SOFTWARE ENGINEERING
COURSEWORK 2

PROCESS DOCUMENTATION
BLUE TEAM

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Contents

INTRODUCTION

This document is the "Process Documentation" component of our submission for Software Engineering Coursework 2.

In this introductory section, we outline the structure of this document and provide a suggested reading methodology. We also explain our use of agile events, artefacts and tools, and provide details of our code repository.

CODE REPOSITORY

The code and documents for our completed product are available at the following git repository, in the "delivery" branch: https://github.com/aimeedowell/SE_Coursework2_Fruit_Game.

Detailed installation instructions are set out in the Maintenance Guide (for developers) and the User Manual (for players).

HOW TO READ THIS DOCUMENT

This document is structured as follows:

- in the remainder of this introductory section, we explain and summarise our adaptations and use of agile events, artefacts and tools during this project;
- the main section of the document is split into seven sub-sections, each corresponding to a sprint iteration and having the following structure:
    1. a *sprint overview* – a brief summary of the team's goals and activities during the sprint;
    2. a *summary of sprint events and documentation* – a more detailed, chronological summary of the key events during the sprint, with cross-references to our documentation (using coded document references);
    3. a *sprint review* – drawn from our sprint retrospective meetings, a detailed review of the team's progress towards the sprint goals, quantitative analysis of productivity (Sprints 2-6), analysis of significant difficulties faced and exception handling and a brief outline of the team's proposals for the next sprint; and
    4. the *documentation* – a coded collection of documentation relating to each sprint, with a covering table displaying the contents of each collection; and
- the final section incorporates the final versions (as at the end of Sprint 7) of our master documentation, including user stories, use cases, CRC cards, acceptance tests and UI design notes.

Although the reader is invited to chart their own path through this document as they consider appropriate, we suggest that the following methodology is applied, for the reasons set out below:

- first, the reader should understand how we have adapted and used agile events, artefacts and tools to manage our development project – this is set out concisely in the following sub-section;
- then, we suggest that the reader reviews the *sprint overview*, *summary of sprint events and documentation* and *sprint review* sections of each chapter – typically around 4 pages in length, these sections provide a concise, detailed summary of the team's activities in each sprint iteration, and signpost the relevant documentation; and
- finally, the reader should then be able to make informed decisions about which documentation they wish to review, whether that may be specific documentation from a given sprint or the final, comprehensive master documentation in the final section of this document.

OUR USE OF AGILE EVENTS, ARTEFACTS AND TOOLS

From our discussions with the module tutors and the customer, we understand that our use of some agile artefacts may differ from their traditional purposes. However, aligned with the core agile principles, we have adapted those artefacts in light of the strengths and weaknesses of our team and the specific tasks for which they were used.

In order to clarify how we have used agile events, artefacts and tools during our project, we have set out a summary explanation in the tables below.

SPRINT EVENTS

Our sprint iterations were typically orientated around four key events: a customer meeting, an iteration planning meeting, a stand-up meeting and a sprint retrospective meeting. Sprint 1 differed most notably from this template, as there were multiple brainstorming and design meetings. However, most other sprints closely followed this typical structure, as it worked well for the team.

Our sprints were one-week in length, running from Wednesday (at the customer meeting) to Tuesday (at the sprint retrospective meeting). Sprint 1 differed from this structure, as it was extended to two-weeks in length to allow for the development and refinement our game proposal.

Sprint Event	**Explanation**
Customer Meeting	Once per sprint, on Wednesday (save for Sprint 5, due to cancellation). Team-led demonstration of product progress and update on documentation. Discussion of product feature proposals and agreement of priorities for the following sprint.
Iteration Planning Meeting	Once per sprint, typically on Thursday. Allocation of Scrum roles by rotation. Discussion of customer requirements and production of product backlog. Discussion of individual and team work capacity. Discussion and allocation of tasks and production of sprint backlog.
Stand-up Meeting	Typically, once per sprint, at the weekend. Discussion of team members' tasks and progress towards sprint goals, driven by the Jira board.

	Discussion of sprint-specific items (e.g. exceptional events, development tasks requiring collaboration). Updates to the sprint backlog (if required).
Sprint Retrospective Meeting	Once per sprint, on Tuesday. General reflection on progress made during the sprint towards the sprint goals, significant difficulties faced and exceptional events (and how those difficulties and exceptions were handled). Quantitative analysis of team productivity (velocity and task completion rate). Review of acceptance tests master documentation. Updates to the sprint and product backlogs.

SPRINT ARTEFACTS AND TOOLS

The main agile artefacts and tools that we used during our project were product and sprint backlogs, user stories, use cases, CRC cards, pair programming, acceptance tests and UI design notes.

Sprint Artefact	**Explanation**	
Product backlogs	**Purpose**	Used to record unsatisfied user stories, failed tests and other tasks for completion by the development team.
	Utilisation	Produced at the iteration planning meeting (version 1) and updated at the sprint retrospective meeting (version 2). Sorted using the "MoSCoW" prioritisation framework.
Sprint backlogs	**Purpose**	Used to record the sprint goal, selected product backlog items and development/documentation tasks for the current sprint. Task allocations, timeframes and status are also recorded. The sprint backlog tasks were reflected in a Jira board, which was used to manage the sprint process and formed the basis of discussions at the stand-up meeting.
	Utilisation	Produced at the iteration planning meeting (version 1) and updated at the sprint retrospective meeting (version 2). Sorted using the "MoSCoW" prioritisation framework.
User Stories	**Purpose**	Used to record and clarify customer requirements in concise, effective terms. Expanded through high-level, developer-written comments and specific acceptance criteria, which formed the basis for acceptance tests.
	Utilisation	Produced after customer meeting/iteration planning meeting to record new requirements. Updated after customer meeting/iteration planning meeting if requirements changed *or* after acceptance testing. Recorded in the user stories master documentation.

