

SE 3XA3: Module Interface Specification

Mini-Arcade

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Table 1: **Revision History**

Date	Version	Notes
3/9/2020	1.0	Arshan and Andrew created document and sections
3/11/2020	1.1	Andrew completed all modules relevant to Maze
3/12/2020	1.2	Arshan updated all modules relevant to Pong
3/12/2020	1.3	William completed modules relevant to launcher and scoreboard.
3/13/2020	1.4	Jame completed modules relevant to Flappy
4/2/2020	1.5	Andrew Revision 1

Level 1	Level 2
Hardware-Hiding Module	
Behaviour-Hiding Module	Launcher Modules Scoreboard Modules Draw Game (Maze) Player Movement (Maze) Menu and Settings (Maze) Draw Game (Pong) Player Movement (Pong) Menu and Settings (Pong) Draw Game (Flappy) Player Movement (Flappy) Menu and Settings (Flappy)
Software Decision-Hiding Module	Maze Generator (Maze) Score Tracking (Maze) Ball Trajectory (Pong) Score Tracking (Pong) Map Generator (Flappy) Score Tracking (Flappy)

Table 2: Module Hierarchy

1 MIS of Launcher Module

1.1 Interface Syntax

1.1.1 Exported Access Programs

Name	In	Out	Exceptions
displayLauncher	-	GUI	-
launchGame	integer	-	-
launchScoreboard	-	-	-

1.2 Interface Semantics

1.2.1 State Variables

None

1.2.2 Assumptions

None

1.2.3 Access Program Semantics

displayLauncher():

Input: None

Transition: draws the launcher to the output window and display it.

Output: the launcher's UI to the screen.

Exceptions: None

launchGame(gameID):

Input: integer representing the game to be launched

Transition: call the drawInterface function of the mini-game (depending on the input integer).

Output: None

Exceptions: None

launchScoreboard():

Input: None

Transition: call the drawScoreboard function of the scoreboard.

Output: None

Exceptions: None

2 MIS of Scoreboard Module

2.1 Interface Syntax

2.1.1 Exported Access Programs

Name	In	Out	Exceptions
drawScoreboard	String	GUI	-
changeGame	integer	-	-
exitScoreBoard	-	-	-
readData	-	-	FileNotFound, FileCannotRead
writeData	-	FileSystem	FileCannotWrite
updateScore	String, integer	-	-
highScore	String	integer	-

2.2 Interface Semantics

2.2.1 State Variables

displayGame: integer - representing the game the scoreboard will be displayed for.

exitScreen: integer - which screen will it display when it exits.

scores: array of arrays of integer - each array stores high scores of a game in descending order.

2.2.2 Assumptions

The input to each function (integers) are in appropriate range.

2.2.3 Access Program Semantics

drawScoreboard(gameName):

Input: string representing which screen was displayed before scoreboard.

Transition: set the value of exitScreen depending on gameName, and draws the scoreboard to the output window and display it,

Output: the scoreboard's UI to the screen.

Exceptions: None

changeGame(gameID):

Input: integer representing the game the scoreboard is displayed for.

Transition: Change the value of displayGame to the value of gameID.

Output: None

Exceptions: None

exitScoreboard():

Input: None

Transition: call the appropriate draw function (such as displayLauncher, or drawInterface of a minigame) depending on the exitScreen variable.

Output: None

Exceptions: None

readData():

Input: None

Transition: reads data for a dedicated file and store them in scores.

Output: None

Exceptions: FileNotFoundException - cannot find the file to be read, FileCannotRead - unable to read the file

writeData():

Input: None

Transition: write the values in scores to a dedicated file.

Output: the dedicated file to file system of the computer.

Exceptions: FileCannotWrite - unable to write to file

updateScore(game, score):

Input: string representing which game the score is from, integer representing the score to be updated.

Transition: search for the first element in the appropriate array in scores(depending on the value of game) that is smaller than score, if not found, do nothing. Otherwise, save the score into that location in the array and move every value starting at that position to the next index.

Output: None

Exceptions: None

highScore(game):

Input: string representing a mini-game

Transition: Return the highest score of the inputted mini-game.

