

2017

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CollegeBoard

AP Computer Science Principles

Sample Student Responses and Scoring Commentary

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Student Samples provided separately

AP[®] COMPUTER SCIENCE PRINCIPLES 2017 SCORING GUIDELINES

Performance Task: Create — Applications from Ideas

CONTENT AREA & WEIGHTING	PERFORMANCE QUALITY		
	LOW	MEDIUM	HIGH
<p>1: Developing a Program with a Purpose</p> <p>Submission Requirement: 1; 2a</p> <p>LO: 5.1.1; OR 5.1.2; 5.4.1</p> <p>Weighted: 20%</p>	<p>The video demonstrates the running of at least one feature of the program.</p> <p style="text-align: center;">OR</p> <p>The written response or video narration summarizes what the video illustrates, without clearly identifying the program's purpose.</p>	<p>The video demonstrates the running of at least one feature of the program.</p> <p style="text-align: center;">AND</p> <p>The written response or video narration summarizes what the video illustrates, without clearly identifying the program's purpose.</p>	<p>The video demonstrates the running of at least one feature of the program that illustrates the program's intended purpose as described in the written response or the video narration.</p>
<p>2: Developing a Program with a Purpose</p> <p>Submission Requirement: 2b</p> <p>LO: 5.1.1; OR 5.1.2</p> <p>Weighted: 20%</p>	<p>The response identifies the steps in the development of the program in at least one point.</p> <p style="text-align: center;">AND</p> <p>The response must identify at least one point in the development of the program that was completed independently.</p>	<p>The response describes a difficulty and an opportunity encountered (or two difficulties or two opportunities) at two points in the development of the program.</p> <p style="text-align: center;">AND</p> <p>The response must identify at least one point in the development of the program that was completed independently.</p>	<p>The response describes a difficulty and an opportunity encountered (or two difficulties or two opportunities) at two points in the development of the program.</p> <p style="text-align: center;">AND</p> <p>The response describes how each of the difficulties and/or opportunities were resolved and incorporated as part of an incremental and iterative development process.</p> <p style="text-align: center;">AND</p> <p>The response must identify at least one point in the development of the program that was completed independently.</p>
<p>3: Applying Algorithms</p> <p>Submission Requirement: 2c</p> <p>LO: 4.1.1; 4.1.2; 5.2.1; 5.5.1</p> <p>Weighted: 30%</p>	<p>The selected algorithm is a commonly used algorithm and integrates mathematical and/or logical concepts.</p> <p style="text-align: center;">AND</p> <p>The response provides a general description of the algorithm OR a correct line-by-line summary of the algorithm.</p> <p>*If needed, more than one area of the program code can be selected as part of the response to describe the algorithm.</p>	<p>The selected algorithm integrates two or more commonly used or new algorithms and integrates mathematical and/or logical concepts to create a new algorithm.</p> <p style="text-align: center;">AND</p> <p>The response identifies the algorithm's purpose in the program and accurately describes with specificity how the algorithm achieves this purpose.</p> <p>*If needed, more than one area of the program code can be selected as part of the response to describe the algorithm.</p>	<p>The selected algorithm integrates two or more commonly used or new algorithms, and integrates mathematical and/or logical concepts to create a new algorithm.</p> <p style="text-align: center;">AND</p> <p>The response identifies the algorithm's purpose in the program and accurately describes with specificity how the algorithm achieves this purpose.</p> <p style="text-align: center;">AND</p> <p>The response accurately describes how two of the algorithms function independently as well as in combination to create a new algorithm.</p> <p>*If needed, more than one area of the program code can be selected as part of the response to describe the algorithm.</p>
<p>4: Applying Abstraction</p> <p>Submission Requirement: 2d</p> <p>LO: 2.2.1; 5.3.1</p> <p>Weighted: 30%</p>	<p>The selected abstraction includes mathematical and/or logical concepts and serves to manage complexity of the program.</p> <p style="text-align: center;">AND</p> <p>The response indicates that an abstraction was developed and provides a general description or summary of the purpose the abstraction.</p> <p>*If needed, more than one area of the program code can be selected as part of the response to describe the abstraction.</p>	<p>The selected abstraction integrates mathematical and/or logical concepts and serves to manage complexity of the program.</p> <p style="text-align: center;">AND</p> <p>The response indicates that an abstraction was developed and provides an accurate description with specificity of the purpose of the abstraction.</p> <p>*When necessary, the response should include descriptions of a list(s) or procedure(s), and explains any use of parameters and return values in the abstraction.</p> <p>**If needed, more than one area of the program code can be selected as part of the response to describe the abstraction.</p>	<p>The selected abstraction integrates mathematical and/or logical concepts and serves to manage complexity of the program.</p> <p style="text-align: center;">AND</p> <p>The response indicates that an abstraction was developed and provides an accurate description with specificity of the purpose of the abstraction.</p> <p style="text-align: center;">AND</p> <p>The response explains how the abstraction manages complexity of the program due to the inclusion of the abstraction in the program or explains how the program would function without the abstraction.</p> <p>*When necessary, the response should include descriptions of a list(s) or procedure(s), and explains any use of parameters and return values in the abstraction.</p> <p>**If needed, more than one area of the program code can be selected as part of the response to describe the abstraction.</p>

