



Instructor's Name:

Office Location:

Office Hours:

Office Phone:

E-mail:

Course Description

This is a survey course of mathematical concepts used widely in the physical and social sciences. Intended for students whose programs do not specify a particular mathematics course. The course focuses on mathematical reasoning and the solving of real-life problems. Three or four topics from the following general areas are studied in depth: graph theory, mathematics of finance, voting methods, probability and statistics and math in nature.

Illinois Articulation Initiative (IAI) number: M1 904

Credit and Contact Hours:

Lecture 3

Lab 0

Credit Hours 3

Prerequisites: Satisfactory placement test score or grade of "C" in Math 098 or equivalent

Books, Supplies, and Supplementary Materials

A. Textbooks

Required: A Survey of Mathematics with Applications with MyMathLab, 10th Ed., 2017; Angel, Abbott, and Runde.

ISBN: 9780134112237

Publisher: Pearson Education

B. Other Required Materials

Scientific Calculator

Methods of Instruction:

Lecture

Online

General Education Student Learning Outcomes:

Students will demonstrate the ability to accurately apply correct mathematical methods and techniques in various applications such as applied sciences, theoretical mathematics, physics, natural sciences and other applied sciences

Student Learning Outcomes:

The Mathematics of Voting

1. Create and understand a preference ballot/schedule
2. Explain the plurality method of voting
3. Explain the difference between the words "majority" and "plurality"
4. Apply the plurality method of picking a winner in an election
5. Give some advantages and disadvantages to the plurality method of voting
6. Explain the process in a runoff election (plurality with runoff elimination) and when it is used
7. Explain strategic voting and when it is used
8. Explain a preference ranking for a voting situation
9. Explain the Borda method of voting
10. Determine the Borda count winner from a preference ranking
11. Give the formula to check that a Borda count is correct
12. Give some advantages and disadvantages to the Borda method of voting
13. Explain what is meant by a Condorcet winner
14. Explain the method of pair wise comparisons
15. How to determine the number of pair wise comparisons
16. Apply the method of pair wise comparisons for picking the winner of an election
17. Give advantages and disadvantages to the pair wise comparison method of voting
18. Explain the idea of an extended ranking methods and its uses
19. Determine the Approval method winner from an approval ballot
20. Give advantages and disadvantages to the Approval method of voting
21. Discuss Arrow's impossibility theorem
22. Discuss fairness criteria that are basic standards in a fair election.

Weighted voting may also be discussed!

Euler Circuits

1. Identify vertices and edges of a given graph

2. Determine by observation if a graph is connected
3. Given two vertices on a graph, determine if they are adjacent
4. Given two edges on a graph, determine if they are adjacent
5. Given a vertex on a graph, determine its degree
6. Given a sequence of vertices, determine if the sequence forms a path
7. Given a sequence of vertices, determine if the sequence forms a circuit
8. Given a path, determine if it is an Euler path
9. Given a circuit, determine if it is an Euler circuit
10. Apply Euler's theorem to determine if a graph has an Euler circuit
11. Apply Euler's theorem to determine if a graph has an Euler path
12. Explain an algorithm
13. Explain what is meant by eulerizing a graph
14. Given a graph, find an optimal eulerization for it
15. Explain what is meant by the Konigsberg bridge problem
16. Apply the theory of Euler circuits and Euler paths to practical management science problems such as routing mail delivery and garbage pickup
17. Understand and apply Fleury's algorithm for finding an Euler circuit or path on a graph

Hamilton Circuits

1. Define a Hamilton circuit
2. Define a Hamilton path
3. Determine whether a given graph has an Euler circuit, Hamilton circuit, both, or neither
4. Define what is meant by a complete graph
5. Know the formula for the number of edges in a complete graph
6. Determine the number of Hamilton circuits in a complete graph with N vertices
7. Explain what is meant by a traveling salesman problem
8. Explain what is meant by a weighted graph
9. Give some examples of real world problems that can be formulated as traveling salesman problems
10. Explain an approximate algorithm
11. Apply the nearest neighbor algorithm to find an optimal Hamilton circuit
12. Apply the brute-force algorithm to find an optimal Hamilton circuit
13. Apply the repetitive nearest-neighbor algorithm to find an optimal Hamilton circuit
14. Apply the cheapest-link algorithm to find an optimal Hamilton circuit

