27th International Biology Olympiad

July 17-23, 2016
Hanoi, Vietnam

Practical Exam 2

ANIMAL SYSTEMATICS動物系統分類 AND ANATOMY及解剖

Total points: 100
Duration: 90 minutes

DEAR PARTICIPANTS,

In this practical test, do the following two parts此實作要做下面兩部份：

EXPERIMENT 1. CLASSIFICATION OF BUTTERFLIES (65 points)
實驗 1 .蝴蝶的分類(65分)

- Task 1. Identify all the butterfly specimens provided.
  操作1.辨識所有提供的蝴蝶標本
- Task 2. Compile the character matrix
  操作2. 匯整成特徵矩陣
- Task 3. Calculate the distance matrix based on the characteristic matrix provided
  操作3.根據所提供的特徵矩陣計算距離矩陣
- Task 4. Resolve the phylogenetic relationship of all the specimens
  操作4.解答所有標本的親緣關係
- Task 5. Draw a phylogenetic tree (dendrogram)
  操作5.畫出親緣關係樹(支序圖)

EXPERIMENT 2. ANATOMY OF EARTHWORM Amynthas aspergillum (35 points)實驗2. Amynthas aspergillum蚯蚓的解剖

- Task 6. Identify the external structures of Amynthas aspergillum
  操作6.辨識蚯蚓的外部構造
- Task 7. Dissect and identify the internal structures of Amynthas aspergillum
  操作7.解剖並標示蚯蚓的內部構造

Important Information:注意事項

- Please remember to write your Country and Student code in the given box.
  請記得在提供的方格中填寫你的國家及學生編碼
- Write your answers in the separate Answer Sheet. Only the answers given in the Answer Sheet will be evaluated.
  將答案寫在答案卷上，答案只有寫在答案卷上才會被計分。
- Make sure that you have received all the materials and equipment listed. If any of these items are missing, please raise the Red card immediately.
  確定你清單上所有列出的材料及設備。
  如有缺少或損壞，立刻舉起紅卡。
- During experiments, ensure to handle equipment properly. Any spilled solutions or broken equipment will not be replenished.
  實驗中正確使用器材，如有任何溶夜溢出或儀器損壞將不再補充。
- Stop answering and put down your pen immediately when the bell rings at the end of the exam. Enclose the Question Paper and Answer Sheet, in the provided envelope.
  考試結束鈴響時，將筆放下停止作答。將試卷及答案卷放入所提供之封袋。
- No paper, materials or equipment should be taken out of the laboratory.紙張、材料及設備不可帶出實驗室。

Good luck!!!

Materials and Equipment材料及設備

Experiment 1. Classification of Butterflies
實驗1.蝴蝶的分類

Name名稱	Quantity數量
Box containing 8 butterfly specimens 裝有8隻蝴蝶標本的盒子	1box1盒
Mask口罩	1 piece1個
Forceps鑷子	1 pair1付
Magnifier glass 放大鏡	1 piece1個
Ruler尺	1 piece1把
Pen筆	1 piece1枝
Calculator計算機	1 piece1台
Scratch papers for calculating 計算用草稿紙	1 set1疊
Gloves手套	2 pairs2雙
Tissue papers面紙	1 box一盒

Experiment 2. Anatomy of Earthworm (Amythas aspergillum)
實驗2.蚯蚓解剖

Name名稱	Quantity數量
Alcohol pre-treated earthworm 酒精處理過的蚯蚓	1 specimen 1標本
Stereomicroscope 解剖顯微鏡	1 piece1台
Tray 解剖盤	1 piece1個
Forceps 鑷子	1 pair1付
Mounted needle 固定針	1 piece1枝
Scissors剪刀	1 piece1付
Knife刀	1 piece1把
Petri disc培養皿	1 piece1個
Glass slide載玻片	1 piece1片
Pipette吸管	1 piece1個
Plate with pins 盤內有針	1 plate1盤
Plate with 5 colour-headed pins 5色珠針盤	1 plate1盤
Magnifier glass放大鏡	1 piece1付
Gloves手套	2 pairs2雙
Mask口罩	1 piece1付
Student Code Sheet學生編碼單	1 piece1張
Pen筆	1 piece1枝
Tissue papers面紙	1 box1盒

* Participants carefully check the materials and equipment. If any of these items is missing or damaged or unable to distinguish the colour-headed pins, please raise the RED card immediately.
參賽者仔細檢查材料及設備，如有任何短缺或損壞或無法區分有色珠針時，請立刻舉紅卡

實驗1.蝴蝶的分類（65）分

Introduction介紹

Vietnam has rich and diverse fauna and flora. There are more than 1,200 species of butterflies. However, due to habitat disturbance and destruction, some species are threatened and endangered, thus learning about butterflies may contribute to preserving their diversity. The purpose of this practical task is to identify some butterfly species in Vietnam and compile the phylogenetic relationship of these species based on their morphological characters.
Note: Butterfly box will be a gift for the participants after completing all the practical (Please, write your name in the label on the box).
越南有豐富及多元的動植物相，有超過1200種的蝴蝶。但由於棲地遭受干擾及破壞，有些物種遭受威脅及瀕危。
是以對蝴蝶的了解，可提供對牠們多樣性的保存。
本實作是要辨識在越南的蝴蝶並根據牠們的形態特徵來匯整牠們的親緣關係。
注意：蝴蝶盒將在你完成所有實作測驗後當作禮物送給你。（請將你的名字寫在盒上的標籤上）

