New Course Proposal

Prepare course proposal in accordance with the guidelines below and the format shown on the following pages.

COURSE PROPOSAL NUMBER: 25-26-11 (b)

REVISION (label Revision #1, #2, etc.): 0

SECTION 1: PROPOSAL INFORMATION

Name:	James A. Long Jr.
Title:	Assistant Professor of Computer Science
E-mail Address:	James.Long@fairmontstate.edu
Phone Number:	x4626

College:	College of Science and Technology
Department:	Computer Science and Mathematics
Program Level:	Undergraduate
Date Originally Submitted:	Click or tap to enter a date.
Implementation Date Requested:	August 2026

APPROVAL

The Deans of the affected colleges must sign below to indicate their notification and departmental support of this new course proposal. Should this new course affect any other department or program in another college, a memo must be sent to the Dean of each college impacted and a copy of the letters(s) or email(s) of support must be included with this proposal.

By signing below, you are indicating your college and department(s)'s approval of this proposal.

College	**Dean's Signature**
Science and Technology	
LIberal Arts	

ADDITIONAL COMMENTS:

SECTION 2: COURSE CATALOG INFORMATION

1. **Course Subject Prefix and number (e.g., ENGL 1101):** Course number/prefix combinations may be used only once, and may not be recycled; please check with the Registrar's Office to get a list of available, valid course numbers.	MATH 2651
2. Course Title: The title of the course as it will appear in the course catalog.	Unsupervised Machine Learning
3. **Number of Credit Hours:** Indicate the total number of credit hours for the course. If you are proposing a course with variable credit options, explain that here.	3
4. **Repeatability (number of repeat credit hours):** Students can repeat the course for credit.	No
5. **Course Prerequisites:** Include subject prefix and course number. List only immediate prerequisites (not prerequisites for other prerequisite courses).	MATH 1550 AND (COMP 1110 OR COMP 1125)
6. **Course Co-requisites:** Include subject prefix and course number.	None
7. **Course Cross-listings** (e.g., PSYC 2230 and SOCY 2230)	N/A
8. **Course Restrictions** (e.g., Seniors only)	None
9. **Grade Type:** Indicate whether students will be assigned a standard A-F final grade, a Pass/Fail (P/F) grade, or No Grade (NG).	A-F Final Grade
10. **Requirements:** Will the course be a required or elective course? What course requirements will this course satisfy? Indicate specific major, minor, or College/Department requirement(s).	Required by Data Science Minor, Behavioral Psychology Concentration
11. **Course Terms:** In what semester(s) will the course be offered? (e.g., Fall only, Summer)	Fall Semester Only
12. **Writing Intensive:** Does this course fulfill the Writing Intensive major requirement?	NO
13. **Core Curriculum:** Will the course be reviewed and considered as a University Core Curriculum course offering? If yes, you will need to submit a separate Core Curriculum application to the General Studies Committee.	NO

SECTION 3: CURRICULUM-BASED RATIONALE

What is the reason for developing the proposed course? Explain how the course fits into the curriculum. For example, is it a required or elective course for any specific program (if so, which one)? Which students will be taking this course? If there are already similar courses offered, explain why the needs of the program cannot be satisfied by an existing course. The curriculum-based rationale should be brief and to the point.
The current Data Science Minor courses MATH/COMP 2541 and 2542 have not generated much interest. In addition, these two courses were also intended to bridge a gap between MATH 1550 and COMP 1110 on the one hand, and COMP 4450–Data Mining on the other. We no longer believe this is necessary. For these reasons, we developed an industry advisory board to evaluate what was needed in a data science course of study. Broadly speaking, the topics suggested broke down into two main categories: Supervised Learning and Unsupervised Learning. We are not aware of any other courses that cover the topics herein. This course will be an elective for the math major and required for the Behavioral Psychology Concentration.

SECTION 4: COURSE SYLLABUS

Attach the course syllabus or at minimum the following course components:

Catalog Course Description: Include a course catalog description written in complete sentences that will be published in the university catalog. The word length for a catalog description should be less than 80 words. Do not include any prerequisites, corequisites or any other restrictions in the description.

Course Learning Outcomes: These should be stated in terms of what new knowledge and/or skills students should be able to <u>demonstrate</u> upon successful completion of the course. Present course learning outcomes as a bulleted list predicated with "Upon successful completion of this course, students should be able to…"

Assessment: Describe generally how students' achievement of the course learning outcomes will be assessed.

Course Outline: Attach a course content outline consisting of at least two levels.

Catalogue Description:

This course explores unsupervised machine learning methods used to discover patterns, structures, and relationships in unlabeled data. Students will explore key concepts, algorithms, and applications of clustering, dimensionality reduction, density estimation, generative models, and representation learning. The course emphasizes practical application through software-based tools (e.g. Python) and real-world datasets, with a focus on interpretability and exploratory data analysis rather than mathematical formalism.

Course Learning Outcomes:

1. Apply key unsupervised learning algorithms (e.g. K-means, PCA)
2. Analyze the strengths and weaknesses of various models and methods, especially using visualization techniques
3. Evaluate clustering and dimensionality reduction results

Assessment:

Aside from the final project, students will be assigned homework questions that build familiarity with the software and concepts. Because of the prevalence of AI tools, we will also incorporate in-class quizzes and tests to gauge individual knowledge of concepts.

Outcome	Assessment Method	Threshold for Mastery
#1	Quiz question	Average score of 3.5 out of 4 using the Arizona Math Rubric
#2	Quiz Question	Average score of 3 out of 4 using the Arizona Math Rubric
#3	Quiz Question	Average score of 3 out of 4 using the Arizona Math Rubric

Course Outline:

1. Introduction to Unsupervised Machine Learning
    a. The Difference Between Supervised and Unsupervised Learning
    b. Motivation
    c. Overview of basic unsupervised learning techniques
    d. Real-world applications
2. Clustering
    a. Partitional Clustering
    b. Hierarchical Clustering

    c. Evaluations Metrics
    d. Visualization
3. Association Mining
    a. Basics concepts
    b. Apriori Algorithm
    c. Evaluation of Association Rules
4. Dimensionality Reduction:
    a. Introduction to dimensionality reduction
    b. Principal Component Analysis and other algorithms (e.g. ICA, truncated SVD)
    c. Visualization
5. Applications of Unsupervised (May change semester to semester):
    a. Self-Supervised and Contrastive Learning
    b. Anomaly Detection