Information in Browse Course Catalog is subject to change. Information is term specific. Please refer to the appropriate term when searching for course content. Key to Course Descriptions may be found at: **http://rcs.registrar.arizona.edu/course_descriptions_key**.

Information Sci, Tech & Arts (ISTA)

ISTA 100: Great Ideas of the Information Age (3 units)
Description: Important ideas and applications of information science and technology in the sciences, humanities and arts. Information, entropy, coding; grammar and parsing; syntax and semantics; networks and relational representations; decision theory, game theory; and other great ideas form the intellectual motifs of the Information Age and are explored through applications such as robotic soccer, chess-playing programs, web search, population genetics among others.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture   Required
Course typically offered:
Main Campus: Fall, Spring, Summer

Recommendations and additional information: Required in the major. College algebra recommended.

ISTA 116: Statistical Foundations for the Information Age (3 units)
Description: Understanding uncertainty and variation in modern data: data summarization and description, rules of counting and basic probability, data visualization, graphical data summaries, working with large data sets, prediction of stochastic outputs from quantitative inputs. Operations with statistical computer packages such as R.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Laboratory   Required
                         Lecture   Required
Course typically offered:
Main Campus: Fall, Spring

Enrollment requirement: PPL 60+ or SAT I MSS 640+ or ACT MATH 26+ or MATH 107, 112, 113, 116, 120, 120R, 122B, 124, 125, 129, or 223. Test scores expire after 2 years.

-SA represents a Student Abroad & Student Exchange offering
-CC represents a Correspondence Course offering
May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ISTA 130: Computational Thinking and Doing (4 units)
Description: An introduction to computational techniques and using a modern programming language to solve current problems drawn from science, technology, and the arts. Topics include control structures, elementary data structures, and effective program design and implementation techniques. Weekly laboratory.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Laboratory   Required
                         Lecture   Required
Course typically offered:
Main Campus: Fall, Spring, Summer

Recommendations and additional information: Required in the major. College algebra recommended.

ISTA 131: Dealing with Data (4 units)
Description: At the core of Information Science lies the digital data that is the object of study. This course aims to introduce the tools, techniques, and issues involved with the handling of this data: where it comes from, how to store and retrieve it, how to extract knowledge from the data via analysis, and the social, ethical, and legal issues involved in its use. Throughout the course, students will be given hands-on experience with actual datasets from a variety of sources including social media and citizen science projects, as well as experience with common tools for analysis and visualization. Students will also examine topical case studies involving legal and ethical issues surrounding data.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Laboratory   Required
                         Lecture   Required
Course typically offered:
Main Campus: Fall, Spring

Recommendations and additional information: Completion of MATH 109C or 112 or higher, or math placement at a level higher than MATH 112.
Enrollment requirement: ISTA 130 or CSC 110 or equivalent, or consent of instructor.

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-CC represents a Correspondence Course offering
May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ISTA 161: Ethics in a Digital World (3 units)
Description: This course explores the social, legal, and cultural fallout from the exponential explosion in communication, storage, and increasing uses of data and data production. In this class, we emphasize the opposing potentials of information technologies to make knowledge widely available and to distort and restrict our perceptions. In a world of rapid technological change, topics include (but are not limited to): eavesdropping and secret communications, privacy; Internet censorship and filtering, cyberwarfare, computer ethics and ethical behavior, copyright protection and peer-to-peer networks, broadcast and telecommunications regulation, including net neutrality, data leakage, and the power and control of search engines.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture   Required
Course typically offered:
Main Campus: Fall, Spring, Summer

ISTA 230: Introduction to Web Design and Development (3 units)
Description: An introduction to web design and development, with an emphasis on client-side technologies. Topics include HTML, Cascading Style Sheets (CSS), JavaScript, and web design best practices.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Discussion   May Be Offered
                         Lecture   Required
Course typically offered:
Main Campus: Fall, Spring

ISTA 251: Introduction to Game Design (3 units)
Description: This course provides an introduction to game design and teaches students the fundamental concepts for creating games. Students will survey many different games, exploring the issues game designers face when designing games in different genres. Students will participate in a series of game design challenges and will be responsible for designing and prototyping simple games using a game building tool. Students will present their solutions to these challenges in front of the class for general discussion and constructive criticism.
Grading basis: Regular Grades
Career: Undergraduate
Flat Fee: $97
Course Components: Lecture   Required
Course typically offered:
Main Campus: Fall, Spring, Summer

