Multiple choice. (3 pts each; 60 pts total)

1. Which of the following is an example of "byproduct mutualism?" [L, SS]
   a. the ant-Acacia interaction.
   b. the mycorrhizae-plant root interaction.
   c. the dung beetle-elephant interaction.
   d. all of the above.
   e. none of the above.

2. The measure of relative differences experienced by individual competitors is most accurately referred to as [L]
   a. the species’ responses to competition.
   b. asymmetric competition.
   c. relative response to competition.
   d. competition.
   e. coevolution.

3. To conduct a sound scientific test for competition between two plant species (“A” and “B”) which of the following is not absolutely necessary. [TB, L]
   a. Grow individuals of these two species together.
   b. Grow individuals of these two species apart.
   c. Replicate each treatment level (a treatment level could be species “A” and “B” together).
   d. Vary the density of both species independently.
   e. Measure plant performance, such as growth rate or fitness.

4. Results from Thomas Park’s experiments suggest that two species of Tribolium [L]
   a. have exactly the same niche.
   b. have niches that do not overlap.
   c. function as predators on each other’s young.
   d. may coexist if environmental variables fluctuate over time.
   e. would kick human butt on the TV show “Survivor Meets Bugs Life II.”

5. The “continuum concept” of community structure grew from opposition to the [TB: 404, L]
   a. “climax” concept put forth by Clements.
   b. “initial floristics composition model” of Egler.
   c. “individualistic” concept of Gleason.
   d. “Q” concept put forth by Jean Luc Picard.
   e. none of the above.

6. “Species richness” refers to [TB: 401, L]
   a. the economic value of most or all species in a region.
   b. the economic value of an individual species.
   c. the number of endemic species at risk of extinction due to human activities.
   d. the abundance of species in an area.
   e. none of the above.

7. If a forest gets blasted by a tornado and then begins to grow back we refer to this as [TB: 424]
   a. primary succession.
   b. secondary succession.
   c. tertiary succession.
   d. quaternary succession.
   e. a crying shame.
8. The graph suggests [L]
   a. the presence of large granivores negatively affects small granivores through competition.
   b. the presence of small granivores negatively affects large granivores through competition.
   c. large granivores eat insectivores.
   d. insectivores compete with both small and large granivores.
   e. all of the above are consistent with the results from this graph.

9. The distribution of *Chthamalus* and *Balanus*, two barnacles studied by Joseph Connell in Scotland, was found to be influenced by [TB: 375, L]
   a. competition.
   b. predation.
   c. competition and predation.
   d. physical factors.
   e. competition, predation, and physical factors.

10. The graph to the right suggests bumblebees [L]
    a. gain the ability to forage on different flowers as they age.
    b. tend to have foraging trips that are of decreasing duration.
    c. tend to increase the number of foraging trips as they age.
    d. tend to favor one type of flower over time.
    e. all of the above are consistent with the graph.

11. The graph shows \(\frac{1}{N_1} \frac{dN_1}{dt}\) as a function of density for intraspecific competition (line connecting to \(K_1\)). The graph suggests that, for the conditions of this model, [TB: 370]
    a. interspecific competition increases per capita growth rates.
    b. interspecific competition decreases per capita growth rates.
    c. intraspecific competition decreases per capita growth rates relative to interspecific competition.
    d. intraspecific competition increases per capita growth rates as a function of density.
    e. all of the above.

12. Evolution [L]
    a. can lead to drug resistance but not increases in virulence of diseases.
    b. will lead to more virulent strains of diseases.
    c. will lead to less virulent strains of diseases (evolution toward benign coexistence).
    d. could lead to more virulent strains of diseases because selection is expected to favor increased values of \(R_0\).
    e. affects hosts but not disease agents.

13. Which is not an easily observable characteristic of natural selection?
    a. variability in traits
    b. heritability in traits
    c. high reproductive potential
    d. differential reproduction
    e. scoping at the IB by under-aged drinkers.
14. The main point of this graph, relating beak depth to culmen length, is that Galapagos finch species [L]
a. have different sized bills on the same island.
b. occur on many different sized islands.
c. have names that start with C or G.
d. all live on most of the islands.
e. none of the above.

15. Frank Egler offered up to $10,000 if someone could[website reading]
a. tattoo “NO LIFE SUPPORT” on his chest.
b. provide a clear example of “initial floristics.”
c. provide a clear example of “relay floristics.”
d. all of the above.
e. none of the above.

16. In Pimental et al.’s article “Benefits of Biodiversity” that you read on the website, which of the following
was not a benefit of biodiversity?[website reading]
a. Soil formation.
b. Environmental remediation (fixing).
c. Pollination.
d. Ecotourism (trips to ecologically cool places).
e. None of the above (they’re all discussed as benefits).

17. Sam McNaughton presented the graph on the right in response to Sir Bob May’s conjecture that [L]
a. communities are dominated by unstable equilibria.
b. communities are dominated by stable equilibria.
c. communities with more species are more stable.
d. communities with more species are less stable.
e. the Earth must contain > 10 million species.

18. In deeply shaded forests, leaves near the bottom of smaller saplings and trees will generally be [FG: 321]
a. large and multilayered.
b. small and multilayered.
c. large and monolayered.
d. small and monolayered.
e. all of the above.

19. Which of the following is not supported by evidence [L]
a. diversity decreases with altitude.
b. diversity decreases with latitude.
c. diversity increases with productivity.
d. diversity increases with area.
e. all of the above are supported.

20. Steve Hubbell, who has worked on a 50 ha forest in Panama for over 20 years, suggested that for half the species (those that do not exhibit clear niche differentiation) are able to coexist because they [TB: 455, L]
a. lack herbivores.
b. lack fungal parasites.
c. have competitors that went extinct thousands of years ago.
d. are affected by the mechanism described in the Janzen-Connell hypothesis.
e. rarely compete with better competitors.
Short answers (10 pts each, 20 pts total):

1. Provide a graph of the intermediate disturbance hypothesis. Clearly label your axes. Provide an example and explain the phenomenon (you don’t have to discuss it out the wazoo!). [TB: 454, L]

2. Please provide a graph that summarizes the theory of island biogeography for small and large islands that are near and far from the mainland. **LABEL THE AXES CLEARLY, ANALYZE THE GRAPH.** Provide an additional graph that provides **TWO** pieces of observational data that support this theory. [TB: 452, L, website]
Imagine that you have assessed the competitive interactions between crab grass and Kentucky bluegrass in field plots in the Arboretum. You have determined that these two species have a **locally stable equilibrium** where they coexist. Do the following:

1. Label the axes and indicate the carrying capacities for each species (where isoclines intercept the axes).
2. Analyze the graph. Assume this model fully describes the system (no immigration).
3. Provide an accompanying graph of **N versus time** which starts from the point (dot) indicated on the phase-plane graph and ends when it reaches an equilibrium.
4. In two sentences or less tell me what the final outcome will be if we started the populations off at that point (dot on phase-plane graph). This should read like a result statement that you might include in an abstract of your paper reporting this finding.
Extra Credit (3 points)

This graph, discussed during “what’s new,” suggests what? Please be specific.