Mid Term Exam Spring Semester 2019
Ecology and Conservation (LS3201)
(Course Instructor: Anuradha Bhat)

Time: 1.5 hours **Total Marks: 20**

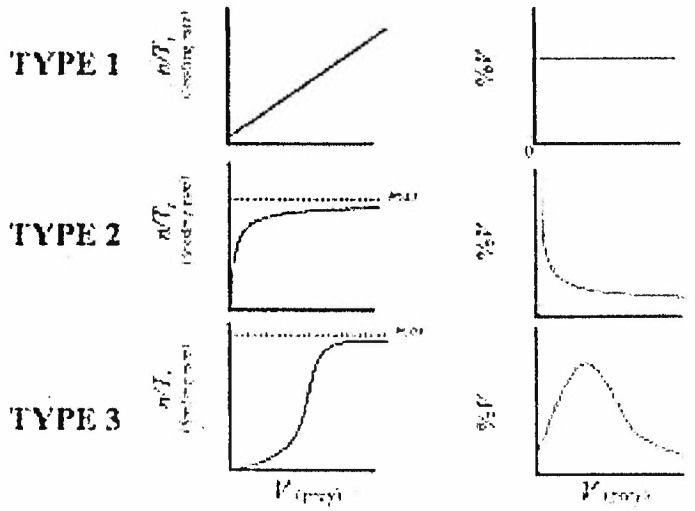
SECTION I. Select the correct option in the questions given below. Each correct option is for 1 mark.

1. True/ False:
   Mullerian mimicry is when a harmless species mimics a poisonous species to escape the negative effects of predation.

2. r selected species typically show
   a. high fecundity and population growth rate,
   b. large body size and iteroparous reproduction
   c. high parental care of offsprings
   d. type I survivorship curve

3. According to the classical metapopulation model developed by Levins, the probability of persistence of populations is dependent on
   a. emigration rate
   b. colonization rate
   c. patch size and inter patch distance
   d. all of the above

4. Which kind of functional response can result in the "predator pit" situation: i.e., predators regulate prey densities within a certain range- prey densities above this range can "escape" the regulation of growth by predators?



A. Type I **B.** Type II C. Type III **D.** All of the above

Anuradha Bhat
19/2/19

SECTION II: Answer the following questions. Each question is worth 2 marks.

1. Define the ecological concept of the Niche. How would you differentiate between fundamental and realized niche of a species?

2. What does the r/K selection theory explain? What kind of ecological factors influence the evolution of these (r or K) strategies in different species?

SECTION III: Please choose to answer any **THREE** of the following questions. Each question is worth **4 marks.**

1. A small number of house mice are introduced to an island where no house mice previously occurred. The island has many resources and the population begins to grow in a pattern that appears to be exponential growth. Answer the following questions

a) Could this really be logistic growth? Justify your answer with as to whether or not population growth according to the logistic model shows the same pattern as exponential growth for small populations. (2 marks)

b) What is density dependence? What part of the logistic growth equation makes it density dependent? When and how does a population reach stable equilibrium? (2 marks)

2. In a Lotka-Volterra model of interspecific competition the rates of change in population size for species 1 and 2 are given by the two following equations:

$$\frac{dN_1}{dt} = r_1 N_1 \frac{(K_1 - N_1 - \alpha_{12} N_2)}{K_1} \quad \text{and} \quad \frac{dN_2}{dt} = r_2 N_2 \frac{(K_2 - N_2 - \alpha_{21} N_1)}{K_2}$$

Where: t = *time;* N_1 and N_2 = Population sizes of species 1 & 2, respectively; r_1 and r_2 = The intrinsic rate of increase of species 1 & 2, respectively; K_1 and K_2 = The carrying capacity of species 1 & 2, respectively; α_{12} = A competition coefficient denoting the effect of species 2 on species 1; α_{21} = A competition coefficient denoting the effect of species 1 on species 2. For the above model:

a) Graphically (with labels) depict the model conditions under which the stable equilibrium solution predicts the coexistence of the two species. (2 marks)

b) Briefly describe the ecological/evolutionary significance of the graph. (2 marks)

3. Levins (1969) introduced the concept of metapopulations to explain the dynamics of subpopulations in a fragmented landscape and developed a model to explain dispersal and persistence of populations. Answer the following questions based on his classical model and more recent models developed by Gotelli, Hanki etc.
   a. What were the major shortcomings of Levins' classical model? (2 marks)
   b. Explain briefly the concepts of "rescue effect"(proposed by Hanski) and "propagule rain"(proposed by Gotelli) (2 marks)

4. The Optimal foraging theory predicts how an organism behaves when searching for food, and expects that responses would be to maximize fitness by balancing benefits against costs. Irons *et al.* (1986) studied the foraging behavior of Glaucous-winged Gulls in rocky intertidal habitats on the Aleutian Islands. Based on the data below, answer the following questions. Mean search and handling times are given in seconds.

Prey type	Search Time (s_i)	Handling Time (h_i)	Energy per Prey E_i (kJ)
Urchins	35.8	8.3	7.45
Chitons	37.9	3.1	24.52
Mussels	18.9	2.9	1.42

a) For a gull that happens upon an urchin, would it continue to search for some other prey time (e.g. Chiton) or would it prefer to eat the urchin? Explain. (2 marks)

b) The abundance of mussels in some locations is much more than either of the two other prey items. In such locations, would the gulls eat the mussel it happens to encounter, or would it prefer some other prey item? Justify your answer. (2 marks)