A program that uses a **code segment(s)** written by someone else without citation or reference is considered plagiarized work. The work should be returned to the student to add the necessary citations or references before submitting it to College Board.

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Performance Task: Create — Applications from Ideas

Scoring Notes

Row		Low	Medium	High
Developing a Program with a Purpose Submission Requirements: 1, 2a	Criteria	The video demonstrates the running of at least one feature of the program. OR The written response or video narration summarizes what the video illustrates, without clearly identifying the program’s purpose.	The video demonstrates the running of at least one feature of the program. AND The written response or video narration summarizes what the video illustrates, without clearly identifying the program’s purpose.	The video demonstrates the running of at least one feature of the program that illustrates the program’s intended purpose as described in the written response or the video narration.
	General Scoring Notes for All criteria	<ul style="list-style-type: none"> There MUST be a video, and it should demonstrate the continuous running of the program. (A video consisting of a series of individual screen shots is not acceptable and will receive a 0.) Where written responses or video narration are provided (med and high), program purpose must be clearly described to obtain a HIGH. 		
	Scoring Notes	VIDEO DEMOS FEATURE	VIDEO DEMOS FEATURE and NARR WR SUMMARIZES VIDEO (BUT NO PROGRAM PURPOSE)	VIDEO DEMOS FEATURE and NARR WR SUMMARIZES VIDEO CLEARLY IDENTIFIES PURPOSE
Row		Low	Medium	High
Developing a Program with a Purpose Submission Requirements: 2b	Criteria	The response identifies the steps in the development of the program in at least one point. AND The response must identify at least one point in the development of the program that was completed independently.	The response describes a difficulty and an opportunity encountered (or two difficulties or two opportunities) at two points in the development of the program. AND The response must identify at least one point in the development of the program that was completed independently.	The response describes a difficulty and an opportunity encountered (or two difficulties or two opportunities) at two points in the development of the program. AND The response describes how each of the difficulties and /or opportunities were resolved and incorporated as part of an incremental and iterative development process. AND The response must identify at least one point in the development of the program that was completed independently.
	General Scoring Notes for ALL Criteria	<p>Note that each scoring criteria states that the response must identify at least one point in the development of the program that was completed independently.</p> <p>To be considered independent work:</p> <ul style="list-style-type: none"> States their portion of work was done independently. Uses at least one “I” statement instead of all “we” statements Resolution may include explicit decision to drop/delete the feature “I fixed it”, “I found it in documentation” without explanation does not receive credit; technical “how” required ZERO unless one independent development step which is required to be any step in the software design process (design, interface, programming, debugging, etc.) 		
	Scoring Notes	1 INDEP DEV STEP	1 INDEP DEV STEP and 2 DECISION POINTS BUT NOT 2 RESOLUTIONS	1 INDEP DEV STEP and 2 DECISION POINTS EACH WITH RESOLUTION

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Performance Task: Create — Applications from Ideas

