General Education Course Inclusion Proposal

Quantitative Reasoning and Analysis

This proposal form is intended for departments proposing a course for inclusion in the Northern Michigan University General Education Program. Courses in a component satisfy both the Critical Thinking and the component learning outcomes. Departments should complete this form and submit it electronically through the General Education SHARE site.

Course Name and Number: MA 171 Introduction to Porbability and Statistics

Home Department: Mathematics & Computer Science

Department Chair Name and Contact Information (phone, email): J.D. Phillips 227 2020 jophilli@nmu.edu

Expected frequency of Offering of the course (e.g. every semester, every fall): every semester

Official Course Status: Has this course been approved by CUP and Senate? YES

Courses that have not yet been approved by CUP must be submitted to CUP prior to review by GEC. Note that GEC is able to review courses that are in the process of approval; however, inclusion in the General Education Program is dependent upon Senate and Academic Affairs approval of the course into the overall curriculum.

Overview of course (please attach a current syllabus as well): *Please limit the overview to two pages (not including the syllabus)*

A. Overview of the course content

Statistics is the language of numbers. In this class students learn how to interpret numerical data and make inferences for answering research questions. The laws of probability are what make this possible. Methods for the analysis and interpretation of research data will be presented in a logical, practical sequence of steps that will lead to conclusions based on research data. Statistics is used in all fields in some form or another - even in our day-to-day living. An understanding of basic statistical concepts is essential for making judgments and predictions. Even the reading of the daily newspaper involves a degree of understanding of these basic statistical concepts in order to form rational and logical opinions. Emphasis in this class is on application of these methods with supporting theoretical concepts presented as needed.

Upon completion of this course, students will be able to:

- understand the difference between descriptive statistics and inferential statistics
- determine sample spaces and find the probability of an event
- summarize a set of data numerically and graphically
- formulate and test hypotheses about parameters for both one and two populations for both population means and proportions
- construct and interpret confidence interval estimates for population parameters

B. Explain why this course satisfies the Component specified and significantly addresses both learning outcomes

Critical Thinking Learning Outcomes:

- Evidence: Students are often presented with problems (particularly "word" problems) in which they must determine what pieces of the information given should be used to find the solution.

- Integrate: In a majority of problems on exams, students are not told how to solve the given problem. They must choose from a variety of known methods to solve the given problem.
- Evaluate: The student needs to be able to recognize when they have arrived at a solution to a given problem and present the solution coherently. For example, the method chosen to produce a solution may have resulted in extraneous answers. The student must stop and evaluate which one, if any, is correct.

Quantitative Reasoning and Analysis Learning Outcomes:

- Calculation: 90% (or more) of exam and homework problems require a mathematical calculation.
- Analysis / Application: At each stage in the process of problem-solving, the student needs to analyze the current state of the "data" at hand to move to a new step In the process. This is true for all problems requiring calculation of any sort, as well as problems requiring a mathematical proof.
- Interpretation: A substantial number of problems require students to take information given and mathematically model the situation (interpretation in its own right) and use the model to arrive at a solution.

C. Describe the target audience (level, student groups, etc.)

MA 171 is a 100-level introductory statistics course that is required for a variety of majors, including math secondary education and computer science. Many of our MA 171 students have a business school major. At present, MA 171 can be taken in lieu of a modern language to satisfy the corresponding division in the liberal studies curriculum.

D. Give information on other roles this course may serve (e.g. University Requirement, required for a major(s), etc.)

Currently MA 171 is required for secondary education mathematics, computer science, physics, and many business majors (among others). It counts as an elective for the mathematics and computer science minors. MA 171 will also satisfy the new mathematics competency requirement.

E. Provide any other information that may be relevant to the review of the course by GEC

At this time we do not have anything to add. However, if you have questions or would like us to clarify anything, please let us know.

PLAN FOR LEARNING OUTCOMES
CRITICAL THINKING

Attainment of the CRITICAL THINKING Learning Outcome is required for courses in this component. There are several dimensions to this learning outcome. Please complete the following Plan for Assessment with information regarding course assignments (type, frequency, importance) that will be used by the department to assess the attainment of students in each of the dimensions of the learning outcome. Type refers to the types of assignments used for assessment such as written work, presentations, etc. Frequency refers to the number of assignments included such as a single paper or multiple papers. Importance refers to the relative emphasis or weight of the assignment to the entire course. For each dimension, please specify the expected success rate for students completing the course that meet the proficiency level and explain your reasoning. Please refer to the Critical Thinking Rubric for more information on student performance/proficiency in this area. Note that courses are expected to meaningfully address all dimensions of the learning outcome.