ISTA 263: Learning in the Information Age (3 units)
Description: Students will study how digital technologies are changing how people learn, how technology-based learning supports new approaches to assessment, how theories of learning are being developed to support research in these emerging areas, and how research on human learning is informing the design of computers that learn.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture   Required
Course typically offered:
Main Campus: Fall, Spring

General Education: Tier 2 Individuals & Societies

ISTA 299H: Honors Independent Study (1 - 4 units)
Description: Qualified students working on an individual basis with professors who have agreed to supervise such work.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Independent Study   Required
Repeatable: Course can be repeated a maximum of 99 times.
Recommendations and additional information: Consent of instructor.
Enrollment requirement: Student must be active in the Honors College.
Honors Course: Honors Course
Honors Course: Honors Course

ISTA 301: Computing and the Arts (3 units)
Description: This course examines the ways in which computing and information science support and facilitate the production and creation of art in current society. A particular focus of the course will be to discuss how artists have used advances in technology and computing capacity to explore new ways of making art, and to investigate the relationships between technical innovation and the artistic process.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture   Required
Course typically offered:
Main Campus: Fall, Spring

General Education: Tier 2 Arts

-SA represents a Student Abroad & Student Exchange offering
-CC represents a Correspondence Course offering
May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ISTA 302: Technology of Sound (3 units)
Description: This course will provide the student with the information and experience necessary for the creation and manipulation of digital audio. Students will have the opportunity to experience the music-making process with the technology tools and techniques that are common in both home and professional studios. The class will make use of a variety of software packages designed for contemporary music production, explaining the universal techniques and concepts that run through all major software programs. Topics will include musical analysis, MIDI control, synthesis techniques, audio editing, and audio mixing. Lab assignments will emphasize hands-on experience working with musical hardware and software to provide the necessary skills to create music based on today¿s musical styles. The course provides the foundation for further study, creative applications, and personal expression.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Laboratory   May Be Offered
                         Lecture   Required
Course typically offered:
Main Campus: Fall, Spring

Student Engagement Activity: Creative Expression
Student Engagement Competency: Interdisciplinarity

ISTA 303: Introduction to Creative Coding (3 units)
Description: While the 20th Century saw the rise of the knowledge worker and the information worker, the 21st Century has ushered in the era of the creative professional. Our society is being rapidly transformed by new technologies that are revolutionizing many spheres of life, from entrepreneurship to artistic production. This course provides an introduction to software and hardware packages that are spurring innovation and creativity. Students will explore rapid prototyping, object design, and physical computing using Computer-Aided Design Software, 3D printing technology, and Arduino circuit boards. The Processing programming language will be introduced in this course and used to create generative artworks in both visual and audio idioms. An overview of creative evolutionary computation will survey applications of genetic algorithms and artificial intelligence for creating art.
Grading basis: Regular Grades
Career: Undergraduate
Flat Fee: $97
Course Components: Lecture   Required
Course typically offered:
Main Campus: Fall, Spring

Enrollment requirement: CSC 127A or CSC 110 or ISTA 130 or ECE 175 or equivalent or consent of instructor.
Student Engagement Activity: Creative Expression
Student Engagement Competency: Innovation and Creativity

ISTA 311: Foundation of Information and Inference (3 units)
Description: An introduction to the mathematical theories of probability and information as tools for inference, decision-making, and efficient communication. Topics include discrete and continuous random variables, measures of information and uncertainty, discrete time/discrete state Markov chains, elements of Bayesian inference and decision-making, Bayesian and Maximum Likelihood parameter estimation, and elementary coding theory.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Discussion   May Be Offered
                                         Lecture   Required
Course typically offered:
Main Campus: Fall, Spring

Enrollment requirement: (ISTA 116 or MATH 163 or MATH 263) and (ISTA 130 or CSC 110) or Consent of instructor.

