UNIVERSITY OF RUHUNA

Bachelor of Science Honors Degree in Fisheries and Marine Sciences
Bachelor of Science Honors Degree in Marine and Freshwater Sciences

Examination – August/September 2018

Level II Semester I

LIM 2123 – Theoretical Ecology and Ecological Modeling

Time 2 hours

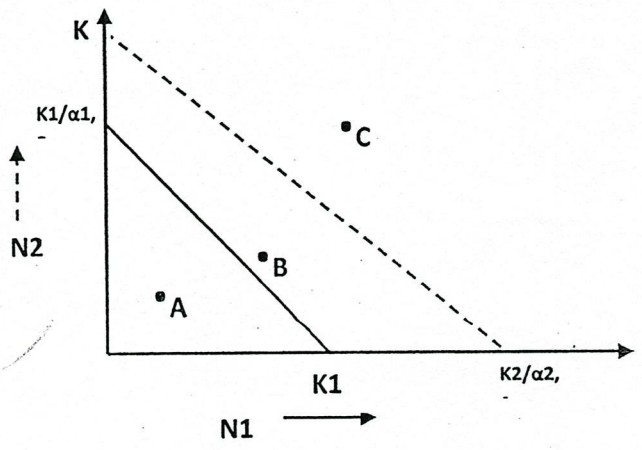
Part A

Answer **all** questions. Underline the most suitable answer for each of the following multiple-choice questions.

Time: Thirty (30) minutes

1. Gypsy moths (*Lymantria disor*) are annual insects in which breading takes place in early to mid-summer. After females lay eggs, all adults die. The eggs hatch the following spring into larvae that feed on the leaves of tree species. A researcher found, 4 gypsy moths egg masses/ha in 2012. When he returned in again in 2015, he found 5 egg masses/ha with an average of 40 eggs/mass. What is the net growth rate per generation?
   i. 1.56
   ii. 1.25
   iii. 1.90
   iv. 1.00
   v. 0.87

2. Consider the following three statements which are based on the below graph that shows one of the possible scenarios of the competition over a limited resource among N1 and N2 Populations.

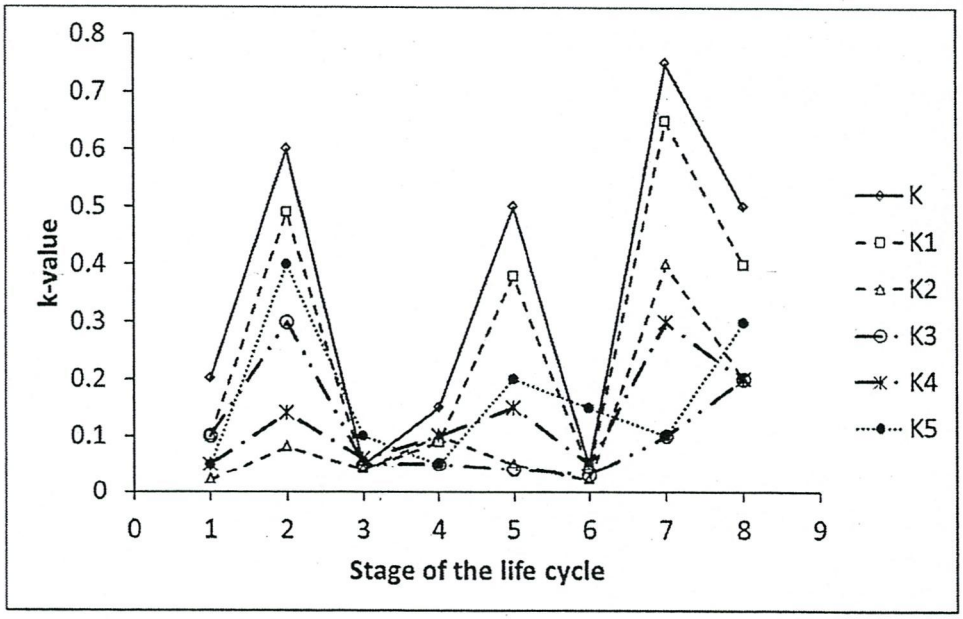


a. At the stage B, both N1 and N2 increase their population size
b. At the stage C, both N1 and N2 reduce their population size
c. At the stage B, the population size of N2 is higher than their carrying capacity

Select the correct statement/s from the above

i. Only a
ii. Only b
iii. Only c
iv. a and b
v. b and c

3. Key factor analysis from life table data of an aquatic insect is given in the following graph, where K1: natural enemies, K2: hatching failure, K3: human activity, K4: pathogens and insolation, K5: parasites. Numbers in the x-axis from 1-8 are the different stages of the life cycle.