DIMENSION	WHAT IS BEING ASSESSED	PLAN FOR ASSESSMENT
Evidence	Assesses quality of information that may be integrated into an argument	❖ Task type: 3 or more in-class exams / quizzes and a comprehensive final exam ❖ Frequency: in-class exams / quizzes roughly equally spaced throughout the semester, with the comprehensive final exam at the end of the semester. ❖ Overall Grading Weight: Between 80% & 100% for the exams, roughly 60% of this grade involves problems that would address this learning objective ❖ Assessment: Problems requiring students to select from given information to arrive at a solution will be embedded in the final exam and scored independently and tracked from semester to semester for assessment purposes. ❖ Expected Proficiency Rate: We expect 70% of students to earn 70% or higher on the assessment problems
Integrate	Integrates insight and or reasoning with existing understanding to reach informed conclusions and/or understanding	❖ Task type: 3 or more in-class exams / quizzes and a comprehensive final exam ❖ Frequency: in-class exams / quizzes roughly equally spaced throughout the semester, with the comprehensive final exam at the end of the semester. ❖ Overall Grading Weight: Between 80% & 100% for the exams, at least 30% of this grade involves problems that would address this learning objective ❖ Assessment: Problems requiring students to select from a variety of known methods to arrive at a solution will be embedded in the final exam and scored independently and tracked from semester to semester for assessment purposes. ❖ Expected Proficiency Rate: We expect 70% of students to earn 70% or higher on the assessment problems
Evaluate	Evaluates information, ideas, and activities according to established principles	❖ Task type: 3 or more in-class exams / quizzes and a comprehensive final exam ❖ Frequency: in-class exams / quizzes roughly equally spaced throughout the semester, with the comprehensive final exam at

	and guidelines	the end of the semester. ❖ Overall Grading Weight: Between 80% & 100% for the exams, at least 35% of this grade involves problems that would address this learning objective ❖ Assessment: Problems requiring students either to identify a solution from several possible answers produced during the solution process or to recognize and coherently express the final answer will be embedded in the final exam and scored independently and tracked from semester to semester for assessment purposes. ❖ Expected Proficiency Rate: We expect 70% of students to earn 70% or higher on the assessment problems

PLAN FOR LEARNING OUTCOMES
QUANTITATIVE REASONING AND ANALYSIS

Attainment of the QUANTITATIVE REASONING AND ANALYSIS Learning Outcome is required for courses in this component. There are several dimensions to this learning outcome. Please complete the following Plan for Assessment with information regarding course assignments (type, frequency, importance) that will be used by the department to assess the attainment of students in each of the dimensions of the learning outcome. Type refers to the types of assignments used for assessment such as written work, presentations, etc. Frequency refers to the number of assignments included such as a single paper or multiple papers. Importance refers to the relative emphasis or weight of the assignment to the entire course. For each dimension, please specify the expected success rate for students completing the course that meet the proficiency level and explain your reasoning. Please refer to the Rubric for more information on student performance/proficiency in this learning outcome. Note that courses are expected to meaningfully address all dimensions of the learning outcome.

DIMENSION	WHAT IS BEING ASSESSED	PLAN FOR ASSESSMENT
Calculation	Ability to perform mathematical/numerical operations.	❖ Task type: 3 or more in-class exams / quizzes and a comprehensive final exam ❖ Frequency: in-class exams / quizzes roughly equally spaced throughout the semester, with the comprehensive final exam at the end of the semester. ❖ Overall Grading Weight: Between 80% & 100% for the exams, at least 80% of this grade involves problems that would address this learning objective ❖ Assessment: Problems requiring mathematical calculation will be embedded in the final exam and scored independently and tracked from semester to semester for assessment purposes. ❖ Expected Proficiency Rate: We expect 70% of students to earn 70% or higher on the assessment problems
Analysis/Application	Ability to manipulate quantitative data to produce new data. Ability to use data to make judgments and draw conclusions.	❖ Task type: 3 or more in-class exams / quizzes and a comprehensive final exam ❖ Frequency: in-class exams / quizzes roughly equally spaced throughout the semester, with the comprehensive final exam at the end of the semester. ❖ Overall Grading Weight: Between 80% & 100% for the exams, at least 35% of this grade involves problems that would address this learning objective ❖ Assessment: Problems requiring hypothesis testing (i.e. drawing a statistical inference) will be embedded in the final exam and scored independently and tracked from semester to semester for assessment purposes. ❖ Expected Proficiency Rate: We expect 70% of students to earn 70% or higher on the assessment problems.
Interpretation	Ability to explain information presented in mathematical forms (e.g. equations, graphs,	❖ Task type: 3 or more in-class exams / quizzes and a comprehensive final exam ❖ Frequency: in-class exams / quizzes roughly equally spaced throughout the semester, with the comprehensive final

