CSE2 COURSE DESCRIPTION

[SPRING 2022 PREVIEW; SUBJECT TO CHANGE]

Computer Science Explorations 2 (CSE 2) is an introductory course developed in partnership with MIT AI for K-12 designed to help students explore AI and its far-reaching societal impacts in our world. The course is designed around engaging activities and learning units that integrate foundational AI concepts and real-world applications with ethical design and responsible use, as students explore how these technologies can help solve problems and improve life for themselves and their communities.

Across six units and three Block Projects, students will investigate the broad implications of AI technology such as targeted advertising, facial and voice recognition, self-driving cars, and neural networks. Through a combination of group activities, individual explorations, and end-of-module deep dive projects, students will build familiarity with AI technology and the current state of machine learning. Students will close the course with a look into the future of AI and discuss the implications of AI technology for our society and our world.

GRADE LEVEL	PREREQUISITES
Grade 7-8+	No prior computer science knowledge or coursework is required. Not a prerequisite for CSE 3.

CS EXPLORATIONS PATHWAY

CSE 1: FUNDAMENTALS IN SCRATCH	CSE 2: ARTIFICIAL INTELLIGENCE	CSE 3: CS AND CREATIVE MEDIA
Grade 6+	Grade 7+	Grade 8

COURSE OBJECTIVES

By the end of this course, students will be prepared to continue on the CSE pathway with CSE 3 in 8th grade. Students will build an understanding of the fundamental principles of artificial intelligence and the ways that AI technologies are used in society today.

PACING GUIDANCE

CSE 2 can be flexibly taught over the course of 9 weeks, 12 weeks, a single semester, a full school year, or broken up over multiple school years. Additional pacing options are available to support alternate elective blocks.

GETTING STARTED: YOUR PROJECT STEM TEACHER ACCOUNT

To get started with the curriculum, teachers will need to create and verify a Project STEM teacher account. This will give you access to all teacher lesson resources, including lesson plans, activity guides, and all online activities that your students will see.

SUPPORTING TEACHERS FROM DIVERSE BACKGROUNDS

CS Explorations 2 is developed for teachers from diverse backgrounds. Designed with new-to-CS teachers in mind, it does not require a teacher to be an expert in computer science to teach the lessons. In addition to extensive lesson materials and resources, and detailed lesson plans that include a discussion of goals, teaching tips, and additional information to support your role in the classroom, teachers may also access the self-paced professional development course that will be available later in 2022. We encourage all Project STEM teachers to go through the course activities to better understand, anticipate and plan for supporting students as they engage with the course resources.

CORE COURSE STRUCTURE

The CSE 2 curriculum consists of lessons, units, and blocks. Each CS block (A–C) contains 2 units that cover closely related artificial intelligence concepts. Each unit contains several lessons that each cover an aspect of the unit's major concept.

BLOCK A: GETTING STARTED WITH ARTIFICIAL INTELLIGENCE

Block A of CSE 2 provides students with an introduction to artificial intelligence, designed around engaging activities and lessons that integrate CS and computational thinking concepts with ethical design and responsible use, as students explore how these technologies can help solve problems and improve life for themselves and their communities.

UNIT 0 GETTING STARTED WITH AI

In this introductory unit, students start exploring what artificial intelligence is and how it is defined. They will begin with an overview of topics including the definition of intelligence, the key principles that will be covered in this course, and how to use Scratch.

- **0.1** Why AI?
- **0.2** What is Intelligence?
- **0.3** Intro to AI
- **0.4** Growth Mindset
- **0.5** Scratch Fundamentals

UNIT 1 INTRODUCTION TO AI

In this unit, students are introduced to artificial intelligence in more detail as they examine four fields that rely on AI technology every day: robotics, entertainment, social media, and chatbots. Through a mix of real-world examples and coding activities, students will continue to build a strong understanding of artificial intelligence and the technology that it is used to create.

- **1.1** What is AI?
- **1.2** Can AI Do This or Not?
- **1.3** Real-world AI: Robotics
- **1.4** Real-world AI: Entertainment
- **1.5** Mid-Unit Recap and Assessment
- **1.6** Algorithms and Optimization
- **1.7** Ethical Optimization Matrix
- **1.8** Real-world AI: Social Media
- **1.9** Real-world AI: Chatbots
- **1.10** End-of-Unit Recap and Assessment

BLOCK A PROJECT

The Block A Project is a five day coding-based project that will ask students to apply what they've learned about artificial intelligence to create a unique, creative program in Scratch.

BLOCK B: REPRESENTATION, REASONING, AND MACHINE LEARNING

Block B of CSE 2 builds on students' foundational knowledge from Block A, to introduce them to additional principles of Artificial Intelligence including data representation and reasoning.

UNIT 2 REPRESENTATION AND REASONING

In this unit, students will explore representations of data structures and how AI technology uses representations and reasoning to make decisions. Students will look at various ways that data can be represented, whether by looking at data represented hierarchically in a decision tree, locations represented in a coordinate graph, or the representation of words and natural language.