Sprint Artefact	Explanation	
Use Cases	**Purpose**	Used to develop requirements (recorded through user stories) into clear, actionable system design specifics for implementation by the development team. ***Note:*** *Following discussion with the tutors, we understand that we implemented use cases corresponding to the traditional roles of "design use cases" and CRC cards together – determining and refining system design. Due to the simplicity of our game system and the clarity of our user stories, we did not consider it necessary to further refine our requirements beyond those user stories. Therefore, we did not implement "requirements use cases" as a simpler version of use cases to clarify requirements.*
	Utilisation	Produced immediately after/alongside user stories in relation to new and updated requirements. Reviewed during development and at sprint retrospective meeting. Recorded in the use cases master documentation.
CRC Cards	**Purpose**	To visualise our system's design and interdependencies when scaling up from smaller to larger levels. Used as a complement to the use cases. ***Note:*** *As noted above, due to the simplicity of our game system, we did not consider it necessary to design the system using CRC cards initially - we found that our use cases provided a sufficiently clear system design. However, when scaling-up the 3x3 grid level to a 5x5 grid level during Sprint 4, we decided to use CRC cards as predominantly a visualisation tool, to visualise in simple terms the roles and dependencies set out in our use cases (which were, by then, growing in number). Several team members revisited the CRC cards in later sprints to visualise the system, but system design remained driven through our use cases, which worked well for our team.*
	Utilisation	Produced at the CRC cards discussion meeting in Sprint 4. Recorded in the CRC cards master documentation.
Pair Programming	**Purpose**	To enable less-experienced developers to learn from those with prior experience and skills, and to improve overall code quality and productivity.
	Utilisation	Used extensively during Sprints 2-4, when team work capacity was greatest and the team's skill level was rapidly developing. Used in Sprints 5-6 for more complex tasks, as individual competency had improved and team

Sprint Artefact		Explanation	
			work capacity was reduced due to competing coursework demands.
Testing	*Formal code inspections*	**Purpose**	To allow the few experienced developers in the team to evaluate and test code before implementation. ***Note:*** *As noted in the early sprints, very few team members had previous programming experience (in particular, in using Unity/C#). Therefore, throughout the project, code testing was primarily (but not exclusively) undertaken by our most experienced developers – the team did not feel sufficiently experienced to use TDD.*
		Utilisation	Experienced developers were added as reviewers to GitHub pull requests and reviewed/tested code before merging into our main branch. Utilised during every development sprint iteration (Sprints 2-6).
	Unit testing	**Purpose**	To automate a consistent and broad testing regime to evaluate our codebase on an on-going basis.
		Utilisation	Implemented in Sprints 4 and 5 and tested throughout subsequent sprints.
	Acceptance testing	**Purpose**	To evaluate and re-align our progress against the customer's requirements.
		Utilisation	Tested at each sprint retrospective meeting and through the formal code inspections. Recorded in the acceptance testing master documentation.
UI Design Notes		**Purpose**	To record the development of UI and artwork elements of our product.
		Utilisation	Produced and updated at the end of each sprint. Recorded in the UI design notes master documentation.

SPRINT 1

Dates: 2-9 November 2021.

Product Owner: Abel Tom Varghese.

Scrum Master: Christian Bentley.

SPRINT OVERVIEW

Key Documentation

UI Design: **StB1-2, CD1-3**

The goals for Sprint 1 were:

1. to develop a range of initial game proposals, to be presented to the customer at the customer meeting on 3 November 2021; and
2. after the customer had selected a game proposal at that customer meeting, to develop more detailed stories for that proposal, to be presented to the customer at the customer meeting on 10 November 2021.

The overall purpose of Sprint 1 was to develop and refine our game proposal, with a view to commencing the development of that proposal in Sprint 2.

At the start of Sprint 2, all team members attended a general meet-up and brainstorming session. The team got to know each other and discussed previous programming experience and relevant skills – in particular, it was noted that only Aimee and Abel had any significant previous programming experience and that others may require assistance and additional practice time to develop relevant game development skills. Following on from the first coursework project, the team also brainstormed relevant agile methodologies and expressed preferences towards a Scrum- and XP-based framework.

At that session, the team brainstormed a range of game proposals, which were presented to the customer at a customer meeting on 3 November 2021. From the proposals, the customer preferred a tile-based, quiz game, which the team and the customer then discussed at a high level. The customer asked for more detailed stories in relation to that proposal to be presented at the next customer meeting on 10 November 2021.

The team then held an iteration planning meeting, at which the team discussed:

1. the implementation of Scrum and XP agile methodologies, as well as the MoSCoW prioritisation framework of DSDM;
2. each individual's work capacity for the remainder of Sprint 1 – observing that there were several coursework deadlines at around this time; and
3. a product and sprint backlog for the remainder of Sprint 1.

Team members then individually brainstormed proposed game features, which were then discussed as a group in a design meeting. Following that meeting, the backlogs and task allocations were updated and several team members developed formal storyboards and functionality documentation for presentation to the customer at the next customer meeting.

The team then held a sprint retrospective meeting, at which the team reflected on the team's progress in this first sprint and updated the sprint and product backlogs, ahead of the next sprint.

SUMMARY OF SPRINT EVENTS AND DOCUMENTATION

Meet-up and Game Proposals Brainstorming Meeting – 2 November 2021

Attended by: All team members.

At the first team meeting, team members were generally introduced through an icebreaker to develop team cohesion. The team then brainstormed:

1. a range of initial game proposals, including a maze-based, fruit game, a hungry caterpillar-based game, dungeon-themed chess and puzzle games, a tile-based, grid game and a combination game (combining aspects of the other proposals);
2. initial preferences for agile methodologies for this project – tending towards a Scrum- and XP-based approach.

At that meeting, the team's brainstorming was recorded in a mind map, which is appended to this sprint as document **BS1.** In order to illustrate the combined game proposal, Aimee produced a concept drawing, which is appended to this sprint, as document **CD1**.

Customer Meeting – 3 November 2021

Attended by: All team members and the customer.

At the first customer meeting, the team presented the BS1 mind map and discussed the game proposals with the customer. The customer expressed a preference for the combined, tile-based, quiz game, which was then discussed at a high level – including progression mechanics, engagement hooks and the target audience (both adults and children).

The agreed deliverables for the second customer meeting were more detailed stories, based on the preferred game proposal.

The minutes of the customer meeting are appended to this sprint, as document **CM1**.

Iteration Planning Meeting – 3 November 2021

Attended by: All team members.