Scoring Notes

Row		Low	Medium	High
Applying Algorithms Submission Requirement: 2C	Criteria	The selected algorithm is a commonly used algorithm and-integrates mathematical and/or logical concepts. AND The response provides a general description of the algorithm OR a correct line-by-line summary of the algorithm.	The selected algorithm integrates two or more commonly used or new algorithms and integrates mathematical and/or logical concepts to create a new algorithm. AND The response identifies the algorithm’s purpose in the program and accurately describes with specificity how the algorithm achieves this purpose.	The selected algorithm integrates two or more commonly used or new algorithms and integrates mathematical and / or logical concepts to create a new algorithm. AND The response identifies the algorithm’s purpose in the program and accurately describes with specificity how the algorithm achieves this purpose. AND The response accurately describes how two of the algorithms function independently as well as in combination to create a new algorithm.
	General Scoring Notes for ALL rows	<ul style="list-style-type: none"> • ZERO if NONE of the algorithms contains MATH or LOGIC (e.g., only sequences of statements) • If needed, more than one area of the program code can be selected as part of the response to describe the algorithm(s). • The written response is used to aid in understanding the algorithm(s). • For HIGH, note that the instructions ask for the selection of an algorithm that utilizes at least two other algorithms. The selected algorithm must be described with specificity, but the utilized algorithms can be more briefly described. The selected algorithm description must include a description of how the utilized algorithms are integrated. 		
	Scoring Notes	MINIMUM OF 1 ALG and GEN DESCRIPTION [HOW OR WHAT] OF ALG or LINE-BY-LINE SUMMARY	SELECTED ALG INTEGRATES 2+ UTILIZED ALGS and IDENTIFIES PURPOSE OF SELECTED and SPECIFICALLY DESCRIBES HOW SELECTED WORKS	SELECTED ALG INTEGRATES 2+ UTILIZED ALGS and IDENTIFIES PURPOSE OF SELECTED and SPECIFICALLY DESCRIBES HOW SELECTED WORKS and DESCRIBES HOW UTILIZED ALGS WORK INDEP and DESCRIBES HOW UTILIZED ALGS COMBINE TO MAKE SELECTED ALG
Row		Low	Medium	High
Applying Abstraction Submission Requirements: 2d	Criteria	The selected abstraction includes mathematical and/or logical concepts and serves to manage complexity of the program. AND The response indicates that an abstraction was developed and provides a general description or summary of the purpose of the abstraction.	The selected abstraction includes mathematical and/or logical concepts and serves to manage complexity of the program. AND The response indicates that an abstraction was developed and provides an accurate description with specificity of the purpose of the abstraction.	The selected abstraction includes mathematical and/or logical concepts and serves to manage complexity of the program. AND The response indicates that an abstraction was developed and provides an accurate description with specificity of the purpose of the abstraction. AND The response explains how the abstraction manages complexity of the program due to the inclusion of the abstraction in the program or explains how the program would function without the abstraction.
	General Scoring Notes for ALL rows	<ul style="list-style-type: none"> • ZERO if selected abstraction is a variable, existing control structure (ex. loop, if stmt, sequence), or event-handler widget. • If needed, more than one area of the program code can be selected as part of the response to describe the abstraction. • HIGH requires the DESCRIPTION of how the selected abstraction functions and how the abstraction contributes to managing complexity. • When necessary, the response should include descriptions of a list(s) or procedure(s), and explains any use of parameters and return values in the abstraction. • Abstraction needs to be substantially developed by the student. • The 1st criteria refers to the code, and the 2nd (and 3rd) criteria deal with the written response. Readers should look at the response to aid understanding the abstraction. 		
	Scoring Notes	STUDENT-CREATED ABS ID’D and PURPOSE GENERALLY DESCRIBED (e.g., LINE-BY-LINE)	STUDENT-CREATED ABS ID’D and PURPOSE SPECIFICALLY DESCRIBED	STUDENT-CREATED ABS ID’D and PURPOSE SPECIFICALLY DESCRIBED and COMPLEXITY MANAGEMENT DESCRIBED

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Create Performance Task

Sample: A

1 Video Score: High

2 Program Code Development Score: High

3 Algorithms Purpose and Function Score: High

4 Abstraction Purpose Complexity Score: High

Developing a Program with a Purpose — Row 1

The response earned a HIGH score for this row because the video demonstrates how to log in, review, and add entries to the personal diary. The response indicates that keeping a personal diary is the purpose of this program.