Task1. Identify all the butterfly specimens provided
操作1.辨識所有提供的蝴蝶標本

Identify all butterfly specimens (A to H) using the following identification keys. Consult the figures (1, 2, 3) below to identify the required morphological characters. 利用下面檢索表來辨識所有蝴蝶標本(A到H)。參考下圖(1.2.3)來辨識所要求的形態特徵。

Morphological characters
形態特徵

The following figures describe the required morphological characters.
下圖描述所需要的形態特徵

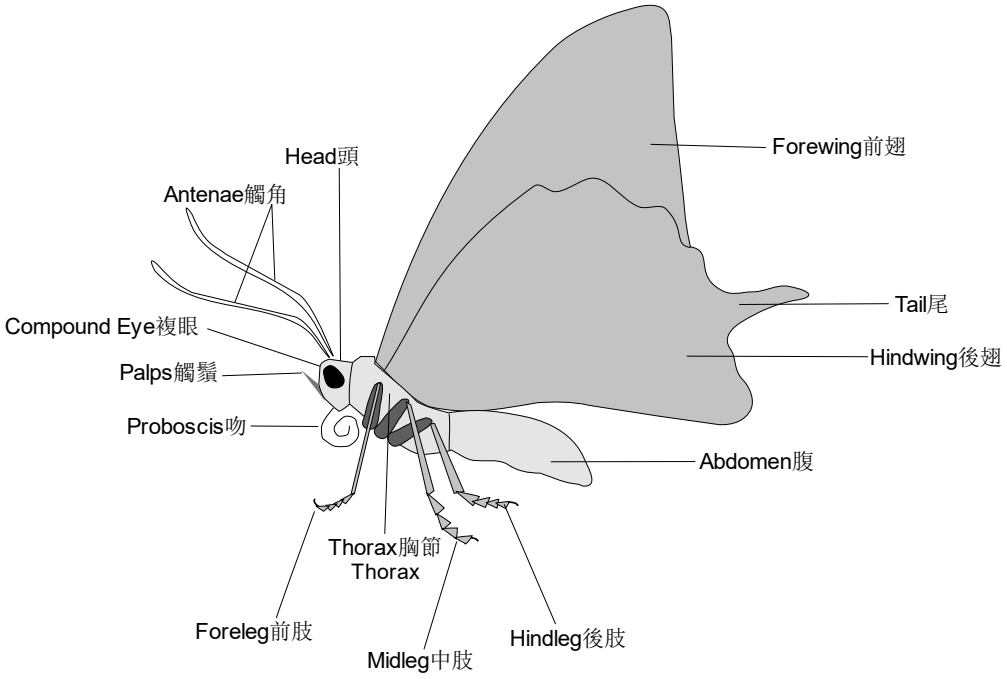

Figure 1. External structure of butterfly.
圖1.蝴蝶的外部構造

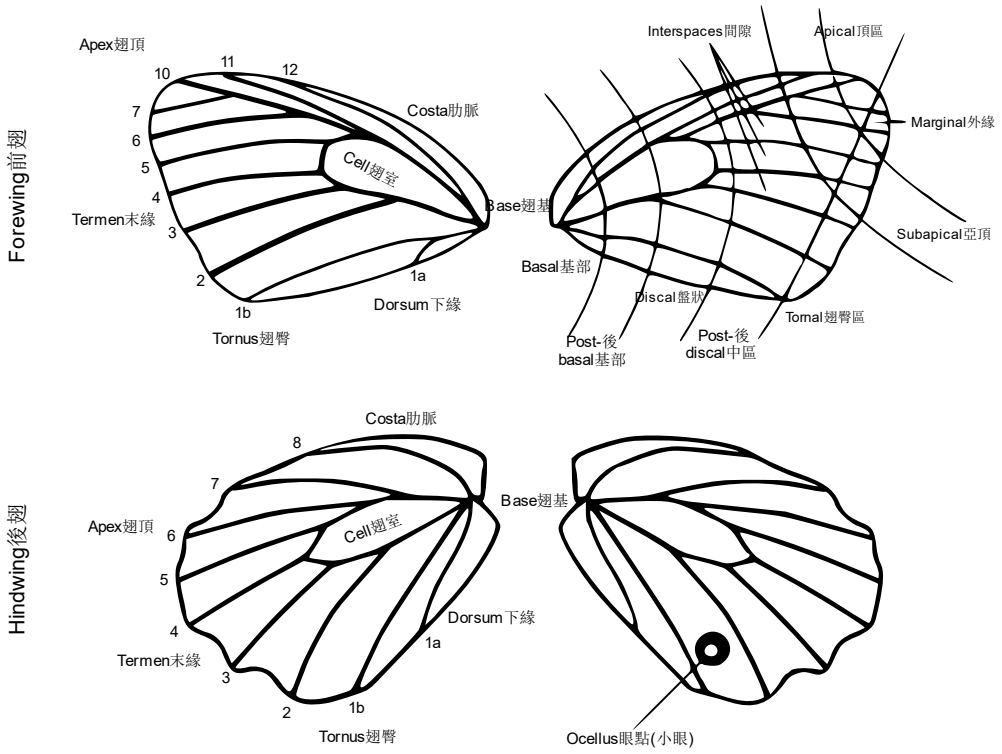

Figure 2. Butterfly wing terms.
圖2蝴蝶翅膀名稱

The wing is divided into several areas and interspaces. The wing vein are numbered. The forewing veins are numbered from 1 (1a, 1b) to 12; the hindwing veins are numbered from 1 (1a, 1b) to 8.
翅膀分成許多區及間隙，翅脈由數字標記，前翅翅脈從1(1a,1b)到12;後翅翅脈從1(1a,1b)到8。

