CBM003 ADD/CHANGE FORM

APPROVED APR 24 2013

☒ Undergraduate Council ☐ New Course ☒ Course Change **Core Category: <u>Math/Reason</u> Effective Fall** ~~2013~~ 2014	or	☐ Graduate/Professional Studies Council ☐ New Course ☐ Course Change **Effective Fall <u>2013</u>**

1. Department: <u>Mathematics</u> College: <u>NSM</u>

2. Faculty Contact Person: <u>Charles Peters</u> Telephone: <u>743-3516</u> Email: <u>charles@math.uh.edu</u>

3. Course Information on New/Revised course:
   - Instructional Area / Course Number / Long Course Title:
     <u>MATH</u> / <u>2311</u> / <u>Introduction to Probability and Statistics</u>

     RECEIVED APR - 4 2013

   - Instructional Area / Course Number / Short Course Title (30 characters max.)
     <u>MATH</u> / <u>2311</u> / <u>INTRO TO PROB & STATISTICS</u>

   - SCH: <u>3.00</u> Level: <u>SO</u> CIP Code: <u>27.0101.00.01</u> Lect Hrs: <u>3</u> Lab Hrs: <u>0</u>

4. Justification for adding/changing course: **To meet core curriculum requirements**

5. Was the proposed/revised course previously offered as a special topics course? ☐ Yes ☒ No
   If Yes, please complete:
   - Instructional Area / Course Number / Long Course Title:
     _____ / _____ / _____
   - Course ID: _____ Effective Date (currently active row): _____

6. Authorized Degree Program(s): _____
   - Does this course affect major/minor requirements in the College/Department? ☐ Yes ☒ No
   - Does this course affect major/minor requirements in other Colleges/Departments? ☐ Yes ☒ No
   - Can the course be repeated for credit? ☐ Yes ☒ No (if yes, include in course description)

7. Grade Option: <u>Letter (A, B, C ...)</u> Instruction Type: <u>lecture ONLY</u> (Note: Lect/Lab info. must match item 3, above.)

8. If this form involves a change to an existing course, please obtain the following information from the course inventory: Instructional Area / Course Number / Long Course Title
   <u>MATH</u> / <u>2311</u> / <u>Introduction to Probability and Statistics</u>
   - Course ID: <u>31117</u> Effective Date (currently active row): <u>8272012</u>

9. Proposed Catalog Description: (If there are no prerequisites, type in "none".)
   Cr: 3. (3-0). Prerequisites: MATH 1310 or 1311 Description (30 words max.): May not apply to course or gpa requirements for a major or minor in natural sciences and mathematics. Students with credit for MATH 3338 or 3339 may not enroll in or receive credit for MATH 2311. Probability, correct probabilistic reasoning, distributions, graphical and descriptive methods, sampling estimation, hypotheses and statistical inference.

10. Dean's Signature: _____ Date:_____

    Print/Type Name: _____

REQUEST FOR COURSES IN THE CORE CURRICULUM

Originating Department or College: Department of Mathematics

Person Making Request: Charles Peters   Telephone: 713-743-3516

Email: charles@math.uh.edu

Dean's Signature: _____   Date: 2/13/2013

Course Number and Title: MATH 2311: Introduction to Probability and Statistics

Please attach in separate documents:

☒ Completed CBM003 Add/Change Form with Catalog Description

☒ Syllabus

List the student learning outcomes for the course (Statements of what students will know and be able to do as a result of taking this course. See appended hints for constructing these statements):

Students will be familiar with basic rules of probability and will be able to use them in modeling uncertainty in obtaining and recording data. They will be able to utilize graphical and numerical summaries of data in understanding data generating processes. They will understand the logic of statistical inference and will be able to apply common inferential procedures. Students will gain experience in the computational aspects of statistics through the use of calculators, spreadsheet programs or special purpose data analysis packages.

Component Area for which the course is being proposed (check one):

*Note: If you check the Component Area Option, you would need to also check a Foundational Component Area.

☐ Communication	☐ American History
☐ Mathematics	☐ Government/Political Science
☐ Language, Philosophy, & Culture	☐ Social & Behavioral Science
☐ Creative Arts	☒ Component Area Option
☐ Life & Physical Sciences	

Competency areas addressed by the course (refer to appended chart for competencies that are required and optional in each component area):

☒ Critical Thinking   ☐ Teamwork

☒ Communication Skills   ☐ Social Responsibility

☒ Empirical & Quantitative Skills   ☐ Personal Responsibility

Because we will be assessing student learning outcomes across multiple core courses, assessments assigned in your course must include assessments of the core competencies. For each competency checked above, indicated the specific course assignment(s) which, when completed by students, will provide evidence of the competency. Provide detailed information, such as copies of the paper or project assignment, copies of individual test items, etc. A single assignment may be used to provide data for multiple competencies.

Critical Thinking:
Several examples of exercises and assignments addressing critical thinking competencies are attached.