ISTA 321: Data Mining and Discovery (4 units)
Description: This course will introduce students to the theory and practice of data mining for knowledge discovery. This includes methods developed in the fields of statistics, large-scale data analytics, machine learning and artificial intelligence for automatic or semi-automatic analysis of large quantities of data to extract previously unknown interesting patterns. Topics include understanding varieties of data, classification, association rule analysis, cluster analysis, and anomaly detection. We will use software packages for data mining, explaining the underlying algorithms and their use and limitations. The course include laboratory exercises, with data mining case studies using data from biological sequences and networks, social networks, linguistics, ecology, geo-spatial applications, marketing and psychology.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Laboratory   Required
                                         Lecture   Required
Course typically offered:
Main Campus: Fall

Enrollment requirement: ISTA 116 or equivalent; or consent of instructor.

ISTA 322: Data Engineering (3 units)
Description: This course will be inviting for a wide variety of students from across disciplines, and they will learn how to use industry standard tools and practices to make large data sets usable for scientists and other decision makers. From data collection and preparation, to the creation of big data stores, databases, or systems to make data flow, this course will focus on the practical work needed to prepare big data for analyses across contexts. Students will be introduced to a variety of technical tools for data management, storage, use, and manipulation.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture   Required
Course typically offered:
Main Campus: Fall

Field trip: None
Enrollment requirement: ISTA 130 or equivalent

ISTA 330: Advanced Web Design (3 units)
Description: Introduction to event-driven programming and prototype-oriented programming using JavaScript. Course topics include JavaScript language basics, Document Object Model (DOM) interaction and manipulation, DOM event management, and dynamic media creation.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture   Required
Course typically offered:
Main Campus: Spring

Recommendations and additional information: Must have successfully completed ISTA 230 or equivalent course work before enrolling in this course
Field trip: N/A

ISTA 331: Principles and Practice of Data Science (3 units)
Description: ISTA 331 explores the ideas and techniques that businesspersons and scientists alike use to exploit data in order to create knowledge and make money. Topics and projects may include recommender systems (which powered Amazon's rise to global retail dominance), spam filters (the first machine learning application that affected our daily lives), topic extraction from documents, and an introduction to neural networks.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Discussion   May Be Offered
                         Lecture   Required
Course typically offered:
Main Campus: Fall (even years only)

Enrollment requirement: ISTA 116 and ISTA 131

ISTA 350: Programming for Informatics Applications (4 units)
Description: This course will provide an introduction to informatics application programming using the python programming language and applying statistical concepts from a first semester statistics course. A key goal of this course is to prepare students for upper division ISTA courses by expanding on the skills gained in ISTA 116 and 130 but will be broadly applicable to any informatics discipline. Throughout the semester students will be faced with information application problems drawn from several different disciplines in order to expand their breadth of experience while simultaneously increasing their depth of knowledge of scientific and informatics programming methods. Students will practice problem decomposition and abstraction, gaining experience in identifying commonly occurring information processing issues and in applying well-known solutions. In addition, students will design their own algorithmic solutions to problems and will learn how to effectively compare different solutions, evaluating efficiency in order to choose the best solution for a given problem. Periodic code reviews will be held in order to expose students to a range of different solution methods, which will aid them in discovering weaknesses in their own work and will improve their ability to communicate with others on technical topics. The course will include an introduction to the python scientific computing libraries and other statistical packages. Additional course topics will include the use of version control systems, software profiling, general software engineering practices and basic shell scripting.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Laboratory   Required
                         Lecture   Required
Course typically offered:
Main Campus: Spring

Enrollment requirement: ISTA 131 and ISTA 116; or consent of instructor.
Student Engagement Activity: Discovery
Student Engagement Competency: Innovation and Creativity

-SA represents a Student Abroad & Student Exchange offering
-CC represents a Correspondence Course offering
May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ISTA 352: Images: Past, Present, and Future (3 units)
Description: A significant portion of the human brain is devoted to understanding spatial data and its relation to the world. Through the ages humans have naturally developed external representations of such information for communication, planning, understanding, and entertainment. Further, the digital age has led to an explosion of images available to everyone in forms that are convenient to share, manipulate, and automatically mine for information. In this thematic course we will study images from perspectives that transcend disciplines, and applicable to many of them, including the arts, science and biomedicine, computational intelligence, geography, and security. We will study what images are, how images are stored and distributed, the reproduction of images, how they can be manipulated, using images for visualization, and extracting semantics from images.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture   Required
Course typically offered:
Main Campus: Fall, Spring