Output: The highest score of the mini-game

Exceptions: None

3 MIS of Maze Generation Module

3.1 Interface Syntax

3.1.1 Exported Access Programs

Name	In	Out	Exceptions
Cell	integer, integer	-	Invalid Input
Cell.genWalls	-	-	-
Maze	integer	-	Invalid Input
Maze.setMaze	integer	-	Invalid Input
Maze.checkVisited	(integer, integer)	Cell	Invalid Input
Maze.genMaze	-	-	-

3.2 Interface Semantics

3.2.1 State Variables

allRect: array of pygame rectangles - represents the walls of the maze in the form of a drawable figure for pygame

mazeWalls: array of Cell - representing the layout of the maze

3.2.2 Environment Variables

None

3.2.3 Assumptions

Variables should be set before trying to access them

Constructor Cell will be called before genWalls or Maze can be called

Constructor Maze will be called before genMaze can be called

3.2.4 Access Program Semantics

Cell(id, gridLength):

Input: two integers representing the cell ID and the maze dimensions

Transition: initializes the Cell object

Output: None

Exceptions: Invalid Input they are not positive integers

Cell.genWalls():

Input: None

Transition: adds integers corresponding to neighbouring cells to cellWalls

Output: None

Exceptions: None

Maze(size):

Input: integer representing the size of the maze

Transition: initializes the Maze Object

Output: None

Exceptions: Invalid Input size is not a positive integer

Maze.setMaze(size):

Input: an integer representing the size of the maze

Transition: creates a maze of the specified size

Output: None

Exceptions: Invalid Input

Maze.checkVisited(id):

Input: a tuple of the form (integer, integer) representing the id's of the two cells

Transition: None

Output: A cell that is unvisited

Exceptions: Invalid Input

Maze.genMaze():

Input: None

Transition: utilizes Prim's Algorithm to randomly remove walls from the maze and manipulates mazeWalls to represent the remaining walls of the maze

Output: None

Exceptions: None

4 MIS of Score Tracking (Maze) Module

4.1 Interface Syntax

4.1.1 Exported Access Programs

Name	In	Out	Exceptions
saveScore	float	-	Invalid Input
checkRank	float	integer	Invalid Input

4.2 Interface Semantics

4.2.1 State Variables

score: float - represents the user's score once the maze is completed

4.2.2 Environment Variables

None

4.2.3 Assumptions

Variables should be set before trying to access them

4.2.4 Access Program Semantics

saveScore(time):

Input: a float value representing the total elapsed time during the game

Transition: saves the score to the maze scores file

Output: None

Exceptions: Invalid Input if the input is not a positive float

checkRank(time):

Input: a float value representing the total elapsed time during the game

Transition: None

Output: the user's current rank based upon previous scores

Exceptions: Invalid Input if the input is not a positive float

5 MIS of Draw Game (Maze) Module

5.1 Interface Syntax

5.1.1 Exported Access Programs

Name	In	Out	Exceptions
drawMaze Maze_draw	display_surface	GUI	Invalid Input
drawCharacter	integer, integer	GUI	Invalid Input
showTime pauseScreen	-	GUI	-
difficultyScreen	-	GUI	-
renderMaze	-	-	-
victoryScreen	-	GUI	-
on_execute	-	GUI	-

5.2 Interface Semantics

5.2.1 State Variables

charPos: x,y - coordinates of the character's current position

timeElapsed: float - represents the current time elapsed

currState: string - represents the current state of the game

5.2.2 Environment Variables

~~keyDown~~ keyPressed: captures which key is currently being pressed down

5.2.3 Assumptions

Variables should be set before trying to access them

Maze must be properly initialized before drawTime can be called

5.2.4 Access Program Semantics

~~drawMaze(Maze):~~ Maze_draw():

~~Input: Maze object used to draw the layout~~ None

~~Transition: Sets currState to maze~~

~~Output: draws the maze to the output window~~

~~Exceptions: Invalid Input if the object is not of type Maze~~

~~drawCharacter(startx,starty):~~

~~Input: two integers representing the coordinates to draw the character~~

~~Transition: adjusts charPos based on keyDown using Player Movement Module~~

~~Output: character is drawn according to it's current position of the maze~~

Exceptions: Invalid input if the integers are not of the correct coordinates

showTime(time):