At the iteration planning meeting, the team discussed further the agile methodologies brainstormed at the initial brainstorming meeting. The team decided to use Scrum as a project management framework, prioritising backlog tasks using the MoSCoW methodology of DSDM, whilst utilising the practices and tools of XP (in particular, extensive pair programming and "just in time" planning, orientated around user stories and, later, use cases).

The team also discussed each individual's work capacity for the remainder of the iteration, observing that there were several coursework deadlines falling on 5 November 2021. Taking into account that discussion, the team then produced a product backlog (**PB1.1**) and a sprint backlog (**SB1.1**), in order to manage and allocate tasks to team members with capacity, intending this to be a trial-run for later iterations (given the small number of tasks at this stage).

Design Proposals Brainstorming Meeting – 8 November 2021

Attended by: All team members.

After team members individually brainstormed functionality proposals, the team held a brainstorming meeting to collate the proposals for presentation to the customer. The collation of the team's brainstorming was recorded in a mind map, which is appended to this sprint as document **BS2**.

The team decided that it would be useful to present storyboards at the next customer meeting, detailing a player's progression through a simple and more complex game level, as well as producing a formal record of the team's proposals for fruit, vegetable and board functionalities. These tasks were recorded and allocated to team members in an updated sprint backlog (**SB1.2**).

The design products that the team developed after this meeting are appended to this sprint, as documents **StB1**, **StB2**, **CD2** and **CD3**.

Sprint Retrospective Meeting – 9 November 2021

Attended by: All team members.

At the end of this sprint, the team held a short sprint retrospective meeting. The team's reflection on this iteration is set out in the Sprint Review below, and a record of the sprint retrospective meeting is appended to this sprint, as document **SR1**.

The team also updated the sprint and product backlogs (**SB1.3** and **PB1.2**) at the end of this sprint.

SPRINT REVIEW

At the sprint retrospective meeting, the team reflected on the team's progress in this first sprint.

General comments

The team considered that both of the sprint goals for this sprint had been satisfied – in particular:

1. the team had presented a range of initial game proposals to the customer at the customer meeting on 3 November 2021, which resulted in a clearly defined project that all team members and the customer were happy with; and
2. the team had developed detailed storyboards and functionality proposals to be presented to the customer at the customer meeting on 10 November 2021.

Difficulties faced

The two main issues which the team faced in Sprint 1 were building early team cohesion within the newly-formed group and managing low team work capacity due to coursework deadlines. The former did not cause significant difficulty for the team, as through the initial icebreaker at the first meeting and subsequent in-person meetings the team quickly developed a collaborative and friendly atmosphere.

Low team work capacity was a more significant issue for the team, as competing coursework priorities meant that some team members had less time than others to allocate to work on the tasks in this sprint. The team overcame this issue by openly discussing individuals' work capacities at an early stage (the iteration planning meeting) and incorporating these discussions into the allocation of tasks in the sprint backlog. By taking these competing priorities into account, the team adapted well to produce the client's requested deliverables on time and with excellent quality, which the customer noted at the next customer meeting.

Exception handling

The team did not consider that there were any unexpected events which had to be overcome in this sprint. The team's work capacity was identified as an issue early in the iteration planning phase and was effectively managed through the sprint backlog.

Sprint 2

The team considered the Scrum framework, and the form of the product and sprint backlogs developed in this iteration, to be very effective in communicating and managing workflows, although the team observed that the more complex and numerous tasks in the next development iteration would be a greater test of our agile management skills. The team decided to continue using this project management framework in Sprint 2, whilst incorporating further agile practices and tools, including user stories and pair programming. The team also decided to incorporate more frequent communication at the team-level, through regular stand-up meetings, in addition to the iteration planning and retrospective meetings.