	diagrams, tables, and words)	exam at the end of the semester. ❖ Overall Grading Weight: Between 80% & 100% for the exams, at least 50% of this grade involves problems that would address this learning objective ❖ Assessment: Problems requiring students to use graphs and statistical tests to model situations will be embedded in the final exam and scored independently and tracked from semester to semester for assessment purposes. ❖ Expected Proficiency Rate: We expect 70% of students to earn 70% or higher on the assessment problems

Introduction to Probability and Statistics

MA171 01, 02, and 05 Winter 2015

Professor: Dr. Olga Herman (Hocking)
Office: JXJ 2215
Email: opendlet@nmu.edu
Potential Office Hours*: M,T,W,R,F 10:00 am - 3:00pm
*appointments must be made via e-mail in advance; other hours available

Text: Moore, McCabe, Craig. Exploring the Practice of Statistics. Loose-leaf version available packaged with code for access to on-line system. To purchase electronic version go to: http://courses.bfwpub.com/eps . Electronic access to this website IS REQUIRED. Access code can be purchased separately. See Paul Wright at NMU Bookstore for detail. Text and access code must be purchased and online access obtained by Jan. 26, 2015.

Course description: Statistics is the language of numbers. In this class you will learn how to interpret numerical data and make inferences for answering research questions. The laws of probability are what make this possible. Methods for the analysis and interpretation of research data will be presented in a logical, practical sequence of steps that will lead to conclusions based on research data. Statistics is used in all fields in some form or another - even in our day-to-day living. An understanding of basic statistical concepts is essential for making judgments and predictions. Even the reading of the daily newspaper involves a degree of understanding of these basic statistical concepts in order to form rational and logical opinions. Emphasis in this class is on application of these methods with supporting theoretical concepts presented as needed.

Learning Objectives: Upon completion of this course, students will be able to:
- understand the difference between descriptive statistics and inferential statistics
- determine sample spaces and find the probability of an event
- summarize a set of data numerically and graphically
- formulate and test hypotheses about parameters for both one and two populations for both population means and proportions
- construct and interpret confidence interval estimates for population parameters

Evaluation of these learning outcomes will be done through homework assignments, quizzes and exams.

Course Requirements:

Students will complete five online exams. An online practice test will be available for each quiz prior to testing and reviewed in class... Homework will be assigned intermittently and may or may not be collected or reviewed. The text book code allowing online access to the course material and tests via the text book's stats portal is required.

Grades:

Homework : 10%

Five interim Tests: 60%

Final Exam: 30%

Scate:

A $\geq$ 94% A- 90% - 93% B+ 87% - 89% B 84% - 86% B- 80% - 83%

C+ 77% - 79% C 74% - 76% C- 70% - 73% D+ 67% - 69% D 74% - 76%

D- 60% - 63% F < 60%

Extra credit may be available for having successfully completing practice tests prior to each test.

Schedule:

Expect to spend an average of 15 hours of study per chapter. A few things to consider –

- Some chapters are easier than others and will take less time. Expect to spend more than 15 hours on some of the harder chapters.
- This course starts out slow and picks up rapidly. The easier chapters and tests are the earlier ones so do not become complacent if you score well in the beginning. The practice tests are designed to identify the areas of concern. Use these wisely and make an appointment for private consultation before the test if you need extra assistance with a particular area. There is a math help lab available in West 2810 open daily from 8-5 for drop-in help. These are conducted by students who have usually had this class and can offer assistance.

Attendance: Attendance in lecture classes is not mandatory. Attendance will be taken sporadically primarily so I can get to know you individually. You are, however, responsible for any material or announcements (i.e. test dates, assignment due dates, etc.) made in class. Except for test days, no absentee excuses are necessary.

