DE LA SALLE UNIVERSITY
**College of Science**
Mathematics and Statistics Department

**NONPARM** – *Nonparametric Methods*
*Prerequisite:LINMODE* *Prerequisite to:*

**Instructor:**_____ **Contact details:**_____
**Consultation Hours:**_____ **Class Schedule and Room:**_____

## Course Description

This course discusses different nonparametric and distribution-free statistical procedures. They are grouped according to the data available: one-sample tests, two-sample tests, three or more-sample tests, goodness of fit tests and measures of association.

## Learning Outcomes

On completion of this course, the student is expected to present the following learning outcomes in line with the Expected Lasallian Graduate Attributes (ELGA) and the outcomes prescribed by the CHED Memorandum Order for the BS Mathematics program.

| ELGA | Learning Outcome | Program Outcome | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | At the end of the course, the student will | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| Critical and Creative Thinker Effective Communicator Lifelong Learner | distinguish between parametric and nonparametric tests | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | | ✓ | ✓ | ✓ | ✓ |
| | know when to use the different nonparametric tests | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | | ✓ | ✓ | ✓ | ✓ |
| | apply these tests with flexibility and creativity to various problems | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | | ✓ | ✓ | ✓ | ✓ |

## Program Outcomes (BS Statistics)

A graduate of the program should be able to

1. Demonstrate broad and coherent knowledge and understanding of the core areas of statistical theory and statistical modeling .
2. Apply critical and problem solving skills using the scientific method.
3. Interpret scientific data and make judgments that include reflection on relevant scientific and ethical issues.
4. Carry out basic mathematical and statistical computations and use appropriate technologies in (a) the analysis of data; and ( b) In pattern recognition, generalization, abstraction, critical analysis and problem solving.
5. Communicate information, ideas problems and solutions, both, orally and in writing, to other scientists, decision makers and the public.
6. Relate science and mathematics with other disciplines.
7. Design and perform safe and responsible techniques and procedures in laboratory or field practices.
8. Critically evaluate input from others.
9. Appreciate the limitations and implications of science in everyday life.
10. Commit to the integrity of data.
11. Demonstrate broad and coherent knowledge and understanding in the core areas of statistics, computing and mathematics.
12. Generate information involving the conceptualization of a strategy for generating timely and accurate/reliable data, organizing a process for putting together or compiling the needed data, and transforming available data into relevant and useful forms.
13. Translate real-life problems into statistical problems.
14. Identify appropriate statistical tests and methods and their proper use for the given problems, select optimal solutions to problems and make decision in the face of uncertainty.

## Final Course Output

As evidence of attaining the above learning outcomes, the student is required to submit the following during the indicated dates of the term.

| Learning Outcome | Required Output | Due Date |
|---|---|---|
| At the end of the course, the student will apply appropriate statistical concepts, processes, tools, and technologies in the solution to various conceptual and real-world problems. | An inquiry-based individual and group presentations highlighting the uses of nonparametric statistical methods using real empirical data | Week 13 |

## Rubric for assessment

| Criteria | Excellent 4 | Satisfactory 3 | Developing 2 | Needs Improvement 1 |
|---|---|---|---|---|
| ***Formulation of the Research Problem and Objectives (10%)*** | Research problem and objectives are clearly defined and significant; Demonstrates evidence that the research problem was researched and designed well. | Research problem and objectives are clearly defined and significant. | Research problem is clearly defined but some objectives are insignificant. | Research problem and objectives are vague and insignificant. |
| ***Correct Application of the Statistical Concepts (35%)*** | Statistical analyses are appropriate with correct interpretations and relevant conclusions. | Statistical analyses are appropriate with correct interpretations. | Some statistical analyses are inappropriate. | Statistical analyses are inappropriate |
| ***Depth of Analysis (30%)*** | The analysis convinces the reader about the wisdom of conclusions, implications and consequences on the basis of statistical methods and findings | The analysis engages the reader to appreciate the wisdom of conclusions, implications and consequences on the basis of statistical methods and findings | The analysis have limited ideas that do not explain the wisdom of conclusions, implications and consequences on the basis of statistical methods and findings | The analysis has incorrect ideas and conclusions. |
| ***Clarity and Organization of Written Report (10%)*** | Written report is organized logically and presented clearly with effective transitions. | Written report is organized logically and presented clearly. | Written report is organized and some discussions are not clear. | Written report is not organized. |
| ***Oral Presentation (15%)*** | Overall presentation is creative and well organized with innovative ideas. | Overall presentation is creative and well organized. | Overall presentation is organized | Overall presentation is not organized |

