Student Code:

24th International Biology Olympiad

14th-21st July, 2013

Bern, Switzerland

BERN 2013 International Biology Olympiad

Practical Exam

Comparative and Functional Biosystematics

Answer Key

Total points: **100**

Duration: **90 minutes**

Q 1

Species		1	2	3	4	5	6	7	8	9	10	11	12
arte	*Arvicola terrestris*	1	1	1	-	1	-	-	-	1	-	-	-
caca	*Capreolus capreolus*	-	-	-	-	1	-	-	1	-	-	-	-
feca	*Felis catus*	1	-	-	-	-	1	1	-	-	-	1	-
leeu	*Lepus europaeus*	1	1	-	1	1	-	-	-	1	-	-	-
meme	*Meles meles*	1	-	-	-	-	1	1	-	-	-	1	-
scvu	*Sciurus vulgaris*	1	1	1	-	1	-	-	-	-	-	-	-
vuvu	*Vulpes vulpes*	1	-	-	-	-	1	1	-	-	-	1	-

→ 42 points (max)

Less than four correct = 0

Four traits correct = 0.5

Five traits correct = 1.5

Six traits correct = 2.5

Seven traits correct = 3.5

Q2

Character	1	2	3	4	5	6	7	8	9	10	11	12
Informative	1	1			1	1			1		1	
not informative			1	1			1	1		1		1

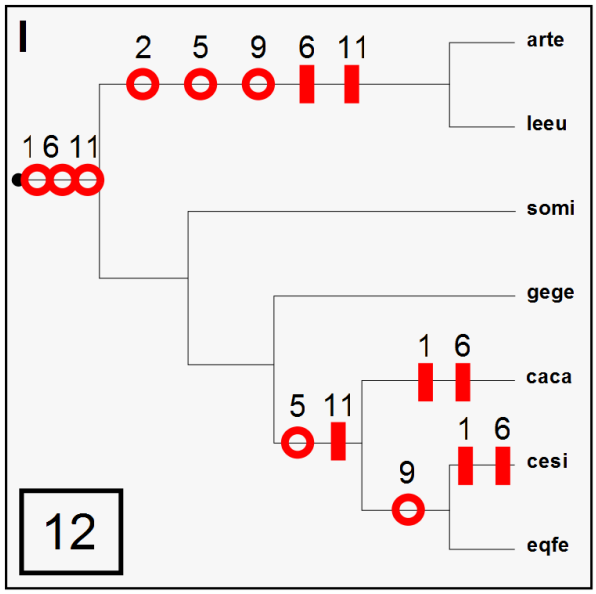
→ 2 points (max)

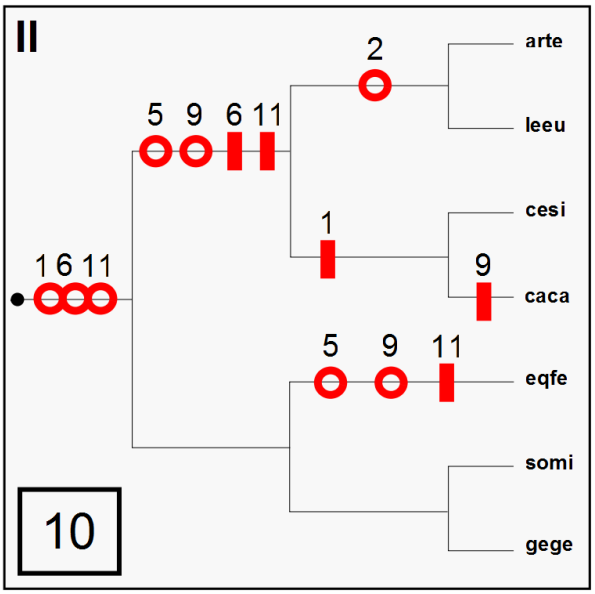
System understood (all characters match conditions when using students list) = 2

System understood (not all but more than 6 characters match conditions) = 1 + 0.084 per right character

System not understood (less than 7 characters match conditions) = 0

Q3





→ 7 points (max)

System understood (all characters are indicated which derived or went lost compared with the root, based on the students Table Appendix 1)

all characters indicating lost traits placed at the right location = 1.75 (1.75/n points for each trait lost according to the table of the student)

all characters indicating derived traits placed at the right location = 1.75 (1.75/n points for each trait derived according to the table of the student)

if the presence and absence of all characters is inversed the student get punished with - 2 point but then all traits are corrected as mentioned before.

