The following questions were selected from previous tests to illustrate several styles of questioning you might expect in this course. This collection is not a "practice exam"; it has not been balanced to represent the length, topic coverage nor difficulty of the coming Final Exam. Answers will be posted on Thursday, December 6. In the meantime, discuss your answers in study groups and come to a consensus.

1. How does sustained directional selection affect the amount of genetic variation within a population?

A. The amount of genetic variation increases.
B. The amount of genetic variation decreases.
C. The amount of genetic variation stays the same.

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2. Imagine a population of raccoons in which food-washing behaviour is controlled by the **W** locus. **WW** individuals wash their food thoroughly before eating; **Ww** individuals wash their food less thoroughly; and **ww** individuals never wash their food. After observing 1000 raccoons, you count 300 **WW**, 200 **Ww** and 500 **ww** individuals.

   What is the frequency of the **w** allele for this population?

A. 0.36
B. 0.5
C. 0.6
D. 0.7
E. Because the population is not in Hardy-Weinberg equilibrium at the W locus, it is impossible to calculate the frequency of **w**.

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3. Western's mascot is a wild horse called a mustang. Imagine that fur colour in mustangs is controlled by the **R** locus: **RR** individuals are red, **Rr** individuals are purple, and **rr** individuals are blue. In a population of 100 mustangs, you count 5 red, 90 purple and 5 blue individuals.

   Which of the following is a likely explanation?

A. Fitness is not related to fur colour.
B. This locus works by blending inheritance.
C. **R** and **r** are equally frequent, so the population is in Hardy-Weinberg equilibrium.
D. The population is extremely inbred.
E. This locus shows heterozygote advantage (overdominance).

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4. Which of the following processes is most likely to increase the frequency of homozygotes in a population?

A. genetic drift
B. disassortative mating
C. overdominance
D. negative frequency-dependent selection
E. migration

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5. What is/are the major genetic effect(s) of inbreeding on a population?

    1. It increases the frequency of harmful alleles.
    2. It increases the frequency of recessive alleles.
    3. It increases the mutation rate.
    4. It decreases the proportion of individuals that are heterozygous.

A. 1, 2 and 3
B. 1 and 3
C. 2 and 4
D. 4 only
E. 1, 2, 3 and 4 are correct

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6. According to sexual selection theory, when should females compete for mates more intensely than males do?

A. Whenever females have higher average fitness than males.
B. Whenever females have higher potential fitness than males.
C. Whenever females have lower average fitness than males.
D. Whenever females have lower potential fitness than males.
E. Females should never compete for mates more intensely than males do.

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7. Which of the following accurately describe sexual selection in humans?

    1. Males and females are both very choosy when selecting **short-term** mating partners.
    2. Males and females are both very choosy when selecting **long-term** mating partners.
    3. Males and females have very similar **potential** fitness.
    4. Males and females have very similar **average** fitness.

A. 1, 2 and 3
B. 1 and 3
C. 2 and 4
D. 4 only
E. 1, 2, 3 and 4 are correct

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8. According to the "ruby in the rubbish" hypothesis, which of the following is an important advantage of sex?

A. Sex increases the rate of helpful mutations and decreases the rate of harmful mutations.
B. Sex preserves adaptations to a stable environment.
C. Sex increases the chance that at least some offspring will have fewer harmful mutations than their parents.
D. Sex reduces the mutation rate.

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9. For what type of population is the Biological Species Concept most useful?

A. Populations that are extinct.
B. Populations that are allopatric.
C. Populations that are sympatric.
D. Populations that reproduce asexually.

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10. Which of the following examples represent **postzygotic** isolating mechanisms?

    1. When male donkeys mate with female horses, the offspring are sterile.
    2. When two types of rose are crossed, the offspring are more fit than either parental type.
    3. When male goats mate with female sheep, the offspring die before being born.
    4. One type of flower is visited and pollinated only by bees; another type of flower is visited and pollinated only by hummingbirds.

A. 1, 2 and 3
B. 1 and 3
C. 2 and 4
D. 4 only
E. 1, 2, 3 and 4 are correct

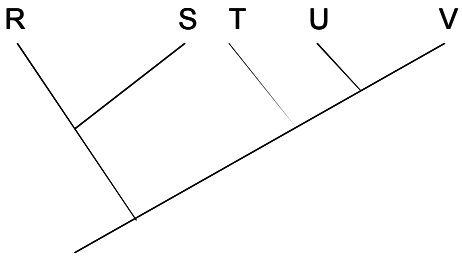

Fig 1: Evolutionary relationships among species R, S, T, U and V.