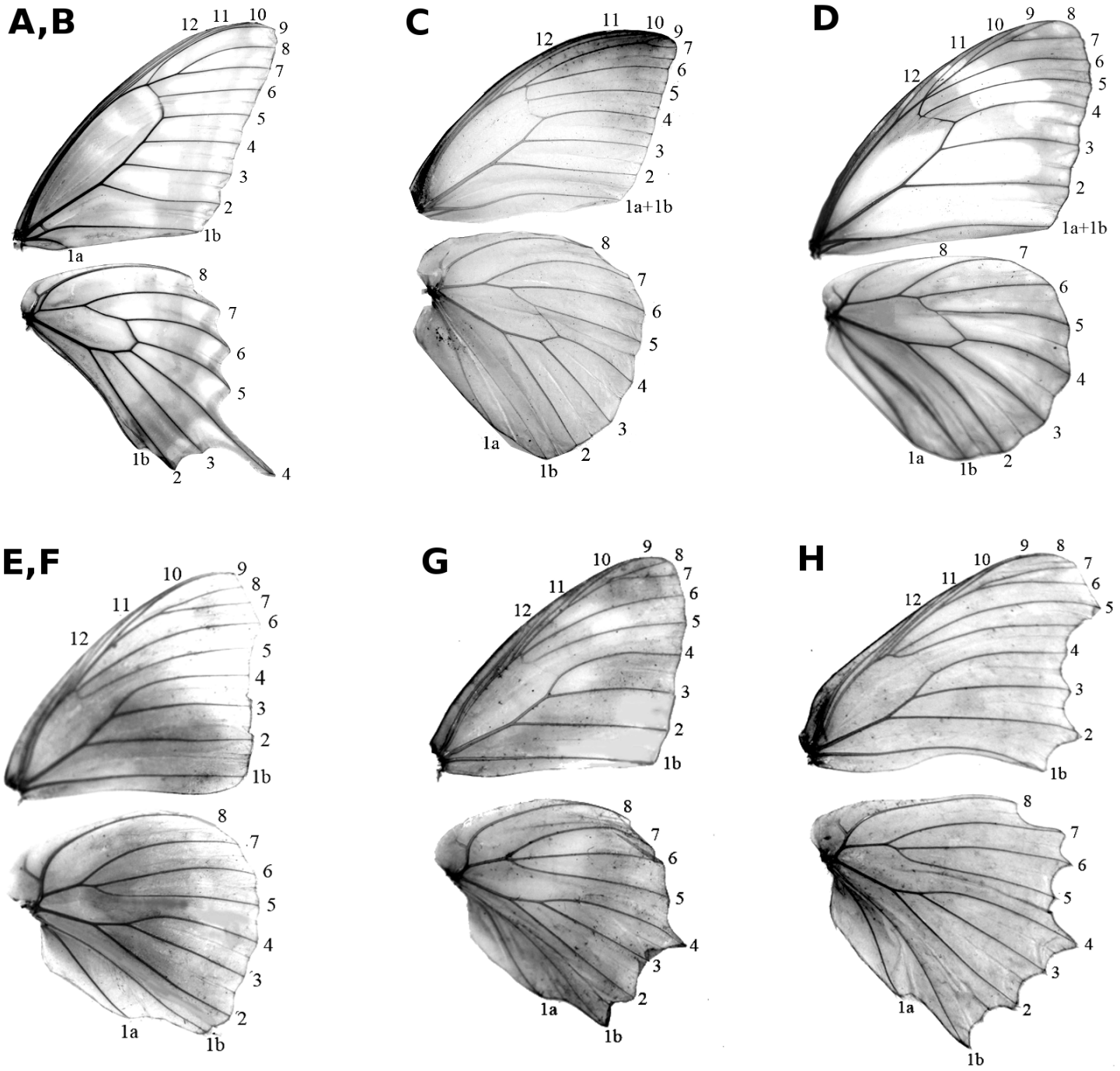

Figure 3.圖 3

Specimens A, B) With Veins 1a, 1b in the forewing; without Vein 1a on the hindwing; with long tail on the hindwing,

標本A, B)前翅有1a,1b翅脈；後翅無1a翅脈；後翅有長尾

Specimen C) With Veins 1a, 1b in the forewing intersected; Veins 8 and 9 in the forewing overlapped.

標本C)前翅1a,1b翅脈相接；前翅8和9翅脈重疊

Specimen D) With Vein 1a, 1b in the hindwing; Vein 1a and 1b on the forewing intersected.

標本D)後翅有1a,1b翅脈；前翅1a和1b翅脈相接

Specimens E, F) With Vein 1a, 1b in the hindwing, without Vein 1a on the forewing, open wing cells ; apex of forewing cut

標本E,F)後翅有1a,1b翅脈，前翅無1a翅脈，開放式翅室；前翅翅頂有剪痕

Specimen G), H) Without Vein 1a in the forewing, with Veins 1a and 1b in the hindwing, knob tail on the Vein 4 in the hindwing; open wing cells.

標本G),H)前翅無1a翅脈，後翅有1a和1b翅脈，後翅翅脈4有突起的尾端；開放式翅室

Specimen H) Apex of forewing cut.