Communication Skills:
See attached.

Empirical & Quantitative Skills:
See attached.

Teamwork:
Click here to enter text.

Social Responsibility:
Click here to enter text.

Personal Responsibility:
Click here to enter text.

Will the syllabus vary across multiple section of the course?   ☐ Yes   ☒ No

If yes, list the assignments that will be constant across sections:
Click here to enter text.

Inclusion in the core is contingent upon the course being offered and taught at least once every other academic year. Courses will be reviewed for renewal every 5 years.

The department understands that instructors will be expected to provide student work and to participate in university-wide assessments of student work. This could include, but may not be limited to, designing instruments such as rubrics, and scoring work by students in this or other courses. In addition, instructors of core courses may be asked to include brief assessment activities in their course.

Dept. Signature: _____

The following courses have been reviewed and approved by the NSM Curriculum Committee to meet the new core requirements. Given the length of the individual submissions I have elected to submit these requests by electronic means only.

Natural Sciences: Core Courses

BIOL 1309 – Human Genetics and Society

BIOL 1310 – General Biology

BIOL 1320 – General Biology

BIOL 1361 - Introduction to Biological Science I

BIOL 1362 - Introduction to Biological Science II

CHEM 1301 – Foundations of Chemistry

CHEM 1331 – Fundamentals of Chemistry I

CHEM 1332 – Fundamentals of Chemistry II

GEOL 1302 - Introduction to Global Climate Change

GEOL 1330 - Physical Geology

GEOL 1340 - Introduction to Earth Systems

GEOL 1350 - Introduction to Meteorology

GEOL 1360 - Introduction to Oceanography

GEOL 1376 - Historical Geology

PHYS 1301 - Introductory General Physics I

PHYS 1302 - Introductory General Physics II

PHYS 1321 - University Physics I

PHYS 1322 - University Physics II

Mathematics: Core Courses

MATH 1310 – College Algebra

MATH 1311 – Elementary Mathematical Modeling

Math/Reasoning: Core Courses

COSC 1306 – Computer Science and Programming

MATH 1330 - Precalculus

MATH 1431 - Calculus I

MATH 1432 – Calculus II

MATH 2311 – Introduction to Probability and Statistics

Writing in the Disciplines: Core Courses

BCHS Biochemistry Lab II

BIOL 3311 – Genetics Lab

PHYS 3313 – Advanced Lab I

Ian Evans

Associate Dean

4/4/13

Math 2311
Introduction to Mathematical Reasoning
Core Curriculum Report
Fall 2012

Central Course Goal

Introduction to Probability and Statistics is designed to be a comprehensive introduction to the basics of producing meaningful statistics and drawing reasonable inferences from given data . The course is designed for non-science majors and has College Algebra as a prerequisite.

List of topics in Math 2311

USING NUMBERS TO DESCRIBE DATA

Introduction: The Qualifying Exam for Registered Nurses
3.1 Measures and Central Tendency
3.2 Measures of Variability
3.3 Measures of Relative Standing
3.4 Using Numerical Measures to Describe Data Sets
3.5 Using Numbers to Make Inferences

PROBABILITY: A MEASURE OF RELIABILITY

4.1 Experiments and Sample Spaces
4.2 Events and Probability
4.4 Compound Events and Complements
4.5 Conditional Probability and Independence
Chapter Summary

INTRODUCTION TO SAMPLING DISTRIBUTIONS

Introduction: The Blind Taste Test
5.1 Statistics and Sampling Distributions
5.2 the Mean of a Sampling Distribution
5.3 the Variability of a Sampling Distribution
5.4 the Binomial Experiment

THE CENTRAL LIMIT THEOREM AND THE NORMAL DISTRIBUTION

6.1 The Central Limit Theorem
6.2 Calculating Probabilities for the Sample Mean

INFERENCES ABOUT ONE POPULATION

Introduction: A Gallup Report
7.1 The Elements of a Test of a Hypothesis
7.2 A Large Sample Test of Hypothesis about a Population Mean
7.4 A Large Sample Confidence Interval for a Population Mean
7.5 Small Sample Inferences about a Population Mean
7.6 Large Sample Inferences About a Proportion
7.7 Selecting the Sample Size
7.8 Inferences About a Population Variance
Chapter Summary

INFERENCES COMPARING TWO POPULATIONS

Introduction: Comparing City Living and Country Living
8.1 Independent and Dependent Samples
8.2 Large Sample Inferences About the Difference between Two Population Means: Independent Samples
8.3 Small Sample Inferences About the Difference Between Two Population Means: Independent Samples
8.4 Inferences About the Difference Between Two Population Means: Dependent samples
8.5 Large Sample Inferences About the Difference Between Two Population Proportions: Independent Samples
8.6 Selecting the Sample Sizes
8.7 Comparing Two Population Variances : Independent Samples
Chapter Summary

LEAST SQUARES: A STRAIGHT LINE RELATIONSHIP

Introduction: Analyzing Crime Rates
9.1   Exploratory Data Analysis:
        The Scatter-plot
        The Equation of a Straight Line
        Fitting the Model: The Method of Least Squares

We think this course has excellent problems and will develop and expand a student's critical thinking skills. It will also foster careful communication and reading skills. There are ample opportunities for a student to use and develop stronger quantitative and empirical skills within the context of the course.

