Dominican International School
Syllabus Grade 10 Computer Science Discoveries, Design, Data and Physical Computing

SY: 2022-23

Grade Level 10
1 Year, 1 Credit

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Course Description

Computer Science Discoveries 10 is the second half of an introductory computer science course focusing on Innovation and Impact. Students in this course should have already taken the first part in grade 9. The two parts of this course take a wide lens on computer science by covering topics such as programming, physical computing, HTML/CSS, and data. Students are empowered to create authentic artifacts and engage with CS as a medium for creativity, communication, problem solving, and fun. This course uses Code.org's CS Discoveries Curriculum, for more details, please see the 2022-23 Curriculum Guide.

Content

The content covered in this year includes:

- Unit 4 - The Design Process
- Unit 5: Data and Society
- Unit 6: Physical Computing

Objectives

Upon completion of unit 4, students should be able to:

- See the design process as a form of problem solving that prioritizes the needs of a user.
- Identify user needs and assess how well different designs address them. In particular they know how to develop paper and digital prototypes, gather and respond to feedback about a prototype, and consider ways different user interfaces do or do not affect the usability of their apps.
- Understand other roles in software development, such as product management, marketing, design, and testing, and to use what they have learned as a tool for social impact.

Upon completion of unit 5, students should be able to:

- Describe the importance of data in solving problems and hypothesize how computers can help in this process.
- Analyze different systems used to represent information in a computer and identify the challenges and tradeoffs posed by using them.
- Explain how collections of data are used to solve problems, and how computers help to automate the steps of this process.
- Give Examples of how the data problem solving process can be applied to an area of your choosing.

Upon completion of unit 6, students should be able to:

- Examine the role of hardware platforms in computing and how different sensors can provide more effective input and output than the traditional keyboard, mouse, and monitor.

- Use App Lab and Adafruit's Circuit Playground, to develop programs that utilize the same hardware inputs and outputs that you see in the smart devices, looking at how a simple rough prototype can lead to a finished product.
- Use the Circuit Playground as the basis for an innovation of your own design.

Classroom Practices

The 6 Main Classroom Practices of CS Discoveries:

- Lead Learner
- Pair Programming
- Think-Pair-Share
- Authentic Choice
- Unplugged Activities
- Peer Feedback

Student Practices

Students in CS Discoveries work in a wide array of contexts, but these experiences are tied together by a core set of practices they develop throughout the course

- Problem Solving
- Persistence
- Creativity
- Collaboration
- Communication

LTO's D'TORCH (Truthful, Organized, Reflective, Courageous and Helpful)

In CS classes the categories of the D'TORCH most practiced and assessed are:

- Organized - Students utilize Google Classroom to edit, submit and keep track of their assignments.
- Reflective - Students will regularly write activity reflections in their online journal.
- Helpful - Students are empowered to ask for and provide explanations and give examples to help classmates through particularly difficult problems.

Class Expectations

- Come to class on time and be prepared
- Have a positive attitude and be willing to learn.
- Respect yourself, others, and our school.
- Always complete your work and try your best.
- Actively participate, listen carefully, but don't speak out of turn.
- All assignments must be completed.

Homework and Quiz Rules

- All assignments must be turned in on the day they are due.
- 1 day late = Maximum of only 60%
- 2+ days late = Project-I & Only 60%
- If a student has been absent, it is his/her duty to find out what work is due, and hand it in a day later.
- All assignments must satisfactorily be completed.
- If you are absent on the day of the quiz, you will only be able to get a maximum of 60%.

Classroom Rules

- All students are expected to follow the rules. Consequences will follow if rules are broken.
- Read and follow the standard school rules.
- Be on time and neatly dressed, in full school uniform.

- Speak in ENGLISH ONLY.
- Respect your teachers, fellow students and their property.
- Keep your seating space and classroom clean and neat.
- No eating or drinking in the ICT Labs.
- Ask permission to leave the class.
- Neither cheating nor copying in any form will be accepted. Anyone caught doing either during an activity, project or assessment will be given a zero.

