In addition to the Arkansas Teaching Standards, the teacher of Computer Science / Mathematics, grades 7-12, will demonstrate knowledge and competencies in the following areas:

1. Computational Thinking CSTA: Comp. Thinking	1.1 The ability to use the basic steps in algorithmic problem-solving to design solutions (e.g., problem statement and exploration, examination of sample instances, design, implementing a solution, testing, evaluation). • The ability to evaluate ways that different algorithms may be used to solve the same problem. 1.2 The ability to describe the process of parallelization as it relates to problem solving, including describing the concept of parallel processing as a strategy to solve large problems. 1.3 The ability to use the process of order of operations, integer division, and mod. 1.4 The ability to define an algorithm as a sequence of instructions that can be processed by a computer and to demonstrate an understanding of the basic characteristics uses, and practical applications of algorithms by: • Acting out searching and sorting algorithms. • Explaining how sequence, selection, iteration, and recursion are building blocks of algorithms. • Explaining the value of heuristic algorithms to approximate solutions for intractable problems. • Critically examining classical algorithms and implement an original algorithm. • Evaluating algorithms by their efficiency, correctness, and clarity. 1.5 The ability to describe and analyze a sequence of instructions being followed (e.g., describe a character's behavior in a video game as driven by rules and algorithms). 1.6 The ability to represent data in a variety of ways including text, sounds, pictures, and numbers. 1.7 The ability to use visual representations of problem states, structures, and data (e.g., graphs, charts, network diagrams, flowcharts). 1.8 The ability to interact with content-specific models and simulations (e.g., ecosystems, epidemics, molecular

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	dynamics) to support learning and research. 1.9 The ability to evaluate what kinds of problems can be solved using modeling and simulation. 1.10 The ability to analyze the degree to which a computer model accurately represents the real world. 1.11 The ability to decompose a problem through the use of abstraction into sub problems or by defining new functions and classes and to discuss the value of abstraction to manage problem complexity. 1.12 The ability to understand the notion of hierarchy and abstraction in computing including high level languages, translation, instruction set, and logic circuits. 1.13 The ability to examine connections between elements of mathematics and computer science including binary numbers, logic, sets, and functions. 1.14 The ability to provide examples of interdisciplinary applications of computational thinking, such as describing how computation shares features with art and music by translating human intention into an artifact. 1.15 The ability to use predefined functions and parameters, classes and methods to divide a complex problem into simpler parts. 1.16 The ability to describe a software development process used to solve software problems (e.g., design, coding, testing, verification). 1.17 The ability to compare techniques for analyzing massive data collections. 1.18 The ability to describe the relationship between binary and hexadecimal representations. 1.19 The ability to analyze the representation and trade-offs among various forms of digital information. 1.20 The ability to describe how various types of data are stored in a computer system. 1.21 The ability to use modeling and simulation to represent and understand natural phenomena. 1.22 The ability to classify problems as tractable, intractable, or computationally unsolvable. 1.23 The ability to compare and contrast simple data structures and their uses (e.g., arrays and lists).

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	1.24 The ability to discuss the interpretation of binary sequences in a variety of forms (e.g., instructions, numbers, text, sound, image). 1.25 The ability to use models and simulations to help formulate, refine, and test scientific hypotheses. 1.26 The ability to analyze data and identify patterns through modeling and simulation. 1.27 The ability to demonstrate concurrency by separating processes into threads and dividing data into parallel streams.
2. Collaboration CSTA: Collaboration	2.1 The ability to demonstrate a knowledge of communication and collaboration tools for everyday needs by • Applying productivity/multimedia tools and peripherals to group collaboration and support learning throughout the curriculum. • Collaboratively designing, developing, publishing, and presenting products (e.g., videos, podcasts, websites) using technology resources that demonstrate and communicate curriculum concepts. 2.2 The ability to demonstrate a knowledge of techniques used to develop software collaboratively by • Evaluating programs written by others for readability and usability. Use collaborative tools to communicate with project team members (e.g., discussion threads, wikis, blogs, version control, etc.). • Using project collaboration tools, version control systems, and Integrated Development Environments (IDEs) while working on a collaborative software project. 2.3 The ability to demonstrate a knowledge of the software life cycle process by participating on a software project team.
3. Computing Practice & Programming CSTA: Collaboration	3.1 The ability to select appropriate tools and technology resources to accomplish a variety of tasks and solve problems (e.g., editing databases). 3.2 The ability to create and organize Web pages through the use of a variety of web programming design tools. 3.3 The ability to use mobile devices/emulators to design, develop, and implement mobile computing applications. 3.4 The ability to select appropriate file formats for various types and uses of data.

