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UNIVERSITI SAINS MALAYSIA

Peperiksaan Semester Kedua  
Sidang Akademik 2002/2003

Februari/Mac 2003

**BST 203E/3 - Community and Population Ecology**  
**BST 203E/3 - Ekologi Populasi dan Komuniti**

Masa : [3 jam]

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Please ensure that this examination paper contains EIGHT printed pages.

Answer FIVE out of SIX questions. Candidates are allowed to answer all questions in English or Bahasa Malaysia or combination of both.

Each questions carries 20 marks.

*Sila pastikan bahawa kertas peperiksaan ini mengandungi LAPAN muka surat yang bercetak sebelum anda memulakan peperiksaan ini.*

*Jawab LIMA daripada ENAM soalan yang diberikan, dalam Bahasa Inggeris atau Bahasa Malaysia atau kombinasi kedua-duanya.*

Tiap-tiap soalan bernilai 20 markah.

1. Ecologists have developed various indices that measure the degree of species overlap in an attempt to gain insight into community structure. Hypothetical data showing four resources states as prey for three predator species.

		Resource states			
Prey order	(1)	(2)	(3)	(4)	
Relative availability of resources	0.4	0.4	0.1	0.1	
<hr/>					
	Species				
Relative utilization by predators	1	0.25	0.25	0.25	0.25
	2	0.50	0.50	0.0	0.0
	3	0.0	0.0	0.50	0.50

Determine the value of the following :

- (a) The value of Levins index for overlap ( $LO_{12}$ ) of species 1 with species 2.
- (b) The value of Levins index for overlap ( $LO_{21}$ ) of species 2 with species 1.

Explain the process involved.

(20 marks)

1. Ahli ekologi telah membentuk beberapa indeks untuk mengukur derajat pertindihan spesies di dalam percubaan untuk mendapatkan pandangan tentang struktur komuniti. Data hipotetikal menunjukkan keadaan empat sumber sebagai mangsa untuk tiga spesies pemangsa

Mangsa	Sumber			
	(1)	(2)	(3)	(4)
Kehadiran sumber secara relatif	0.4	0.4	0.1	0.1

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Kegunaan spesies pemangsa secara relatif	Spesies				
	1	2	3	4	
	1	0.25	0.25	0.25	0.25
	2	0.50	0.50	0.0	0.0
	3	0.0	0.0	0.50	0.50

Tentukan nilai-nilai berikut:

- (a) Nilai indeks Levins untuk pertindihan ( $LO_{12}$ ) spesies 1 dengan spesies 2
- (b) Nilai indeks Levins untuk pertindihan ( $LO_{21}$ ) spesies 2 dengan spesies 1

Jelaskan proses yang terlibat

(20 markah)

2. The initial step in pattern detection in community ecology often involves testing the hypothesis that the distribution of the number of individuals per sampling unit (SU). The dispersals for individuals plant species are shown;

SU	1	2	3	4	5	6	7	8	9	10
Site	Individual									
1	2	4	4	1	3	5	5	3	0	3
2	0	8	0	3	0	10	0	0	0	9
3	3	3	3	2	3	4	3	3	3	3

What types of pattern distribution for each of the following site and explain each of the pattern:

- (a) Site 1
- (b) Site 2
- (c) Site 3

(20 marks)

2. *Tahap permulaan di dalam penentuan corak ekologi komuniti biasanya termasuk ujian hipotesis tentang taburan jumlah individu per unit sampel (US). Taburan individu-individu spesies tumbuhan seperti di bawah;*

US	1	2	3	4	5	6	7	8	9	10
Tapak	Individu									
1	2	4	4	1	3	5	5	3	0	3
2	0	8	0	3	0	10	0	0	0	9
3	3	3	3	2	3	4	3	3	3	3

Nyatakan jenis corak taburan bagi setiap tapak berikut serta jelaskan setiap corak taburan.

- (a) Tapak 1
- (b) Tapak 2
- (c) Tapak 3

(20 markah)

3. The following is the list of diatom species encountered at 5 sampling sites (A - E) having different levels of pollution).

Berikut adalah senarai species diatom yang terdapat di 5 kawasan persampelan (A - E) yang mempunyai tahap pencemaran yang berbeza.