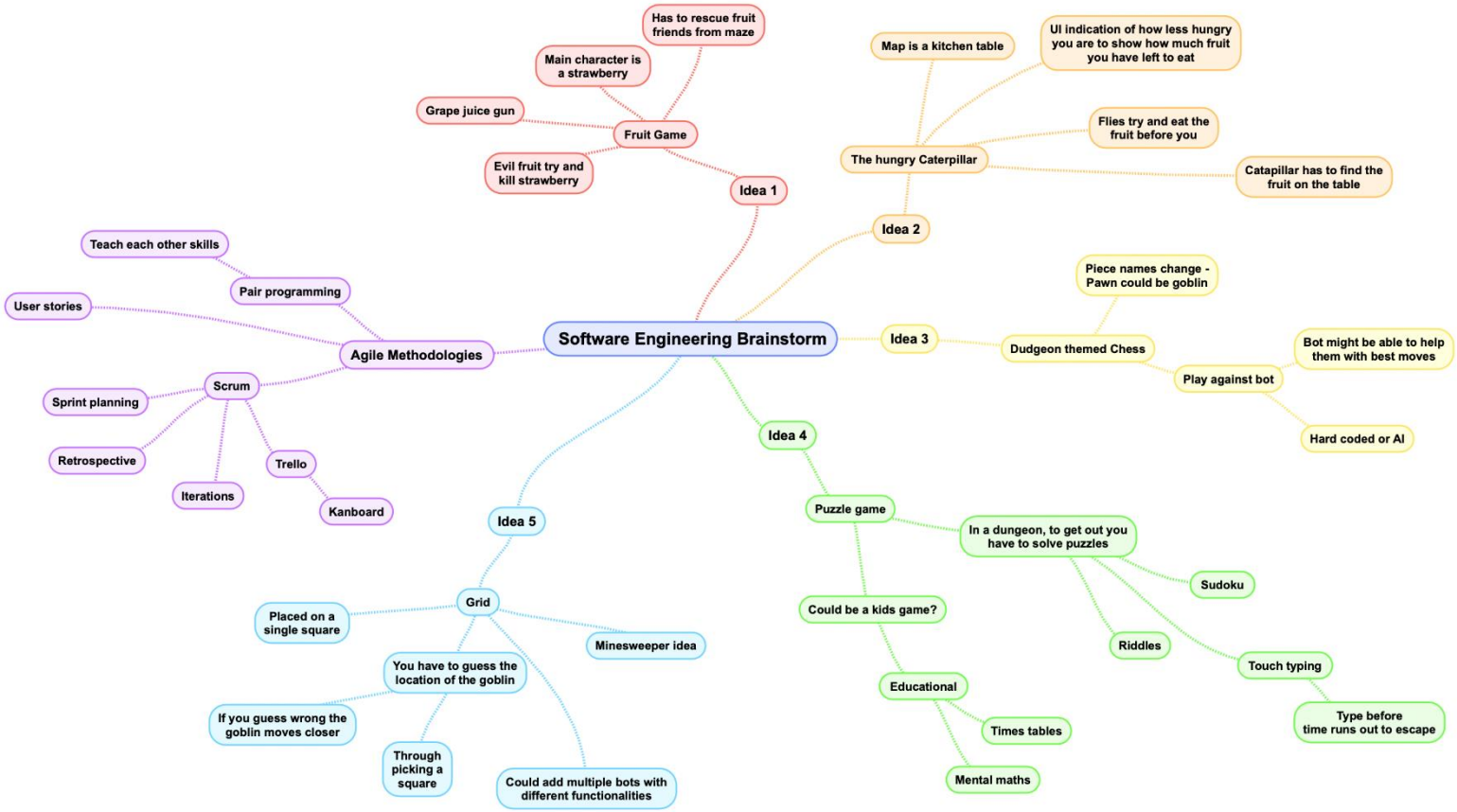
SPRINT DOCUMENTATION

Date	ID	Document
2/11/21	BS1	Mind Map – Game Proposals and Agile Methodologies
2/11/21	CD1	Concept Documentation – Combined Game Proposal
3/11/21	CM1	Minutes of a Customer Meeting
3/11/21	PB1.1	Product Backlog – Iteration Planning Meeting
3/11/21	SB1.1	Sprint Backlog – Iteration Planning Meeting
8/11/21	BS2	Mind Map – Design Proposals
8/11/21	SB1.2	Sprint Backlog – Design Proposals Brainstorming Meeting
8/11/21	StB1	Storyboard – 3x3 Level
8/11/21	StB2	Storyboard – 7x7 Level
9/11/21	CD2	Concept Documentation – Alternative Board Structures
9/11/21	CD3	Concept Documentation – Fruit, Vegetable and Board Functionalities
9/11/21	SR1	Record of a Sprint Retrospective Meeting
9/11/21	SB1.3	Sprint Backlog – Sprint Retrospective Meeting
9/11/21	PB1.2	Product Backlog – Sprint Retrospective Meeting

MIND MAP – GAME PROPOSALS AND AGILE METHODOLOGIES

Date: 2 November 2021

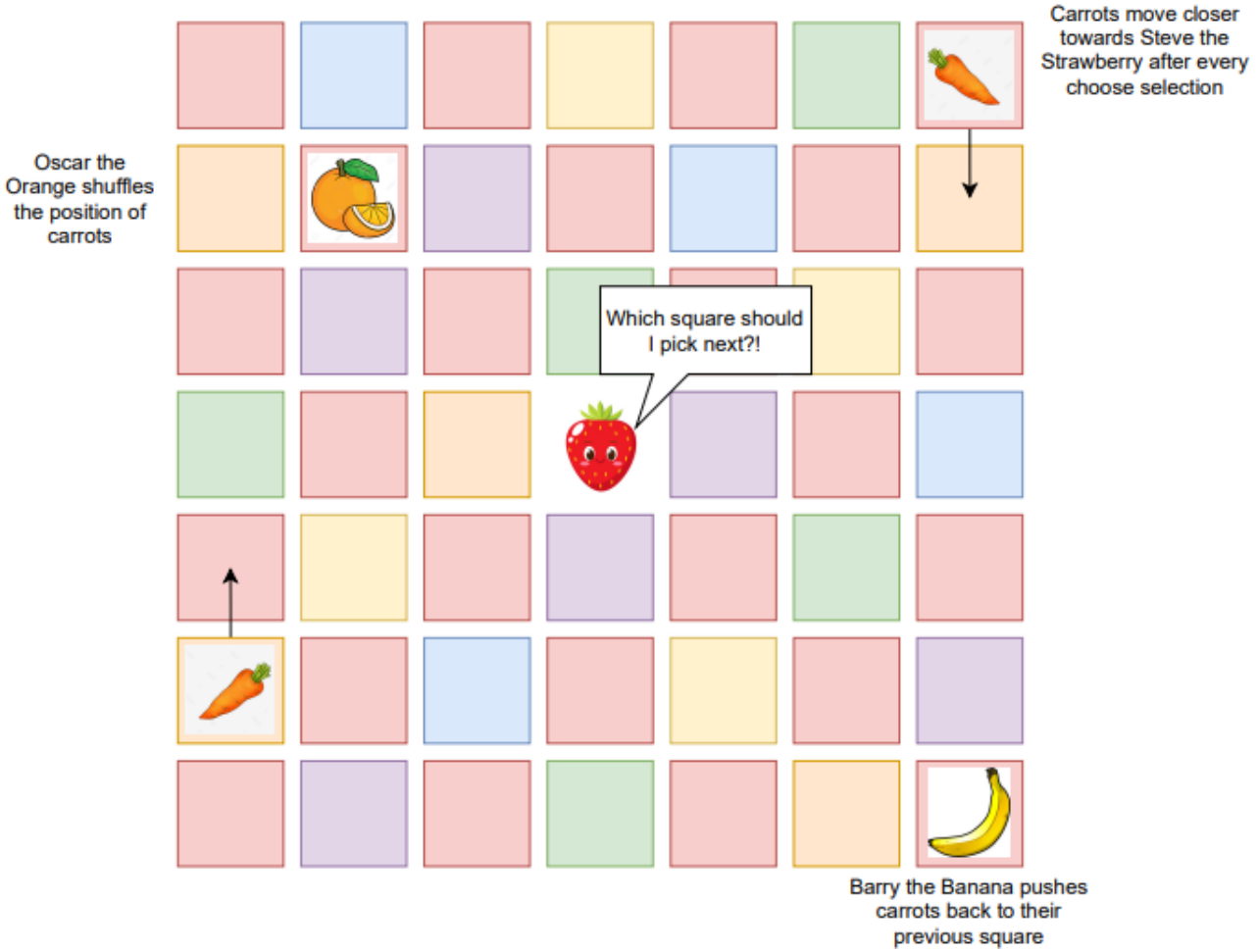
Document created by: Aimee Dowell, working with all team members.