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	3.5 The ability to describe a variety of programming languages available to solve problems and develop systems. 3.6 The ability to design, develop, publish, and present products (e.g., webpages, mobile applications, animations, and database managers) using technology resources that demonstrate and communicate curriculum concepts. 3.7 The ability to implement problem solutions using a programming language, including: looping behavior, conditional statements, logic, expressions, variables, and functions (e.g., if, if-else, multi-branching). 3.8 Knowledge of cyber security issues, including personal information security, password security, encryption, and secure transactions. 3.9 The ability to explain the principles of security by examining encryption, cryptography, and authentication techniques, and to deploy these principles through implementation. 3.10 The ability to collect and analyze data that is output from multiple runs of a computer program and move data from one program to another. 3.11 The ability to use various debugging and testing methods to ensure program correctness (e.g., test cases, unit testing, white box, black box, integration testing) 3.12 The ability to apply analysis, design, and implementation techniques to solve problems (e.g., use one or more software lifecycle models). 3.13 The ability to use Application Program Interfaces (APIs) and libraries to facilitate programming solutions. 3.14 The ability to explain the program execution process, including the difference between compilers and interpreters. 3.15 The ability to use advanced tools to create digital artifacts (e.g., web design, animation, video, multimedia). 3.16 Knowledge of procedural and object-oriented programming. 3.17 The ability to explore principles of system design in scaling, efficiency, and security. 3.18 The ability to use data analysis to enhance

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	understanding of complex natural and human systems. 3.19 The ability to deploy various data collection techniques for different types of problems.
4. Computers & Communication Devices CSTA: Comp. & Com. Dev.	4.1 The ability to demonstrate proficient computer use by • Using appropriate, accurate terminology when communicating about technology. • Applying strategies for identifying and solving routine problems that occur during everyday computer use. 4.2 The ability to demonstrate a knowledge of components of computer organization by • Identifying and describing hardware • Understanding the relationship between hardware and software • Identifying and describing various forms of input and output • Identifying and describing the effect of computer hardware on computational capabilities 4.3 The ability to demonstrate knowledge about computational processors appearing in many devices such as traditional computers; computers embedded in mobile devices and vehicles (e.g., cell phones, automobiles, airplanes) and their unique features; and various computing devices and their limitations and applications. 4.4 Knowledge of the relationship between the operating system and the hardware, the effect of operating systems on the choices for available application software and tools, and techniques for moving data between different operating systems 4.5 The ability to demonstrate a knowledge of networks and the Internet including • Issues that impact network functionality, • How to work in a networked environment, • How the Internet facilitates global communication using a variety of devices, • An awareness of security and privacy issues related to networked information and an awareness of best practices 4.6 The ability to describe ways in which computers can