ISTA 355: Introduction to Natural Language Processing (3 units)
Description: Natural language processing (NLP) is the study of how we can teach computers to use language by extracting knowledge from text, and then use that knowledge in some meaningful way. In this introductory course, we will examine the fundamental components on which natural language processing systems are built, including frequency distributions, part of speech tagging, syntactic parsing, semantics and analyzing meaning, search, introductory information and relation extraction, and structured knowledge resources. We will also examine pragmatic concerns in processing raw text from real-world sources.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Discussion   May Be Offered
                         Laboratory   May Be Offered
                         Lecture   Required
Course typically offered:
Main Campus: Fall

Recommendations and additional information: May only have credit for one of the following: LING/CSC 439/539 or ISTA 355
Enrollment requirement: Requires ISTA 350 or CSC 345. Must have not taken LING/CSC 439/539

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-CC represents a Correspondence Course offering
May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ISTA 370: Research Methods for the Information Age (3 units)
Description: For some reason, the methods and tools used by the natural sciences are not taught in the information sciences. Consequently, information scientists are rarely good at designing experiments, making data give up its secrets, or quantifying their confidence in results. This course is about how to think and work like a scientist. It covers exploratory data analysis and visualization, experimental design, statistical hypothesis testing and effect size, computer intensive methods such as the bootstrap and Monte Carlo sampling, performance assessment and other performance measures, modeling complex systems, and other empirical methods for students in the information disciplines.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture   Required
Recommendations and additional information: College Algebra (MATH 109C or MATH 112) and ISTA 116.

ISTA 391: Preceptorship (1 - 3 units)
Description: Specialized work on an individual basis, consisting of instruction and practice in actual service in a department, program, or discipline. Teaching formats may include seminars, in-depth studies, laboratory work and patient study.
Grading basis: Alternative Grading: S, P, F
Career: Undergraduate
Course Components: Independent Study   Required
Course typically offered:
Main Campus: Fall, Spring

Recommendations and additional information: Consent of instructor.

ISTA 392: Directed Research (1 - 6 units)
Description: Individual or small group research under the guidance of faculty.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Independent Study   Required
Repeatable: Course can be repeated a maximum of 99 times.
Recommendations and additional information: Consent of instructor.
Student Engagement Activity: Professional Development
Student Engagement Competency: Innovation and Creativity

ISTA 397S: STEM Diversity and Outreach Workshop (3 units)
Description: This workshop-based course aims to give UA students the opportunity to learn about issues of diversity (e.g., gender, race, class) in STEM fields and give them the opportunity to directly engage in STEM outreaching and programming efforts in the Tucson area. Students will receive hands-on training in STEM lesson planning, inter-active workshop design, and program evaluation provided by the STEMAZing Program of the Pima County Superintendent's Office and other community organizations. Students will be then be placed with a community organization or school program to assist in designing and implementing STEM programming. Students are expected to work with their organization for an average of 6-10 hours per week, in addition to attending weekly class meetings.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Discussion   Required
                         Workshop   Required
Repeatable: Course can be repeated a maximum of 3 times.
Also offered as: GWS 397S
Course typically offered:
Main Campus: Fall, Spring

Home department: School of Information
Student Engagement Activity: Community Partnership
Student Engagement Competency: Civic and Community

ISTA 399: Independent Study (1 - 4 units)
Description: Qualified students working on an individual basis with professors who have agreed to supervise such work.
Grading basis: Alternative Grading: S, P, F
Career: Undergraduate
Course Components: Independent Study   Required
Repeatable: Course can be repeated a maximum of 99 times.
Recommendations and additional information: Consent of instructor.
Student Engagement Activity: Engagement Activity TBD
Student Engagement Competency: Engagement Competency TBD

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-CC represents a Correspondence Course offering
May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ISTA 399H: Honors Independent Study (1 - 4 units)
Description: Qualified students working on an individual basis with professors who have agreed to supervise such work.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Independent Study   Required
Repeatable: Course can be repeated a maximum of 99 times.
Recommendations and additional information: Consent of instructor.
Enrollment requirement: Student must be active in the Honors College.
Honors Course: Honors Course
Honors Course: Honors Course
Student Engagement Activity: Engagement Activity TBD
Student Engagement Competency: Engagement Competency TBD