For each counted number of character changes (n=2) = 1.75

Q4

	I	II
Preferred phylogeny according to the concept of maximum parsimony		1

→ 1 point (max)

The right tree with the fewest character changes has been chosen according to the students counting in Q3.

Q5

Character	1	2	3	4	5	6	7	8	9	10	11	12
typical for animalivores											1	
typical for herbivores		1							1			

not typical for either	1		1	1	1	1	1	1		1		1

→ 4 points (max)

For each character assigned to the corresponding trophic level = 0.334 points

Iteration 1

Q6

	A			
A	0.00	B,D		
B,D		0.00		
C			0.00	
				0.00

Relative age of newly formed cluster

→ 2 points (max)

Identifing the most closely related pair correctly = 0.75 point

If all distances are correct = 0.75 point

Correct relative age = 0.5 point

wrong distance = - 0.25 point (deducted)

Iteration 2

Q7

	0.00		
		0.00	
			0.00

Relative age of newly formed cluster

→ 1.75 points (max)

Identifing the most closely related pair correctly = 0.75 point

If all distances are correct = 0.5 point

Correct relative age = 0.5 point

wrong distance = - 0.25 point (deducted)

Iteration 3

Q8

	0.00	
		0.00

Relative age of newly formed cluster

→ 1.5 points (max)

Identifing the most closely related pair correctly = 0.75 point

If all distances are correct = 0.25 point

Correct relative age = 0.5 point

wrong distance = - 0.25 point (deducted)

Iteration 4

Q9

Relative age of newly formed cluster

→ 1 points (max)

Correct relative age = 1

Q10

→ 3.75 points (max)

true topology = 1 point (0.25 for feca+gege, 0.25 for muni+meme, 0.25 for vuvu/muni+meme, 0.25 for vuvu/muni+meme/fega+gege)

true distances indicated above lines in the tree = 1 point (0.167 point per right branch length written on top)

true distances drawn to scale (+/-5%) = 1 + 0.75 point (0.3 point per right ratio of branch length to total length of all branches + 0.75 if all are right)

Q11

	M_1	M_2	M_3	M_4	M_5	M_6	M_7
arte *Arvicola terrestris*							
leeu *Lepus europaeus*							

→ 15 points (max)

measurement which differ less than 5% = 1.5 points

measurement which differ less than 10% = 1 point

measurement which differ less than 15% = 0.5 point

All skulls were measure several times individually and marking will be based on the measurements of the same skull the student was handling.

Q12

arte *Arvicola terrestris*					-0.367	-0.478
leeu *Lepus europaeus*					-0.547	-0.382

→ 6 points (max)

For students handling the caliper wrongly but consistently we also attribute points for correct ratios using the same scale as above. This implies:

if log10(Mi/M7) is within +/- 0.043 of the true ratio for that skull = 0.5 points

if log10(Mi/M7) is within +/- 0.087 of the true ratio for that skull = 0.3 points

if log10(Mi/M7) is within +/- 0.131 of the true ratio for that skull = 0.1 points

These points are attributed based on the measurement in table Q11.

In addition:

per correct calculation (n=8) = 0.25 point

– 0.25 when more or less than three digits after decimal point are indicated (max deduction 0.5 points)

Q13

arte and **leeu**						

→ 3.5 points (max)

right number (n=6) = 0.583 point

when more or less than three digits after decimal point are indicated =- 1 point (deduction)

Q14

arte and **leeu**						

→ 3.5 points (max)

per right number (n=6) = 0.583 point

when more or less than three digits after decimal point are indicated =- 1 point (deduction)