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	solve problems that previously required human effort including: • Knowledge of how computers can model intelligent behavior (e.g., vision, speech, game playing, etc.) • Knowledge of how computers can be used to solve business problems • Knowledge of how computers can be used for social and entertainment
5. Community, Global, and Ethical Impacts CSTA: Community, Global, and Ethical Impacts ISTE: 1.d.	5.1 The ability to exhibit legal and ethical behaviors when using information and technology and discuss the consequences of misuse. 5.2 The ability to compare and analyze the positive and negative impacts of technology and computing on human culture (e.g., social networking, delivery of news and other public media, and intercultural communication). 5.3 The ability to evaluate the accuracy, relevance, appropriateness, comprehensiveness, and bias of electronic information sources concerning real-world problems. 5.4 The ability to describe ethical issues that relate to computers and networks (e.g., security, privacy, ownership, and information sharing). 5.5 The ability to discuss how the unequal distribution of computing resources in a global economy raises issues of equity, access, and power. 5.6 Knowledge of the role computer science plays and its impact in the modern world by • Demonstrating an understanding of the social, ethical, and legal issues and impacts of computing, and attendant responsibilities of computer scientists and users • Analyzing the contributions of computer science to current and future innovations in sciences, humanities, the arts, and commerce 5.7 The ability to discuss the impact of computing technology on business and commerce (e.g., automated tracking of goods, automated financial transactions, e-commerce, cloud computing). 5.8 The ability to describe the role that adaptive technology

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ISTE: 3.a.1 APCS: L.O. 7.2.1	can play in the lives of people with special needs. 5.9 The ability to describe strategies for determining the reliability of information found on the Internet. 5.10 The ability to differentiate between information access and information distribution rights. 5.11 The ability to describe how different kinds of software licenses can be used to share and protect intellectual property. 5.12 The ability to discuss the social and economic implications associated with hacking and software piracy. 5.13 The ability to describe different ways in which software is created and shared and their benefits and drawbacks (commercial software, public domain software, open source development). 5.14 The ability to describe security and privacy issues that relate to computer networks. 5.15 The ability to design environments that promote effective teaching and learning in computer science classrooms and online learning environments and promote digital citizenship by • Promoting and modeling the safe and effective use of computer hardware, software, peripherals, and networks 5.16 The ability to analyze the beneficial and harmful effects of computing innovations. 5.17 The ability to summarize how financial markets, transactions, and predictions have been transformed by automation. 5.18 The ability to summarize how computation has revolutionized the way people build real and virtual organizations and infrastructures. 5.19 The ability to identify laws and regulations that impact the development and use of software. 5.20 The ability to analyze the impact of government regulation on privacy and security. 5.21 The ability to use a variety of multimedia tools and peripherals to support personal productivity and learning throughout the curriculum.
6. Disciplinary Literacy	<u>Reading in Science and Technical Subjects, Grades 7-12</u>

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CCSS-ELA	Reading competencies for literacy in science and technical subjects for grades 7-12 include the ability to read informational texts in science and technical subjects closely and critically to analyze the key ideas and details as well as craft and structure with the purpose of integrating knowledge and ideas both within and across texts by 6.1 Citing specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account 6.2 Determining the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms 6.3 Following precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, analyzing the specific results based on explanations in the text 6.4 Determining the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 7-12 text and topics 6.5 Analyzing how the text structures information or ideas are organized into categories or hierarchies, demonstrating understanding of the information or ideas 6.6 Analyzing the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved 6.7 Integrating and evaluating multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem 6.8 Evaluating the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information 6.9 Synthesizing information from a range of sources (e.g., texts, experiments, simulations) into a coherent

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	understanding of a process, phenomenon, or concept, resolving conflicting information when possible 6.10 Reading and comprehending a variety of scientific and technical documents appropriate for instruction within the 7-12 text complexity band <u>Writing in History/Social Studies, Science, and Technical Subjects, Grades 7-12</u> Writing competencies for literacy in history/social studies, science, and technical subjects for grades 7-12 will be demonstrated by 6.11 Writing arguments focused on discipline-specific content by • Introducing precise, knowledgeable claim(s), establishing the significance of the claim(s),distinguishing the claim(s) from alternate or opposing claims, and creating an organization that logically sequences the claim(s), counterclaims, reasons, and evidence • Developing claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases. • Using words, phrases, and clauses as well as varied syntax to link the major sections of the text, creating cohesion, and clarification of the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims. • Establishing and maintaining a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing. • Providing a concluding statement or section that follows from or supports the argument presented 6.12 Writing informative/explanatory texts, including the

