right side governs social recognition. Therefore, anything the birds see with their left eye (which is processed by the right side of the brain) tends to yield a quicker social response.

"The degree of coordination that flocks achieve is really impressive," Biro says. "We identified a clear hierarchical structure within the decision-making process." She says the team next plans to study flock members in greater depth, including their genders, ages, navigational experiences, to determine "what airborne leaders are made of."

The findings could help explain group behavior of other animals, such as schooling fish, says evolutionary biologist Iain Couzin of Princeton University. There's a "fascinating balance" between democratic and hierarchical control in the pigeon flocks, he says. And this sophisticated study reveals the link between the birds' brain \*hemispheres and how they gather information during their flights. It achieves "a deeper understanding of coordinated control in animal groups," he says.

*Science Now* By Phil Berardelli 8 April 2010

[注] airborne hierarchy 「空中の序列」 en masse 「集団で」、英語で in a mass という意味  
statistical physicist 「統計物理学者」 roost 「ねぐら」 egalitarian 「平等主義の」 hemispheres 「(脳の)両半球」

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問 1. 次の各文の内容が問題文の内容と一致する場合は○、一致しない場合は×を書きなさい。ただし、全部○・全部×はない。全部○を書いた場合、あるいは全部×を書いた場合はゼロ配点とする。

1. Only high-ranking pigeons in a flock can guide the group.
2. It is still not known what causes birds to suddenly take flight.
3. The time interval of 0.4 seconds is so short that it must be a reflexive action.
4. Dora Biro points out the possibility that the interchangeable leadership in the flock could be related to a survival strategy.
5. The researchers think that the position of lower-ranking birds in flight could be linked to the way the different hemispheres in the brain work.

問 2. 次のPart I・II・III中のかっこに適切な語をそれぞれの下から選び、必要があれば語形を変えて書き入れなさい。

Part I Flocks of pigeons are a ( 1 ) sight in cities. If you watch a flock in flight you will see them make many changes of direction in a short time. Also, you will see them ( 2 ) stop and settle on a roof or telephone wire, and then just as ( 3 ) take to the air. The flock may look like a ( 4 ) group, but in fact flocks are highly organized. Researchers have found that a pigeon flock has several leaders. What's more, some low-ranking birds have the chance to take a turn as a leader. This research is important because an understanding of how pigeons act may lead to a better ( 5 ) of how other groups of animals behave.

[ chaotic, common, quick, suddenly, understand ]

Part II To find out how a flock behaves, a team of researchers attached a tiny GPS receiver to each bird in a flock of trained pigeons. The receiver determined the bird's ( 1 ) five times a second. Groups of birds were then ( 2 ) out on 15 test flights. The researchers tracked each bird's changes in ( 3 ) during the flight. Also, they noted how often those changes were followed by other birds in the flock. As expected, they found that the flock followed the leaders, who almost always flew in front. What's more, the time lag between a change in a leader's position and its followers' reaction was about 0.4 seconds. This amount of time is too long to be reflexive. Thus, it appears that the followers are *consciously* changing direction in response to a leader's command. As mentioned above, it was also found that low-ranking birds were able to ( 4 ) the flock for short periods. The researchers speculate that group decision-making has proven better for survival than ( 5 ) completely on one or two leaders would have.

[ direction, guide, position, rely, send ]

Part III The research also indicated that followers usually flew behind and to the right of lead birds. This behavior is assumed to be due to the pigeon brain ( 1 ). The right side of the brain handles social recognition. Thus, anything seen by the left eye, and therefore ( 2 ) by the right side of the brain, would yield a quicker response. One of the co-authors of the study remarked that the level of coordination ( 3 ) by the birds was very impressive. An evolutionary biologist who was not involved in the study believes that the balance between ( 4 ) and hierarchical control is fascinating. As for the original research team, they plan to study flock members in more depth soon, taking into account age, gender, and navigational experience. Their goal is to find out what is necessary for a bird to become a leader. Their findings may lead to a ( 5 ) understanding of how other animals, including humans, behave in groups.

[ democratic, great, processed, show, structure ]

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II. 次の会話が完成するように、(1)～(10)のかっこに補うべき適切な文を a～jの中から選び、その記号を書きなさい。  
ただし、それぞれの文は1度しか使えない。

<The Best Idea I've Heard So Far>

Matt: ( 1 )

Tony: You mean the town-hall meeting about the new resort they want to build near Coral Beach?

Josh: ( 2 )

Matt: ( 3 ) The last thing we need is something that'll only make money for a handful of strangers.

Tony: Well, if you ask me, a resort would bring a lot of business into the community. As a matter of fact, that marine resort at Bedford Harbor increased tax revenues by more than 25 percent.

Josh: We all know this town could use a boost like that.

Tony: I couldn't agree with you more. ( 4 )

Matt: I'm not so sure a resort's the answer. I mean most of the jobs are seasonal, low-paying service jobs.

Josh: ( 5 ) Besides tourists need cafes and restaurants, and that means business opportunities.

Matt: Yeah, but you can't live off the tourists in the winter. ( 6 )

Josh: Quite frankly it doesn't matter much what any of us think.

Tony: ( 7 )

Josh: ( 8 ) Those developers have got the town council in their pocket, and this meeting's just a way to make everybody think they've got a say.

Matt: Regardless, I'm going to the meeting anyway. ( 9 )

Tony: ( 10 ) After all, it is a free country.

- a. I disagree.
- b. Good point, Matt.
- c. What do you mean, Josh?
- d. Somebody's got to speak out.
- e. Josh, what's your take on this?
- f. So, you guys going to the meeting tonight?
- g. The way I see it, the decision's already made.
- h. The way I look at it, a resort's just what we need.
- i. In my opinion a seasonal job's better than no job.
- j. As it is, there just aren't enough jobs to keep our young people here.