Networks

1. Define sub graph
2. Define a tree
3. State some properties of trees
4. Given a graph, determine if it is a tree
5. Define spanning tree

6. Define minimum spanning tree
7. Given a graph, find all possible spanning trees
8. Give a real world example that uses networks.
9. Apply Kruskal's Algorithm to find a minimum spanning tree
10. Discuss the shortest network connecting three points
11. Define junction points
12. Understand Torricelli's construction for finding the Steiner point
13. Discuss the shortest network connecting four or more points

Mathematics of Finance

1. Understand percentages and percentage increase and decrease
2. Use the simple interest formula to determine future values, annual interest rates, and time periods
3. Explain the difference between future value and the present value
4. Use the compound interest formula to determine future values, annual interest rates, periods of compounding, and time periods
5. Explain the difference between simple interest and compounded interest
6. Explain the periodic interest rate
7. Explain the difference between annual yield and annual interest rate; give the formula for Annual Percentage Yield
8. Given an annual interest rate and period of compounding, determine the annual percentage
9. Explain the difference between a regular savings account and an installment plan
10. Use the systematic savings formula to determine future values, annual interest rates, periods of compounding, and time periods
11. Explain an amortized loan
12. Use the loan formula to determine present values, loan payments, annual interest rates, periods of compounding, and time periods

Statistics

1. Define a population and the n-value of a population
2. Define a popular opinion poll
3. Explain sampling of data – convenience sampling, quota sampling, simple random sampling, and stratified sampling
4. Understand and know how to use the Capture-recapture method for estimating the n-value of a population
5. Name two variables used in describing data
6. Given a set of data, construct a frequency table summarizing the information.
7. Given a set of data, construct a bar graph to represent the data
8. Given a set of data, construct a relative frequency bar graph to represent the data
9. Given a set of data, construct a pie chart to represent relative frequencies
10. Given a set of data, group the data into class intervals
11. Given a set of data, find the mean

12. Given a set of data, find the median
13. Given a set of data, find the quartiles.
14. Given a set of data, give the five number summary and box plot
15. Define a percentile and know how to find the p th percentile of a data set
16. Estimate the mean from grouped data
17. Given a set of data presented by a frequency distribution, find the mean
18. Given a set of data, find the range and interquartile range
19. Given a set of data, find the standard deviation
20. Given a set of data presented by a frequency distribution, find the standard deviation
21. Estimate the standard deviation from grouped data

Normal Distributions

1. Describe the normal distribution
2. Discuss the relationship between the median and the mean of a data set that is normally distributed
3. Discuss the relationship between a normal distribution and an approximately normal distribution
4. Name the properties of a normal distribution
5. Explain a random variable
6. Explain a z-score
7. Explain what it means to "standardize" a normally distributed data set.
8. Understand the 68-95-99.7 rule
9. Understand the honest-coin principle; know how to use the dishonest-coin principle to find the mean and standard deviation

Probability

1. Define an experiment, sample space, outcome, and event
2. Define permutations and combinations
3. Determine the probability of an event in an equiprobable space
4. Define the "odds in favor of an event"
5. Define the "odds against an event"
6. Given the probability of an event, find the odds in favor of the event
7. Given the probability of an event, find the odds against the event
8. Given the odds in favor of an event, find the probability of the event
9. Given the odds against an event, find the probability of the event
10. Determine probabilities using the multiplication rule
11. Explain events that are independent; determine probabilities using the multiplication rule for independent events.
12. Determine the number of permutations of n objects taken r at a time
13. Determine the number of combinations of n objects taken r at a time
14. Determine probabilities using counting techniques

Math in Nature

1. Define the Fibonacci numbers
2. Understand a recursive rule

3. Give examples of Fibonacci numbers in nature
4. Define the Golden Ratio
5. Understand how the Golden Ratio and Fibonacci numbers are related
6. Define a gnomon
7. Understand the golden rectangle and the Fibonacci rectangle
8. Give examples of spiral growth in nature

TOPICAL OUTLINE

<u>Days</u>	<u>Topic or Class Activity</u>
0-5	Probability
0-5	Graph Theory
0-5	Mathematics of Finance
0-5	Voting Methods
0-5	Statistics
0-5	Math in Nature

Note: The instructor has flexibility with this course. Three or four topics from the above list are studied in depth. The instructor can pick the topics.

