

February 6, 2013

EVENING CLASS

DURATION OF EXAMINATION: 80 minutes

Part A = /30

Part B = 8 /15

TUTORIAL SECTION: 

THIS EXAMINATION PAPER INCLUDES 10 PAGES AND 37 QUESTIONS. YOU ARE RESPONSIBLE FOR ENSURING THAT YOUR COPY OF THE PAPER IS COMPLETE. BRING ANY DISCREPANCY TO THE ATTENTION OF YOUR INVIGILATOR.

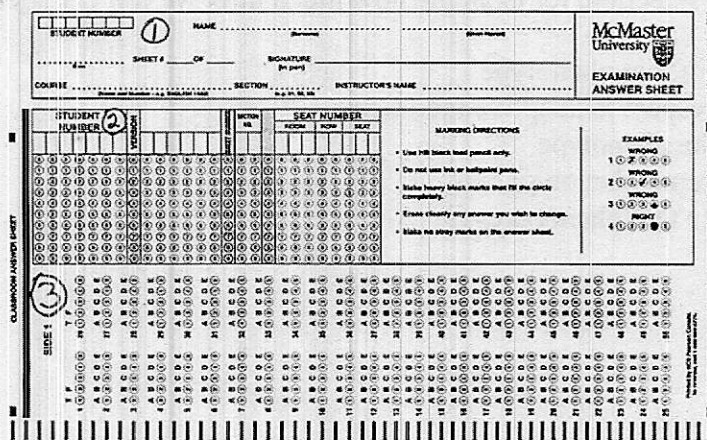
Special Instructions: McMaster standard (Casio-FX991) is permitted for this exam.
All questions 1 to 30 are to be answered on the Scan Sheet.
Questions 31 – 37 are to be answered on the exam paper
Print your Name and Student # on pages 1, 8, 9 and 10 of this examination paper.

OMR EXAMINATION - INSTRUCTIONS

NOTE: IT IS YOUR RESPONSIBILITY TO ENSURE THAT THE ANSWER SHEET IS PROPERLY COMPLETED; YOUR EXAMINATION RESULT DEPENDS UPON PROPER ATTENTION TO THESE INSTRUCTIONS.

The scanner, which reads the sheets, senses the shaded areas by their non-reflection of light. A heavy mark must be made, completely filling the circular bubble, **with an HB pencil**. Marks made with a pen or felt-tip marker will **NOT** be sensed. Erasures must be thorough or the scanner may still sense a mark. Do **NOT** use correction fluid on the sheets. Do **NOT** put any unnecessary marks or writing on the sheet.

1. Sides 1 (red side) of the form, in the top box, in pen, print your student number, name, course name, section number, instructor name and the date in the spaces provided. Then you **MUST** write your signature in the space marked SIGNATURE.
2. In the second box, with a pencil, mark your **student number**, **exam version number** and course section number in the space provided and fill in the corresponding bubbles underneath.
3. Use Red side of the form for questions 1-50 and grey side of the form for questions 51-100. Answers, mark only **ONE** choice from the alternatives (1, 2, 3, 4, 5 or A, B, C, D, E) provided for each question. If there is a True/False questions, enter response of 1 (or A) as True, and 2 (or B) as False. The question number is to the left of the bubbles. Make sure that the number of the question on the scan sheet is the same as the question number on the exam paper.
4. Pay particular attention to the Marking Directions on the form.
5. Begin answering questions using the first set of bubbles, marked "1".



The form is the McMaster University Examination Answer Sheet. It includes a header with fields for Student Number, Name, Section, and Instructor. Below this is a section for marking directions and examples. The main body of the form consists of two columns of bubbles for marking answers, labeled 'SIDE 1' and 'SIDE 2'. The bubbles are arranged in rows corresponding to question numbers. The form also includes a section for the student's signature and a section for the instructor's name.

IMPORTANT NOTE

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temporal
de - colonizing
quantitative
embryonic
order

Continued on next page...

