## Computer Science Principles:

The Computer Science Principles course is a continuation of the Computer Science Foundations course. This course has a strong focus on real-world applications, equipping students with a deeper understanding and expertise within computer science. Technical principles of abstraction are addressed as students gain understanding of the intricate relationship between hardware, system software, and application software. Students gain insight and understanding of the utilization of the C-I-A triad and its role in establishing cybersecurity best practices and implementation techniques to fortify defenses against threats and vulnerabilities. Data science is a pivotal component within the data and analysis content strand. Students utilize the data cycle for meaningful and informative analysis. Training data and data bias is a significant area of focus as students examine the real-world implications and uses of machine learning and Artificial Intelligence.

### Algorithms and Programming (AP)

#### CSP.AP.1 The student will apply computational thinking to address a computational problem.

1. Identify and categorize real-world problems as classification, prediction, and sequential decision.
2. Identify the process used by specialized algorithms used for perceptual tasks using sensory inputs.
3. Decompose a computational problem or process into sub-components.
4. Use abstraction to improve program modularity, reusability, and readability.
5. Create a prototype that uses algorithms to address a complex computational problem.
6. Justify selected control structure(s) used to design algorithm.

#### CSP.AP.2 The student will design and create programs that use and manipulate data, include primitive data types and higher-order data structures.

1. Determine appropriate data structures to implement when given a programming problem or task.
2. Create, modify, store data in, and manipulate primitive data types like numbers, strings/characters, or Boolean values.
3. Create, modify, store data in, and manipulate linear and non-linear collections containing primitive and higher order data types: arrays, lists, objectives, or key-values structures.
4. Read and write programs that include linear data structures and processes a collection of data.

#### CSP.AP.3 The student will use the iterative design process to plan, implement, and create programs that satisfy user and design specifications.

1. Use project management skills to work individually and in teams.
2. Design an interactive program that accepts input from a variety of sources and produce output based on input.
3. Create a design specification document.
4. Design and create programs for various computing platforms.
5. Document programs to improve the ability to trace, test, and debug.
6. Trace the execution of an algorithm and predict its results.
7. Use proper attribution to incorporate code written by others.
8. Use multiple test cases to verify and refine program.
9. Revise and improve an algorithm to resolve errors or produce desired outcomes.
10. Solicit and synthesize user feedback to test and refine the program.
11. Apply best practices in developing programs: program development cycle, code styling, documentation, and version control.

#### CSP.AP.4 The student will weigh the affordances and constraints of different coding representations.

1. Compare and contrast schematic representation, pictorial representation, and other coding representations.
2. Generalize programming concepts, structures, and practices across coding representations.
3. Communicate the ways a coding representation or approach shapes solutions to problems.
4. Evaluate coding languages for specific real-world applications.

### Computing Systems (CSY)

#### CSP.CSY.1 The student will compare the structures, functions, and interactions between application software, system software, and hardware.

1. Explain the role of abstraction and computing systems for user usability.
2. Explore the interdependent relationship between hardware and software and the effect on functionality and system architecture.
3. Analyze the components of hardware and software and propose solutions to increase functionality.
4. Describe the functions of an operating system, including resource management and process execution.
5. Construct a model to show the hierarchy of hardware, system software, and application software.

### Cybersecurity (CYB)

#### CSP.CYB.1 The student will evaluate security technologies, techniques, and practices in terms of confidentiality, integrity, and availability.

1. Explain the C-I-A (Confidentiality, Integrity, and Availability) Triad.
2. Solve a cybersecurity problem and propose security measures related to confidentiality, integrity, and availability.
3. Compare information security and physical security measures to assess potential threats and vulnerabilities.

#### CSP.CYB.2 The student will explain the legal and ethical ramifications of cybersecurity breaches.

1. Describe state and federal laws that relate to cybersecurity and privacy.
2. Compare and contrast ethical and unethical hacking.
3. Evaluate the social and economic implications of privacy in the context of safety, law, or ethics.

#### CSP.CYB.3 The student will explain the importance of protecting personally identifiable information (PII) and social identity.