Critical Thinking Skills

Most of the material is about USING procedures to find out more about a situation rather than performing a procedure and getting an answer. This emphasis on interpretation is essential to developing and honing critical thinking skills.

Example:

Given the data:
-9, -6, -8, 1, 2
Calculate the z-score of 1 and tell if 1 is an unusual measurement.

In the above example the student has to calculate the mean and the standard deviation before they find the z-score. Then they are asked to interpret the significance of the z-score.

Example:

An auditor for a hardware store chain wishes to compare the efficiency of two dependent auditing techniques. To do this, he selected a sample of nine store accounts and applied auditing techniques A and B to each of the accounts selected. The number of errors found in each of techniques A and B is listed in the table below. Does the data provide sufficient evidence to conclude that the number of errors in technique A is different from the number of errors in technique B at the 0.10 level of significance? Include the test statistic in your answer and state whether to accept or reject the null hypothesis.

The question is quite detailed, requires the student to set up the appropriate test statistic, crunch the data, and arrive at a conclusion. We think this is the essence of critical thinking.

Example

An oil company is interesting is estimating the true proportion of female truck drivers based in five southern states. A statistician hired by the oil company must determine the sample size needed in order to make the estimate accurate to within 2% of the true proportion with 90% confidence. What is the minimum number of truck drivers that the statistician should sample in these southern states in order to achieve the desired accuracy?

Again, choosing from among various formulas and procedures to hit a given standard. This requires a great deal of basic knowledge and a certain maturity of judgement. This type of question also has the advantage of being quite "real world".

Example

Use the least squares line for the following data to predict the value for $x = 0.4$.

This emphasizes the use of a procedure to get a prediction.

Communication Skills

Example:

Nine instruments are tested and four are bad. If two instruments are randomly selected, what is the probability that at least one is bad?

A student must be able to pick the correct formula and to interpret the question correctly. Learning to distinguish "at least one" from "exactly one" in a question is an important skill.

Example:

How many ways can we have a license plate if we select five non repeating alphabets and three repeating digits.

Again, an emphasis on reading carefully and then reporting accurately.

Example

A random sample of 900, 32-ounce cans of fruit nectar is drawn from among all cans produced in a run. Prior experience has shown that the distribution of the contents has a mean of 32 ounces and a standard deviation of .32 ounce. What is the probability that the mean contents of the 900 sample cans is less than 31.984 ounces?

Here the need for care with assertions about the truth of a situation is paramount. The class discussion focuses heavily on accuracy.

Example

A manufacturer claims his best product has an average life span of exactly 20 years. He collected data from a random sample of 36 people. Using the data, an average product lifespan of 15 years and a standard deviation of 4 years was calculated. Does the data indicate, at the significance level 0.05, that the true mean lifespan of the product is less than that of the claimed average? Include a test statistic in your answer, and state whether to accept or reject the null hypothesis.

The analysis of claims is a regular theme in the course. Checking carefully, being careful in your counter assertion, and using the proper methods are important.

Example:
An ammunition producer claims his best product has an average lifespan of exactly 20 years. A skeptical product evaluator asks for evidence (data) that might be used to evaluate this claim. The product evaluator was provided data collected from a random sample of 30 people who used the product. Using the data, an average product lifespan of 15 years and a standard deviation of 4 years were calculated. Does the data indicate, at the significance level 0.1, that true mean lifespan of the product is less than that of the claimed average lifespan? Select the [Rejection Region, Decision to Reject (RH0] or Failure to Reject [FRH0)]. Use the appropriate table in your book.

There is a certain level of skill required to pick out the proper test statistic and use the charts to find probabilities. This type of question is very typical.

Example:

What is the minimum number of employees that should be sampled by the Exxon Corporation if it wishes to estimate the true mean number of years to retirement of its employees to within one month of the true mean and with 99% confidence if the range of the data is 5 years? Use the appropriate table in your book.

Again, real world question with an underlying need for the student to pick the correct equation, and interpret the results.

Example:

The reputation of many businesses can be damaged by shipments with a large percentage of broken goods. A certain manufacturer only wants to ship if less than 4% of the items are defective. If a random sample of 40 orders is selected and 5 are found to be defective, does the data indicate at the significance level of 0.01, that these shipments are unacceptable? Give the null hypothesis, the alternate hypothesis, test statistic, rejection area, and the conclusion. Check and list all applicable conditions under which you are performing the test – use the formula handout for your list.

This question has it all – it's very real world, the student must have the mechanics down, and must be able to pick out limiting conditions as well as reach a conclusion.