11. Based on the phylogeny shown in Figure 1, which of the following groupings are monophyletic?

    1. U and V
    2. R, S, T, U and V
    3. T, U and V
    4. S, T, U and V

A. 1, 2 and 3
B. 1 and 3
C. 2 and 4
D. 4 only
E. 1, 2, 3 and 4 are all monophyletic groupings

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12. According to the phylogeny shown in Figure 1, which species is most closely related to T?

A. S
B. U
C. S and U are equally closely related to T
D. U and V are equally closely related to T
E. R, S, U and V are equally closely related to T

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13. If Figure 1 is correct, what can you conclude about a trait that is present in species R and U, but absent in species S, T and V?

A. The trait is ancestral.
B. The trait is derived.
C. The trait is an autapomorphy.
D. The trait is shared by R and U due to homoplasy.
E. None of the above: if Figure 1 is correct, R and U cannot share traits that are not also present in S, T and V.

14. Many years ago, when Dr. MacShack first went birdwatching, myrtle warblers and Audubon's warblers were thought to represent two different species. Based on the Biological Species Concept, myrtle warblers and Audubon's warblers are now considered all part of the same species. What must have been discovered about these birds?

A. Myrtle and Audubon's warblers interbreed in the wild to produce fertile offspring.
B. Myrtle and Audubon's warblers look too similar for us to reliably tell them apart.
C. Myrtle and Audubon's warblers live in the same geographic area.
D. Myrtle and Audubon's warblers are genetically quite similar to one another.

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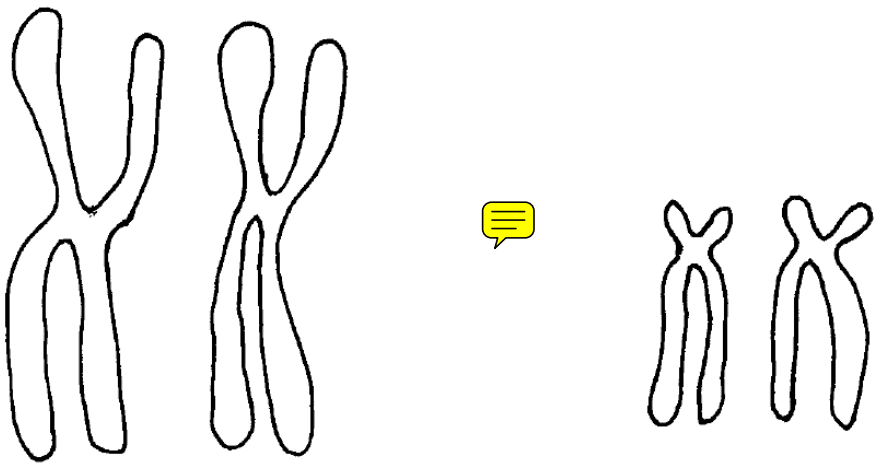
15. Which of the following best describes an "adaptive radiation"?

A. A helpful new trait spreads throughout a population.
B. A helpful new trait jumps from species to species.
C. Two formerly isolated populations come back into secondary contact and produce hybrids that are well adapted to the new environment.
D. A species that is well adapted to its current environment expands its geographic range.
E. A species diverges into many new descendant species, each in its own ecological niche.

Section C: **Short Answer**

16. During S phase, actively cycling cells can be provided with radioactively labelled 5 bromouracil (5 BU) that will be incorporated into growing DNA strands. During the following mitosis, metaphase chromosomes can be observed microscopically and the location of the radioactive 5 BU can be revealed by "dots" on X-ray film.

    The figures below indicate two pairs of typical homologous chromosomes at metaphase, prepared as described above. Add a series of dots to indicate the expected distribution of radioactive 5 BU.



17. Recall that some species of fungi spend most of their life cycle as haploids that make gametes by mitosis. Fertilized diploid zygotes then undergo meiosis immediately to make haploid spores that germinate into the next round of haploid organisms etc. etc.

Consider one such species of fungi having 3 pairs of homologous chromosomes.
On the axes below, plot both the coefficient of n (O) and the coefficient of C (X) as they would be *at the end* of the indicated cell cycle stages. (That is, at the end of S phase, would the zygote be 1 x C? 2 x C? 6 x C?; Would it be 1 x n? 2 x n? 6 x n?)