標本H)前翅翅頂有剪痕

Identification Key for Butterflies

蝴蝶檢索表

1.	Hindwing with long tail 後翅有長尾	Continue at 2.續接2
	Hindwing without long tail 後翅無長尾	Continue at 6.續接6
2.	A white patch on the wing 翅膀有一白色區塊	Continue at 3.續接3
	No white patch on the wing 翅膀無白色區塊	Continue at 4.續接4
3.	Forewing with white spots in interspace between 1a and 1b (Figure 2) 前翅1a和1b間隙間有白點(圖2)	Papilio noblei
	Forewing without white spots in interspace between 1a and 1b 前翅1a和1b間隙間無白點	Papilio helenus
4.	Upper side of wings with a pale yellowish green macular band from the apex to the mid of dorsum of the forewing 前翅翅膀上面，從頂翅到下緣中間有一淡黃綠的斑點帶	Papilio demolion
	緣Upper side of wings without a pale yellowish green macular band from the apex to the mid of dorsum of the forewing 前翅翅膀上面，從頂翅到下緣中間無一淡黃綠的斑點帶	Continue at 5.續接5
5.	Upper side of hindwings tornus with a red spot but no black dot inside 後翅翅膀上面，翅臀有一個紅點但內無黑點	Papilio machaon
	Upper side of hindwings tornus with an orange or pale yellow spot and a black dot inside 後翅翅膀上面，翅臀有一個橘色或淡黃色斑點且內有黑點	Papilio xuthus
6.	White or yellow wings 白色或黃色翅膀	Continue at 7.續接7
	No white or yellow wings 無白色或黃色翅膀	Continue at 8.續接8
7.	Yellow wings with a wide orange band in the forewings 翅膀黃色，前翅有一寬廣的橘色帶	Ixias pyrene
	White wings with a big red-orange patch on half of forewing 翅膀白色，前翅中有一半為一大塊紅—橘色斑	Hebomoia glaucippe
8.	Apex of forewing rounded or pointed 前翅翅頂為圓型或尖型	Continue at 9.續接9
	Apex of forewing cut 前翅翅頂有剪痕	Continue at 11.續接11
9.	Hindwing with knob tail; upper side with orange bands on brown wings 後翅具突起的尾端；棕色翅膀上面有橘色帶狀	Symbrenthia lilaea
	Hindwing without knob tail 後翅無突起的尾端	Continue at 10.續接10
10.	Wing veins brown; upper side of hindwings orange without black spots 翅脈棕色；後翅上面為橘色無黑點	Danaus genutia
	Wing veins not brown; upper side of hindwings orange with black spots 翅脈非棕色；後翅上面為橘色有黑點	Danaus chrysippus
11.	Ocelli on wings 翅膀有眼點(小眼)	Continue at 12.續接12
	No ocelli on wings 翅膀無眼點(小眼)	Continue at 13.續接13
12.	Blue hindwing; upper side of hindwing with 2 ocelli 後翅為藍色，後翅上面有2個眼點(小眼)	Jumonia orythia
	No blue hindwing; lower side with very broad darker brown transverse fasciae	

	後翅非藍色；後翅下面有非常寬的黑棕色橫帶	Junonia iphita
13.	Black wings with white macular bands and spots 黑色翅膀有白色斑點帶和斑點	Athyma asura
	Orange wings with black spots 橘色翅膀有黑色斑點	Polygonia c–aureum

Q.1.1. CLASSIFICATION OF BUTTERFLIES (16 POINTS)
Q1.1.蝴蝶分類(16分)

Mark the correct species name for each Specimen A-H with a "✓" in the ANSWER SHEET.
在答案卷上以"✓" 選取A-H的標本中正確的種名。

Task 2. Compile the character matrix
操作2.匯整成特徵矩陣

Consider the following characters:
考量下列特徵：

a. Long tail on hindwing
後翅有長尾

b. Knob tail on hindwing
後翅有突起尾巴

c. Vein 1a on forewing
前翅有 1a翅脈

d. Vein 1a on hindwing
後翅有 1a翅脈

e. Wing vein 8 and 9 in forewing: overlapped = 1, not overlapped = 0
前翅8和9翅脈：重疊 = 1，未重疊=0

f. Wing vein 1a: "stretches the dorsum near the base of forewing " = 1, "other cases" = 0
1a翅脈："延伸至下緣靠近前翅的翅基 "= 1， "其他情形 ""=0

g. Wing vein 1a and 1b in forewing: intersected = 1, other cases = 0
前翅翅脈1a 和1b相接= 1，其他情形= 0

h. Wing cells: open = 1, close = 0
翅室：開放 = 1, 關閉= 0

i. Orange hindwings with brown wing veins
橘色後翅有棕色翅脈

j. A big red-orange patch on half of forewing
前翅有一半為一大塊紅橘斑點所占

k. Upper side with orange bands on brown wings
棕色翅膀上面有橘色帶

l. A series of white spots on the marginal area of wings
在翅膀邊緣區域有一系列白色斑點

m. White patch on hindwing
後翅有白色區塊

n. Upper side hindwing with an orange or a pale yellow tornal spot with a black dot inside
後翅上面有一個橘色或一個淡黃色翅臀斑點且斑點內有一黑點

o. Ocelli on wings
翅膀有眼點(小眼)

p. Apex of forewing: cut = 1, rounded or pointed = 0
前翅翅頂：有剪痕= 1，圓形或尖形 = 0

Q.2.1 CHARACTER MATRIX (25.6 POINTS)
Q.2.1特徵矩陣(25.6分)

Compile the character matrix for the character listed above in the ANSWER SHEET .
Use “1” for present and “0” for absent.
根據上面答案卷所提供之特徵匯整特徵矩陣。用“1”代表存在“0” 代表不存在

Task 3. Calculate the distance matrix based on the characteristic matrix provided
根據所提供之特徵矩陣計算距離矩陣