Input: a float representing the current time elapsed

Transition: None

Output: a clock on the output window representing the current time elapsed

Exceptions: Invalid Input if the input is not a float or negative

pauseScreen():

Input: None

Transition: sets current state to pause

Output: the pause screen to the window

Exceptions: None

difficultyScreen():

Input: None

Transition: sets current state to difficulty

Output: the difficulty screen to the window

Exceptions: None

renderMaze():

Input: None

Transition: sets current state to easy/medium/hard maze

Output: None

Exceptions: None

victoryScreen():

Input: None

Transition: sets current state to victory

Output: the victory screen to the window

Exceptions: None

on_execute():

Input: None

Transition: responds according to the current state and changes charPos and timeElapsed

Output: the screen corresponds according to the state

Exceptions: None

6 MIS of Player Movement (Maze) Module

6.1 Interface Syntax

6.1.1 Exported Access Programs

Name	In	Out	Exceptions
moveUp	-	integer, integer	-
moveDown	-	integer, integer	-
moveLeft	-	integer, integer	-
moveRight	-	integer, integer	-
Player	-	-	-
Player.setPlayer	integer, []	-	-
Player.playerPos	-	GUI	-
Player.goalPos	-	GUI	-
Player.move	float, float	-	Invalid Input
Player.move_single_axis	float, float	-	Invalid Input

6.2 Interface Semantics

6.2.1 State Variables

~~charPos: int, int - representing the character's current position as coordinates (x,y)~~

~~dx: float - representing the character's position on the x-axis~~

~~dy: float - representing the character's position on the y-axis~~

6.2.2 Environment Variables

None

6.2.3 Assumptions

Variables should be set before trying to access them

6.2.4 Access Program Semantics

~~moveUp():~~

~~Input: None~~

~~Transition: Adjust charPos upwards (decrease y coordinate)~~

~~Output: two integers representing the new position of the character~~

~~Exceptions: None~~

~~moveDown():~~

~~Input: None~~

Transition: Adjust charPos downwards (increase y coordinate)
Output: two integers representing the new position of the character
Exceptions: None

moveLeft():

Input: None
Transition: Adjust charPos to the left (decrease x coordinate)
Output: two integers representing the new position of the character
Exceptions: None

moveRight():

Input: None
Transition: Adjust charPos to the right (increase x coordinate)
Output: two integers representing the new position of the character
Exceptions: None

Player():

Input: None
Transition: Constructor for the Player class
Output: None
Exceptions: None

Player.setPlayer(size, walls):

Input: an integer representing the size of the maze and a list of walls representing the collision blocks
Transition: sets the initial values for the player object given the size of the maze
Output: None
Exceptions: None

Player.playerPos():

Input: None
Transition: draws the player in the correct position based upon the size of the maze
Output: draws the player onto the game window
Exceptions: None

Player.goalPos():

Input: None
Transition: draws the goal in the correct position based upon the size of the maze
Output: draws the goal onto the game window
Exceptions: None

Player.move(dx, dy):

Input: two float values containing the position of the player
 Transition: changes the value of dx and dy
 Output: None
 Exceptions: Invalid Input

Player.move(dx, dy):

Input: two float values containing the position of the player
 Transition: determines if the move function results in a collision with the maze walls
 Output: None
 Exceptions: Invalid Input

7 MIS of Menu and Settings (Maze) Module

7.1 Interface Syntax

7.1.1 Exported Access Programs

Name	In	Out	Exceptions
drawInterface menuScreen	integer-	GUI	-
checkEvent	float, float, boolean	integer	Invalid Input

7.2 Interface Semantics

7.2.1 State Variables

currState: int - represents the game's current state

7.2.2 Environment Variables

mousePos: the mouse/pointer's current position mouseEvent: captures a mouse event

7.2.3 Assumptions

Variables should be set before trying to access them

~~If no event is chosen, checkEvent returns a default value 0~~

If currState is 0 **not menu**, ~~drawInterface~~ menuScreen does not change **the current window**

7.2.4 Access Program Semantics

~~drawInterface(currState)~~ menuScreen():