ISTA 401: Designing an Installation (3 units)
Description: This course is a hands-on, project-based approach to understanding and designing art installations. Enrollees will learn principles, tools, and techniques of rapid prototyping and installation design, and will collaborate to design and implement a large-scale installation by the end of the semester. The course lectures will also provide an overview of the history, theory, and aesthetics of installation art.
Grading basis: Regular Grades
Career: Undergraduate
Flat Fee: $97
Course Components: Laboratory   May Be Offered
                         Lecture   Required
Co-convened with: INFO 501
Course typically offered:
Main Campus: Spring

Recommendations and additional information: ISTA 301 recommended but not required.
Student Engagement Activity: Creative Expression
Student Engagement Competency: Professionalism

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-CC represents a Correspondence Course offering
May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ISTA 403: Creative Coding (3 units)
Description: This course continues the exploration of creative coding that began in ISTA 303. Students will develop experimental and creative works based, in part, on techniques from the fields of human-computer interaction, computer vision, virtual reality, machine learning, and other disciplines that have the potential to impact our culture through the introduction of new technologies. Aside from gaining technical proficiencies needed to engage with these topics (e.g., software engineering, physical computing techniques, familiarity with multimedia packages and libraries), students will have the opportunity to explore the use of novel interaction devices (e.g., Kinect, Wii, LeapMotion, Glasses, and Oculus Rift) as well as to experiment with a range of digital media environments (e.g., projection mapping, live coding, sonification, mobile devices, physical sensors,augmented reality, immersive systems). Moreover, students will become more familiar with the history and current state of the fields of new media art and creative coding. Students will read widely from journal articles and from media arts conference and festival proceedings, and will be expected to document their own work in a clear, professional manner, both through writing assignments and the creation of an online portfolio of creative projects. By the end of this course students will have the ability to participate meaningfully (through the implementation and documentation of creative projects) in contemporary discourse regarding art and technology.
Grading basis: Regular Grades
Career: Undergraduate
Flat Fee: $97

Course Components:	Laboratory	Required
	Lecture	Required

Course typically offered:
Main Campus: Fall, Spring

Enrollment requirement: ISTA 303 or consent of instructor.
Student Engagement Activity: Creative Expression
Student Engagement Competency: Innovation and Creativity

-SA represents a Student Abroad & Student Exchange offering
-CC represents a Correspondence Course offering
May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ISTA 410: Bayesian Modeling and Inference (3 units)
Description: Bayesian modeling and inference is a powerful modern approach to representing the statistics of the world, reasoning about the world in the face of uncertainty, and learning about it from data. It cleanly separates the notions of representation, reasoning, and learning. It provides a principled framework for combining multiple source of information such as prior knowledge about the world with evidence about a particular case in observed data. This course will provide a solid introduction to the methodology and associated techniques, and show how they are applied in diverse domains ranging from computer vision to molecular biology to astronomy.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture   Required
Co-convened with: ISTA 510
Course typically offered:
Main Campus: Spring

Enrollment requirement: (MATH 223 and MATH 313 and MATH 464; and (ISTA 350 or CSC 345)) OR ISTA 421 OR Consent of instructor.

ISTA 416: Introduction to Human Computer Interaction (3 units)
Description: The field of Human-Computer Interaction (HCI) encompasses the design, implementation, and evaluation of interactive computing systems. This course will provide a survey of HCI theory and practice. The course will address the presentation of information and the design of interaction from a human-centered perspective, looking at relevant perceptive, cognitive, and social factors influencing in the design process. It will motivate practical design guidelines for information presentation through Gestalt theory and studies of consistency, memory, and interpretation. Technological concerns will be examined that include interaction styles, devices, constraints, affordances, and metaphors. Theories, principles and design guidelines will be surveyed for both classical and emerging interaction paradigms, with case studies from practical application scenarios. As a central theme, the course will promote the processes of usability engineering, introducing the concepts of participatory design, requirements analysis, rapid prototyping, iterative development, and user evaluation. Both quantitative and qualitative evaluation strategies will be discussed. This course is co-convened: Upper-level undergraduates and graduate students are encouraged to enroll. Graduate students will be expected to complete more substantial projects and will be given more in-depth reading assignments.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture   Required
Co-convened with: ISTA 516
Course typically offered:
Main Campus: Fall, Spring

Recommendations and additional information: ISTA 350 or CSC 120 recommended by not required.
Enrollment requirement: ISTA 130 or CSC 110 or ECE 175 or consent of the instructor.

