University Studies Course Approval Proposal
Basic Skills—Mathematics and Statistics

The Department of Mathematics and Statistics proposes the following course for inclusion in University Studies, Basic Skills—Mathematics and Statistics at Winona State University. This was approved by the full department on Thursday, October 6, 2005.

Course: Statistics (STAT 210), 3 s.h.

Catalog Description: First course in statistics for students with a strong mathematics background.
Prerequisites: MATH 140 or MATH 160 or consent of instructor.

This is an existing course, previously approved by A2C2.

Department Contact Person for this course:
Name: Brant Deppa
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General Discussion of University Studies – Basic Skills—Mathematics and Statistics in relation to STAT 210:

University Studies—Basic Skills—Mathematics and Statistics

The purpose of the Mathematics requirement in University Studies is to help students develop an appreciation of the uses and usefulness of mathematical models of our world, as applied in a variety of specific contexts. Students should complete the requirement as soon as possible, preferably in their first year and certainly no later than their third semester. Only approved courses offered by the Department of Mathematics and Statistics can be used to satisfy the University Studies requirements for Basic Skills in Mathematics. Each of these courses must address at least four of the following outcomes.

These courses must include requirements and learning activities that promote students’ abilities to...

a. use logical reasoning by studying mathematical patterns and relationships;
One of the major goals of statistics is to find patterns and relationships in datasets. Hence almost all lectures, homework problems, and test questions in the course have the study of patterns for variables and relationships between variables as their basis.

b. use mathematical models to describe real-world phenomena and to solve real-world problems - as well as understand the limitations of models in making predictions and drawing conclusions;
In all of the textbooks used in STAT 210 the majority of the problems are real-world based and are “word” problems. Further, all instructors require the students when doing such problems to write conclusions and discuss limitations.

c. organize data, communicate the essential features of the data, and interpret the data in a meaningful way;
This is the heart of STAT 210. The topics covered are chosen so that students who complete the course can organize data, communicate essential features of the data both numerically and graphically and provide interpretations/conclusions.
d. **do a critical analysis of scientific and other research;**

The scientific method is discussed early in the course. The logic of hypothesis testing is discussed in detail. Further, on tests and written assignments the students are expected to go beyond a simple analysis and provide implications, interpretations, and conclusions.

e. **extract correct information from tables and common graphical displays, such as line graphs, scatter plots, histograms, and frequency tables;**

All of these topics are explicitly taught in STAT 210 and are on the course outline. Please note that “line graphs” is subsumed under “Frequency distributions and histograms”. Also, please note that “scatter plots” are more formally called “Bivariate displays” by statisticians.

f. **express the relationships illustrated in graphical displays and tables clearly and correctly in words; and/or**

As can be seen from the course outline, graphical displays and tables cover a significant portion of the course content. As discussed above, interpretation in words is expected by all instructors on homework and tests.

g. **use appropriate technology to describe and solve quantitative problems.**

As stated on the course outline, “It is required that at least one assignment using an appropriate computer package be included in the course.”
Course Title: Statistics

Course Description: First course in statistics for students with a strong mathematics background. Prerequisites: MATH 140 or MATH 160 or consent of instructor.

Number of Credits: 3


Topics Covered:

I. Descriptive statistics
   A. Stem-and-leaf displays
   B. Frequency distributions and histograms
   C. Measures of central tendency
   D. Measures of variation
   E. Measures of shape (including skewness & kurtosis—cover lightly)
   F. Measures of relative standing
   G. Bivariate displays and correlation (cover lightly)

II. Some simple probability concepts

III. Discrete random variables
    A. Distributions
    B. Expected value
    C. Binomial and Poisson distributions

IV. Continuous random variables
    A. Distributions
    B. Expected value
    C. Normal distribution

V. Sampling distributions and Central Limit Theorem

VI. Estimation
    A. Point estimation and desirable properties
    B. Interval estimation

VII. Logic of hypothesis testing

VIII. Common hypothesis testing situations
    A. One mean
    B. Two means—both independent and dependent samples
    C. Probability values
    D. Wilcoxon Rank Sum and Signed Rank tests

IX. Contingency table analysis (cover lightly)

X. Additional topics as time permits

Method of Instruction: Methods may include lecture, group work, case studies, discussion of examples, and discussion of computer output.

Evaluation Procedures: Possible methods include computer assignments, homework problems, examinations, quizzes, and/or a final examination.
Notes: 1. The topics covered in Statistics 210 overlap substantially with Statistics 110. The main difference between the courses is that appropriate proofs and use of calculus are included in 210 but not in 110.

2. It is required that at least one assignment using an appropriate computer package be included in the course.

University Studies—Basic Skills—Mathematics and Statistics

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b. use mathematical models to describe real-world phenomena and to solve real-world problems - as well as understand the limitations of models in making predictions and drawing conclusions;

c. organize data, communicate the essential features of the data, and interpret the data in a meaningful way;

d. do a critical analysis of scientific and other research;

e. extract correct information from tables and common graphical displays, such as line graphs, scatter plots, histograms, and frequency tables;

f. express the relationships illustrated in graphical displays and tables clearly and correctly in words; and/or

g. use appropriate technology to describe and solve quantitative problems.

Topics below which include such requirements and learning activities are indicated below using lower case, boldface letters a-g corresponding to these requirements.

Course Outline of the Major Topics and Subtopics

I. Descriptive statistics
   A. Stem-and-leaf displays a, c, e, f
   B. Frequency distributions and histograms a, c, e, f, g
   C. Measures of central tendency a, c, e, g
   D. Measures of variation a, c, e, g
   E. Measures of shape(including skewness & kurtosis—cover lightly) a, c, e, g
   F. Measures of relative standing a, c, e, g
   G. Bivariate displays and correlation (cover lightly) a, c, d, e, f, g

II. Some simple probability concepts a, b, d

III. Discrete random variables
   A. Distributions a, b
   B. Expected value a, b
C. Binomial and Poisson distributions a, b, e
IV. Continuous random variables
   A. Distributions a, b
   B. Expected value a, b
   C. Normal distribution a, b, e
V. Sampling distributions and Central Limit Theorem a, b, d, e, f, g
VI. Estimation
   A. Point estimation and desirable properties b, d
   B. Interval estimation a, b, c, d
VII. Logic of hypothesis testing a, b, c, d
VIII. Common hypothesis testing situations
   A. One mean a, b, c, d, e, f, g
   B. Two means--both independent and dependent samples a, b, c, d, e, f, g
   C. Probability values a, b, c, d, e, f, g
   D. Wilcoxon Rank Sum and Signed Rank tests a, b, c, d, e, f, g
IX. Contingency table analysis (cover lightly) a, b, c, d, e, f, g
### Approval/Disapproval Recommendations

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<th>Recommendation</th>
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| *In the case of a Dean's recommendation to disapprove a proposal, a written rationale for the recommendation to disapprove shall be provided to USS*
| **USS Recommendation**         |          |             |       |
| University Studies Director's Signature |          |             |       |
| **A2C2 Recommendation**         |          |             |       |
| A2C2 Chairperson Signature      |          |             |       |
| **Faculty Senate Recommendation** |        |             |       |
| FA President's Signature        |          |             |       |
| **Academic VP's Recommendation**|          |             |       |
| VP's Signature                  |          |             |       |
| **President's Decision**        |          |             |       |
| President's Signature           |          |             |       |