Input: ~~an integer representing the game's current state~~ **None**

Transition: ~~None~~ Sets currState to menu

Output: draws the interface corresponding to the current state to the output window

Exceptions: ~~Invalid Input if the input doesn't correspond to a game state~~ None

~~checkEvent(xpos, ypos, clicked):~~

~~Input: float values representing the mouse's current position on the screen and if the mouse has been clicked~~

~~Transition: determines if the current position represents a specified event~~

~~Output: integer representing the current state of the game based on the mouse~~

~~Exceptions: Invalid Input if the coordinates are not part of the window~~

8 MIS of Ball Tracking Module

8.1 Interface Syntax

8.1.1 Exported Access Programs

Name	In	Out	Exceptions
Ball	integer, integer, integer, [integer, integer]	None	Invalid Input
ballColor	integer, integer, integer	(integer, integer, integer)	Invalid Input
checkBounds	None	None	None
scoreGoal	None	None	None
resetBall	None	None	None
drawBall	None	None	None

8.2 Interface Semantics

8.2.1 State Variables

ballCenter_x: int - horizontal coordinate of the ball

ballCenter_y: int - vertical coordinate of the ball

8.2.2 Assumptions

Variables should be set before trying to access them

Ball is never created outside the visible area

Top, left, right, and bottom of ball can be calculated with ballCenter_x and ballCenter_y

Ball is initiated before other methods are called

8.2.3 Access Program Semantics

Ball(x, y, size, color, movement):

Input: integers for (x,y) position of the ball, its size, and the (x,y) speed of the ball

Transition: initializes the Ball object

Exceptions: Invalid Input if they are neither integers nor positive

ballColor():

Input: three integers each equivalent to a red, green, or blue color value

Transition: converts the three integers into a color tuple to create the ball's color

Output: color tuple based on desired ball color

Exceptions: Invalid Input if numbers are not positive integers or not in between 0 and 255

checkBounds():

Input: None

Transition: flip vertical speed at vertical bound collision, hold still at horizontal bounds

Exceptions: None

scoreGoal():

Input: None

Transition: ball at right bound is +1, ball at left bound is -1

Exceptions: Invalid Input size is not a positive integer

resetBall():

Input: None

Transition: moves the ball back to the center of the screen (after a side has scored)

Exceptions: None

drawBall():

Input: None

Transition: displays the ball to the screen

Exceptions: None

9 MIS of Score Tracking (Pong) Module

9.1 Interface Syntax

9.1.1 Exported Access Programs

Name	In	Out	Exceptions
saveScore	integer, integer	[integer, integer]	Invalid Input
checkRank	[integer, integer]	integer	Invalid Input

9.2 Interface Semantics

9.2.1 State Variables

playerScore: int - scores earned by main player

opponentScore: int - scores earned by secondary/computer player

9.2.2 Assumptions

Variables should be set before trying to access them

saveScore is only called after a game is over

9.2.3 Access Program Semantics

saveScore(playerScore, opponentScore):

Input: two integers representing the scores obtained by the players

Transition: converts two scores into an array

Output: a 1x2 integer array containing the two scores

Exceptions: Invalid Input if the inputs are not positive integers

checkRank([playerScore, opponentScore]):

Input: 1x2 integer array containing the main and secondary player's score

Transition: None

Output: the games current rank based upon previous scores

Exceptions: Invalid Input if the input is not a positive integer array of the right size

10 MIS of Draw Game (Pong) Module

10.1 Interface Syntax

10.1.1 Exported Access Programs

Name	In	Out	Exceptions
drawPong	Ball	GUI	Invalid Input
drawSprites	Paddle	GUI	None
showScore	scoreGoal	GUI	None

10.2 Interface Semantics

10.2.1 State Variables

gameOver: bool - determines if game has ended or not; keeps current match running

playerOne: Paddle - movement of main player

playerTwo: Paddle - movement of secondary player

score: int - keeps track of total points earned
 fps: int - keeps track of the number of times (per second) to refresh the game's state

10.2.2 Access Program Semantics

drawPong(Ball):

Input: Ball object to move around
 Transition: None
 Output: draws the ball to the output window
 Exceptions: Invalid Input if the object is not of type Ball

drawSprites(Paddle):