Copying (plagiarism) is a serious offense and a form of theft. In certain cases, it is also a criminal offense. It is defined as taking words, phrasing, sentence structure, or any other element of the expression of another person's ideas, and using them as if they were your own. Plagiarism is a violation of another person's rights, whether the material stolen is great or small – it is not a matter of degree or intent. Plagiarism has serious consequences.
Any act of plagiarism will result in an automatic zero on the entire assignment.

Discipline

- Verbal warning
- Write-Up, entered into the discipline system and then referral to the Discipline Office.
- Parent-Teacher conference as required.

Links, tools and references:

- https://code.org/educate/csd
- https://developer.mozilla.org/en-US/docs/Learn
- https://www.w3schools.com/
- App Lab — A browser-based JavaScript programming environment for creating interactive apps, with the ability to freely switch between programming in blocks or text
- Maker Toolkit — A collection of commands that extends App Lab's capabilities to allow students to easily program the Circuit Playground and many other physical computing devices directly from App Lab
- Circuit Playground — Adafruit's new low-cost Arduino-based microcontroller featuring multiple integrated sensors and output devices

Schedule for Computer Science Discoveries, Design, Data and Physical Computing

(NB: Depending on time and interest, the teacher may delete and/or add other selections.)

Week / Date	Topic / Projects / Assessments
Week 1 **Aug 10th to 12th** **3 Days of Class** *10~ First Day / Orientation Day*	**The Design Process** The Design Process unit transitions students from thinking about computer science as a tool to solve their own problems towards considering the broader social impacts of computing. Through a series of design challenges, students are asked to consider and understand the needs of others while developing a solution to a problem. The second half of the unit consists of an iterative team project, during which students have the opportunity to identify a need that they care about, prototype solutions both on paper and in App Lab, and test their solutions with real users to get feedback and drive further iteration. **Lesson 1: Designing with Empathy** The class explores a variety of different shoe designs to consider design choices. Building on this, students explore the relationship between users, their needs, and the design of objects they use.
Week 2 **Aug 15th to 19th**	**Lesson 2: Understanding Your User** Using user profiles, students explore how different users might react to a variety of products.

Opening Mass	Role playing as a different person, each member of the class will get to experience designs through someone else's eyes. **Lesson 3: User-Centered Design - Define and Prepare** In small groups, students use the design process to come up with ideas for smart clothing. Today's lesson focuses on brainstorming users and ideas that will meet their needs. Over the course of both lessons, students will brainstorm ideas, identify users, and finally propose a design. This activity serves as the first of several opportunities for students to practice designing a solution for the needs of others.
Week 3 **Aug 22nd to 26th**	**Lesson 4: User-Centered Design - Try and Reflect** In small groups, students will use the design process to come up with ideas for smart clothing. Today's lesson focuses on creating a design and reflecting on how well it meets the needs of users. Over the course of both lessons, students will brainstorm ideas, identify users, and finally propose a design. This activity serves as the first of several opportunities for students to practice designing a solution for the needs of others. **Lesson 5: User Interfaces** In this lesson, students get to see how a paper prototype can be used to test and get feedback before writing any code. To help out a developer with their idea, the class tests and provides feedback on an app prototype made of paper.
Week 4 **Aug 29th to Sep 2nd**	**Lesson 6: Feedback and Testing** Users have been testing an app, and they have lots of feedback for the developer. The class needs to sort through all of this feedback, identify the common themes and needs, and start revising the prototype to make it better meet the users' needs. **Lesson 7: Identifying User Needs** In this lesson, the class begins thinking about designing their own paper prototype for an app that can solve a problem in our community. Using interviews from different users, students identify needs and interests that they can use to design an app for these people in their community.
Week 5 **Sep 5th to 9th** **4 Days of Class** *8~ Mass &Birthday Mother Mary* *9th – Moon Festival*	**Lesson 8: Project - Paper Prototype** Using the interview information from the previous lesson, students come up with app ideas to address the needs of their users. To express those ideas, and test out their effectiveness, students create and test paper prototypes.
Week 6 **Sep 12th to 16th** FYI – Pre-Exam Days	**Lesson 9: Designing Apps for Good** To kick off the app design project, the class organizes into teams and starts exploring app topics. Several examples of socially impactful apps serve as inspiration for the project. **Lesson 10: Market Research** In this lesson, the class dives into app development by exploring existing apps that may serve similar users. In groups, students will identify a handful of apps that address the same topic they are working on, and use those apps to help refine the app idea they will pursue.
Week 7 **Sep 19th to 23rd**	**Lesson 11: Exploring UI Elements** Paper prototypes allow developers to quickly test ideas before investing a lot of time writing code. In this lesson, teams explore some example apps created in App Lab and use these examples to help inform the first paper prototypes of their apps. **Lesson 12: Build a Paper Prototype** In teams, students will create a paper prototype for the app they've been developing. Each team member will create a different screen and design how the user will navigate between each screen.
Week 8 **Sep 26th to 30th** **2 Days of Class** *28-30 ~Teacher's Conference*	**Final Exam**
Week 9 **Oct 3rd to 7th** **3 Days of Class** *6-7 ~Q1 Exams*	**Lesson 13: Prototype Testing** In this lesson, teams test out their paper prototypes with other members of the class. As one student role plays as the computer, one narrates, and the rest observe, teams will get immediate feedback on their app designs, which will inform the next version of their app prototypes.