7. In class we discussed an example of antibiotic resistance in the *M. tuberculosis* bacteria. Which of the following were not key features of that example?
- (a) Bacteria resistance to the antibiotics had a genetic basis ✓
 - (b) The patient was initially infected with only one strain of bacteria ✓
 - (c) Natural selection favored the antibiotic-resistant strain ✓
 - (d) B and C
8. One way to represent phylogenies is with "parenthetical notation". For example, the following : ((Species 1, Species2), Species 3) indicates that Species 1 and Species 2 are more closely related to each other than either is to species 3. Given this notation, which of the following is not a correct phylogeny?
- (a) (Fungi, Maidenhair fern), Plants)
 - (b) ((Animals, Fungi), Plants)
 - (c) ((Placental Mammals, Marsupial Mammals), Monotremes)
 - (d) ((Bacteria, duck billed platypus), Archaea)
9. In class we discussed experimental designs aimed at testing whether naked mole rates roll in the colony's latrine in order to identify themselves as members of the same colony. Which of the following would not be considered controls for the proposed experiments?
- (a) remove an animal from colony 1 and then re-introduce the animal into colony 1
 - (b) remove an animal from colony 1, wash it, roll the animal in the colony 1 latrine, and then re-introduce the animal into colony 1
 - (c) remove an animal from colony 2, wash it, roll the animal in the colony 2 latrine, and then re-introduce the animal into colony 1
 - (d) A and C
10. Which of the following is not consistent with the theory of evolution.
- (a) The presence of transitional forms that illustrate an inevitable increase in complexity associated with the hierarchy of life.
 - (b) The presence of fossils that illustrate that the composition and nature of species has changed over time
 - (c) The observation that there is geographical continuity between fossils and extant species
 - (d) During development there are key examples of structures that were present in a more developed form that have been lost in descendant species but that still undergo partial development in the descendant species.
11. In class we discussed an example where the Bmp4 gene was implicated as a possible target of natural selection after a drought affected phenotypic variation of beak morphology of a species of Galapagos finch. If this gene was in fact the target of natural selection in this example, how would you expect allelic number and genetic diversity to be affected if you could quantify each before and after the drought?
- (a) both would go down
 - (b) allele number would stay the same but genetic diversity would go up
 - (c) both would stay the same
 - (d) allele number would increase and genetic diversity would stay the same
 - (e) both would go up

17. In an attempt to better understand the evolution of beak morphology in Darwin's finches, researchers examined beak morphology of transgenic chicken that had overexpression of a gene called BMP4. Which of the following phenotypes were observed in these transgenic chickens?
- (a) The transgenic chickens were able to crack thicker seeds *In situ hydration*
 - (b) The transgenic chickens were darker during development where the BMP4 gene was expressed.
 - (c) The transgenic chickens had phenotypic changes that were similar to the changes observed in the Galapagos finches after the drought
 - (d) B and C
 - (e) None of the above
18. A population has the following genotype proportions for a biallelic locus with alleles A_1 and A_2 : 90% of the A_1A_1 genotype, 6% of the A_1A_2 genotype, and the rest are the A_2A_2 genotype. What is the frequency of the A_2 allele?
- $90\% A_1A_1$ $6\% A_1A_2$ $4\% A_2A_2$
 $0.90 + 0.06 + q^2 = 1$
 $q^2 = 0.04$
 $q = 0.2$
 $p = 0.9 + \frac{1}{2}(0.6)$
 $A_1 p = 0.93$ $A_2 = 0.07$
- (a) 0.01
 - (b) 0.02
 - (c) 0.04
 - (d) 0.07
19. Is a group containing all species that lack a vertebrae ("invertebrates") a "monophyletic group"?
- (a) Yes
 - (b) No
20. Which of the following must be associated with allopatric speciation?
- (a) Dispersal
 - (b) Vicariance
 - (c) Genome duplication *sympatric*
 - (d) All of the above
 - (e) None of the above
21. What type of symmetry does a fish exhibit?
- (a) bilateral
 - (b) radial
 - (c) directional
 - (d) no symmetry
 - (e) symmetrical
22. Which of the following options is not an application of DNA barcodes?
- (a) paternity analysis in humans
 - (b) monitoring the trade of endangered species
 - (c) identifying new species
 - (d) monitoring the accuracy of food labeling
23. Which of the following lines of information does not support the hypothesis that Hox genes in fruit flies are homologous to Hox genes in snails
- (a) These genes are similar in DNA sequences and have similar function
 - (b) These genes are distributed along a diversity of chromosome in both of these genomes
 - (c) These genes are expressed at similar places in the developing embryo
 - (d) These genes are expressed at similar times during development.
 - (e) All of these responses support the hypothesis that Hox genes in fruit flies and snails are homologous