-SA represents a Student Abroad & Student Exchange offering
-CC represents a Correspondence Course offering
May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ISTA 421: Introduction to Machine Learning (3 units)
Description: Machine learning describes algorithms which can modify their internal parameters (i.e., "learn") to recognize patterns and make decisions based on examples or through interaction with the environment. This course will introduce the fundamentals of machine learning, will describe how to implement several practical methods for pattern recognition, feature selection, clustering, and decision making for reward maximization, and will provide a foundation for the development of new machine learning algorithms.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture   Required
Co-convened with: ISTA 521
Course typically offered:
Main Campus: Fall

Enrollment requirement: ISTA 311, MATH 129, and MATH 313, or equivalent, or consent of instructor. ISTA 116 or comparable is recommended.
Honors Course: Honors Contract
Honors Course: Honors Contract

ISTA 424: Virtual Reality (3 units)
Description: Virtual reality is an emerging technology that has been widely used in recent years in various areas, such as education, training, well-being, and entertainment. Virtual reality offers a highly immersive experience as the head mounted displays replace the vision of the users with digital imagery. It encompasses many disciplines, such as computer science, human computer interaction, game design and development, information science, and psychology. This course merges a theoretical and practical approach to give students the necessary knowledge to design, develop, and critique virtual reality games and applications.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture   Required
Co-convened with: INFO 524
Course typically offered:
Main Campus: Fall, Spring

Recommendations and additional information: ISTA 350 or CSC 335 recommended but not required. Knowledge of object-oriented programming essential for course.
Enrollment requirement: ISTA 350

ISTA 425: Algorithms for Games (3 units)
Description: Algorithms is a crucial component of game development. This course will provide students with an in-depth introduction to algorithm concepts for game development. The course will cover basic algorithm and data structures concepts, basic math concepts related to game algorithms, physics and artificial intelligence based game algorithms that are supplemented with modern examples. Unity Game Engine along with C# programming language will be used throughout the class.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture   Required
Co-convened with: INFO 525
Course typically offered:
Main Campus: Fall, Spring

Enrollment requirement: ISTA 331 and ISTA 350 or consent of instructor.

ISTA 429: Applied Cyberinfrastructure Concepts (3 units)
Description: Students will learn from experts from projects that have developed widely adopted foundational Cyberinfrastrcutrue resources, followed by hands-on laboratory exercises focused around those resources. Students will use these resources and gain practical experience from laboratory exercises for a final project using a data set and meeting requirements provided by domain scientists. Students will be provided access to computer resources at: UA campus clusters, iPlant Collaborative and at NSF XSEDE. Students will also learn to write a proposal for obtaining future allocation to large scale national resources through XSEDE.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture   Required
Also offered as: BE 429, PLS 429
Co-convened with: ISTA 520
Course typically offered:
Main Campus: Fall

Recommendations and additional information: Programming experience at the level of CSC 120 is recommended but not required.

ISTA 439: Statistical Natural Language Processing (3 units)
Description: This course introduces the key concepts underlying statistical natural language processing. Students will learn a variety of techniques for the computational modeling of natural language, including: n-gram models, smoothing, Hidden Markov models, Bayesian Inference, Expectation Maximization, Viterbi, Inside-Outside Algorithm for Probabilistic Context-Free Grammars, and higher-order language models.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture   Required
Equivalent to: CSC 439
Also offered as: CSC 439, LING 439
Course typically offered:
Main Campus: Fall

Home department: Linguistics

ISTA 450: Artificial Intelligence (3 units)
Description: The methods and tools of Artificial Intelligence used to provide systems with the ability to autonomously problem solve and reason with uncertain information. Topics include: problem solving (search spaces, uninformed and informed search, games, constraint satisfaction), principles of knowledge representation and reasoning (propositional and first-order logic, logical inference, planning), and representing and reasoning with uncertainty (Bayesian networks, probabilistic inference, decision theory).
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture   Required
Co-convened with: ISTA 550
Course typically offered:
Main Campus: Spring

Enrollment requirement: ISTA 350 or CSC 245 or MATH 243 or equivalent or consent of instructor.