For the remaining part of this experiment use the character matrix provided Table 1. This matrix is not related to Tasks 1 and 2.
接下來後面的實驗，要使用表1特徵矩陣所提供的資料，此矩陣與操作1與2無關。
(表一)

Characters 特徵	A	B	C	D	E	F	G	H
1	1	1	0	0	0	0	0	0
2	1	0	0	0	0	0	0	0
3	0	1	0	0	0	0	0	0
4	0	0	1	0	0	0	0	0
5	0	0	0	1	0	0	0	0
6	0	0	1	0	0	0	0	0
7	0	0	0	0	1	0	0	0
8	1	1	1	0	0	0	0	0
9	1	1	0	0	0	0	0	0
10	0	0	0	0	0	0	1	1
11	0	0	1	0	0	0	0	0
12	0	0	1	1	0	0	0	0
13	0	0	0	1	1	1	1	1
14	1	1	0	0	0	0	0	0
15	0	0	0	0	1	1	1	1
16	0	0	0	1	0	0	0	0
17	0	0	0	0	1	1	0	0
18	0	0	0	1	1	1	1	1
19	1	0	0	0	0	0	0	0
20	0	0	0	0	1	1	1	1
21	0	0	0	0	1	1	0	1
22	0	0	0	0	0	0	0	1
23	0	0	0	1	0	0	0	0
24	0	1	0	0	0	0	0	0
25	0	0	0	0	0	1	0	0
26	0	0	0	0	0	0	1	0

Q.3.1. CALCULATE DISTANCE MATRIX
Q3.1. 計算距離矩陣

Calculate the distance matrix based on the character matrix provided in Table 1. The distance between two specimens is defined as the number of characters at which the two specimens show different character states (present: “1”; absent: “0”). Write the numerical results in the ANSWER SHEET (8.4 points).
根據表一所提供的特徵矩陣計算距離矩陣。兩標本的距離定義為兩標本特徵中呈現不同狀態者（存在: “1”; 不存在: “0”）的數量來表示。
將數字結果寫在答案卷(8.4分)。

Reconstructing Phylogenetic Realtionship using UPGMA
利用UPGMA重建親緣關係

UPGMA (Unweighted Pair Group Method with Arithmetic Mean) is considered the simplest method for reconstructing phylogenetic trees with the assumption that the data provided have constant rates of evolution.
UPGMA(算數平均數之非加權集群對比的方法) 係用最簡單的方法來重建親緣關係樹，其前提為所提供的資料，其演化速率是不變的。
In the method, the pair of clusters with the shortest distance is combined into a cluster of higher level at each iteration.
此方法是藉由計算，將其中距離最近的一對(兩個)群集組合成一個較高層次的群集。
To illustrate this concept, consider the numbers of character differences between the taxa (specimens) M, N, O, P, and Q.
要了解此概念可以用不同分類群taxa（標本）M, N, O, P, 及 Q特徵差異的數量來說明。

Taxa分類群	M	N	O	P	Q
M	0				
N	2	0			
O	6	6	0		
P	4	5	7	0	
Q	7	8	9	7	0

Iteration 1: The pair of clusters with the smallest distance is the pair M and N, which is thus combined into a higher–level cluster (M,N). The relative age of newly formed cluster is computed as half the distance between two original clusters. In this case, the relative age of the cluster is 1.
演算1：各集群對中有最小距離的是M及N對，是以兩者將組合成一較高層次之集群（M,N）。此新組成之集群其相對年齡是以此二原始集群間距離之半來計算。在此例中此集群之相對年齡為1。
Next, a new matrix of all distance is generated by computing the distance between clusters as the average distance between all taxa from one cluster to all taxa of the other cluster.
其次，一個新的矩陣包含所有集群間的距離，此距離的計算是由一個集群的所有分類群到其他集群的所有分類群的平均距離。
The distance between Cluster (M,N) and Cluster (P), for instance, is computed as the average between d(M,P) and d(N,P) as (4+5)/2, where d(x,y) is a notation to indicate the distance between Clusters x and y. The result is presented as the table below:
例如集群 (M,N) 和集群 (P)的距離是由 d(M,P)和d(N,P)的平均來計算，如(4+5)/2。此d(x,y)符號表示集群 x 和 y 之間的距離。其結果顯示如下表。

Taxa分類群	(M,N)			
(M,N)	0.0	O		
O	6	0.0	P	
P	4.5	7	0.0	Q
Q	7.5	9	7	0.0

Iteration 2: The pair of clusters with the smallest distance is now the pair of MN and P, which is thus combined into a higher–level cluster ((M,N),P) with a relative age of 2.25.
演算2：集群中具有最小距離的集群對現在是MN 和 P，由此其組成一個較高層次的集群((M,N),P)，其相對年齡為2.25。
Again, a new matrix is constructed by calculating all distances as indicated above.
接下來，如同上述方式計算所有的距離來建構一個新的矩陣。
The distance between Cluster ((M,N),P) and Cluster (O), for instance, is computed as the average between d(M, 0), d (N, O), and d(P,O) as (6+6+7)/3 = 6.33. The result is presented as the table below:
例如集群((M,N),P)和集群(O)的距離是藉由計算d(M, 0), d (N, O), 和 d(P,O) 的平均來獲得，如(6+6+7)/3 = 6.33。結果的呈現如下表。

Taxa分類群	((M,N),P)		
((M,N),P)	0.0	O	
O	6.33	0.0	Q
Q	7.33	9	0.0

Iteration3: The pair of clusters with the smallest distance is now the pair of MNP and O, which is thus combined into a higher–level cluster(((M,N),P),O) with a relative age of 3.17.
演算3:目前所形成的集群對中，距離最小的是MNP和O，如此可組成一較高層次的集群(((M,N),P),O)其相對年齡為3.17。
Again, a new matrix is constructed by calculating all distances as indicated above. The result is presented as the table below:
再接下來，如同上述方式計算所有的距離來建構一個新的矩陣。結果的呈現如下表。