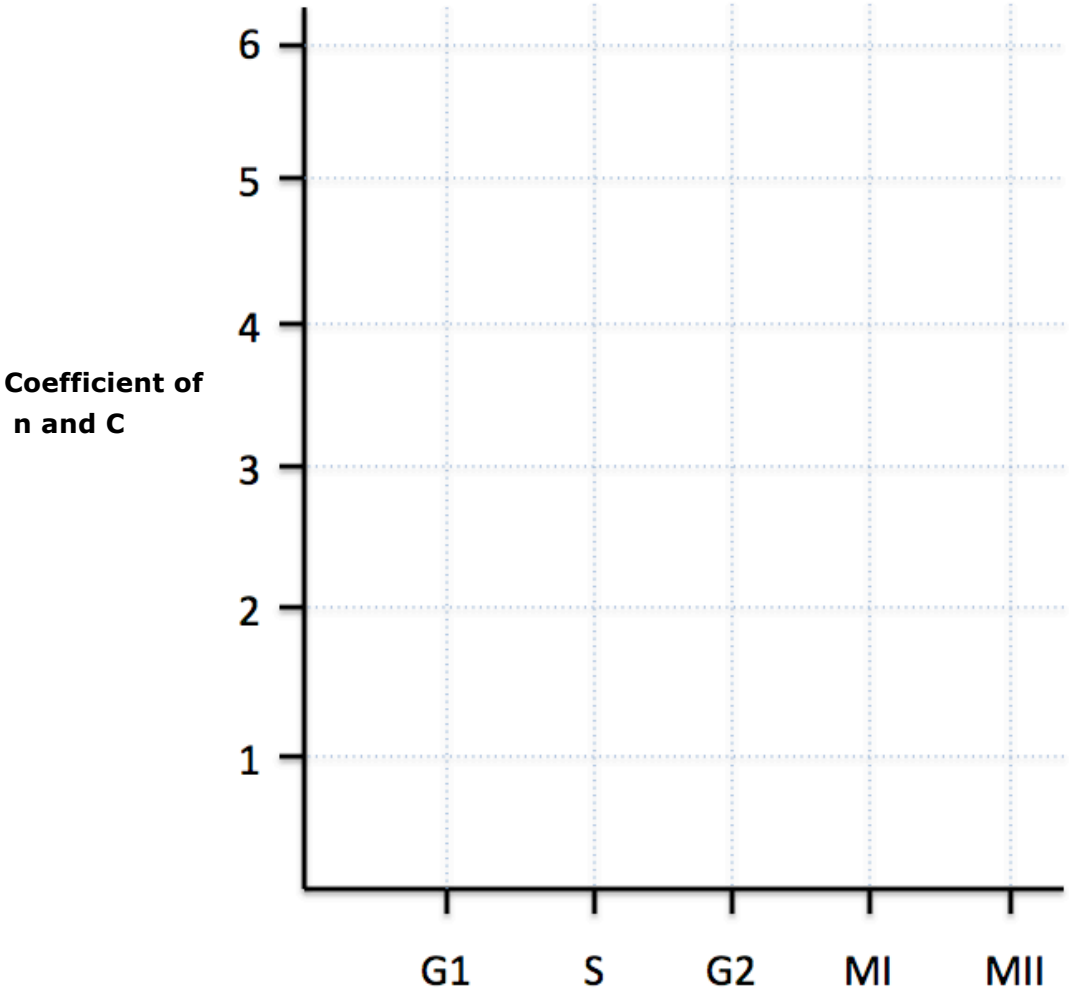


Figure. The coefficient of n (O) and the value of C (X) at the end of the indicated stages of cell cycle/division for a fungal zygote having 3 pairs of homologous chromosomes.

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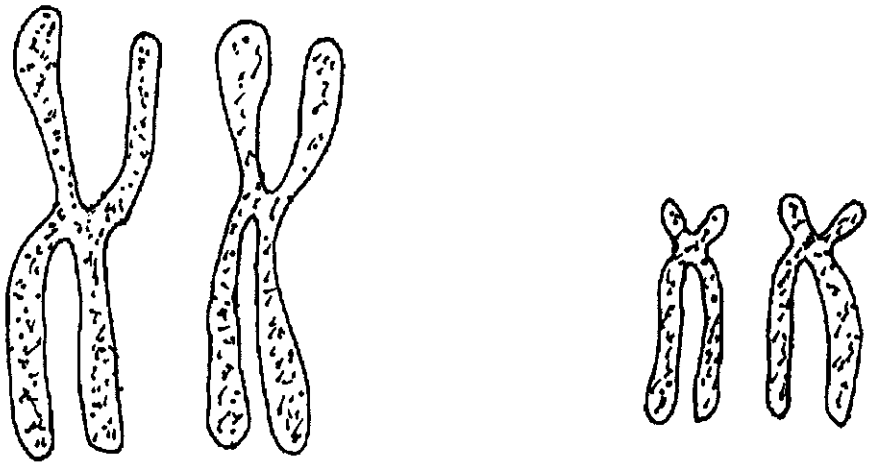