CONCEPT DOCUMENTATION – COMBINED GAME PROPOSAL

Date: 2 November 2021

Document created by: Aimee Dowell.



CM1

MINUTES OF CUSTOMER MEETING – 10:30AM, 3 NOVEMBER 2021

Attendees: All team members, customer.

Scribe: Christian Bentley.

Presentation of proposals

- The team presented six proposals for the game:
    - Fruit game, hungry caterpillar game, chess game, puzzle game, grid/minesweeper game, combined game
- The customer preferred the combined game, with a wide variety of constructive functionalities.

Progression

- The customer asked whether there could be a notion of "winning".
- The team explained that the player survives by clicking on the vegetables, with expansions to different levels of size, puzzle difficulty and vegetable functionalities.

Engagement hooks

- The customer asked what would keep users coming back to the game.
- The team considered that there could be different board/character styles and levels of difficulty.
- The customer noted that this could include hexagonal grids and trapdoors to new levels.

Documentation

- The team asked how the project should be documented, particularly for submission.
- The customer explained that there should be a single PDF containing the team's process records – generally one chapter per sprint.
- The customer preferred to have documentation included in that PDF, rather than through URLs to separate pages.

Target audience

- The team asked whether the customer would prefer for the game to be targeted at children or at adults.
- The customer asked that there be varying difficulties so that both could be targeted – with puzzles ranging from simple arithmetic to sudokus and the mastermind board game.

Deliverables for next meeting

- The team asked what the customer's expectations are for the next meeting.
- The customer asked for more detailed stories based on the game proposed.

Platform

- The team asked which platform the customer would prefer for the game.

- The customer explained that the team should use whichever platform they may be most productive using – PyGame, Unity, Java-based platforms.

Deliverables

- Develop more detailed stories for the next meeting.

PB1.1

PRODUCT BACKLOG

Sprint: 1.

Version: 1.

Date: 3/11/2021.

Timing: Iteration Planning Meeting.

Created/Last updated by: Christian Bentley and Abel Tom Varghese.

PRIORITY	TASKS
Must Have	Produce detailed stories, setting out core functionalities of the proposed game.
Should Have	
Could Have	
Won't Have This Time	

SPRINT BACKLOG

Sprint: 1.

Version: 1.

Date: 3/11/2021.

Timing: Iteration Planning Meeting.

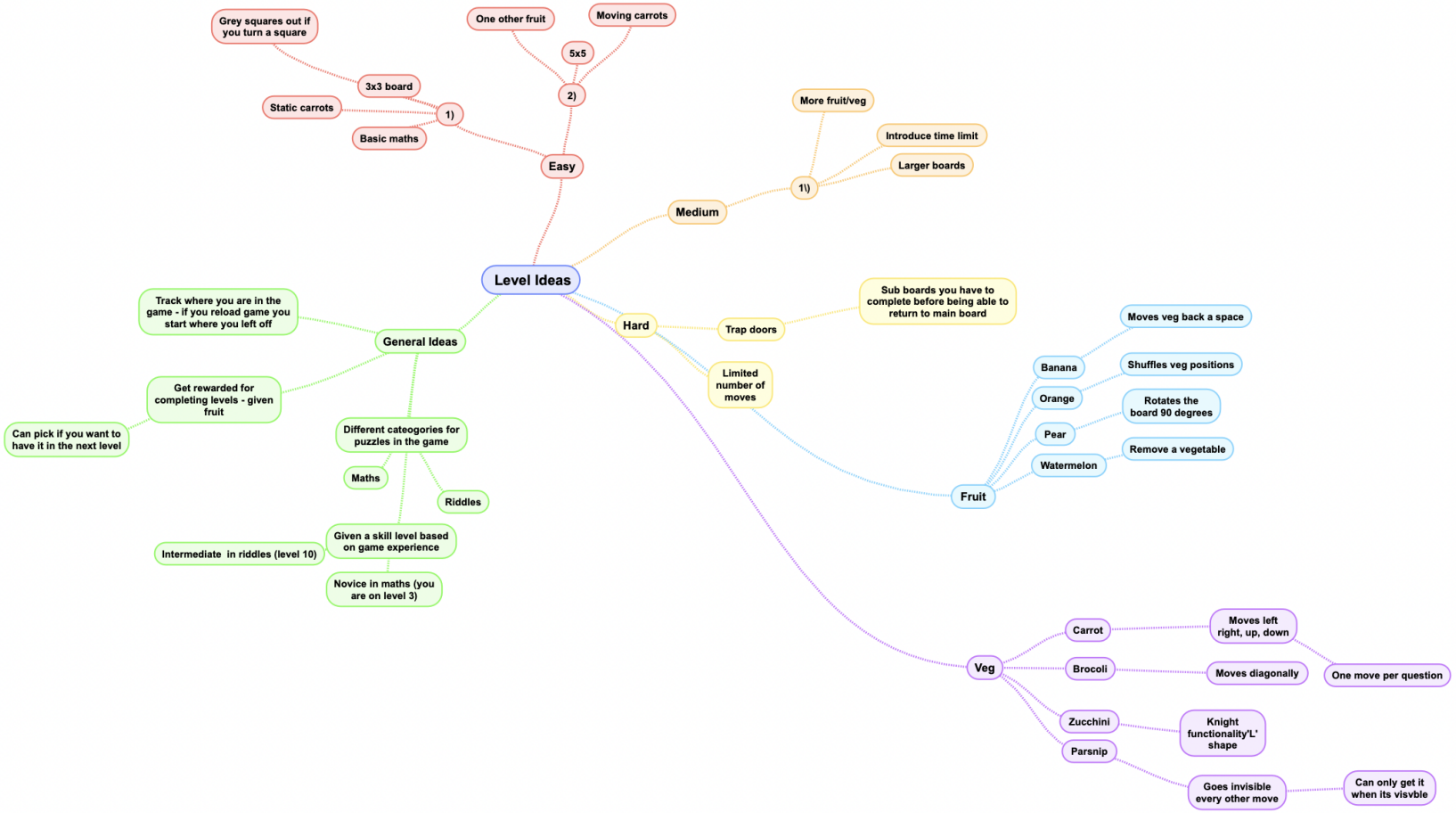
Created/Last updated by: Christian Bentley, working with all team members.