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	narration of historical events, scientific procedures/experiments, or technical processes by • Introducing a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension • Developing the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic • Using varied transitions and sentence structures to link the major sections of the text, creating cohesion, and clarifying the relationships among complex ideas and concepts • Using precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; conveying a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers • Providing a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic) 6.13 Producing clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience 6.14 Developing and strengthening writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience 6.15 Using technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information 6.16 Conducting short as well as more sustained research

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	projects to answer a question (including a self-generated question) or solve a problem, narrowing or broadening the inquiry when appropriate, synthesizing multiple sources on the subject, demonstrating understanding of the subject under investigation 6.17 Gathering relevant information from multiple authoritative print and digital sources, using advanced searches effectively, assessing the strengths and limitations of each source in terms of the specific task, purpose, and audience, integrating information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source, and following a standard format for citation 6.18 Drawing evidence from informational texts to support analysis, reflection, and research 6.19 Writing routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences
7. Mathematical Practices CCSS-M Mathematical Practices 1-8	Standard 7: To be prepared to develop student mathematical proficiency, all secondary mathematics teachers should know how to develop student expertise in the content area incorporating the following Standards for Mathematical Practice throughout all 7-12 mathematics by 7.1 Making sense of problems and persevering in solving them 7.2 Reasoning abstractly and quantitatively 7.3 Constructing viable arguments and critiquing the reasoning of others 7.4 Modeling with mathematics 7.5 Using appropriate tools strategically 7.6 Attending to precision 7.7 Looking for and making use of structure 7.8 Looking for and expressing regularity in repeated reasoning
8. Number and Quantity	Standard 8: To be prepared to develop student mathematical proficiency, all secondary mathematics teachers should know the following topics related to number and quantity with their

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NCTM: A.1.1 - A.1.5 CCSS: Math. Content. HSN	content understanding and mathematical practices, supported by appropriate technology and varied representational tools, including concrete models by 8.1 Knowing structure, properties, relationships, operations, and representations including standard and non-standard algorithms, of numbers and number systems including integer, rational, irrational, real, and complex numbers 8.2 Knowing fundamental ideas of number theory (divisors, factors and factorization, primes, composite numbers, greatest common factor, least common multiple, and modular arithmetic) 8.3 Knowing quantitative reasoning and relationships that include ratio, rate, and proportion and the use of units in problem situations 8.4 Knowing vector and matrix operations, modeling, and applications 8.5 Knowing historical development and perspectives of number, number systems, and quantity including contributions of significant figures and diverse cultures
9. Algebra NCTM/NCATE: A.2.1 - A.2.5 CCSS: Math. Content. HSA	Standard 9: To be prepared to develop student mathematical proficiency, all secondary mathematics teachers should know the following topics related to algebra with their content understanding and mathematical practices supported by appropriate technology and varied representational tools, including concrete models by 9.1 Knowing algebraic notation, symbols, expressions, equations, inequalities, and proportional relationships, and their use in describing, interpreting, modeling, generalizing, and justifying relationships and operations 9.2 Knowing function classes including polynomial, exponential, and logarithmic, absolute value, rational, and trigonometric, including those with discrete domains (e.g., sequences), and how the choices of parameters determine particular cases and model specific situations 9.3 Knowing functional representations (tables, graphs, equations, descriptions, recursive definitions, and finite differences), characteristics (e.g., zeroes, intervals of increase or decrease, extrema, average rates of change, domain and range, and end behavior), and notations as a means to describe, reason, interpret, and analyze relationships and to build new functions