The key factor of the above population is

i. Predation
ii. Hatching failure
iii. Human activities
iv. Pathogens and insolation
v. Parasites

4. Intrinsic rate of increase in a population is
   i. the growth rate per individual per unit time
   ii. The average number of offspring produced by an individual in a population during its life lime
   iii. the growth rate of the population at their carrying capacity
   iv. the rate at which the population reach to the carrying capacity
   v. the effect of an individual of a species on the rate of population growth of other species

5. Select the correct statement
   i. Nutrient spiraling is best described in the flood pulse concept
   ii. River continuum concept is a model that describes the gradient of physical factors of a river from upstream to downstream
   iii. Trophic State Index (TSI) is a classification system designed to rate bodies of water based on the amount of biological activity they sustain
   iv. Flood pulse concept is a model that describes the ecology of headwater regions
   v. Biofilm on rekey substrate in a river bottom is a matrix of shredders

6. Select the false answer about the primary productivity
   i. The rate at which energy is stored in organic matter of plants per unit area of the earth's surface is called as primary production.
   ii. the amount of energy fixed by plants in photosynthesis per unit area per unit time is the gross primary productivity.
   iii. Net primary productivity is the amount of organic matters that is left after the respiration.
   iv. Primary productivity usually measures as gross primary productivity.
   v. The tight relationship between photosynthetic and heterotrophic metabolism in microbial communities makes, NPP very easy to conceptualize and measure.

7. Select the false statement about Deep Chlorophyll Layers; the reason for the formation of Deep Chlorophyll layer is
   i. In-situ productivity.
   ii. Depth specific zooplankton grazing.
   iii. Epilimnetic nutrient.
   iv. Phytoplankton sedimentation.
   v. Both in-situ productivity and phytoplankton sedimentation.

8. Select the correct statement
   i. Forested small streams have higher primary productivity than the open canopy streams.
   ii. Spring streams have lower productivity than open canopy streams.
   iii. Ultra-oligotrophic lakes have lower primary productivity than spring streams.
   iv. Mesotrophic lakes are more productive than eutrophic lakes.
   v. Forested streams have relatively a higher primary productivity.

9. Select the correct statement on secondary productivity
   i. Most of the classical models consider the population biomass as the predictor.
   ii. Many studies have suggested that the biomass along is a good predictor of secondary productivity.
   iii. The empirical estimates are hard to calculate and they need to be interpreted carefully.
   iv. The secondary production cannot be used to predict the environmental dynamics.
   v. Life span and body length cannot be used in empirical methods.

10. Select the false statement about empirical models in secondary production estimation. Empirical models allow the estimation of potential production

   i. When classical methods cannot be used.
   ii. For the community production assessment that consider rare species or unknown dynamics.
   iii. When data are not sufficient for an estimation
   iv. For determining spatial and (or) temporal comparison of community production from different habitats in similar ecosystems.
   v. For generating new hypothesis based on production trends.

11. What is correct about biomes?
   i. They are closed systems.
   ii. Matter exchange with outside is negligible.
   iii. Nutrients should be recycled again and again within the biome.
   iv. Exchange energy with other biomes.
   v. Usually consists of one type of ecosystem.

12. In a soil profile

i. E horizon gets leachates from B horizon.
ii. C horizon contains live tissue of organisms.
iii. B horizon is full of weathered rock fragments.
iv. A horizon has distinctive colors and banding patterns.
v. O horizon and C horizon is mixed by the burrowing animals.

13. According to the niche concept

i. Realized niche is free of interactions.
ii. Fundamental niche is not an n–dimensional hyper-volume.
iii. Ecological niche is smaller than fundamental niche.
iv. Law of Tolerance is not considered in the fundamental niche.
v. Intense intraspecific competition results in a narrower realized niche.

14. Select the false statement regarding graphical presentations of food webs.

i. Standing crop does not give pyramidal shape.
ii. Few numbers at lower trophic levels represents the energy loss.
iii. Plotting energy always give a true pyramid.
iv. More the trophic levels greater the cumulative loss of usable energy.
v. Exploitation efficiency is decided by the amount of prey ingested.

15. In food web modeling

i. One species can be divided into few different trophic species.
ii. Primary producer is not considered to calculate linkage density.
iii. Cannibalism is also a part of the connectance .
iv. Rigid circuits show niche segregation.
v. Guilds are decided using taxonomy.

Part B

Answer **any three (03)** of the following questions

1.
   a. Stream ecosystems has specific physical structure and characteristics which gives its basic ecological identity. List identical features of river ecosystems that are different from lake ecosystems
   b. "*Benthic organism found in flowing waters are well adapted against water currents*". Justify this statement with suitable examples

2. Describe the two-station, free water method for estimating primary productivity of stream water.

3. Briefly describe the following topics,
   a. Intermediate Disturbance Hypothesis (IDH)
   b. Interaction between carrion insects with decomposing animal remains

4. Describe the different types of trophic cascades found in aquatic ecosystems.

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