SPRINT GOAL				
Develop detailed stories for the approved game proposal, to be presented to the customer at the customer meeting on 10 November 2021.				
SELECTED PRODUCT BACKLOG ITEMS				
MUST HAVE	Produce detailed stories, setting out core functionalities of the proposed game.			
SHOULD HAVE				
COULD HAVE				
SPRINT TASKS				
Priority	**Tasks (ordered)**	**Timeframe (hours)**	**Individual/Pair**	**Status**
MUST HAVE	Brainstorm fruit, vegetable and board functionalities and game mechanics	Up to 2 (per team member)	All team members with capacity	Not started
SHOULD HAVE				
COULD HAVE				

MIND MAP – DESIGN PROPOSALS

Date: 8 November 2021

Document created by: Aimee Dowell, working with all team members.



SB1.2

SPRINT BACKLOG

Sprint: 1.

Version: 2.

Date: 8/11/2021.

Timing: Design Proposals Brainstorming Meeting.

Created/Last updated by: Christian Bentley, working with all team members.

SPRINT GOAL				
Develop detailed stories for the approved game proposal, to be presented to the customer at the customer meeting on 10 November 2021.				
SELECTED PRODUCT BACKLOG ITEMS				
MUST HAVE	Produce detailed stories, setting out core functionalities of the proposed game.			
SHOULD HAVE				
COULD HAVE				
SPRINT TASKS				
Priority	**Tasks (ordered)**	**Timeframe (hours)**	**Individual/Pair**	**Status**
MUST HAVE	Brainstorm fruit, vegetable and board functionalities and game mechanics	Up to 2 (per team member)	All team members with capacity	Completed
	Produce a storyboard for a simple 3x3 game level	2	Christian	Not started
	Produce a storyboard for a more complex 7x7 game level	2	Aimee	Not started
	Produce a formal record of the proposed fruit, vegetable and board functionalities	2	Oscar	Not started
SHOULD HAVE	Produce concept drawings for proposed alternative board structures	1	Christian	Not started
COULD HAVE				

STORYBOARD – 3X3 LEVEL

Date: 8 November 2021

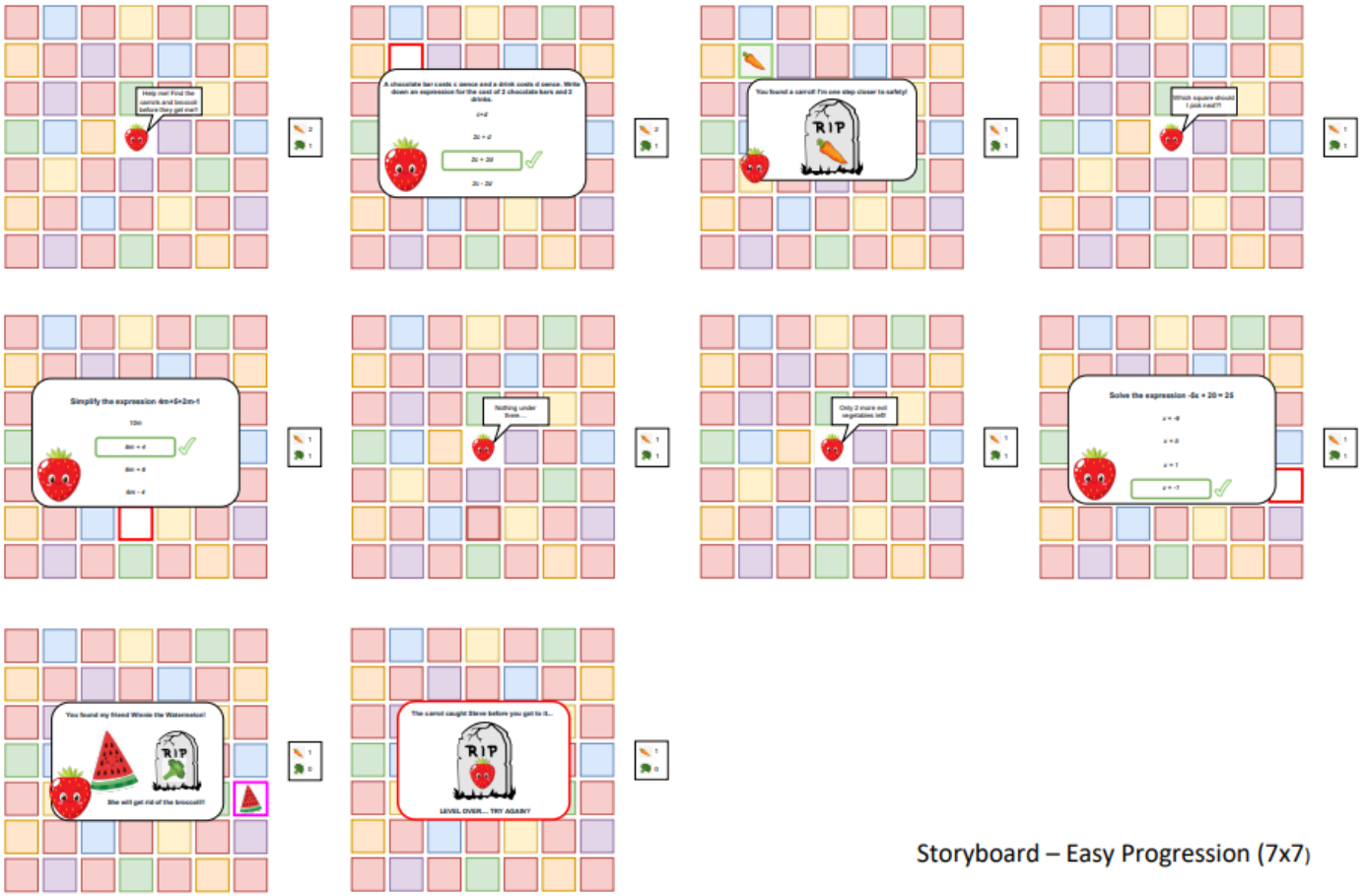
Document created by: Christian Bentley.