Developing a Program with a Purpose — Row 2

The response earned a HIGH score for this row because it describes two difficulties that were encountered and how these were resolved in a process approach. These difficulties are resolved independently. The first difficulty is that when including a third Firebase database, the program could no longer be packaged or loaded onto a device for testing. This is resolved by deleting portions of the code until the app worked, and then adding back in the deleted portions. The second difficulty is transferring variables across screens. This is resolved by using the visible property of these arrangements to make them appear and disappear, providing the illusions of multiple screens.

Applying Algorithms — Row 3

The response earned a HIGH score for this row because the two algorithms that are presented (login and createAccount procedures) are integrated to create a new, main algorithm (account access). The main algorithm (account access) is described as handling “all data retrieved from the account database such as users and passwords” and specifically explains the use of Firebase to manage the data. The response goes on to describe the login and createAccount procedures function independently as well as in combination to create the account access algorithm.

Applying Abstraction — Row 4

The response earned a HIGH score for this row because the abstraction being described is a procedure with a parameter that loads user entry data. The description of this procedure indicates that the procedure is used to populate a list of user entries and is called multiple times throughout the program. The response indicates that this abstraction reduces redundancy, improves the readability, and manages complexity as changes can be done in a single place.

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Create Performance Task

Sample: B

1 Video Score: High

2 Program Code Development Score: High

3 Algorithms Purpose and Function Score: High

4 Abstraction Purpose Complexity Score: High

Developing a Program with a Purpose — Row 1

This response earned a HIGH score for this row because the provided video demonstrates continuously running code, and the purpose and functional operation of the game is described. (“This program is a strategical domination game written in Snap!. The purpose of the program is to have the user plan placement and attacks to ultimately take over every cell and win the game”)

Developing a Program with a Purpose — Row 2

This response earned a HIGH score for this row because a process approach to addressing two difficulties is provided, along with resolution for each difficulty. At least one of the difficulties is addressed independently. The first difficulty is how to randomly place wasps in cells without overlapping. This resolved overlapping wasp placement by placing subsequent wasp placement underneath original wasps. This is resolved collaboratively after first considering using a list of coordinates, and finally adjusting the y-coordinate. The second difficulty is determining a winner and replacing the bees/wasps. This difficulty is resolved independently by a swap algorithm that removed “ownership” of a cell from one opponent and gave it to the other opponent.

Applying Algorithms — Row 3

This response earned a HIGH score for this row because the selected algorithm (one that chooses a valid attack location) is described in detail, and two utilized algorithms (one that performs a sequential search across wasp-occupied cells, and one that performs a sequential search across all wasp neighbor cells and looks for particular cells) are described that are integrated by the parent complex algorithm. Furthermore, the student describes how each utilized algorithm would work independently when the student indicates they are both sequential search algorithms, but different in context.

Applying Abstraction — Row 4

This response earned a HIGH score for this row because it clearly identifies an abstraction as the process of replacing wasps with bees which has been made into a block. The response indicates this abstraction manages complexity by hiding the long list of coordinates and coding used to execute the tasks. The response further explains that these blocks contain the 25 lines of code which keeps the main code clear and easy to debug.

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Create Performance Task

Sample: C

1 Video Score: High

2 Program Code Development Score: High

3 Algorithms Purpose and Function Score: High

4 Abstraction Purpose Complexity Score: High

Developing a Program with a Purpose — Row 1

The response earned a HIGH score for this row because the video demonstrates two adventures in the adventure game. The response indicates that the purpose of this program is to create a fun and interactive adventure game.

Developing a Program with a Purpose — Row 2

The response earned a HIGH score for this row because it describes two difficulties that were encountered and how these were resolved. Though the difficulties are similar the solutions were slightly different. The first difficulty is with the carrying of inputs to a different screen. This is resolved by using a global variable instead of a local variable. The second difficulty is the moving of the user's character between screens. This is resolved by using a variable and an if statement to set the image of the user's character throughout the program. The work was done independently.