Taxa	(((M,N),P),O)	
(((M,N),P),O)	0.0	Q
Q	7.75	0.0

Iteration 4: In the last cluster, the two remaining taxa are combined into the new cluster ((((M,N),P),O),Q) with a relative age of 3.88.
演算4：在此最後的集群中，剩下的兩個分類群組合成一個新的集群((((M,N),P),O),Q) ，其相對年齡為3.88。

Task 4. Resolve the phylogenetic relationship of all the specimens
操作4.找出所有標本的親緣關係圖

Resolve the phylogenetic relationship of all specimens (A–H), showed at the Table 1, iteratively using the UPGMA method and based on the distance matrix you compiled above (Task 3).
根據你在操作3所匯整的距離矩陣，用UPGMA方法重複演算找出表1標本(A–H)間親緣關係。
Make sure to report the names of the clusters using the Specimen codes A to H. Write the numerical results in the ANSWER SHEET (10.75 points).
使用標本代碼A到H，確定要寫出群集的名稱，將數字結果寫入案卷上(10.75分)

Q.4.1. UPGMA ITERATION 1 (3 POINTS)
Q.4.1. UPGMA演算1(3分)

Q.4.2. UPGMA ITERATION 2 (2.5 POINTS)
Q.4.2. UPGMA 演算2 (2.5 POINTS)

Q.4.3. UPGMA ITERATION 3 (2 POINTS)
Q.4.3. UPGMA演算3(2分)

Q.4.4. UPGMA ITERATION 4 (1.5 POINTS)
Q.4.4.UPGMA演算4(1.5分)

Q.4.5. UPGMA ITERATION 5 (1 POINT)
Q.4.5. UPGMA演算5 (1分)

Q.4.6. UPGMA ITERATION 6 (0.5 POINTS)
Q.4.6. UPGMA演算6(0.5分)

Q.4.7. UPGMA ITERATION 7 (0.25 POINTS)
Q.4.7. UPGMA演算7(0.25分)

Task 5. Draw a phylogenetic tree (dendrogram)
操作5.畫一親緣關係樹(支序圖)

Q.5. PHYLOGENETIC TREE (4.25 POINTS)
Q.5.親緣關係樹(4.25分)

Draw a phylogenetic tree (dendrogram) based on the UPGMA result in the ANSWER SHEET . Indicate the relative length of each branch by writing the correct numbers next to it.
根據UPGMA之結果，在答案卷上畫一親緣關係樹(支序圖)，在每一分支旁寫出正確數字，顯示其相對長度(4.25分)。

EXPERIMENT 2. ANATOMY OF EARTHWORM (AMYNTHAS ASPERGILLUM) (35 POINTS)
實驗2. 解剖蚯蚓(AMYNTHAS ASPERGILLUM) (35 分)

Introduction
介紹

The earthworm Amynthas aspergillum belongs to the Family Megascolecidae, Phylum Annelida and is a common species in Vietnam. It is rich in protein and suitable food for fish, poultry, and cattle. The species is experimentally raised and used for improving the quality of soil in several areas in Vietnam. This practical test is for you to dissect and identify the external and internal structures of Amythas aspergillum.
蚯蚓Amynthas aspergillum 屬Megascolecidae科，環形動物門，是越南常見種，其富含蛋白質為魚、家禽業及牛合適的食物。本種係實驗性養殖，用來改善越南幾個地區的土壤品質。此一實作測驗是要你解剖及分辨此種蚯蚓的外部及內部的構造

Task 6. Identify the external structure of Amynthas aspergillum.
操作6. 分辨蚯蚓Amynthas aspergillum的外部構造

Use a magnifier glass or stereomicroscope to observe the dorsal pores, clitellum, and chaetae (setae) of Amynthas aspergillum. Then, answer the following three questions the ANSWER SHEET.
使用放大鏡或解剖顯微鏡來觀察背孔，生殖環及剛毛，而後在答案卷上回答下列三個問題。

Q.6.1. (3 POINTS)
Q.6.1.（3分）

操作:
Indicate in the Answer sheet with a “✓” which of the following statements is True.
在答案卷上以"✓"來顯示下列敘述何者正確
Location of the clitellum is from (The segment number is counted from the position behind the labium)
生殖環的位置是在（環節數是從唇的後方開始算）

Q. 6.2. (3 POINTS)
Q. 6.2. (3分)

操作
Indicate in the Answer sheet with a “✓” which of the following statements is True.
在答案卷上以"✓"來顯示下列敘述何者正確
The chaetae distribution in each segment is
剛毛在每個環節上的分佈是

Q.6.3. (3 POINTS)
Q.6.3. (3分)

Indicate in the Answer sheet with a "✓" which of the following statements is True.
在答案卷上以"✓"來顯示下列敘述何者正確
The number of dorsal pore on each segment just behind the clitellum is
在生殖環後面的每個環節上，背孔的數目是

Task 7. Dissecting and identifying the internal structure of Amynthas aspergillum
操作7.解剖及辨識蚯蚓的內部構造

- Place the specimen in the dissecting tray, dorsal side up (Figure 4A).
  將標本置入解剖盤中，背部朝上（圖4A）。
- Locate the clitellum and insert the tip of the scissors about 3 cm from the clitellum posteriorly (Figure 4B).
  找到生殖環位置及用剪刀的尖端離生殖環 3 公分處往後方差入（圖4B）