Graded Assignments and Policies

Graded Assignments

Grading Policy

Final grades are based on the following scale:

Percent	Final Grade
90-100	A
80-89	B
70-79	C
60-69	D
0-59	F

The individual instructor will determine which items he or she considers essential for the student to memorize without error and test accordingly.

Each instructor will set minimum standards for performance on tests.

Major Tests and Quizzes

The individual instructor will determine which items he or she considers essential for the student to memorize without error and test accordingly. Each instructor will set minimum standards for performance on tests. A comprehensive final examination will be given.

Classroom Policies and Procedures

General Information

Attendance Policy

Make-up Policy

Extra-credit Policy

Final Exam Information

A comprehensive final examination will be given.

Academic Honor Code

The objective of the academic honor code is to sustain a learning-centered environment in which all students are expected to demonstrate integrity, honor, and responsibility, and recognize the importance of being accountable for one's academic behavior.

College Statement about grades of "F" and Withdrawal from Class

Students may withdraw from a course by processing an add/drop form during regular office hours through the Registration and Records Office at Main Campus or Romeoville Campus, or by phone at 815-744-2200. Please note the withdrawal dates listed on your bill or student schedule. Every course has its own withdrawal date. Failure to withdraw properly may result in a failing grade of "F" in the course.

At any time prior to the deadline dates established, an instructor may withdraw a student from class because of poor attendance, poor academic performance or inappropriate academic behavior, such as, but not limited to, cheating or plagiarism.

Intellectual Property

Students own and hold the copyright to the original work they produce in class. It is a widely accepted practice to use student work as part of the college's internal self-evaluation, assessment procedures, or other efforts to improve teaching and learning and in promoting programs and recruiting new students. If you do not wish your work to be used in this manner, please inform the instructor.

Student Code of Conduct

Each student is responsible for reading and adhering to the Student Code of Conduct as stated in the college catalog.

Sexual Harassment

Joliet Junior College seeks to foster a community environment in which all members respect and trust each other. In a community in which persons respect and trust each other, there is no place for sexual harassment. JJC has a strong policy prohibiting the sexual harassment of one member of the college community by another. See the Catalog or Student Handbook.

Student Support <http://jjc.edu/services-for-students/pages/default.aspx>

- a. Disability Services: <http://www.jjc.edu/disability-services/Pages/default.aspx>. Student Accommodations and Resources (StAR): If you need disability-related accommodations, specialized tutoring, or assistive technology in this class, if you have emergency medical information you wish to share with me, or if you need special arrangements in case the building must be evacuated, please inform me immediately. Please see me privately after class or at my office. New students should request accommodations and support by scheduling an appointment with the Student Accommodations and Resources (StAR) Office, Campus Center 1125, (815) 280-2230.
- b. Tutoring: <http://jjc.edu/tlc/pages/default.aspx>
- c. Counseling and Advising: <http://www.jjc.edu/counseling-advising/Pages/default.aspx>
- d. Academic Resources: <http://www.jjc.edu/academic-resources/Pages/default.aspx>
- e. Support Programs and Services: <http://www.jjc.edu/support-programs-services/Pages/default.aspx>
- f. Technology Support: <http://jjc.edu/services-for-students/Pages/technology-support.aspx>
- g. My Degree Progress: My Degree Progress is a computerized system to track a student's progress toward graduation. The report indicates every course and places these courses into their appropriate category as a General Education, Major Course, or Elective, according to the degree requirements. This tool is useful for preparing before an advising appointment, for planning, for registering, and for checking that the student is on track for graduation. <https://eresources.jjc.edu>

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Date

Revised 5/17
Revised 04/11
Developed 4/09