2nd QUARTER – TENTATIVE COURSE CONTENT

(NB: Depending on time and interest, the teacher may delete and/or add other selections.)	
Week / Date	Topic / Projects / Assessments
Week 1 (10) **Oct 10th to 14th** **4 Days of Class** *10 – Double 10 Holiday*	Lesson 14: Design Mode in App Lab Teams now move to App Lab to build the next iteration of their apps. This lesson focuses on how to use Design Mode in App Lab to create digital prototypes for their apps.
Week 2 (11) **Oct 17th to 21st**	**Lesson 15: Build a Digital Prototype** Using the drag-and-drop Design Mode, each team member builds out at least one page of their team's app, responding to the feedback received in the previous round of testing. **Lesson 16: Events in App Lab** Building on the previous lesson, we learn how to import new screens into our apps and link them together using buttons and events to complete the Recycle Finder app we started in an earlier lesson.
Week 3 (12) **Oct 24th to 28th** *25-27 – Book Fair* *28- Masquerade Night* *TBA-Holy Rosary Mass*	**Lesson 17: Linking Prototype Screens** Building on the screens that they designed in the previous lesson, teams combine screens into a single app. Simple code can then be added to make button clicks change to the appropriate screen. **Lesson 18: Testing the App** In this lesson, teams run another round of user testing with their interactive prototype. Feedback gathered from this round of testing will inform the final iteration of the digital prototype.
Week 4 (13) **Oct 31st to Nov 4th** *1-All Saint's Day Mass*	**Lesson 19: Bugs and Features** Teams analyze the feedback they received from the last round of testing and make a plan for how they would like to address it. Students categorize feedback as either a bug or a feature and decide which items are most important for improving their app. **Lesson 20: Updating Your Prototype** Using the feedback from the last round of testing, teams implement changes that address the needs of their users. Each team tracks and prioritizes the features they want to add and the bugs they need to fix.
Week 5 (14) **Nov 7th to 11th**	**Lesson 21: Project - App Presentation** Each team prepares a presentation to "pitch" the app they've developed. This is the time they can share the struggles, triumphs, and plans for the future.
Week 6 (15) **Nov 14th to 18th**	**Physical Computing** In the Physical Computing unit, students explore the role of physical devices in computing. Using App Lab and Adafruit's Circuit Playground, students develop programs that utilize the same hardware inputs and outputs that you see in the smart devices, looking at how a simple rough prototype can lead to a finished product. Then, students explore how physical devices can be used to react to the world around them using a "maker" mindset to create prototypes with everyday materials. **Lesson 1: Innovations in Computing** In this lesson, students explore a wide variety of new and innovative computing platforms while expanding their understanding of what a computer can be. **Lesson 2: The Circuit Playground** In this lesson students get their first opportunity to write programs that use the Circuit Playground. After first inspecting the board visually and hypothesizing possible functionalities, students move online where they will learn to write applications that control an LED and use a buzzer to make sounds. By combining App Lab screens with the Circuit Playgrounds, students can gradually start to integrate elements of the board as an output device while relying on App Lab for user input.
Week 7 (16) **Nov 21st to 25th** *25 - YSC Contest* *25-Gr.12 Q2 Exam*	**Lesson 3: Updating Screen Elements** Students should already be familiar with programming in App Lab, specifically using Design Mode to create screen elements and using onEvent blocks to create button click events. This lesson introduces the setProperty() and setText() blocks that allow users to change the properties and content of various UI elements. Students explore how they can use events to update elements on the screen