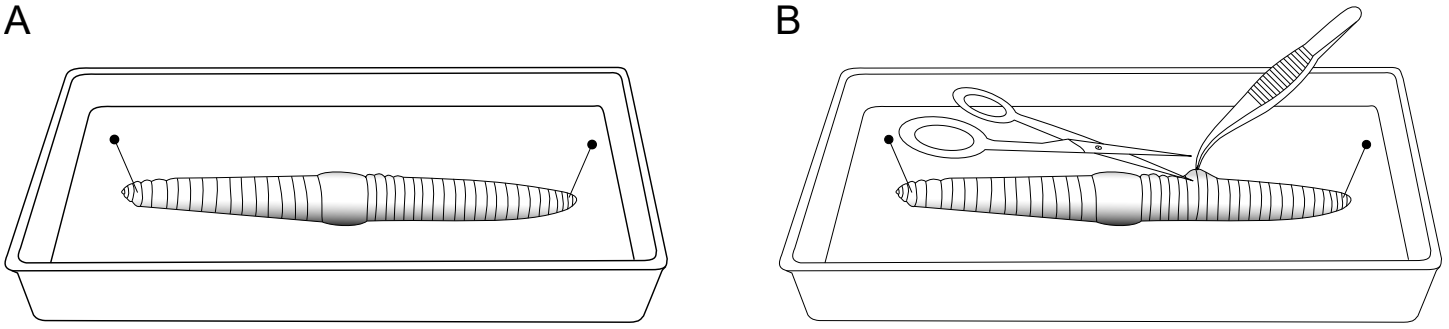

Figure 4.
圖4.

- Cut skin carefully in both ways up to the head and to the anus. Try to keep the scissors pointed up, and only cut through the skin.
  小心地朝頭及肛兩側剪開外皮，盡量將剪刀朝上只要剪開皮膚。
- Spread the skin of the worm out, use a knife to cut the septa (avoid damaging the internal organs).
  將皮膚外張平舖，用刀切隔膜（避免傷害到內部器官）。
- Place pins in the skin to hold it apart, angle the pins out so that they are not in your way.
  用針將皮膚張開，針由外斜插使操作不受影響。
- Pour water into the tray until the earthworm is submerged.
  將水倒入解剖盤中至淹沒蚯蚓為止。

Q.7.1. (3 POINTS)
Q.7.1. （3分）

How many pairs of spermatheca are in Amynthas aspergillum? Write the correct number of spermatheca pair in the box in the ANSWER SHEET .
此蚯蚓有幾對受精囊?在答案卷的空格中填入正確的對數。

Q.7.2 (6 POINTS)
Q.7.2 (6分)

Observe the inside of the body wall and determine the presence/absence of septa between the following segments.
觀察身體內壁，判定下列環節中有無隔膜

Indicate in the Answer sheet with a "✓" if septa are present or absent in the ANSWER SHEET .
在答案卷上以"✓"來顯示節間隔膜存在或不存在

Q.7.3. (10 POINTS)
Q.7.3. (10分)

- Identify the following organs by using the appropriate colour–headed pins.
  用彩色珠針標示下列器官

Colour-headed pin 彩色珠針	Organ器官
Blue藍	Stomach胃
White白	Caecum盲腸
Red紅	Seminal vesicle儲精囊
Yellow黃	Prostate gland攝護腺
Purple紫	Nerve ganglion chain神經節鏈

- Write your student code on the "Student Code Sheet" and place it besides the tray.
  在"學生編碼頁上"寫下你的學生編碼，並將其放在解剖盤旁。
- Raise the green card to inform the supervisor to take photographs and confirm the results on the "Dissecting result confirmation sheet".
  舉起綠卡通知監試人員照相，並在＂解剖確定單＂上確認結果

Q.7.4. (4 POINTS)
Q.7.4.(4分)

- Using the knife to make a cross section (about 0.5 – 1 mm) of the intestine at around segments 30th to 40th. Put this cross section into Petri dish containing water and gently move it in water to remove all remained food. Put the section on the glass slide, add a drop of water, observe the section under the stereomicroscope.
  用刀在蚯蚓身體環節第30到40間的小腸處做橫切面（約0.5-1mm）。將此橫切面放於有水的培養皿中，在水中緩緩移動以移除所有殘存的食物，將此切片放於載玻片上，加一滴水後在解剖顯微鏡下觀察。
- Raise the green card to inform the supervisor to take photographs and confirm the results on the "Dissecting result confirmation sheet".
  舉起綠卡通知監試人員照相，並在＂解剖確定單＂上確認結果。

Q.7.5 (3 POINTS)
Q.7.5 (3分)

Which of the following best describes the intestinal typhlosole observed in the cross section?
在横切面的觀察中，下列何者的敘述最能代表腸皺褶？

A. Intestinal typhlosole ≥ radius of intestine (Figure 5A)
腸皺褶≥腸的半徑（圖5A）

B. Intestinal typhlosole branched (Figure 5B)
腸皺褶分支(圖5B)

C. Intestinal typhlosole < 1/2 radius of intestine (Figure 5C)
腸皺褶< 1/2 腸的半徑(圖5C)

D. No intestinal typhlosole (Figure 5D)
無腸皺褶(圖 5D)

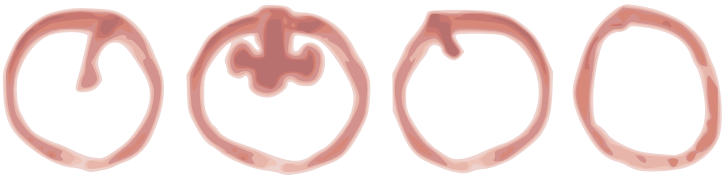

Figure 5.
圖5

Indicate in the Answer sheet with a "✓" the cross section that is observed.
在答案卷上以"✓"顯示所觀察到的横切面

