



## Master Course Syllabus

For additional course information, including prerequisites, corequisites, and course fees, please refer to the Catalog: <https://catalog.uvu.edu/>

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**Semester:** Spring

**Course Prefix:** 30031

**Course Title:** Advanced Mathematics for  
Computer Science

**Year:** 2025

**Course and Section #:** 6700-601

**Credits:** 3

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### *Course Description*

This course covers important mathematical topics and their connections with applied computer science.

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### *Course Attributes*

This course has the following attributes:

- General Education Requirements
- Global/Intercultural Graduation Requirements
- Writing Enriched Graduation Requirements
- Discipline Core Requirements in Program
- Elective Core Requirements in Program
- Open Elective

Other: *Click here to enter text.*

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### *Instructor Information*

**Instructor Name:** Brian Knaeble

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### *Student Learning Outcomes*

By the end of this course, the student will be able to

- Utilize quaternions in computer graphics to rotate objects
  - Appreciate the group law of an elliptic curve in public key cryptography
  - Understand metrics and norms on high-dimensional spaces
  - Apply Bayes' Theorem in near-zero probability situations
  - Connect the concept of concentration of measure with the concept of multiple causes
  - Determine the direction of an association using entropy
  - Recognize when a statistical model is unidentifiable
  - Demonstrate why the halting problem is undecidable
  - Explain how Chua's circuit gives rise to chaos
  - Estimate the fractal dimension of an image
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## ***Course Materials and Texts***

Optional Textbooks:

The Elements of Statistical Learning by Hastie et al.

Numerical Optimization by Nocedal and Wright

Geometric Measure Theory by Herbert Federer

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## ***Course Requirements***

### **Course Assignments, Assessments, and Grading Policy**

There will be ten quizzes, covering the ten topics of this course, at times to be determined and posted well in advance on Canvas. These quizzes will be difficult so make sure you are keeping up with the course.

**Grades:** Each quiz will be worth ten points, for a total out of 100 that determines your grade according to

93-100 A

90-92 A-

87-89 B+

83-86 B

80-82 B-

77-79 C+

73-76 C

70-72 C-

67-69 D+

63-66 D

60-62 D-

0-59 F

Academic misconduct can result in a failing grade for the course.

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### **Required or Recommended Reading Assignments**

Various articles posted on Canvas

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### **General Description of the Subject Matter of Each Lecture or Discussion**

Topics:

1. Quaternions (graphics)
2. Elliptic curves (cryptography)
3. Curse of dimensionality
4. Borel Kolmogorov paradox (Bayes' theorem)

5. Concentration of measure
  6. Shannon Information (Minimum Description Length; causal direction of an association)
  7. Identifiability (statistics)
  8. Decidability (halting problem)
  9. Logistic map (Chua's circuit)
  10. Hausdorff dimension
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## ***Required Course Syllabus Statements***

### **Generative AI**

AI programs are not a replacement for your human creativity, originality, and critical thinking. Writing, thinking, and researching are crafts that you must develop over time to develop your own individual voice. At the same time, you should learn how to use AI and in what instances AI can be helpful to you. However, there may be numerous oral examinations throughout this course. So make sure you are prepared to demonstrate genuine understanding of learned material.

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### **Using Remote Testing Software**

This course does not use remote testing software.

This course uses remote testing software. Remote test-takers may choose their remote testing locations. Please note, however, that the testing software used for this may conduct a brief scan of remote test-takers' immediate surroundings, may require use of a webcam while taking an exam, may require the microphone be on while taking an exam, or may require other practices to confirm academic honesty. Test-takers therefore shall have no expectation of privacy in their test-taking location during, or immediately preceding, remote testing. If a student strongly objects to using test-taking software, the student should contact the instructor at the beginning of the semester to determine whether alternative testing arrangements are feasible. Alternatives are not guaranteed.

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## ***Required University Syllabus Statements***

### **Accommodations/Students with Disabilities**

Students needing accommodations due to a permanent or temporary disability, pregnancy or pregnancy-related conditions may contact UVU [Accessibility Services](#) at [accessibilityservices@uvu.edu](mailto:accessibilityservices@uvu.edu) or 801-863-8747.

Accessibility Services is located on the Orem Campus in BA 110.

Deaf/Hard of Hearing students requesting ASL interpreters or transcribers can contact Accessibility Services to set up accommodations. Deaf/Hard of Hearing services can be contacted at [DHHservices@uvu.edu](mailto:DHHservices@uvu.edu)

DHH is located on the Orem Campus in BA 112.

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### **Academic Integrity**

At Utah Valley University, faculty and students operate in an atmosphere of mutual trust. Maintaining an atmosphere of academic integrity allows for free exchange of ideas and enables all members of the community to achieve their highest potential. Our goal is to foster an intellectual atmosphere that produces scholars of integrity and imaginative thought. In all academic work, the ideas and contributions of others must be appropriately acknowledged and UVU students are expected to produce their own original academic work.

Faculty and students share the responsibility of ensuring the honesty and fairness of the intellectual environment at UVU. Students have a responsibility to promote academic integrity at the university by not participating in or facilitating others' participation in any act of academic dishonesty. As members of the academic community, students must become familiar with their [rights and responsibilities](#). In each course, they are responsible for knowing the requirements and restrictions regarding research and writing, assessments, collaborative work, the use of study aids, the appropriateness of assistance, and other issues. Likewise, instructors are responsible to clearly state expectations and model best practices.

Further information on what constitutes academic dishonesty is detailed in [UVU Policy 541: Student Code of Conduct](#).

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### **Equity and Title IX**

Utah Valley University does not discriminate on the basis of race, color, religion, national origin, sex, sexual orientation, gender identity, gender expression, age (40 and over), disability, veteran status, pregnancy, childbirth, or pregnancy-related conditions, citizenship, genetic information, or other basis protected by applicable law, including Title IX and 34 C.F.R. Part 106, in employment, treatment, admission, access to educational programs and activities, or other University benefits or services. Inquiries about nondiscrimination at UVU may be directed to the U.S. Department of Education's Office for Civil Rights or UVU's Title IX Coordinator at 801-863-7999 – [TitleIX@uvu.edu](mailto:TitleIX@uvu.edu) – 800 W University Pkwy, Orem, 84058, Suite BA 203.

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### **Religious Accommodation**

UVU values and acknowledges the array of worldviews, faiths, and religions represented in our student body, and as such provides supportive accommodations for students. Religious belief or conscience broadly includes religious, non-religious, theistic, or non-theistic moral or ethical beliefs as well as participation in religious holidays, observances, or activities. Accommodations may include scheduling or due-date modifications or make-up assignments for missed class work.

To seek a religious accommodation, a student must provide written notice to the instructor and the Director of Accessibility Services at [accessibilityservices@uvu.edu](mailto:accessibilityservices@uvu.edu). If the accommodation relates to a scheduling conflict, the notice should include the date, time, and brief description of the difficulty posed by the conflict. Such requests should be made as soon as the student is aware of the prospective scheduling conflict.

While religious expression is welcome throughout campus, UVU also has a [specially dedicated space](#) for meditation, prayer, reflection, or other forms of religious expression.