ISTA 451: Game Development (3 units)
Description: This course provides an introduction to video game development. We will explore game design (not just computer games, but all games) and continue with an examination of game prototyping. Once we have working prototypes, we will continue with the development of a complete 2D computer game. The remaining course topics include: designing the game engine, rendering the graphics to the screen, and artificial intelligence. Students will be given periodic homework that reinforces what was learned in class. Homework will include developing a game prototype, game design documentation, some programming tasks. Students will work in small teams to develop a working game as a term project. Grades will be primarily based on the term project with some small amount of weight to homework. The examples provided in class will be programmed in Java and available for execution on any operating system. Programming homework assignments will be done in either Java or the language chosen by the instructor. The term project can be written in any programming language with instructor permission.
Grading basis: Regular Grades
Career: Undergraduate
Flat Fee: $97
Course Components: Lecture   Required
Co-convened with: ISTA 551
Course typically offered:
Main Campus: Fall, Spring

Recommendations and additional information: ISTA 350 or CSC 345 recommended by not required.
Enrollment requirement: ISTA 130 or CSC 110 or CSC 127A or ECE 175 and ISTA 350 or CSC 345 or consent of instructor.
Student Engagement Activity: Creative Expression
Student Engagement Competency: Innovation and Creativity

ISTA 454: Informatics in Biology (3 units)
Description: Analyze genomic sequences through understanding and using a variety of bioinformatics algorithms and software tools. Interdisciplinary approach integrating informatics, statistics, and biology.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture   Required
Co-convened with: ISTA 554
Course typically offered:
Main Campus: Summer

-SA represents a Student Abroad & Student Exchange offering
-CC represents a Correspondence Course offering
May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ISTA 455: Applied Natural Language Processing (4 units)
Description: Most of web data today consists of unstructured text. This course will cover the fundamental knowledge necessary to organize such texts, search them a meaningful way, and extract relevant information from them. This course will teach natural language processing through the design and development of end-to-end natural language understanding applications, including sentiment analysis (e.g., is this review positive or negative?), information extraction (e.g., extracting named entities and their relations from text), and question answering (retrieving exact answers to natural language questions such as "What is the capital of France" from large document collections). We will use several natural language processing toolkits, such as NLTK and Stanford's CoreNLP. The main programming language used in the course will be Python, but code written in Java or Scala will be accepted as well.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture   Required
Co-convened with: ISTA 555
Course typically offered:
Main Campus: Spring

Enrollment requirement: ISTA 350 or CSC 345.
Student Engagement Activity: Discovery
Student Engagement Competency: Interdisciplinarity

ISTA 456: Text Retrieval and Web Search (3 units)
Description: Most of the web data today consists of unstructured text. Of course, the fact that this data exists is irrelevant, unless it is made available such that users can quickly find information that is relevant for their needs. This course will cover the fundamental knowledge necessary to build such systems, such as web crawling, index construction and compression, boolean, vector-based, and probabilistic retrieval models, text classification and clustering, link analysis algorithms such as PageRank, and computational advertising. The students will also complete one programming project, in which they will construct one complex application that combines multiple algorithms into a system that solves real-world problems.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture   Required
Co-convened with: ISTA 556
Course typically offered:
Main Campus: Fall

Recommendations and additional information: ISTA 350 (Programming for Informatics Applications) and Math 215 (Linear Algebra) or equivalent.

ISTA 457: Neural Networks (3 units)
Description: Neural networks are a branch of machine learning that combines a large number of simple computational units to allow computers to learn from and generalize over complex patterns in data. Students in this course will learn how to train and optimize feed forward, convolutional, and recurrent neural networks for tasks such as text classification, image recognition, and game playing.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture   Required
Co-convened with: INFO 557
Course typically offered:
Main Campus: Fall, Spring

Recommendations and additional information: Recommend MATH 313
Enrollment requirement: ISTA 350 or CSC 345 or NSCS 344, or ECE 275 or equivalent, or consent of instructor.
Honors Course: Honors Contract
Honors Course: Honors Contract

