Name_____

Student Number_____

Grade_____

BIO 3122 Practice midterm Fall 2016

Cellular phones, unauthorized electronic devices or course notes (unless an open-book exam) are not allowed during this exam. Phones and devices must be turned off and put away in your bag. Do not keep them in your possession, such as in your pockets. If caught with such a device or document, the following may occur: you will be asked to leave immediately the exam and academic fraud allegations will be filed which may result in you obtaining a 0 (zero) for the exam.

By signing below, you acknowledge that you have ensured that you are complying with the above statement.

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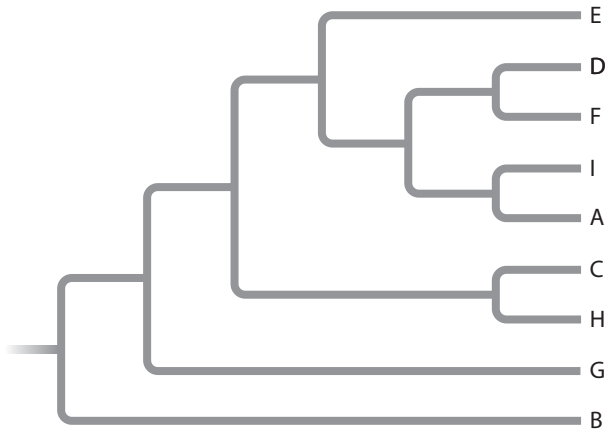
En apposant votre signature, vous reconnaissez vous être assuré de respecter l'énoncé ci-dessus.

Signature_____

Part A: Short Answer questions. In the space provided, answer the following:

1.



Circle any statement that is accurate about the phylogeny above (1 point).

species D, F, I, and A form a monophyletic group
species E, D, F form a paraphyletic group
Species C is equally related to species A and E

2. Using two to three sentences, define a QTL (3 points).

3. In the Lactase Persistence Case Study, we learned about two different mutations that lead to lactase persistence in human populations. What lead to the existence of two different molecular routes to the same trait? This is an example of what type of evolutionary pattern? (3 points)

4. Define phenotypic plasticity. (2 points)

5. Define a selective sweep. How do scientists detect a selective sweep? (3 points)

6. How many times did light coat colour evolve in Hopi Hoekstra's populations of oldfield mice? How do we know? (3 points)

7. What is the minimum number of nucleotide changes needed for phenotypic change? Give an example that we discussed in class to support your answer. (3 points)

Part B: Long Answer questions. In the space provided, answer the following:

8. Read the following passage from a May 27, 2016 New York Times article "Short answers to hard questions about antibiotic resistance" and answer the questions below the passage.

   "*CRE, which stands for carbapenem-resistant Enterobacteriaceae, is the most fearsome family of germs because it is resistant even to last-resort antibiotics.*

   The only drug that reliably treats CRE is colistin, an old and inexpensive drug that came on the market more than 50 years ago. This week researchers reported that they had discovered a gene in a bacteria that makes bugs resistant to colistin. It was found in a strain of E. coli in the urine of a patient in Pennsylvania. The patient was successfully treated, but if that gene makes its way into a strain of CRE, the bug would be unstoppable."

   Questions:

   A. Given what you have learned about evolution, how would you explain the emergence of drug resistance in bacterial pathogens? (4 points)

   B. You are a policy maker for Health Canada and your boss just read this article and asked you to draft policy ideas for how to reduce Canadians' risk of encountering antibiotic resistant bacteria. Describe your two best ideas and why you think the government should focus on them. Use 2-3 sentences per idea. (6 points)

9. Draw a figure representing how genetic distance from a source population changes over generation time for isolated populations of 3 different sizes – 10, 50 and 100 individuals, in the absence of selection. (5 points). In a couple of sentences, describe the main mechanism driving the patterns you've drawn. (5 points)

10. As we discussed in class, snowshoe hares present different phenotypes in summer and winter.
    a. What is the phenotypic change, and what is the explanation for it? (2 points)
    b. Explain how climate change might be influencing natural selection on this trait. What are two possible consequences of climate change for snowshoe hares (with respect to this trait)? (6 points)