	Lesson 4: Board Events This lesson transitions students from considering the Circuit Playground as strictly an output device and instead introduces the buttons and toggle switches as tools for input. Starting with the hardware buttons and switch, students learn to use onBoardEvent(), analogously to onEvent(), in order to take input from their Circuit Playgrounds.
Week 8 (17) **Nov 28th to Dec 2nd** FYI – Pre-Exam Days *28-Gr.12 Q2 Exam*	**Lesson 5: Board Events** Using the hardware buttons and switch, students develop programs that use the Circuit Playground as an input. **Lesson 6: Variables and If Statements** In this lesson, students are introduced to variables, the counter pattern, and if-statements. Students will use these concepts in the context of programming the circuit playground and creating more complex input/output behaviors, such as counting the number of button presses before having the circuit playground make a noise. The concepts in this lesson are used to make more complex and fulfilling apps in future lessons, and students may need to refer back to the videos and examples in this lesson as they continue to master these concepts.
Week 9 (18) **Dec 5th to 9th** 8 - Foundation Day Celebrations	Q2 Final Exam
Week 10 (19) **Dec 12th to 16th** **3 Days of Class** *15-16 ~Q2 Exams*	**Review**
Dec 19th to Jan 2nd	**Christmas Break**

3rd QUARTER – TENTATIVE COURSE CONTENT

(NB: Depending on time and interest, the teacher may delete and/or add other selections.)

Week / Date	Topic / Projects / Assessments
Week 1 (20) **Jan 5 to 6th** **2 Days of Class**	**Lesson 7: Mini-Project - Field Collector App** In this mini-project, students will create an app that uses the Circuit Playground to collect data, then has an app to analyze the data that was collected. This is similar to citizen science fieldwork or survey apps that students may be familiar with. Students will use variables and events to collect data from the circuit playground, then use if-statements to make decisions or recommendations based on the data they collect.
Week 2 (21) **Jan 9th to 13th**	**Lesson 8: Color LEDs** In this lesson, students learn how to use the 10 color LEDs on the Circuit Playground. Students will control the color and intensity of each LED, then use what they have learned to program light patterns to create a light show on their Circuit Playground. **Lesson 9: Getting Screen Inputs** Students learn to use several new design elements - text inputs, dropdowns, and sliders - so they can get user input from the screen of their apps. This lesson also introduces the getProperty and getText blocks, which allow them to access their user input in their code. Students later use getProperty and setProperty together with the counter pattern to make elements move across the screen. A new event trigger, change, is also introduced to represent when a dropdown or slider changes values.
Week 3 (22) **Jan 16th to 20th**	**Lesson 10: Project: Human Device Interaction** In this project, students create an app that controls the Circuit Playground so it interacts with the physical environment around it, similar to many smartphone apps that are used to control devices in a house or car or school. Students use physical materials to help design their physical device, then create an app that lets the user interact with the physical device or change settings. **Lesson 11: Board Sensors** In this lesson, students explore how the three sensors (sound, light, and temperature) can be used to write programs that respond to changes in the environment. This marks a transition in terms of how users interact with a program. By using sensors as an input, the user of an app