Species Spesies	Abundance (no. of individuals per species) at each site) Kelimpahan (bil. Individu di setiap tempat)				
	A	B	C	D	E
<i>Achnanthes exigua</i>	-	-	6	-	5
<i>A. exigua</i> var. <i>heterovalva</i>	-	3	3	4	6
<i>A. oblonga</i>	14	8	-	-	-
<i>Cocconeis placentula</i>	10	13	-	-	-
<i>Coscinodiscus argus</i>	-	-	-	2	-
<i>C. excentricus</i>	-	-	-	2	-
<i>Cyclotella comta</i>	-	-	-	3	-
<i>C. striata</i>	-	-	-	2	-
<i>Fragilaria capucina</i>	7	9	-	-	-
<i>Fragilaria</i> sp. 1	4	12	4	16	2
<i>Gomphonema parvulum</i>	-	1	10	3	10
<i>Hantzschia amphioxys</i>	-	-	6	3	8
<i>Navicula cryptocephala</i>	4	3	3	-	1
<i>Nitzschia amphibia</i>	-	1	4	6	4
<i>N. palea</i>	-	1	23	17	48
<i>Pinnularia biceps</i>	-	1	10	5	10
<i>Psammothidium bioretii</i>	5	6	-	-	-

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- (a) Determine the similarity value between two communities based on Sorensen Similarity Index.
  - (b) Present the values in correlation table.
  - (c) Elaborate the mutual resemblance of diatom species composition between communities.
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- (a) *Tentukan nilai kesamaan antara dua komuniti berdasarkan Indeks Kesamaan Sorensen.*
  - (b) *Nyatakan nilai dalam jadual korelasi.*
  - (c) *Huraikan saling kesamaan komposisi spesies diatom di antara komuniti.*

(20 marks/markah)

4. (a) Write a short notes on Petersen Method of Capture-Mark-Recapture Estimate and the assumptions of the method.

(14 marks)

- (b) If  $M = 300$ ;  $C = 350$  and  $R = 50$  in the population study of *Rattus rattus* in 1 ha plot. Estimate the  $N$  (estimate of population size at time or marking) by using Petersen Method, Chapman Estimator and Bailey Estimator.

(6 marks)

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4. (a) *Tuliskan nota ringkas tentang Kaedah Petersen dalam penganggaran tangkap-tanda-lepas semula dan andaian-andaian untuk kaedah tersebut.*

(14 markah)

- (b) *Jika  $M = 300$ ;  $C = 350$  and  $R = 50$  dalam kajian populasi *Rattus rattus* di dalam plot 1 ha. Anggarkan  $N$  (anggaran saiz populasi pada masa penandaan) dengan menggunakan Kaedah Petersen, Penganggar Chapman dan Penganggar Bailey.*

(6 markah)

5. (a) *Explain the true census and indices methods in estimating population numbers and with appropriate example for each method.*

(10 marks)

- (b) *List the characteristics to distinguish between *r*-species and *K*-species.*

(10 marks)

5. (a) *Terangkan kaedah-kaedah "true census" dan "indices" dalam penganggaran bilangan populasi dan berikan contoh bersesuaian untuk setiap kaedah.*

(10 markah)

- (b) *Senaraikan perbezaan ciri-ciri antara *r*-spesies dan *K*-spesies.*

(10 markah)

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6. Table shows an example of a life table. The data in the  $x$  and  $L_x$  columns were obtained from a population of wild otter. Then, all other columns of data could be derived from them.

Age (yr)	Cohort (age interval) $x$	Number in Cohort, $L_x$	Number Living at Start, $l_x$	Number Dying during $x$ , $d_x$	Probability of Dying during $x$ , $q_x$	Probability of Surviving Interval $x$ , $s_x$	Animal-Years Live, $T_x$	Live to Expectancy, $e_x$ (yr)
0-1	0	33						
1-2	1	16						
2-3	2	9						
3-4	3	4						
4-5	4	1						
5-6	5	0						

Complete the life table by filling all the values of columns  $l_x$ ,  $d_x$ ,  $q_x$ ,  $s_x$ ,  $T_x$  and  $e_x$ .

(20 marks)

6. Jadual di bawah menunjukkan satu jadual hidup. Data-data di dalam kolum  $x$  dan  $L_x$  dicerap daripada satu populasi memering liar. Kemudian data untuk kesemua kolum berikutnya boleh dikira daripada kolum sebelumnya.

Age (yr)	Kohort (sela umur) $x$	Bilangan dalam Kohort, $L_x$	Bilangan hidup pada permulaan sela, $l_x$	Bilangan mati semasa $x$ , $d_x$	Kebarangkalian mati semasa $x$ , $q_x$	Kebarangkalian mandiri pada sela $x$ , $s_x$	Tahun-untuk masih hidup haiwan, $T_x$	Kejangk aan hidup, $e_x$ (yr)
0-1	0	33						
1-2	1	16						
2-3	2	9						
3-4	3	4						
4-5	4	1						
5-6	5	0						

Lengkapkan jadual hidup tersebut dengan mengisi nilai-nilai untuk kolum-kolum  $l_x$ ,  $d_x$ ,  $q_x$ ,  $s_x$ ,  $T_x$  and  $e_x$ .

(20 markah)