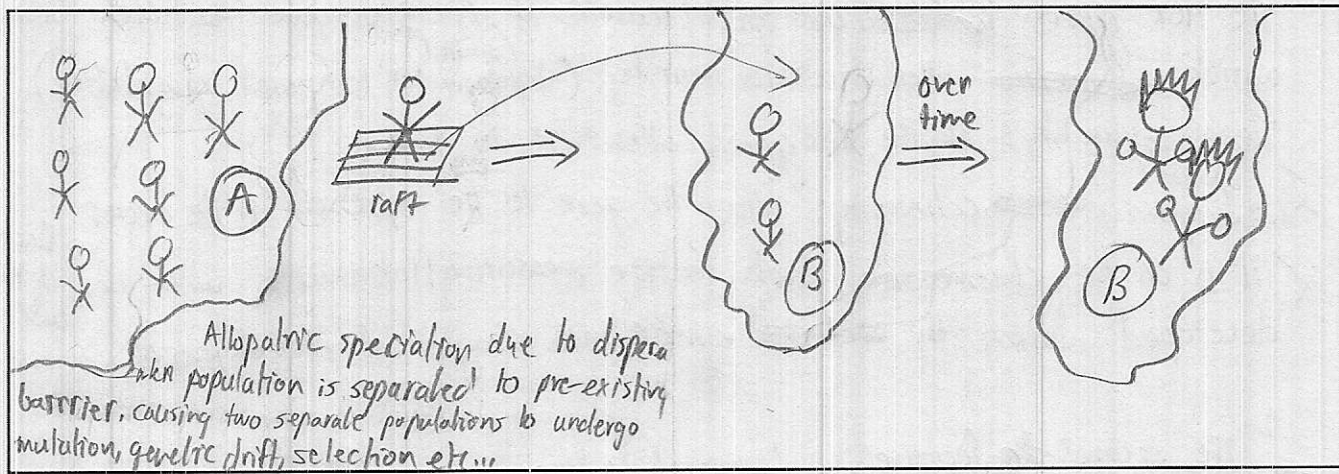
29. What is a "polytomy" and what is the connection between these and adaptive radiations?

- (a) A polytomy represents ambiguous evolutionary relationships among species that could arise, for example, when multiple speciation events occur in rapid succession, as is often the case in adaptive radiations.
- (b) A polytomy is a phylogenetic tree that represents the Cambrian Explosion, which was an adaptive radiation that produced a myriad of animal body forms
- (c) A polytomy is an unresolved portion of a phylogenetic tree that indicates that one ancestor speciated simultaneously into more than two descendants; this is a characteristic of most adaptive radiations
- (d) A polytomy is a phylogenetic tree resulting from phenetic analysis; this type of analysis can be used to understand speciation resulting from adaptive radiations.

30. What impact do you expect artificial selection to have on genetic diversity of cows that are bred for milk production?

- (a) Genetic diversity quantified by Simpson's index of diversity is lower but allele number stays the same
- (b) Genetic diversity quantified by Simpson's index of diversity is higher but allele number stays the same
- (c) Genetic diversity quantified by Simpson's index of diversity is lower and allele number is lower
- (d) Genetic diversity quantified by Simpson's index of diversity is higher and allele number is higher

35. Using the box below, draw the result of a scenario that illustrates the divergence of POPULATION "A" AND POPULATION "B" due to dispersal and colonization. Use the caption line (the line below the box) to BRIEFLY describe what has occurred. (2 marks)



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Caption: Pre-existing barrier separates Population A into population "B" / "B" speciates over time due to genetic drift, selection, mutation etc...

36. Using the space below, please draw phylogenetic relationships between the following taxa: (1) a species in the domain Bacteria, (2) a fish, (3) a lizard, and (4) a platypus (which is a monotreme mammal). On this phylogeny please label (A) the root and (B) where the origin of shelled eggs occurred. (5 marks)