	doesn't have to directly interact with it at all or may interact without actually realizing they are doing so.
Jan 23rd to 27th	**Chinese New Year**
Week 4 (23) **Jan 30th to Feb 3rd**	**Lesson 12: Accelerometer** In this lesson, students will explore the accelerometer and its capabilities. They'll become familiar with its events and properties, as well as create multiple programs utilizing the accelerometer similar to those they've likely come across in real world applications. **Lesson 13: Making Music** In this lesson students will use the buzzer to its full extent by producing sounds, notes, and songs with the buzzer. Students start with a short review of the buzzer's frequency and duration parameters, then move on to the concept of notes. Once students are able to play notes on the buzzer, they use arrays to hold and play sequences of notes, forming simple songs.
Week 5 (24) **Feb 6th to 10th**	**Lesson 14: Functions** This lesson introduces students to functions as a way to organize and group repeated blocks of code together, such as changing all of the LEDs to red or blue. Then, students learn how to use parameters in their functions as a way to generalize behaviors to work for different contexts - for example, changing all the LEDs to a certain color rather than always changing them red or blue. **Lesson 15: Mini-Project - Interactive Art** In this lesson, students create a piece of interactive artwork using the sensors on the Circuit Playground and physical materials. Students explore how the Circuit Playground can augment physical materials to create an interactive experience. This project does not use the App Lab screen except to help with debugging - otherwise, users only interact with the physical artwork itself.
Week 6 (25) **Feb 13th to 17th**	**Lesson 16: Physical Outputs and LEDs** In this lesson, students learn how to attach external LEDs to their circuit playground and use code to light up these LEDs. This allows students to create more flexible devices that mimic real-world products. This lesson requires several external materials, as well as safety protocols to ensure students don't accidentally damage their circuit playground. **Lesson 17: Physical Inputs and Buttons** In this lesson, students learn how to connect external wires to create input events when the wires touch, simulating a button press. Students learn to use code to recognize these external button events to make changes to their app. This allows students to create more flexible devices that mimic real-world products. This lesson requires several external materials, as well as safety protocols to ensure students don't accidentally damage their circuit playground.
Week 7 (26) **Feb 20th to 24th** *20-24 ~IOWA* *22 ~ Ash Wednesday Mass* *21-23 ~ Pre-Exam Days*	**Lesson 18: Project - Prototype an Innovation** In this final project for the course, students team to develop and test a prototype for an innovative computing device based on the Circuit Playground. Using the inputs and outputs available on the board, groups will create programs that allow for interesting and unique user interactions.
Week 8 (27) **Feb 27th to March3rd** **3 Days of Class** 27-28 ~ 228 Memorial Day Holiday	**Final Exam**
Week 9 (28) **March 6th to 10th** **4 Days of Class** *11 – Q3 Exams*	**Lesson 18: Project - Prototype an Innovation, Continued** In this final project for the course, students team to develop and test a prototype for an innovative computing device based on the Circuit Playground. Using the inputs and outputs available on the board, groups will create programs that allow for interesting and unique user interactions.

4th QUARTER – TENTATIVE COURSE CONTENT

(NB: Depending on time and interest, the teacher may delete and/or add other selections.)	
Week / Date	Topic / Projects / Assessments