Applying Algorithms — Row 3

The response earned a HIGH score for this row because at least two algorithms are integrated using the `didWinUnderwater` procedure. The response describes the two separate algorithms that run the treasure and scale games as well as explains specifically how they each work. The response goes on to explain the integration of the two algorithms after winning either game. That is, clicking the continue button calls the `didWinUnderwater` procedure to check if the user won the games.

Applying Abstraction — Row 4

The response earned a HIGH score for this row because the abstraction being described is a procedure `setUpBlastOff` that calls three additional procedures. The response explains that this is an abstraction because it makes the code more manageable and reduces the number of lines of code because `setUpBlastOff` is called multiple times in the program.

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Create Performance Task

Sample: D

1 Video Score: High

2 Program Code Development Score: High

3 Algorithms Purpose and Function Score: High

4 Abstraction Purpose Complexity Score: High

Developing a Program with a Purpose — Row 1

The response earned a HIGH score for this row because the video demonstrates the major feature of the program, which is an attack system (including how to attack and earn EXP). The response indicates that this program is intended to be a turn-based game where players progress through levels by gaining EXP.

Developing a Program with a Purpose — Row 2

The response earned a HIGH score for this row because two difficulties are encountered and the response describes how both were corrected independently. One difficulty described in the response is how to unlock levels when a certain amount of EXP is reached. This is resolved by creating a function that checks to see if the EXP has reached the highest level. Another difficulty described is the tracking of the health of the enemy. This is resolved by using a variable and a function to update the variable accordingly.

Applying Algorithms — Row 3

The response earned a HIGH score for this row because there are two algorithms (playerAttack and enemyAttack) that are presented and those algorithms are integrated into a new algorithm. The purpose of the main algorithm is described as being able to run the attack functions for the program. The response goes on to specifically describe the purpose and how the playerAttack and enemyAttack work independently and together.

Applying Abstraction — Row 4

The response earned a HIGH score for this row because the abstraction being described is a procedure that is used to unlock the next level in the program. This procedure is described as being used to simplify code and manage complexity by simplifying the code so that the levelUnlock procedure can be called when the EXP requirements need to be checked for every level.

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Create Performance Task

Sample: E

1 Video Score: High

2 Program Code Development Score: Medium

3 Algorithms Purpose and Function Score: Low

4 Abstraction Purpose Complexity Score: High

Developing a Program with a Purpose — Row 1

The response earned a HIGH score for this row because at the end of the video it shows the program running when the user clicks on the block of code in the development environment; and the response describes the feature's purpose and functionality.

Developing a Program with a Purpose — Row 2

The response earned a MEDIUM score for this row because two difficulties are described, but only one resolution is described. The first difficulty is how to create a new list from an initial list. The response indicates that this was resolved collaboratively, but it does not explain how it is resolved. The second difficulty is how to take items from one list, use this data, and add to a second list. This is resolved independently by using "replace" to add items to the second list.

Applying Algorithms — Row 3

The response earned a LOW score for this row because the response only identifies and describes one algorithm to set the individual player's score.

Applying Abstraction — Row 4

The response earned a HIGH score for this row because the response indicates that blocks were made for algorithms for time, ran, place, and seconds. The response describes the abstraction with specificity and explains how this inclusion manages complexity by allowing for the diagnosis of a problem without having to look through the code in its entirety.

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Create Performance Task

Sample: F

1 Video Score: High

2 Program Code Development Score: High

3 Algorithms Purpose and Function Score: Low

4 Abstraction Purpose Complexity Score: Zero

Developing a Program with a Purpose — Row 1

This response earned a HIGH score for this row because the video demonstrates the continuous running of a chemistry experiment's program and shows the feature of a slime experiment. The response matches the video and describes the purpose as being a chemistry program that children can understand and have fun with.

Developing a Program with a Purpose — Row 2

This response earned a HIGH score for this row because two difficulties are identified, resolutions are provided for both, and at least one is done independently.

Applying Algorithms — Row 3

This response earned a LOW score for this row because only one algorithm is identified.