Storyboard - Easy Progression (3x3 - Possible tutorial)

STORYBOARD – 7X7 LEVEL

Date: 8 November 2021

Document created by: Aimee Dowell.



Storyboard – Easy Progression (7x7)

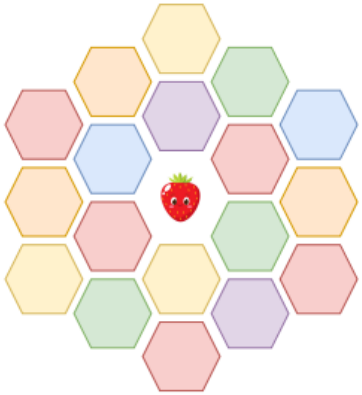
CONCEPT DOCUMENTATION – ALTERNATIVE BOARD STRUCTURES

Date: 9 November 2021

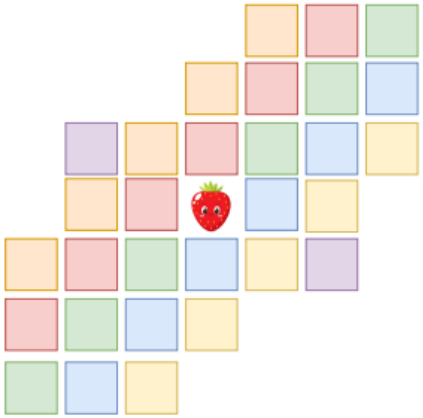
Document created by: Christian Bentley.

Alternative Board Structures

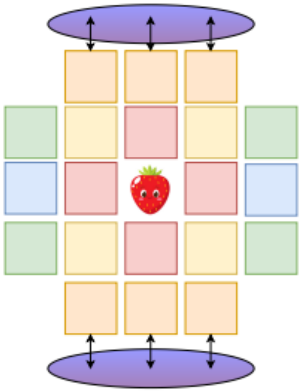
Hexagonal Board Structure



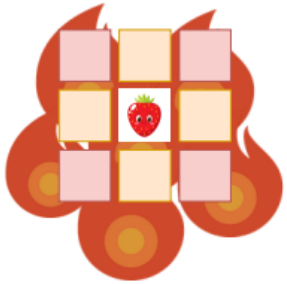
Diagonal Board Structure



Wrap-around Structure



Post-Trapdoor Structure



CONCEPT DOCUMENTATION – FRUIT, VEGETABLE AND BOARD FUNCTIONALITIES

Date: 9 November 2021

Document created by: Oscar Gee.

Functionality Documentation

Fruit, Vegetable and Board Functionality

Fruit

Regarding functionality, the Fruit consistently acts as the Players practical helper in the game by providing useful moves and set-pieces against the antagonists (Vegetables). Fundamental mechanics are based on the type of Fruit activated, with different Fruits offering different advantages. The current ideas in this iteration include:

- **Banana:** Landing on a Banana activates a function that moves Vegetables 1 step backwards on the board. As the difficulty increases, this utility becomes more and more valuable to the player.
- **Orange:** Landing on an Orange activates a "shuffling" function that shifts the current location of all Vegetables on the board to a different tile. For functionality to remain playable the shuffling should not necessarily be entirely random, with the new location of Vegetables still being a certain number of tiles away from the Player.
- **Pear:** Landing on a Pear rotates the format of the board 90 degrees. This includes all the current locations of Vegetables and completed tiles.
- **Watermelon:** Acting as the "rare" Fruit on the board, landing on this Fruit removes a Vegetable from the board entirely for the duration of the game. The Vegetable that is removed is chosen from random. Algorithm could decipher if a player has attempted a level too many times, therefore adding a watermelon to the board on the next attempt to prevent the user quitting the game.

Vegetables

Throughout the game, the Vegetables act as antagonists to the Players actions and their function is to hinder the progress of the game by reactivating tiles already completed by the Player. The movement abilities for many of the Vegetables are based on already existing moves from the game Chess. The current ideas for the functionality of the Vegetables include:

- **Carrot:** Imitates the movement of a King (Up, Down, Left, Right) with one movement per question.
- **Broccoli:** Imitates the movement of a Bishop (Diagonally).
- **Zucchini:** Imitates the movement of a Knight (Up, Down, Left, Right with the addition of two spaces initially.
- **Parsnip:** Differs from the Chess foundation to add excitement - Vegetable turns invisible to the player every other move. Important to note that this Vegetable can only be defeated when Visible.

Board

The Boards formation and structure is directly dependent on the level of difficulty selected by the player. Taking the form of a grid, the Boards format does not change depending on category, but does expand and increase in complexity as the difficulty goes up. The difficulty level acts both as a function to increase engagement and replayability. In this iteration, the difficulty levels have been decided as:

- **Easy:** Either a 5x5 or a 3x3 board, the difficulty spectrum expands to both the quality of questions and also the size of the board. On top of this, Vegetable functionality is capped with certain vegetables (namely Carrots) being static.
- **Medium:** The board size increases (yet to be decided) with the function of a Time Limit being introduced. This means that the Player must locate the Strawberry by a certain number of moves. Vegetable functionality is standard with no abilities being removed.
- **Hard:** Board is at its largest size. The addition of "Trap Doors" is also added, hindering the player should they land on them. At the hardest levels, the functionality of "Sub Boards" enters the game. Sub Boards act as mini-levels that must be completed before returning to the main board. Finally, the prospect of limited moves is added, on top of a time limit.

SPRINT RETROSPECTIVE

Sprint: 1.

Date: 9/11/2021.

Attendees: All team members.

Document created by: Christian Bentley, working with all team members.