## Additional Requirements

- Quizzes and Problem Sets
- Class Participation (seatwork and group exercises, homework, recitation, group reports)
- Computer hands-on exercises using SAS
- Final Examination

## Grading System

| | FOR EXEMPTED STUDENTS (w/out Final Exam) | FOR STUDENTS with FINAL EXAM | |
|---|---|---|---|
| | | *with no missed quiz* | *With one missed quiz* |
| Average of quizzes, problem sets& Project | 90% | 60% | 50% |
| Class participation & Lab exercises | 10% | 10% | 10% |
| Final exam/Project | - | 30% | 40% |

**Scale:**

| | |
|---|---|
| 95-100% | 4.0 |
| 89-94% | 3.5 |
| 83-88% | 3.0 |
| 78-82% | 2.5 |
| 72-77% | 2.0 |
| 66-71% | 1.5 |
| 60-65% | 1.0 |
| <60% | 0.0 |

## Learning Plan

| LEARNING OUTCOME | TOPIC | WEEK NO. | LEARNING ACTIVITIES |
|---|---|---|---|
| At the end of the course, the student will apply appropriate statistical concepts, processes, tools, and technologies in the solution to various conceptual and real-world problems | 1. Introduction and Review<br>1.1 Measurement scales<br>1.2 Distribution-free and nonparametric tests<br>1.3 Hypothesis testing<br>1.4 P-value | 3 hours / Week 1 | Prior knowledge and beliefs survey<br>Concept mapping<br>Library work<br>Group discussion and presentations<br>Computer laboratory activities (SAS)<br>Skills exercises<br>Student self-assessment and reflection |
| | 2. Single Sample Tests<br>2.1 Location parameter tests<br>- Sign test<br>- Wilcoxon signed-ranks test<br>- Confidence intervals<br>2.2 Runs test<br>2.3 Cox-Stuart test for trend | 4.5 hours / Week 2 – 3 | |
| | **Quiz No. 1 & Problem Set 1** | **1.5 hours / Week 3** | |
| | 3. Two Independent Samples Tests<br>3.1 Location parameter tests<br>- Tukey's quick test<br>- The median test<br>- The Mann-Whitney test<br>- Confidence intervals<br>- Binomial test<br>3.2 Dispersion Parameter Tests<br>- The Mood test<br>- The Moses test<br>3.3 Other tests<br>- The Wald-Wolfowitz runs test<br>-The Hollander test of extreme reactions<br>- The Fisher exact test | 9 hours / Week 4 - 6 | |
| | **Quiz No. 2 & Problem Set 2** | **1.5 hours / Week 7** | |
| | 4. Two Related Samples Tests<br>4.1 The sign test for two related samples<br>4.2 The Wilcoxon matched pairs signed-ranks test<br>4.3 Confidence intervals<br>4.4 A test for frequencies | 4.5 hours / Week 7 - 8 | |
| | 5. Methods for Three or More Samples<br>5.1 Kruskall-Wallis test<br>5.2 Friedman test | 4.5 hours / Week 9 - 10 | |
| | 6. Goodness-of Fit Tests<br>6.1 Chi-square goodness-of-fit test<br>6.2 The Kolmogorov-Smirnov test<br>6.3 Comparison of the Chi-square test and the Kolmogorov-Smirnov test | 3 hours / Week 10 - 11 | |

