MASENO UNIVERSITY

UNIVERSITY EXAMINATIONS 2012/2013

SECOND YEAR SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN AQUATIC RESOURCES CONSERVATION & DEVELOPMENT WITH INFORMATION TECHNOLOGY (MAIN CAMPUS)

SZA 202: FISHERIES BIOMETRICS

Date: 22nd July, 2013 *Time: 11.00 a.m. – 1.00 p.m.*

INSTRUCTIONS:

1. Answer ALL questions in Section A (6 marks each).
2. Answer ANY TWO questions in Section B (20 marks each).

SECTION A (60 Marks):

Q1. Based on intended purpose (s), distinguish between the two main types of biometrical measurements

Q2. Name six (6) meristic characteristics used in the description of fishes

Q3. Briefly describe six (6) morphological characteristics used in fish identification

Q4. Explain the term 'population dynamics' and describe the three (3) dynamic rate functions

Q5.

a) **Explain the importance of length-weight relationships in fisheries science**
b) **Describe the Fulton's condition factor (K) based on the Atlantic salmon, *Salmo trutta*.**

Q6.

a) **Describe the Von Bertalanffy growth model**
b) **List four (4) different methods used to estimate a given set of growth parameters**

Q7.

a) **Define the term 'Allometry'**
b) **Using graphic illustrations, describe the different types of allometry**

Q8. A fisheries ecologist has observed that 40% of fishes in a large reservoir are infected with a certain virus. If you take samples of k = 5 fishes each and examine them separately for the presence of the virus, what distribution of samples would you expect if the probability of infection is independent of the others?

Q9.

a) **Explain what is meant by 'Nonparametric statistical tests'**

b) **Describe two nonparametric tests commonly used in fisheries science**

Q10. Using a specific example (s), justify the use of indices as statistical tools for fish stock evaluation

SECTION B:

INSTRUCTIONS: Answer any TWO questions (20 Marks each question)

Q11. A fisheries scientist wishes to test the hypothesis that the growth of a given culture fish X depends on the type of feed it is given. After 6 months culture, he measures the weight of 5 fishes in each of 4 ponds representing different feed types, all 4 ponds being located randomly within a radius of 1 km. His results are tabulated below (Weight is given in grams). Does your analysis support this hypothesis?

Observation number	Ponds			
	1	2	3	4
1	150	250	170	104
2	90	210	231	130
3	45	197	200	160
4	67	203	184	159
5	115	238	197	145

Q12. Using the Principal Component Analysis (PCA), Factor Analysis (FA) and Cluster Analysis (CA), as examples, explain the importance of multivariate data analysis in population studies

Q13. Describe the various methods and procedures used to collect fish samples before measurement and data analysis

Q14. Assuming equality of variances and using the test hypothesis H_o: $\mu_1 = \mu_2$, test the hypothesis that the two fish samples below were obtained from the same population

Sample 1	Sample 2
Mean = 90.8	Mean = 81.52
N = 10	N = 9
SS = 497	SS = 530

Appendix tables

The first five appendix tables have been mainly abridged from Tables I, III, IV, V and VI of Fisher and Yates' *Statistical Tables for Biological, Agricultural and Medical Research*, published by Oliver and Boyd Limited, Edinburgh, by permission of the authors and publishers. Some additional material has also been incorporated from Tables 12 and 18 of *Biometrika Tables for Statisticians*, Vol. I, by permission of the *Biometrika Trustees*. The sixth appendix table, originally by Professor John W. Tukey, has been taken directly from the Ciba–Geigy *Scientific Tables* (7th edn.), by permission of the author and publishers. Finally, the seventh appendix table adapted from Kendall, *Rank Correlation Methods* (4th edn.), 1970, has been reproduced by permission of the publishers, Charles Griffin and Company Ltd. of London and High Wycombe.

Appendix 1. *The normal distribution*

P	0.10	0.05	0.02	0.01	0.002	0.001
d	1.645	1.960	2.326	2.576	3.090	3.291

The table gives the percentage points most frequently required for significance tests and confidence limits based on a normal variable having zero mean and unit standard deviation (usually called d in the text). Thus, for any normal distribution, the probability of observing a departure from the mean of more than 1.960 standard deviations in *either* direction is 0.05 or 5 per cent.

Appendix 2. *'Student's' t-distribution*

Degrees of freedom	Value of P					
	0.10	0.05	0.02	0.01	0.002	0.001
1	6.314	12.71	31.82	63.66	318.3	636.6
2	2.920	4.303	6.965	9.925	22.33	31.60
3	2.353	3.182	4.541	5.841	10.21	12.92
4	2.132	2.776	3.747	4.604	7.173	8.610
5	2.015	2.571	3.365	4.032	5.893	6.869
6	1.943	2.447	3.143	3.707	5.208	5.959
7	1.895	2.365	2.998	3.499	4.785	5.408
8	1.860	2.306	2.896	3.355	4.501	5.041
9	1.833	2.262	2.821	3.250	4.297	4.781
10	1.812	2.228	2.764	3.169	4.144	4.587
11	1.796	2.201	2.718	3.106	4.025	4.437
12	1.782	2.179	2.681	3.055	3.930	4.318
13	1.771	2.160	2.650	3.012	3.852	4.221
14	1.761	2.145	2.624	2.977	3.787	4.140
15	1.753	2.131	2.602	2.947	3.733	4.073
16	1.746	2.120	2.583	2.921	3.686	4.015
17	1.740	2.110	2.567	2.898	3.646	3.965
18	1.734	2.101	2.552	2.878	3.610	3.922
19	1.729	2.093	2.539	2.861	3.579	3.883
20	1.725	2.086	2.528	2.845	3.552	3.850
21	1.721	2.080	2.518	2.831	3.527	3.819
22	1.717	2.074	2.508	2.819	3.505	3.792
23	1.714	2.069	2.500	2.807	3.485	3.767
24	1.711	2.064	2.492	2.797	3.467	3.745
25	1.708	2.060	2.485	2.787	3.450	3.725
26	1.706	2.056	2.479	2.779	3.435	3.707
27	1.703	2.052	2.473	2.771	3.421	3.690
28	1.701	2.048	2.467	2.763	3.408	3.674
29	1.699	2.045	2.462	2.756	3.396	3.659
30	1.697	2.042	2.457	2.750	3.385	3.646

The table gives the percentage points most frequently required for significance tests and confidence limits based on 'Student's' t-distribution. Thus, the probability of observing a value of t, with 10 degrees of freedom, greater in *absolute value* than 3.169 (i.e. < -3.169 or $> +3.169$) is exactly 0.01 or 1 per cent.

$$X^2 = \frac{\sum (O-E)^2}{E}$$

$$r = \frac{\sum (x-\bar{x})(y-\bar{y})}{\sqrt{\sum (x-\bar{x})^2 \sum (y-y)^2}}$$

$$S^2 = \frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n-1}$$