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	9.4 Knowing patterns of change in linear, quadratic, polynomial, and exponential functions and in proportional and inversely proportional relationships and types of real-world relationships these functions can model 9.5 Knowing linear algebra including vectors, matrices, and transformations 9.6 Knowing abstract algebra, including groups, rings, and fields, and the relationship between these structures and formal structures for number systems and numerical and symbolic calculations 9.7 Knowing historical development and perspectives of algebra including contributions of significant figures and diverse cultures
10. Geometry and Trigonometry NCTM: A.4.1 - A.3.10 CCSS: Math. Content. HSG CCSS: Math.Content.HSF.TF	Standard 10: To be prepared to develop student mathematical proficiency, all secondary mathematics teachers should know the following topics related to geometry and trigonometry with their content understanding and mathematical practices supported by appropriate technology and varied representational tools, including concrete models by 10.1 Knowing core concepts and principles of Euclidean geometry in two and three dimensions and two-dimensional non-Euclidean geometries 10.2 Knowing transformations including dilations, translations, rotations, reflections, glide reflections, compositions of transformations, and the expression of symmetry in terms of transformations 10.3 Knowing congruence, similarity and scaling, and their development and expression in terms of transformations 10.4 Knowing right triangles and trigonometry 10.5 Knowing application of periodic phenomena and trigonometric identities 10.6 Knowing identification, classification into categories, visualization, and representation of two- and three-dimensional objects (triangles, quadrilaterals, regular polygons, prisms, pyramids, cones, cylinders, and spheres) 10.7 Knowing formula rationale and derivation (perimeter, area, surface area, and volume) of two- and three-dimensional objects (triangles,

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	quadrilaterals, regular polygons, rectangular prisms, pyramids, cones, cylinders, and spheres), with attention to units, unit comparison, and the iteration, additivity, and invariance related to measurements 10.8 Knowing geometric constructions, axiomatic reasoning, and proof 10.9 Knowing analytic and coordinate geometry including algebraic proofs (e.g., the Pythagorean Theorem and its converse) and equations of lines and planes, and expressing geometric properties of conic sections with equations 10.10 Knowing historical development and perspectives of geometry and trigonometry including contributions of significant figures and diverse cultures
11. Statistics and Probability	Standard 11: To be prepared to develop student mathematical proficiency, all secondary mathematics teachers should know the following topics related to statistics and probability with their content understanding and mathematical practices supported by appropriate technology and varied representational tools, including concrete models by 11.1 Knowing statistical variability and its sources and the role of randomness in statistical inference 11.2 Creating and implementing of surveys and investigations using sampling methods and statistical designs, statistical inference (estimation of population parameters and hypotheses testing), justification of conclusions, and generalization of results 11.3 Knowing univariate and bivariate data distributions for categorical data and for discrete and continuous random variables, including representations, construction and interpretation of graphical displays (e.g., box plots, histograms, cumulative frequency plots, scatter plots), summary measures, and comparisons of distributions 11.4 Knowing empirical and theoretical probability (discrete, continuous, and conditional) for both simple and compound events 11.5 Knowing random (chance) phenomena, simulations, and probability distributions and their application as models of real phenomena and to decision making 11.6 Knowing historical development and perspectives of statistics and probability including contributions of

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	significant figures and diverse cultures
12. Calculus NCTM: A5.1-5.6	Standard 12: To be prepared to develop student mathematical proficiency, all secondary mathematics teachers should know the following topics related to calculus with their content understanding and mathematical practices supported by appropriate technology and varied representational tools, including concrete models by 12.1 Knowing limits, continuity, rates of change, the Fundamental Theorem of Calculus, and the meanings and techniques of differentiation and integration 12.2 Knowing parametric, polar, and vector functions 12.3 Knowing sequences and series 12.4 Knowing multivariate functions 12.5 Knowing applications of function, geometry, and trigonometry concepts to solve problems involving calculus 12.6 Knowing historical development and perspectives of calculus, including contributions of significant figures and diverse cultures
13. Discrete Mathematics NCTM: A.6.1 - A.6.5	Standard 13: To be prepared to develop student mathematical proficiency, all secondary mathematics teachers should know the following topics related to discrete mathematics with their content understanding and mathematical practices supported by appropriate technology and varied representational tools, including concrete models by 13.1 Knowing discrete structures including sets, relations, functions, graphs, trees, and networks 13.2 Knowing enumeration including permutations, combinations, iteration, recursion, and finite differences 13.3 Knowing propositional and predicate logic 13.4 Knowing applications of discrete structures such as modeling and solving linear programming problems and designing data structures 13.5 Knowing historical development and perspectives of discrete mathematics including contributions of significant figures and diverse cultures

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