| | | | |
|---|---|---|---|
| | 7. Chi-square tests of Independence and Homogeneity | | |
| | **Quiz No. 3 & Problem Set 3** | **1.5 hours / Week 11** | |
| | 8. Measures of Association<br>8.1 Spearman's rank correlation coefficient<br>8.2 Kendall's tau<br>8.3 Confidence interval based on Kendall's tau<br>8.4 Kendall's coefficient of concordance W<br>8.5 Partial rank correlation<br>8.6 Measures of association for contingency tables<br>8.7 Other measures of association | 4.5 hrs / Week 12 - 13 | |
| | Group Reports/Projects | 1.5 hours / Week 13 | |
| | 9. Simple Linear Regression Analysis<br>9.1 Fitting the regression line<br>9.2 Testing hypotheses about $\alpha$ and $\beta$<br>9.3 Confidence interval for $\beta$<br>9.4 Test for parallelism of two regression lines<br>9.5 Estimator and CI for difference between slope parameters | | |
| | **Final Examination** | **2.0 hours / Week 14** | |

*Skills exercises/ computer laboratory activities are given weekly and the students are expected to work on the solutions for their fourth hour activity. At the end of the term, the solutions to the problems will be compiled and submitted as one of the course outputs.

## References


Conover, W. J., (1999). *Practical Nonparametric Statistics (3rd edition)*. Wiley.

Gibbons J. D. (1992). *Nonparametric Statistics: An Introduction*. NewburyPark: Sage Publications, Inc

Higgins, James J. (2003). *Introduction to Modern Nonparametric Statistics.* Duxbury Press.

Hollander, Myles, and Wolfe, Douglas A. (1999 ). *Nonparametric Statistical Methods (2nd edition)*. Wiley-Interscience. (ISBN: 978-0-471-19045-5)

Maritz, J. S. (1995). *Distribution-free Statistical Methods (2nd edition)*. London: Chapman and Hall/CRC.

Wayne, Daniel W. (2000). *Applied Nonparametric Statistics (2nd edition)*. Duxbury Press.


## Online Resources

*Second Moment Nonparametric Statistics Site Links.* Accessed October 11, 2012 from: http://www.secondmoment.org/nonparametric.php

*SAS/STAT 9.3 User's Guide: Introduction to Nonparametric Analysis.* Accessed October 11, 2012 from: http://support.sas.com/documentation/onlinedoc/stat/930/intronpar.pdf

## Class Policies

1. The required minimum number of quizzes for a 3-unit course is 3, and 4 for 4-unit course. No part of the final exam may be considered as one quiz.
2. Cancellation of the lowest quiz is not allowed even if the number of quizzes exceeds the required minimum number of quizzes.
3. As a general policy, no special or make-up tests for missed exams other than the final examination will be given. However, a faculty member may give special exams for
   A. approved absences (where the student concerned officially represented the University at some function or activity).
   B. absences due to serious illness which require hospitalization, death in the family and other reasons which the faculty member deems meritorious.
4. If a student missed two (2) examinations, then he/she will be required to take a make up for the second missed examination.

5. If the student has no valid reason for missing an exam (for example, the student was not prepared to take the exam) then the student receives 0% for the missed quiz.
6. Students who get at least 89% in every quiz are exempted from taking the final examination. Their final grade will be based on the average of their quizzes and other prefinal course requirements. The final grade of exempted students who opt to take the final examination will be based on the prescribed computation of final grades inclusive of a final examination. Students who missed and/or took any special/make-up quiz will not be eligible for exemption.
7. Learning outputs are required and not optional to pass the course.
8. Mobile phones and other forms of communication devices should be on silent mode or turned off during class.
9. Students are expected to be attentive and exhibit the behavior of a mature and responsible individual during class. They are also expected to come to class on time and prepared.
10. Sleeping, bringing in food and drinks, and wearing a cap and sunglasses in class are not allowed.
11. Students who wish to go to the washroom must politely ask permission and, if given such, they should be back in class within 5 minutes. Only one student at a time may be allowed to leave the classroom for this purpose.
12. Students who are absent from the class for more than 5 meetings will get a final grade of 0.0 in the course.
13. Only students who are officially enrolled in the course are allowed to attend the class meetings.

Approved by:

**DR. JOSE TRISTAN F. REYES**
Chair, Mathematics and Statistics