Applying Abstraction — Row 4

This response earned a ZERO score for this row because no mathematical or logical concepts are present.

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Create Performance Task

Sample: G

1 Video Score: High

2 Program Code Development Score: High

3 Algorithms Purpose and Function Score: Low

4 Abstraction Purpose Complexity Score: Zero

Developing a Program with a Purpose — Row 1

This response earned a HIGH score for this row because the provided video demonstrates continuous running code and provides a summary of the program's intended purpose (which the response identified as "An Adaptable Inventory Management System.")

Developing a Program with a Purpose — Row 2

This response earned a HIGH score for this row because two difficulties along with resolution are identified in a process manner. The first difficulty is identified as how to save passwords. This is resolved by using text file. The second difficulty is how to provide a level of security for stored passwords (and prompts.) This is resolved by including encryption. Note that this response includes more than 2 examples. These difficulties are resolved independently because the response uses "I" statements.

Applying Algorithms — Row 3

This response earned a LOW score for this row because the response does not describe an overriding complex algorithm that includes two integrated algorithms. The response refers to a "main algorithm" but the code for "main" is neither included nor described. Moreover, the two "child" algorithms are the same algorithm, simply reversing the two utilized arrays.

Applying Abstraction — Row 4

This response earned a ZERO score for this row because the response is a section of code, but not an identified created abstraction.

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Create Performance Task

Sample: H

1 Video Score: High

2 Program Code Development Score: Low

3 Algorithms Purpose and Function Score: Low

4 Abstraction Purpose Complexity Score: High

Developing a Program with a Purpose — Row 1

This response earned a HIGH score for this row because the video is a continuous running of the program. The written response matches

Developing a Program with a Purpose — Row 2

This response earned a LOW score for this row because only one difficulty and resolution is described. The other difficulty is related to the brainstorming process and not the development of the program code. The difficulty described is with the scoring system. It is resolved independently by creating the ECV function which takes the score value as a parameter and increasing it.

Applying Algorithms — Row 3

This response earned a LOW score for this row because only one algorithm is described with a general summary.

Applying Abstraction — Row 4

This response earned a HIGH score for this row because the selected student-developed abstraction is the ECV() function that contains math. The response goes on to describe the purpose of the abstraction and explains that it manages complexity by eliminating the need for rewriting the same code over and over.

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Create Performance Task

Sample: I

1 Video Score: High

2 Program Code Development Score: Zero

3 Algorithms Purpose and Function Score: Zero

4 Abstraction Purpose Complexity Score: Zero

Developing a Program with a Purpose — Row 1

This response earned a HIGH score for this row because the provided video shows continuous operation and the purpose of the feature is identified (as “helping the user to learn French words for common colors.”)

Developing a Program with a Purpose — Row 2

This response earned a ZERO score for this row because the described difficulties are encountered during video capture for the artifact submission, NOT during program development.

Applying Algorithms — Row 3

This response earned a ZERO score for this row because no algorithm is identified or described. Instead, the response simply lists several tasks that were completed, chosen from both programming the application as well as during video capture.

Applying Abstraction — Row 4

This response earned a ZERO score for this row because no student-developed abstraction was identified, nor any management of complexity addressed.

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Create Performance Task

Sample: J

1 Video Score: High

2 Program Code Development Score: Low

3 Algorithms Purpose and Function Score: Low

4 Abstraction Purpose Complexity Score: Low

Developing a Program with a Purpose — Row 1

This response earned a HIGH score for this row because the video demonstrates the flipping of the cards and random card placement. The written response matches the video and indicates that the purpose of the program overall is to be a memory game with matching of cards.

Developing a Program with a Purpose — Row 2

This response earned a LOW score for this row because it only describes one difficulty and one resolution. The response describes the process and indicates that the process was completed independently. The one difficulty described in the response is with making the color dots random. It is resolved by storing the cards in an array.

Applying Algorithms — Row 3

This response earned a LOW score for this row because although there at least two algorithms integrated into the drawCard algorithm, the response does not explain how the algorithms work.

Applying Abstraction — Row 4

This response earned a LOW score for this row because the abstraction for the drawing board is generally described.