Input: Paddle from Player Movement (Pong) Module
 Transition: None
 Output: primary player's paddle from Player Movement (Pong) Module drawn on-screen
 Exceptions: Invalid input if the Paddle does not yet exist

showScore(scoreGoal):

Input: scoreGoal is a notifier of score change
 Transition: positive notifier means primary player scored, negative means secondary player scored
 Output: two numbers shown on screen representing each player's score
 Exceptions: Invalid Input if the input is not an integer

11 MIS of Player Movement (Pong) Module

11.1 Interface Syntax

11.1.1 Exported Access Programs

Name	In	Out	Exceptions
Paddle	integer, integer, color	None	Invalid Input
checkBounds	None	None	None
movePaddle	None	None	None
drawPaddle	None	None	None

11.2 Interface Semantics

11.2.1 State Variables

paddleCenter_x: int - horizontal coordinate of a paddle

11.2.2 Environment Variables

None

11.2.3 Assumptions

Variables should be set before trying to access them

The four corners of a paddle can be calculated from `paddleCenter_x` and `paddleCenter_y`

11.2.4 Access Program Semantics

`Paddle(integer, integer, integer, color):`

Input: 2 integers for the paddle's position and a color tuple defining the paddle's color

Transition: initializes a Paddle object

Output: None

Exceptions: None

`movePaddle():`

Input: None

Transition: moves the paddle (up or down) based on the keyboard input

Output: paddle's vertical coordinate increases or decreases

Exceptions: None

`drawPaddle():`

Input: None

Transition: recalculate the position of a paddle

Output: displays the paddle to the screen

Exceptions: None

12 MIS of Menu and Settings (Pong) Module

12.1 Interface Syntax

12.1.1 Exported Access Programs

Name	In	Out	Exceptions
<code>drawInterface</code>	integer	GUI	-
<code>checkEvent</code>	float, float, boolean	integer	Invalid Input

12.2 Interface Semantics

12.2.1 State Variables

`currState: int` - represents the game's current state

12.2.2 Environment Variables

mousePos: the mouse/pointer's current position

mouseEvent: captures a mouse event

12.2.3 Assumptions

Variables should be set before trying to access them

If no event is chosen, checkEvent returns a default value 0

If currState is 0, drawInterface does not change

12.2.4 Access Program Semantics

drawInterface(currState):

Input: an integer representing the game's current state

Transition: None

Output: draws the interface corresponding to the current state to the output window

Exceptions: Invalid Input if the input doesn't correspond to a game state

checkEvent(xpos, ypos, clicked):

Input: float values of the mouse's position on the screen and if the mouse has been clicked

Transition: determines if the current position represents a specified event

Output: integer representing the current state of the game based on the mouse

Exceptions: Invalid Input if the coordinates are not part of the window

13 MIS of Score Tracking (Flappy) Module

13.1 Interface Syntax

13.1.1 Exported Access Programs

Name	In	Out	Exceptions
saveScore	integer, integer	None	Invalid Input
checkRank	integer	integer	Invalid Input

13.2 Interface Semantics

13.2.1 State Variables

playerScore: float - total time elapsed during the game

13.2.2 Assumptions

Variables should be set before trying to access them
saveScore is only called after a game is over

13.2.3 Access Program Semantics

saveScore(playerScore):

Input: one float representing the score obtained by the player.

Transition: saves the score to the flappy scores file

Output: None

Exceptions: Invalid Input if the input are not positive float

checkRank([playerScore]):

Input: a integer value representing the user's score during the game.

Transition: None

Output: the user's current rank based upon previous scores

Exceptions: Invalid Input if the input is not a positive integer

14 MIS of Map Generation (Flappy) Module

14.1 Interface Syntax

14.1.1 Exported Access Programs

Name	In	Out	Exceptions
topPipe	[integer, integer, integer]	-	Invalid Input
bottomPipe	[integer, integer, integer]	-	Invalid Input
pipeDist	-	[integer, integer, integer]	Invalid Input

14.2 Interface Semantics

14.2.1 State Variables

topPipePos: int, int - representing the top pipe's current position as coordinates (x,y)

bottomPipePos: int, int - representing the bottom pipes's current position as coordinates (x,y)

14.2.2 Environment Variables

14.2.3 Assumptions

Variables should be set before trying to access them

14.2.4 Access Program Semantics

topPipe([integer, integer, size]):

Input: three integer array representing the top's X and Y position, as well as the length of the pipe. Top pipe's location are centered at the top base of the pipe.

