



Second Semester Examination  
2023/2024 Academic Session

July/August 2024

**BST223/BST307 – Community and Population Ecology  
(*Ekologi Populasi dan Komuniti*)**

Duration : 2 hours  
(Masa : 2 jam)

Please check that this examination paper consists of SEVEN (7) pages of printed material before you begin the examination.

*[Sila pastikan bahawa kertas peperiksaan ini mengandungi TUJUH (7) muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]*

**Instructions:** Answer **FOUR (4)** out of **FIVE (5)** questions, in English or Bahasa Malaysia. Each question carries 25 marks.

**Arahan:** Jawab **EMPAT (4)** daripada **LIMA (5)** soalan, menggunakan Bahasa Inggeris atau Bahasa Malaysia. Setiap soalan bernilai 25 markah .]

In the event of any discrepancies, the English version shall be used.

*[Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah digunapakai.]*

...2/-

- 2 -

1. [a] Compare the **THREE (3)** habitat-spatial dispersal patterns graphically and based on descriptive statistics.  
 [Bandingkan **TIGA (3)** corak taburan habitat-spatial secara grafik dan berdasarkan statistik deskriptif.]

(10 marks / 10 markah)

- [b] Analyze the data provided in Table 1.1 and determine if *Mimosa pigra* (giant sensitive tree) is **randomly distributed** by using Chi-square ( $\chi^2$ ) test aided by Table 1.2.  
 [Berikan analisa data yang terdapat dalam Jadual 1.1 dan tentukan jika *Mimosa pigra* (pokok semalu gajah) **bertabur secara rawak** dengan menggunakan ujian Ki-kuasa dua ( $\chi^2$ ) berbantuan Jadual 1.2.]

Table 1.1  
 [Jadual 1.1]

<i>Mimosa pigra</i> per quadrat [ <i>Mimosa pigra</i> per kuadrat]	0	1	2	3	4	5	6
Frequency [Frekuensi]	8	9	7	3	4	2	2

Table 1.2  
 [Jadual 1.2]

<i>Mimosa pigra</i> per quadrat [ <i>Mimosa pigra</i> per kuadrat]	Frequency [Frekuensi]	P(r) Poisson	P(r) Negative Binomial
0	8	0.1353	0.633
1	9	0.2707	?
2	7	0.2707	0.079
3	3	?	0.045
4	4	0.0902	0.028
$\geq 5$	2	0.0527	0.054

(15 marks / 15 markah)

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2. [a] Explain the differences in terms among the number of species, species richness, and diversity index.  
*[Terangkan perbezaan istilah antara bilangan spesies, kekayaan spesies dan indeks diversiti.]*

(10 marks / 10 markah)

- [b] Analyze the data provided in Table 2.1 and determine which site has a greater species diversity based on Shannon-Wiener diversity index.  
*[Berikan analisa data yang terdapat dalam Jadual 2.1 dan tentukan lokasi yang mempunyai kepelbagaian spesies yang lebih tinggi berdasarkan indeks kepelbagaian Shannon-Wiener.]*

Table 2.1: Species abundance recorded by site.  
*[Jadual 2.1: Kelimpahan spesies yang direkodkan mengikut lokasi.]*

Species Name <i>[Nama species]</i>	Bukit Merah Reservoir <i>[Takungan Bukit Merah]</i>	Temengor Reservoir <i>[Takungan Temengor]</i>
<i>Hampala macrolepidota</i>	12	35
<i>Thynnichthys thynnoides</i>	0	8
<i>Labiobarbus fasciatus</i>	24	11
<i>Mastacembelus spp.</i>	5	10
<i>Anabas testudineus</i>	10	0
<i>Mystus nemurus</i>	8	6
<b>Total</b> <i>[Jumlah]</i>	<b>59</b>	<b>70</b>

(15 marks / 15 markah)

3. [a] Explain the **TWO (2)** types of multivariate analysis that are commonly used in analyzing ecological data.  
*[Terangkan **DUA (2)** jenis analisis multivariat yang biasa digunakan dalam analisis data ekologi.]*

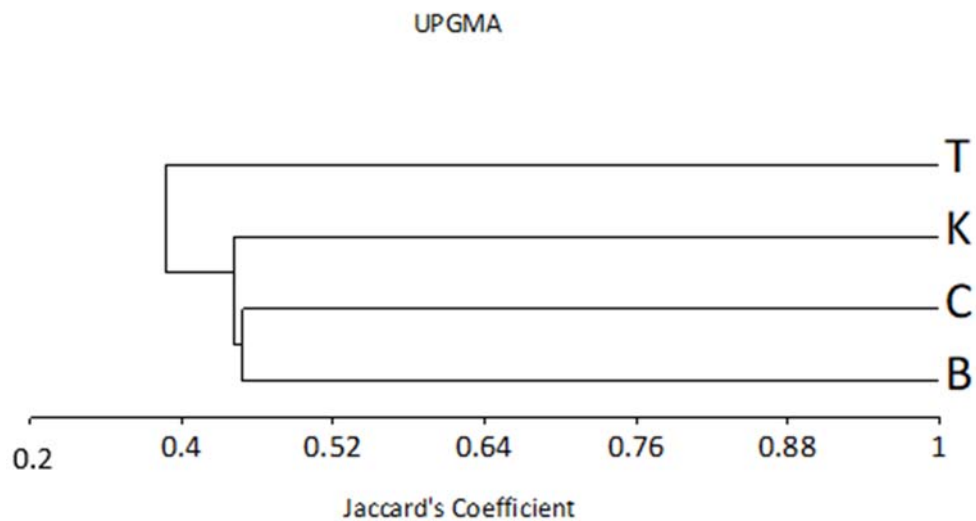
(10 marks / 10 markah)

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- [b] Summarize the following multivariate analysis output (Figure 3.1).  
 [Berikan rumusan output analisis multivariat berikut (Rajah 3.1).]