Students may attend any other MA171 sections which I teach at any time without prior notice. If seating is limited, priority will be given to those students registered for that section. This policy also applies to exams, i.e. you may elect to take exams in any other sections at their scheduled test times. All lectures and exams will be identical for the three sections of MA171 which I teach. Lecture dates/rooms/and times are as follows:

MA171-01 CRN 10394 M,W 5:00-6:50 West 3803

MA171-02 CRN 10395 M,T,R,F 3:00-3:50 West 3803

MA171-05 CRN 10399 M,T,R,F 4:00- 4:50 West 3803

Homework policy: Homework will be evaluated as attempted (1) or not (0) and will be used in assessing the final grade by no more than 10%.This generally serves as a factor in determining borderline grades. If you feel you may need the homework to help your grade you should try to submit all collected assignments. There will be an opportunity before each class period to ask questions about the homework or lecture material. Late homework is always accepted at any time during the semester.

Exam policy and practice tests: Five tests will be given during the semesters. A tentative time-line is attached to this syllabus with potential test dates. These dates are not definite and are subject to change depending upon the pace and amount of material covered throughout the semester. Tests will always be announced at least two days prior to the test date and a practice test and review will always be done prior to testing. Successful completion of the practice tests prior to the actual test can result in extra credit added to the test grade so take advantage of this opportunity and do the practice tests. There will be no limit to the number of times you may take the practice test and answers will be provided.

Make-up exam policy: Exams can be taken during any of the MA171 sections listed above during their assigned test periods. Seating priority will be given to those enrolled in that particular section.

Make-up exams will only be allowed with permission of the instructor for valid health issues or approved extenuating circumstances. If permission is granted, the exams MUST be made-up within ONE-WEEK of the original test date. Re-takes of exams will not be given except in extenuating situations with permission from instructor. Since all exams will have practice exams with them, if you treat your practice exam as "the real thing", your actual exam will serve as a "retake" and greatly assist you in making a good grade!

Communication: Communication will be via my NMU email address: opendlet@nmu.edu . All emails will be answered within 48 hrs. Grades will be communicated via educat. No other forms of electronic communication (i.e. educat email or stats portal) will be acknowledged. If the communication is important, be sure to wait for acknowledgement that it has been received by be before assuming I have received it.

Office appointments: I welcome interaction with students outside of class hours so please take advantage of it. I truly would like to get to know each of my students individually and help you learn the material. However, if it is important to see me outside of class hours make an appointment via e-mail. You initiate the requested time and date and wait for my acknowledgment that I can see you at that time. Do NOT rely on my being in my office during the above proposed office hours. Other commitments arise during the course of the semester which may preclude my availability at those times. However, if I acknowledge an appointment, I will be sure to be there at that time and give you undivided attention.

Disability Services:

If you have a need for disability-related accommodations or services, please inform the Coordinator of Disability Services in the Dean of Students Office at 2001 C. B. Hedgcock Building (227-1700). Reasonable and effective accommodations and services will be provided to students if requests are made in a timely manner, with appropriate documentation, in accordance with federal, state, and University guidelines.

This course satisfies the Formal Communication Studies requirement.

This course is designed to introduce students to the ways in which information and ideas are expressed using a communication system other than English. Such courses should foster the student's ability to conceptualize and communicate in an orderly, rational manner. Characteristics of a communication system include: 1) possession of a grammar; 2) operation from an established set of rules; 3) reasoning properties such as deduction, inference drawing and problem solving. This includes courses in languages and those in which the central focus of the course is on statistics, computers or formal logic.

This syllabus is subject to change with notice.

Tentative Timeline for MA171 Winter 2015

Date (week of)	Chapter	Topic	Assignment
1/12	1-3.1	Terms,graphs,descriptive statistics	HW 1
1/19	1-3.1,Practice test,Test 1	Terminology and descriptive statistics	Test 1
1/26	Review Test 1,3.2	Normal probability density	HW 2
2/2	3.3,Practice test	Normal probability density	Practice Test 2
2/9	Review Practice test, Test 2	Normal Probability density	HW 3, Practice Test 2
2/16	Practice test, Test 3	Regression and correlation	Test 3
2/23	5, 7.1	One sample mean inference	HW 4
3/2	Spring break		
3/9	7.1,8.1	One sample mean inference	Test 4
3/16	Practice test 4 and review, Test 4	One sample mean inference	HW 5
3/23	6.1,6.2	One and two sample proportions	HW 6
3/30	7.2	Two-sample means	HW 7
4/6	Practice test 5 and review,	Proportions and two sample means	Test 5
4/13	Test 5		
4/20	Review test 5, Practice final		