1. Examine measures to prevent the disclosure of personally identifiable information (PII).
2. Compare and contrast ways to conduct threat analysis and to protect data and computing systems from data breaches.
3. Analyze scenarios and propose computing practices to protect personal information and reduce the risk of a data breach.

### Data and Analysis (DA)

#### CSP.DA.1 The student will utilize, develop, evaluate, defend, and refine information about a dataset using computing technologies, techniques, and practices.

1. Identify the role of relational databases in storing data and in data utilization.
2. Analyze tradeoffs inherent in distilling raw data into data representations.
3. Evaluate data reliability and scalability.
4. Identify potential bias present in data representation practices.
5. Discuss the potential effect of data bias and provide recommendations on how to mitigate data bias.

#### CSP.DA.2 The student will collect and use training data.

1. Collect and clean diverse data sets to improve data quality and relevance.
2. Apply preprocessing techniques: missing values, normalization, and encoding categorical variables.
3. Create subsets of training data for training, validation, and testing.
4. Investigate potential imbalances within training data that could result in a biased model.

#### CSP.DA.3 The student will use supervised or unsupervised learning algorithm to train a model on real-world data.

1. Explain the difference between labeled and unlabeled data.
2. Evaluate a dataset used to train an artificial intelligence system.
3. Apply mathematical operations and algorithms to manipulate and extract insights from data sets.
4. Describe how supervised or unsupervised learning algorithms find patterns and make predictions.
5. Discuss how machines learn from data sets and derive new knowledge.
6. Describe how natural language processors (NLP) analyze data and produce output.

#### CSP.DA.4 The student will create and refine predictive models based on patterns in data.

1. Create and refine models or computational artifacts that can be used to make predictions and communicate effectively.
2. Justify tools and data visualizations selected to create and assess the model for accuracy.

### Impacts of Computing (IC)

#### CSP.IC.1 The student will analyze the impacts of computing technologies across global societies.

1. Assess the impact of manufacturing and energy use on communities and the environment.
2. Analyze ways in which global collaboration is supported by new technologies.
3. Identify applications of quantum computing in various fields: scientific research, nonprofit entities, government agencies, and/or business industries.

**CSP.IC.2** **The student will analyze the long-term impact of excessive screen time use on one’s mental and physical health.**

1. Research and analyze the prevalence, causes, and long-term consequences of extended screen time usage.
2. Identify indicators of excessive social media use.
3. Propose techniques and strategies to mitigate or reduce the impact of excessive screen time usage.
4. Examine and discuss the impact of screen time and social media on academic or workplace performance.

#### CSP.IC.3 The student will analyze and design solutions to address local and global impacts of present and future computing technologies.

1. Analyze and evaluate access and influence on the distribution of computing resources in a global society.
2. Analyze the implications of emerging computing technologies to design solutions.
3. Create computing artifacts(s) that illustrates a solution to solve a problem locally or globally.

#### CSP.IC.4 The student will expand career explorations with work-based learning experiences.

1. Engage in work-based learning experiences involving computer science and related pathways.
2. Create a plan to navigate career pathways that include computer science skills and practices.

**CSP.IC.5** **The student will identify and describe the information processing capabilities of Artificial Intelligence in computing technologies.**

1. Identify ways Artificial Intelligence applications can modify their behavior to respond to different people’s emotional states.
2. Describe the role of natural language processing in computing technologies.
3. Examine ethical and privacy concerns related to Artificial Intelligence and propose recommendations to address these concerns.

### Networks and the Internet (NI)

#### CSP.NI.1 The student will explain, analyze, and model computing networks and communication over the Internet.

1. Explain abstraction enabling computing devices to communicate to one another over an Internet connection.
2. Model abstractions and protocols enabling computers to transmit, receive, and interpret-data within networks and over the Internet.
3. Explain how abstraction enables different layers of Internet technology to build on one another.
4. Describe the seven layers of the OSI model.
5. Analyze issues pertaining to networks through the sevens layers of the OSI model.

**CSP.NI.2 The student will explain design principles enabling large-scale operation of the Internet to connect devices and networks all over the world.**

1. Explain design principles that permit scalability and reliability of connected devices on a network.
2. Describe issues that impact network functionality, scalability, and reliability and recommend solutions
3. Create a diagram to illustrate the communication connection between two distant devices.