Week 1 (29) **March 13th to 17th** **4 Days of Class** *13 – Q3 Exams* *14~ Q4 Begins*	**Data and Society** The Data and Society unit is about the importance of using data to solve problems and it highlights how computers can help in this process. The first chapter explores different systems used to represent information in a computer and the challenges and tradeoffs posed by using them. In the second chapter, students learn how collections of data are used to solve problems, and how computers help to automate the steps of this process. In the final project, students gather their own data and use it to develop an automated solution to a problem. **Lesson 1: Representation Matters** This first lesson provides an overview of what data is and how it is used to solve problems. Groups use a data set to make a series of meal recommendations for people with various criteria. Afterward, groups compare their responses and discuss how the different representations of the meal data affected how they were able to solve the different problems.
Week 2 (30) **March 20th to 24th** *20 ~ Fire Drill*	**Lesson 2: Patterns and Representation** This lesson looks closer at what is needed to create a system of representation. Groups create systems that can represent any letter in the alphabet using only a single stack of cards. They then create messages with their systems and exchange with other groups to ensure the system works as intended. Finally, the class discusses commonalities between working systems while recognizing that there are many possible working solutions. **Lesson 3: ASCII and Binary Representation** This lesson introduces students to a formal binary system for encoding information: the ASCII system for representing letters and other characters. At the beginning of the lesson, the teacher introduces the fact that computers must represent information using either "on" or "off." The class then learns about the ASCII system for representing text using binary symbols and practices using this system. Finally, they encode their own messages using ASCII.
Week 3 (31) **March 27th to 31st**	**Lesson 4: Representing Images** This lesson continues the study of binary representation systems, this time with images. The class is introduced to the concept of splitting images into squares or "pixels," which can then be turned on or off individually to make an entire image. After doing a short set of challenges using the Pixelation Widget, students make connections between the system for representing images and the ASCII system for representing text that they learned about in the previous lesson. **Lesson 5: Representing Numbers** This lesson introduces students to the binary number system. With a set of cards that represent the place values in a binary (base-2) number system, the class turns bits "on" or "off" by turning cards face up and face down, then observes the numbers that result from these different patterns. Eventually, the pattern is extended to a generic 4-bit system.
Apr 3rd to 14th	**Easter Break**
Week 4 (33) **Apr 17th to 21st**	**Lesson 6: Combining Representations** This lesson combines all three types of binary representation systems (ASCII characters, binary numbers, and images) to explore ways to encode more complex types of information in a record. After seeing a series of bits and being asked to decode them, students are introduced to the idea that understanding binary information requires an understanding of both the system that is being used, and the meaning of the information encoded. **Lesson 7: Keeping Data Secret** Students continue to explore how data is represented in a punch card, and begin considering whether some data should be protected from public view because it is too personal or sensitive. Once students understand the reasons for protecting data, they learn a binary encryption system that lets them encrypt and decrypt data in their punch cards.
Week 5 (34) **Apr 24th to 28th** 24-28 ~ AP Mock Exams	**Lesson 8: Project - Create a Representation** The class designs structures to represent their perfect day using the binary representation systems they've learned in this chapter. After deciding which pieces of information the record should capture, students decide how a punch card of bytes of information will be interpreted to represent those pieces of information. Afterwards, they use the ASCII, binary number, and image formats they have learned to represent their perfect days and try to decipher what a partner's perfect day is like. **Lesson 9: Problem Solving and Data**

	This lesson covers how the problem solving process can be tailored to deal with data problems. The class is tasked with deciding what a city most needs to spend resources on. They must find and use data from the internet to support their decision.
Week 6 (35) **May 1st to 5th** *2-4~ Pre-Exam* *1-5~ Final Exams (K, 5, 8, 12 only)* *1-5 ~ AP Exams*	**Lesson 10: Structuring Data** This lesson goes further into the interpretation of data, including how to clean and visualize raw data sets. The class first looks at how presenting data in different ways can help people to understand it better. After seeing how cleaning and visualization can help people make better decisions, students look at which parts of this process can be automated, and which parts need a human. **Lesson 11: Interpreting Data** Students look at a cake preference survey and discuss how knowing the relationship between cake and icing preference helps them better decide which combination to recommend. Students are then introduced to cross tabulation, which allows them to graph relationships to different preferences. They use this technique to find relationships in a preference survey, then brainstorm the different types of problems that this process could help solve.
Week 7 (36) **May 8th to 12th** *8-12~ Final Exams(K, 5, 8, 12 only)* *1-5 ~ AP Exams*	**Lesson 12: Making Decisions with Data** This lesson gives students a chance to practice the data problem solving process introduced in the last lesson. Not all questions have right answers, and in some cases the class can and should decide that they need to collect more data. The lesson concludes with a discussion about how different people could draw different conclusions from the same data, and how collecting different data might have affected the decisions they made.
Week 8 (37) **May 15th to 19th** **3 Days of Class** *18-19~ Q4 Exams*	Q4 Exam
Week 9 (38) **May 22nd to 26th** **4 Days of Class** *22~ Record Day* *23-26 ~ Student Clearance*	Clearance
Week 10 (39) **May 29th to June 2nd** **4 Days of Class** *1 ~ Students Last Day* *2~ Teachers/Staff Meeting*	Last day

The end ~ Have a great summer ☺