

※ 注意：請於試卷內之「非選擇題作答區」依序作答，並應註明作答之大題及小題題號。

**I. Explain the following terms (4 points each)**

1. genetic drift
2. homology
3. mass extinction
4. adaptation (2 points) and exaptation (2 points)
5. secondary contact
6. acclimation
7. mimicry
8. ecosystem engineer
9. secondary succession
10. net primary production

**II. Short answer questions**

11. Mr. Anderson is studying the community structure of ants living in the main campus of National Taiwan University (NTU) as his master's thesis. He randomly selected 10 plots, each 10 m by 10 m. He visited each plot five times in July-August 2020. During each visit, he randomly selected an 80 cm by 80 cm quadrat, spent 30 min at the quadrat, and collected all of the ant individuals that showed up on the soil, litter or plant surfaces within the quadrat. He preserved the individuals in 95% ethanol, and identified each individual to the species level in the lab. He then used the data to estimate the density of each ant species on campus, calculated  $\alpha$ -diversity, and estimated the relative abundance of each species. (A) Mr. Anderson's research idea and sampling design have several problems. List four of the problems and explain what you would do to improve the study if you were Mr. Anderson. (8 points) (B) After correcting all of the sampling design issues following your suggestions, Mr. Anderson expanded his sampling to the nearby Taan Forest Park (TFP). After properly analyzing the data, he concluded that the NTU campus has higher  $\alpha$ -diversity and  $\beta$ -diversity than TFP. Mr. Anderson is very excited and wants to explain his findings to his partner. However, his partner has no background in biology or ecology, and has no idea what  $\alpha$ -diversity and  $\beta$ -diversity are. Help Mr. Anderson explain his finding using plain language. Try to be as precise as possible. (4 points)

12. Ecologists generally recognize three types of competition. One of them is interference. What are the other two? Explain the three types of competition (Write down their definitions). (5 points)

13. In many groups of organisms, such as birds and trees, there exists a latitudinal diversity gradient, in which species richness is highest in low latitudes, and gradually decreases with increasing latitudes. Many hypotheses have been proposed to explain this pattern. List three hypotheses and provide the rationales. (9 points)

14. What are the four categories of ecosystem services? (4 points)

15. Please give the definition of evolution and describe how it works. (10 points)

16. Please draw a phylogenetic tree, illustrating the relationships among *Oncorhynchus masou* (known as masu salmon), *Latimeria chalumnae* (West Indian Ocean coelacanth), and yourself, *Homo sapiens* (human). Explain why. (10 points)

17. Please describe Red Queen Hypothesis and explain how it works. (10 points)

試題隨卷繳回