- **2.1** What is Data?
- **2.2** Sensing vs. Perceiving
- **2.3** Feature Perception
- **2.4** Object Perception
- **2.5** Mid-Unit Recap and Assessment
- **2.6** Decision Trees and Object Classification
- **2.7** Representation Data for Relationships
- **2.8** Social Networks and Graph Representation
- **2.9** Real World Applications of Classification and Search
- **2.10** End-of-Unit Recap and Assessment

UNIT 3 MACHINE LEARNING

In this unit, students will explore machine learning, a hot topic in AI. Recently, faster and more powerful computers as well as easier access to large datasets have made it easier to develop machine learning systems. Students will see that supervised machine learning can be used to create classification models, examine how the size, completeness, and diversity of a dataset affects the performance of a machine learning algorithm, and see that machine learning algorithms may extract features that may be different from the conceptual features that humans find valuable or informative.

- **3.1** What is Supervised Machine Learning?
- **3.2** Cat-Dog Classifier and Algorithmic Bias
- **3.3** Introduction to Neural Networks, Part 1
- **3.4** Introduction to Neural Networks, Part 2
- **3.5** Mid-Unit Recap and Assessment
- **3.6** Machine Learning and Algorithmic Bias
- **3.7** Machine Learning and Machine Vision Classification
- **3.8** Ethical Design in AI, Part 1
- **3.9** Ethical Design in AI, Part 2
- **3.10** End-of-Unit Recap and Assessment

BLOCK B PROJECT

The Block B Project is a five day coding-based project that will ask students to apply what they've learned about artificial intelligence to create a unique, creative program in Scratch.

BLOCK C: GENERATIVE AI AND APPLIED AI

Block B of CSE 2 builds on students' foundational knowledge from Block A and B, to introduce them to additional principles of Artificial Intelligence including Generative and Applied AI.

UNIT 4 GENERATIVE AI

In this unit, students will explore types of Generative AI technology, including Generative Adversarial Networks (GANs). They will play a discriminator game to see how GANs work, and learn to use some of the tools that help model

- **4.1** Generation vs. Classification
- **4.2** Style Transfer
- **4.3** How do GANs Work?
- **4.4** Exploring GANs
- **4.5** Mid-Unit Recap and Assessment
- **4.6** Deepfakes

how AI technology works. Students will also dig into the social implications of generative AI, including deepfakes and style transfer, all while discussing the real world impact of AI technology.

- **4.7** Storytelling
- **4.8** Art and Ownership
- **4.9** GANs in the Real World
- **4.10** End-of-Unit Recap and Assessment

UNIT 5 APPLIED AI

In this capstone unit, students will explore the big idea that intelligent agents require many kinds of knowledge to interact naturally with humans. Building on their explorations of chatbots from Unit 1, students will look deeper at how AI technology mimics natural language and common sense reasoning in order to appear more natural and lifelike. Topics include chatbots, data collection and privacy, and a debate about the future of society as AI technology continues to advance at a faster and faster pace.

- **5.1** Chatbots, Part 1
- **5.2** Chatbots, Part 2
- **5.3** Social Robots: Embodied AI
- **5.4** Data Collection and Privacy
- **5.5** Mid-Unit Recap and Assessment
- **5.6** YouTube Redesign, Part 1
- **5.7** YouTube Redesign, Part 2
- **5.8** AI and My Future Job
- **5.9** Debate AI: Future Society
- **5.10** End-of-Unit Recap and Assessment

BLOCK C PROJECT

The Block C Project is a five day coding-based project that will ask students to apply what they've learned about artificial intelligence to create a unique, creative program in Scratch.

NOTE ON PLANNED INTERSESSION CONTENT

CS Explorations 2 provides teachers with Intersessions of between 1 and 4 lessons, that are interspersed between core units in a modular fashion. Intersessions address additional coding and non-coding aspects of computer science and artificial intelligence. Teachers can implement Intersession lessons at their discretion, based on time and student interest.

ADDITIONAL COURSE INFORMATION

COURSE MATERIALS

PROVIDED MATERIALS
The CSE 2 curriculum provides all learning materials necessary for the successful completion of the course. These materials include classroom slides, lesson plans, activity guides and project walkthroughs, assessments, and more, designed to support the instruction of the course.

SUPPLIES NEEDED
In addition to standard school supplies, such as paper and pen or pencils, students will need access to a device (such as a chromebook, laptop, or desktop) with a reliable internet connection to complete the work required in this course.

TECHNICAL REQUIREMENTS

In order to complete the CSE 2 coursework, students will need to be able to access a computer with reliable internet connection each time they work. While there are some offline aspects of the curriculum, the majority of the lesson materials and resources, including Scratch, are located online and can be accessed via browser.

A list of domains that will need to be whitelisted so that students and teachers can access course materials and ensure compatibility with firewalls, if any, will be provided.