ISTA 491: Preceptorship (1 - 6 units)
Description: Specialized work on an individual basis, consisting of instruction and practice in actual service in a department, program, or discipline. Teaching formats may include seminars, in-depth studies, laboratory work and patient study.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Independent Study   Required
Repeatable: Course can be repeated a maximum of 4 times.
Course typically offered:
Main Campus: Fall (even years only)

ISTA 495: Special Topics in Information Science, Technology, and Arts (1 - 6 units)
Description: Special topics courses are offered to allow students to explore specialized topics not covered in the program curriculum. Multiple topics might be offered in any given year, and specialized topic descriptions will be advertised by the School for students interested in enrolling in the course. A specific course syllabus will be published prior to the offer of a special topic course.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Colloquium   Required
Repeatable: Course can be repeated a maximum of 6 times.
Co-convened with: INFO 595
Course typically offered:
Main Campus: Fall, Spring
Online Campus: Fall, Spring

Field trip: None.

ISTA 497: Biodiversity Informatics (1 - 6 units)
Description: Modern science has always been data driven but advances in data gathering tools from ground sensors to aerial-based remote sensing increase the researchers' opportunities and responsibility for the professional management of data to support the reproducibility and validity of science. In this course, biology, engineering, and information science students will learn to design and implement research methodologies for field research that effectively combine 1) the discovery and use of existing data with 2) the collection, organization, analysis, dissemination, and preservation of field generated research data. These research methodologies will be implemented/studied within the motivating context of behavioral wildlife observation research. Working in teams, students will build, program and deploy microcontroller-based field sensors to gather animal behavioral information in challenging field conditions. Students will use tools such as R and Jupyter Notebooks to add metadata, document data for publication and deposit the data in a trusted data repository.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Workshop   Required
Co-convened with:
Course typically offered:
Main Campus: Summer

Field trip: Students will make a trip to the Santa Rita Experimental Range (Tucson, Arizona) and the Organization for Tropical Studies (Costa Rica) to conduct field research. Details to be provided.

-SA represents a Student Abroad & Student Exchange offering
-CC represents a Correspondence Course offering
May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ISTA 498: Senior Capstone (3 units)
Description: A culminating experience for majors involving a substantive project that demonstrates a synthesis of learning accumulated in the major, including broadly comprehensive knowledge of the discipline and its methodologies. Senior standing required.
Grading basis: Alternative Grading: S, P, F
Career: Undergraduate
Course Components: Independent Study   Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring, Summer

Recommendations and additional information: Consent of instructor.
Student Engagement Activity: Entrepreneurship
Student Engagement Competency: Innovation and Creativity

ISTA 498H: Honors Thesis (3 units)
Description: An honors thesis is required of all the students graduating with honors. Students ordinarily sign up for this course as a two-semester sequence. The first semester the student performs research under the supervision of a faculty member; the second semester the student writes an honors thesis.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Independent Study   Required
Repeatable: Course can be repeated a maximum of 2 times.
Course typically offered:
Main Campus: Fall, Spring, Summer

Recommendations and additional information: Consent of instructor.
Enrollment requirement: Student must be active in the Honors College.
Honors Course: Honors Course
Honors Course: Honors Course
Student Engagement Activity: Entrepreneurship
Student Engagement Competency: Innovation and Creativity
Writing Emphasis: Writing Emphasis Course

-SA represents a Student Abroad & Student Exchange offering
-CC represents a Correspondence Course offering
May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ISTA 499H: Honors Independent Study (1 - 4 units)
Description: Qualified students working on an individual basis with professors who have agreed to supervise such work.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Independent Study   Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring

Recommendations and additional information: Consent of instructor.
Enrollment requirement: Student must be active in the Honors College.
Honors Course: Honors Course
Honors Course: Honors Course
Student Engagement Activity: Leadership
Student Engagement Competency: Innovation and Creativity

ISTA 599: Independent Study (1 - 4 units)
Description: Qualified students working on an individual basis with professors who have agreed to supervise such work. Graduate students doing independent work which cannot be classified as actual research will register for credit under course number 599.
Grading basis: Alternative Grading: S, P, F
Career: Graduate
Course Components: Independent Study   Required
Repeatable: Course can be repeated a maximum of 99 times.