End of Practical Exam 2
實作2考題結束

Country:
Student Code:

27th International Biology Olympiad

July 17-23, 2016
Hanoi, Vietnam

Practical Exam 2

ANIMAL SYSTEMATICS動物系統分類 AND ANATOMY及解剖

ANSWER SHEET答案卷

Total points: 100
Duration: 90 minutes

Q.1.1. CLASSIFICATION OF BUTTERFLIES (16 POINTS)
Q1.1.蝴蝶分類(16分)

Specimen 標本	A	B	C	D	E	F	G	H
Papilio demolion								
Papilio machaon								
Papilio xuthus								
Papilio helenus								
Papilio noblei								
Hebomoia glaucippe								
Ixias pyrene								
Danaus genutia								
Danaus chrysippus								
Symbrenthia lilaea								
Junonia iphita								
Junonia orythia								
Athyma asura								
Polygonia c–aureum								

Q.2.1 CHARACTER MATRIX (25.6 POINTS)
Q.2.1特徵矩陣(25.6分)

	A	B	C	D	E	F	G	H
a								
b								
c								
d								
e								
f								
g								
h								
i								
j								
k								
l								
m								
n								
o								
p								

Q.3.1. CALCULATE DISTANCE MATRIX
Q3.1. 計算距離矩陣

Specimens標本	A	B	C	D	E	F	G	H
A	0							
B		0						
C			0					
D				0				
E					0			
F						0		
G							0	
H								0

Q.4.1. UPGMA ITERATION 1 (3 POINTS)
Q.4.1. UPGMA演算1(3分)

Specimens標本							

Age of newly新近的年齡 formed cluster形成的集群

.....

Q.4.2. UPGMA ITERATION 2 (2.5 POINTS)
Q.4.2. UPGMA 演算2 (2.5 POINTS)

Specimens標本						

Age of newly新近的年齡 formed cluster形成的集群

.....

Q.4.3. UPGMA ITERATION 3 (2 POINTS)
Q.4.3. UPGMA演算3(2分)

Specimens標本					

Age of newly新近的年齡 formed cluster形成的群集

……..

Q.4.4. UPGMA ITERATION 4 (1.5 POINTS)
Q.4.4.UPGMA演算4(1.5分)

Specimens標本				

Age of newly新近的年齡 formed cluster形成的群集

……..

Q.4.5. UPGMA ITERATION 5 (1 POINT)
Q.4.5. UPGMA演算5 (1分)

Specimens標本			

Age of newly新近的年齡 formed cluster形成的群集

……..

Q.4.6. UPGMA ITERATION 6 (0.5 POINTS)
Q.4.6. UPGMA演算6(0.5分)

Specimens標本		

Age of newly新近的年齡 formed cluster形成的群集

……..

Q.4.7. UPGMA ITERATION 7 (0.25 POINTS)
Q.4.7. UPGMA演算7(0.25分)

Age of newly新近的年齡 formed cluster形成的群集
……..

Q.5. PHYLOGENETIC TREE (4.25 POINTS)
Q.5.親緣關係樹(4.25分)

Draw your phylogenetic tree here在此畫出你的親緣關係樹

Q.6.1. (3 POINTS)
Q.6.1.（3分）

操作: Indicate in the Answer sheet with a “✓” which of the following statements is True. 在答案卷上以"✓"來顯示下列敘述何者正確 Location of the clitellum is from (The segment number is counted from the position behind the labium) 生殖環的位置是在（環節數是從唇的後方開始算）	
13th to 14h segment 第13到第14節	
14th to 16th segment 第14到第16節	
12th to 15th segment 第12到第15節	
14th to 17th segment 第14到第17節	

Q. 6.2. (3 POINTS)
Q. 6.2. (3分)

操作 Indicate in the Answer sheet with a “✓” which of the following statements is True. 在答案卷上以"✓"來顯示下列敘述何者正確 The chaetae distribution in each segment is 剛毛在每個環節上的分佈是	
Two chaetae in each of four points on a segment 每一環節有4點，每一點有2根剛毛	
Three chaetae in each of four points on a segment 每一環節有4點，每一點有3根剛毛	
Four chaetae in each of four points on a segment 每一環節有4點，每一點有4根剛毛	
A ring of single chaeta evenly distributed around a segment 每一環節具有單一剛毛均勻分佈所形成的環帶	

Q.6.3. (3 POINTS)
Q.6.3. (3分)

Indicate in the Answer sheet with a “✓” which of the following statements is True. 在答案卷上以"✓"來顯示下列敘述何者正確 The number of dorsal pore on each segment just behind the clitellum is 在生殖環後面的每個環節上，背孔的數目是	
1	
2	
3	
4	

Q.7.1. (3 POINTS)
Q.7.1. （3分）

Number of Spermatheca pairs 受精囊對數	

Q.7.2 (6 POINTS)
Q.7.2 (6分)

Septa between segments 節間隔膜	Presence存在	Absence不存在
7/8		
8/9		
9/10		
10/11		

Q.7.3. (10 POINTS)
Q.7.3. (10分)

Q.7.4. (4 POINTS)
Q.7.4.(4分)

Q.7.5 (3 POINTS)
Q.7.5 (3分)

A	B	C	D