Transition: initializes the topPipe object

Output: None

Exceptions: Invalid input if size exceeds the game window

bottomPipe([integer, integer, size]):

Input: three integer array representing the top's X and Y position, as well as the length of the pipe.

Transition: initializes the bottomPipe object

Output: None

Exceptions: Invalid input if size exceeds the game window

pipeDist():

Input: None

Transition: None

Output: three integer array with randomly chosen integers for x, y and the size.

Exceptions: None

15 MIS of Draw Game (Flappy) Module

15.1 Interface Syntax

15.1.1 Exported Access Programs

Name	In	Out	Exceptions
drawTopPipe	topPipe	GUI	Invalid Input
drawBottomPipe	bottomPipe	GUI	Invalid Input
drawBird	bird	GUI	Invalid Input
drawScore	score	GUI	Invalid Input

15.2 Interface Semantics

15.2.1 State Variables

15.2.2 Environment Variables

15.2.3 Assumptions

Variables should be set before trying to access them

15.2.4 Access Program Semantics

drawTopPipe(topPipe):

Input: topPipe object to move around

Transition: None

Output: draws the topPipe to the output window

Exceptions: Invalid input if input is not of type topPipe

drawbottomPipe(bottomPipe):

Input: bottomPipe object to move around

Transition: None

Output: draws the bottomPipe to the output window

Exceptions: Invalid input if input is not of type bottomPipe

drawBird(bird):

Input: bird object to move around

Transition: None

Output: draws the bird object to the output window

Exceptions: Invalid input if input is not of type bird

showScore(score): Input: score is a notifier of score change

Transition: Increases score by one

Output: draws the current score to the output window

Exceptions: Invalid input if input is not of type integer

16 MIS of Player Movement (Flappy) Module

16.1 Interface Syntax

16.1.1 Exported Access Programs

Name	In	Out	Exceptions
Bird	[integer, integer]	None	Invalid Input
moveBird	bottomPipe	None	Invalid Input
updateBird	[integer, integer]	None	Invalid Input

16.2 Interface Semantics

16.2.1 State Variables

birdCenter_pos: [int, int] - x,y of the player's bird

16.2.2 Environment Variables

16.2.3 Assumptions

Variables should be set before trying to access them

16.2.4 Access Program Semantics

Bird([integer, integer]):

Input: two integer array representing the bird's X and Y position

Transition: initializes the Bird object

Output: None

Exceptions: None

moveBird():

Input: None

Transition: moves the bird up based on the keyboard input

Output: bird's vertical coordinate increases

Exceptions: None

updateBird([integer, integer]):

Input: [integer, integer] with new bird positions

Transition: initializes the Bird object

Output: None

Exceptions: None

17 MIS of Menu and Settings (Flappy) Module

17.1 Interface Syntax

17.1.1 Exported Access Programs

Name	In	Out	Exceptions
drawInterface	integer	GUI	-
checkEvent	float, float, boolean	integer	Invalid Input

17.2 Interface Semantics

17.2.1 State Variables

currState: int - represents the game's current state

17.2.2 Environment Variables

mousePos: the mouse/pointer's current position

mouseEvent: captures a mouse event

17.2.3 Assumptions

Variables should be set before trying to access them

If no event is chosen, checkEvent returns a default value 0

If currState is 0, drawInterface does not change

17.2.4 Access Program Semantics

drawInterface(currState):

Input: an integer representing the game's current state

Transition: None

Output: draws the interface corresponding to the current state to the output window

Exceptions: Invalid Input if the input doesn't correspond to a game state

checkEvent(xpos, ypos, clicked):

Input: float values of the mouse's position on the screen and if the mouse has been clicked

Transition: determines if the current position represents a specified event

Output: integer representing the current state of the game based on the mouse

Exceptions: Invalid Input if the coordinates are not part of the window