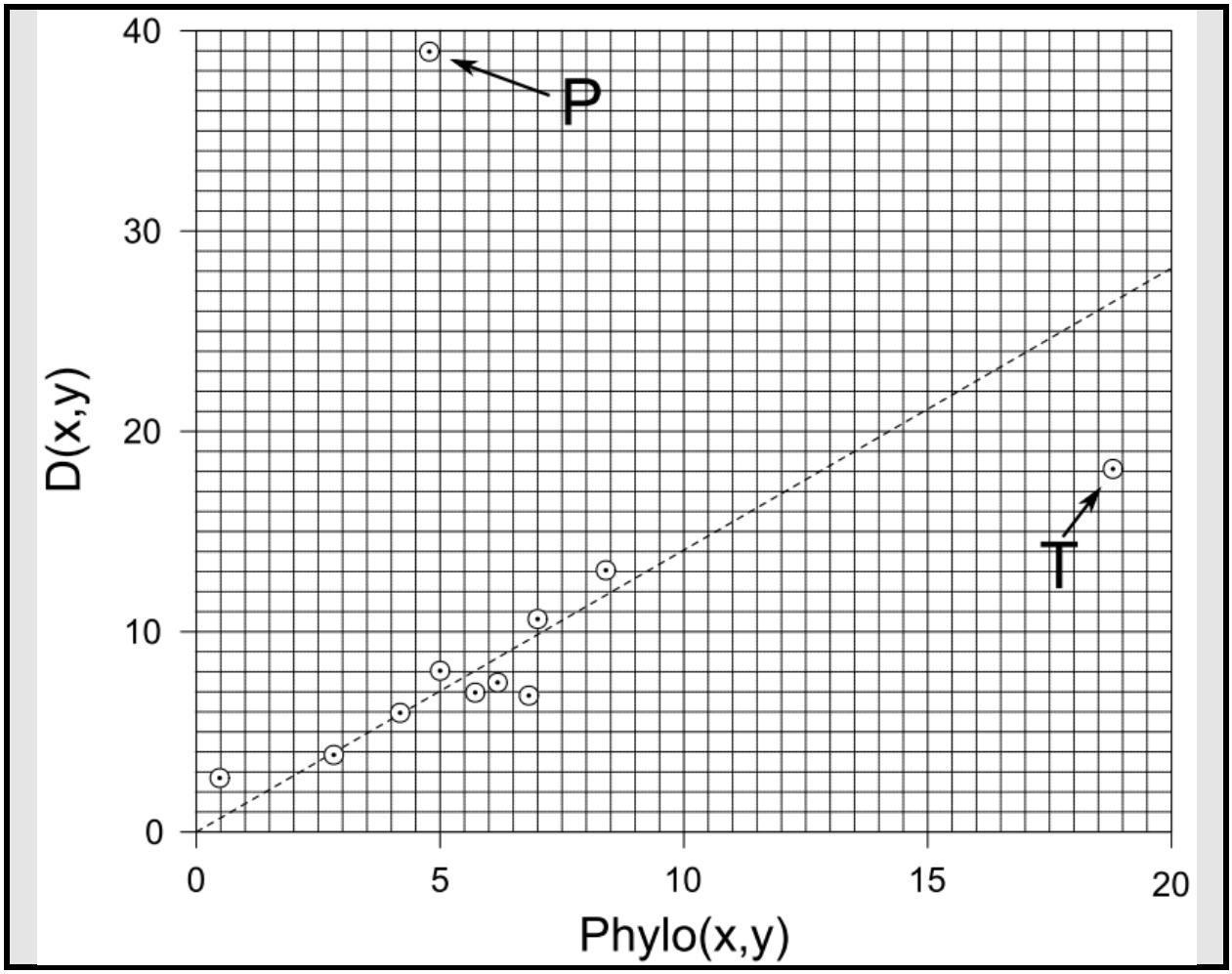
Q15

arte and **leeu**	

→ 2 point (max)

when more or less than three digits after decimal point are indicated =-1 point (deduction)

Q16



→ 2 points (max)

when y-axis is right = 0.75

when x-axis is right = 0.75

when ratio between x and y-axis is right = 0.5

Q17

	yes	no
Both species of pair P are closely related but were geographically separated and evolved convergent adaptations to very similar habitats.		
The ancestor of one species of pair P colonized a totally different environment with fundamentally different selection pressures, changing its skull morphology fundamentally.		
Both species of pair T are part of a fast, ecologically driven adaptive radiation.		
While only distantly related, both species of pair T feed on very similar resources, for which their skulls evolved convergent adaptations.		

→ 2 points (max)

For each true answer = 0.5 point

End of practical exam