Figure 3.1: Multivariate analysis output based on fish species abundance data from Temengor (T), Bersia (B), Kenering (K) and Chenderoh (C), reservoirs.

[Rajah 3.1: Output analisis multivariat berdasarkan data kelimpahan spesies ikan daripada takungan Temengor (T), Bersia (B), Kenering (K) dan Chenderoh (C).]



(15 marks / 15 markah)

4. [a] Document the field methods for carrying out a mark-recapture study of *Rattus norvegicus* (Norway rat) in a 1-hectare residential plot.  
 [Dokumentasikan kaedah lapangan bagi menjalankan kajian tangkap tanda lepas dan tangkap semula *Rattus norvegicus* (Tikus Norway) di dalam plot 1-hektar kawasan residensi.]

(15 marks / 15 markah)

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- [b] Show the mathematical formula used in the analysis and the specific assumptions underlying this method.  
*[Tunjukkan formula matematik dan andaian spesifik bagi kaedah tersebut.]*

(10 marks / 10 markah)

5. [a] Explain how to set up camera traps for studying Order Carnivora in Perlis State Park.  
*[Terangkan kaedah penggunaan perangkap kamera dalam kajian Order Karnivora di Taman Negeri Perlis.]*

(10 marks / 10 markah)

- [b] Analyze expected outcomes on the distribution and activity patterns of the carnivores captured on camera.  
*[Berikan analisis hasil yang dijangkakan untuk taburan dan corak aktiviti karnivor yang direkodkan oleh kamera.]*

(15 marks / 15 markah)

## List of formula

*[Senarai formula]***Population variance**

$$\sigma^2 = \frac{\sum[(x_i - \bar{x})^2]}{N}$$

*Sample variance,  $S^2$*

$$= \frac{\sum[f_i(x_i - \bar{x})^2]}{N - 1}$$

$$\chi^2 = \sum_{i=1}^k \frac{(O_i - E_i)^2}{E_i}$$

$$ID = \frac{S^2}{\bar{x}}$$

$$IC = \left(\frac{S^2}{\bar{x}}\right) - 1 = ID - 1$$

$$GI = \frac{\left(\frac{S^2}{\bar{x}}\right) - 1}{n - 1} = \frac{IC}{n - 1}$$

*Evenness index 1,  $E1$*  =  $\frac{H'}{\ln S}$

**Poisson Distribution Model**

$$P(r) = \frac{(\bar{x})^r e^{-\bar{x}}}{r!} \text{ or } \left(\frac{\bar{x}}{r}\right) P(r - 1)$$

e = 2.7183

**Negative Binomial Distribution Model**

$$\log_{10} \left(\frac{N}{N_0}\right) = \hat{k} \log_{10} \left[1 + \left(\frac{\bar{x}}{\hat{k}}\right)\right] \text{ (E. q. 1)}$$

$$\hat{k} = \frac{\bar{x}^2}{S^2 - \bar{x}} \text{ (E. q. 2)}$$

**Simpson's index**

$$\lambda = \sum \left(\frac{n_i}{N}\right)^2 \text{ or } \lambda = \frac{\sum n(n-1)}{N(N-1)}$$

$$H' = - \sum_{i=1}^s p_i \ln p_i \quad p_i = \frac{n_i}{N}$$

$$I_{Margalef} = \frac{S - 1}{\ln N}$$

$$I_{Menhinick} = \frac{S}{\sqrt{N}}$$

Table A7 The chi-square distribution

The table gives the critical values of  $\chi^2$  in a two-tailed/non-directional test, for different numbers of degrees of freedom (df). For significance, the calculated value must be *greater than or equal to* the critical value.

df	Significance level					
	0.20	0.10	0.05	0.025	0.01	0.001
1	1.64	2.71	3.84	5.02	6.64	10.83
2	3.22	4.61	5.99	7.38	9.21	13.82
3	4.64	6.25	7.82	9.35	11.34	16.27
4	5.99	7.78	9.49	11.14	13.28	18.47
5	7.29	9.24	11.07	12.83	15.09	20.52
6	8.56	10.64	12.59	14.45	16.81	22.46
7	9.80	12.02	14.07	16.01	18.48	24.32
8	11.03	13.36	15.51	17.53	20.09	26.12
9	12.24	14.68	16.92	19.02	21.67	27.88
10	13.44	15.99	18.31	20.48	23.21	29.59
11	14.63	17.28	19.68	21.92	24.72	31.26
12	15.81	18.55	21.03	23.34	26.22	32.91
13	16.98	19.81	22.36	24.74	27.69	34.53
14	18.15	21.06	23.68	26.12	29.14	36.12
15	19.31	22.31	25.00	27.49	30.58	37.70
16	20.47	23.54	26.30	28.85	32.00	39.25
17	21.61	24.77	27.59	30.19	33.41	40.79
18	22.76	25.99	28.87	31.53	34.81	42.31

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