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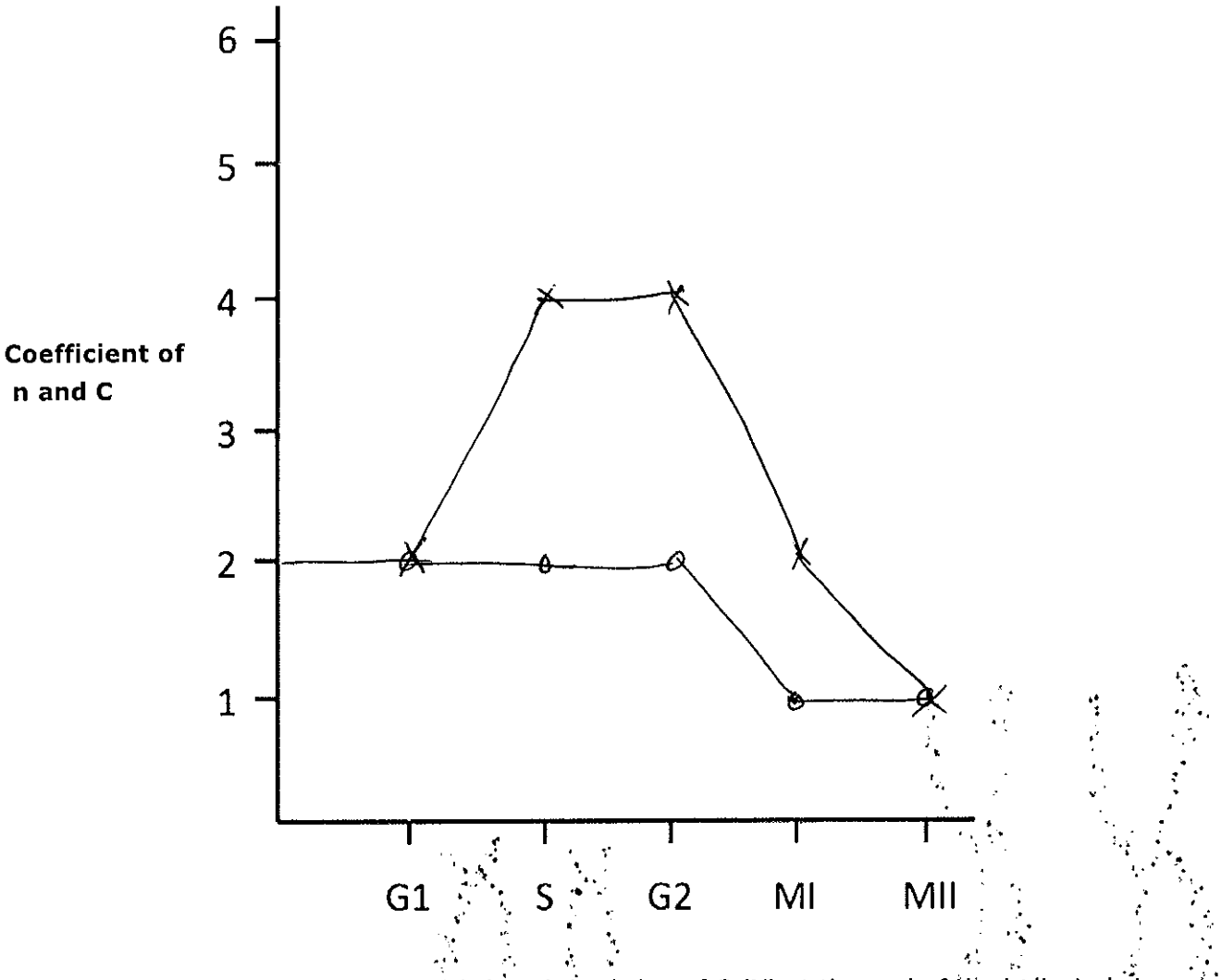

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