GENERAL COMMENTS

1. The team considered that the sprint goals for this sprint had been satisfied, as the team had produced clear, detailed stories for presentation at the next customer meeting.
2. The team noted that there had been two main issues that arose in this first sprint:
    a. the development of early team cohesion within the newly-formed team group; and
    b. the management of low team work capacity due to competing coursework deadlines.
3. The team considered that the issue (a) was not significant and had been effectively managed by the team – an initial icebreaker exercise at the first virtual meeting and then subsequent in-person meetings enabled the team to bond and become effective teammates. The team considered that a collaborative and friendly atmosphere had been developed, which boded well for subsequent iterations.
4. The team considered that issue (b) was a significant issue in this iteration, as several team members were forced to work on other projects and had little time to work on this project. However, the team considered that this issue had been effectively managed through the early discussion of individuals' work capacities at the iteration planning meeting and the mindful allocation of tasks through the sprint backlog. The team observed that this may become an issue in future iterations, and noted that a similar strategy should be employed to mitigate this risk.
5. The team did not consider that there were any unexpected events which had to be overcome in this iteration – the work capacity issue had been identified early and was effectively managed.
6. The team had found the Scrum framework, and the documentation prepared in this sprint, to be very effective in communicating and managing workflows at the team level, although the team observed that the tasks in this iteration were simple and few.
7. The team decided to continue to use the Scrum framework in the next iteration, whilst also incorporating further agile practices and tools, including user stories and pair programming. Observing that future iterations would involve more numerous and complex tasks, the team expressed an intention to incorporate more frequent communication at the team level through regular stand-up meetings in future iterations.

UPDATES TO SPRINT BACKLOG

See **SB1.3**.

UPDATES TO PRODUCT BACKLOG

See **PB1.2**.

SB1.3

SPRINT BACKLOG

Sprint: 1.

Version: 3.

Date: 9/11/2021.

Timing: Sprint Retrospective Meeting.

Created/Last updated by: Christian Bentley, working with all team members.

SPRINT GOAL				
Develop detailed stories for the approved game proposal, to be presented to the customer at the customer meeting on 10 November 2021.				
SELECTED PRODUCT BACKLOG ITEMS				
MUST HAVE	~~Produce detailed stories, setting out core functionalities of the proposed game.~~			
SHOULD HAVE				
COULD HAVE				
SPRINT TASKS				
Priority	**Tasks (ordered)**	**Timeframe (hours)**	**Individual/Pair**	**Status**
MUST HAVE	Brainstorm fruit, vegetable and board functionalities and game mechanics	Up to 2 (per team member)	All team members with capacity	Completed
	Produce a storyboard for a simple 3x3 game level	2	Christian	Completed
	Produce a storyboard for a more complex 7x7 game level	2	Aimee	Completed
	Produce a formal record of the proposed fruit, vegetable and board functionalities	2	Oscar	Completed
SHOULD HAVE	Produce concept drawings for proposed alternative board structures	1	Christian	Completed
COULD HAVE				

PB1.2

PRODUCT BACKLOG

Sprint: 1.

Version: 2.

Date: 9/11/2021.

Timing: Sprint Retrospective Meeting.

Created/Last updated by: Christian Bentley and Abel Tom Varghese.

PRIORITY	TASKS
Must Have	~~Produce detailed stories, setting out core functionalities of the proposed game.~~
Should Have	
Could Have	
Won't Have This Time	

SPRINT 2

Dates: 10-16 November 2021.

Product Owner: Aimee Dowell.

Scrum Master: Christian Bentley.

SPRINT OVERVIEW

Key Documentation

User Stories: **New – US1-23 (see document USM.1)**

Updated – US1-2, 6, 11-12, 15, 19, 23 (see document SR2)

Acc. Tests: **New – AT1-2, 6, 11-12, 15, 19, 23 (see document ATM.1)**

UI Design: **UIDN1**

The goals for Sprint 2 were:

1. to develop the game proposal, as discussed at the customer meeting, into a detailed set of user stories;
2. to develop the team's skills and experience in using Unity and C# for game development; and
3. to produce a functional prototype of the 3x3 square grid tutorial level, to be presented at the customer meeting on 17 November 2021 (at the start of Sprint 3).

At the start of Sprint 2, the team presented a detailed game proposal to the customer, which the customer approved. Therefore, the first task that the team undertook was to develop a detailed set of user stories, allocated between the team members, documenting the proposed functionalities and forming the basis for acceptance testing.

Once the allocated user stories had been developed by individual team members, the team met to discuss the user stories, to form an initial iteration plan and to discuss the product backlog. As the team observed that only Aimee and Abel had any significant previous programming experience, in order to remedy this skills deficit, the team allocated two days (11-12 November 2021) to allow the less experienced programmers to practice using Unity and C# for game development.

After those allocated days, the team met again to formally plan the remainder of the iteration and to develop a sprint backlog, intended to result in the development of a prototype product for the next customer meeting.

During the remainder of the iteration, tasks were managed through a Jira board (replicating the sprint backlog) and pairs programmed together where practicable. The team discussed the Jira board and progress towards the remaining sprint goal at a stand-up meeting on 15 November 2021. Given the uneven balance of programming experience, the team chose to undertake testing in two ways:

1. formal code inspections by experienced programmers, implemented through the review of pull requests on GitHub; and

2. acceptance testing during the sprint retrospective meeting.

At the end of the iteration, the team held a sprint retrospective meeting, at which the team reflected on the sprint and the team's progress towards the sprint goals (see the Sprint Review, below), reviewed acceptance tests for relevant user stories and updated the sprint and product backlogs and existing user stories in light of the team's progress.

SUMMARY OF SPRINT EVENTS AND DOCUMENTATION

Customer Meeting – 10 November 2021

Attended by: All team members and the customer.

The team presented detailed proposals for the game to the customer – in particular, the team presented storyboards **SB1** and **SB2** and functionality proposals (**CD3**) (for these documents, see Sprint 1 Documentation). The customer approved of these detailed proposals and agreed with the team that it would be useful to develop a simple 3x3 grid prototype game during this sprint.

The deliverable for the next customer meeting (17 November 2021) was a playable 3x3 tutorial grid with very simple functionality.

The minutes of the customer meeting are appended to this sprint, as document **CM2**.

Planning Meeting – 10 November 2021

Attended by: All team members.

Immediately after the customer meeting, the team discussed individual capacities and developed an initial plan for the iteration. The first task was to develop user stories from the detailed game proposals ahead of the next iteration planning meeting.

The team developed an initial list of user stories and allocated them between the team members – see document **USA1**. The individual user stories were then collated into a master document – see document **USM.1**.

Iteration Planning Meeting 1 – 11 November 2021

Attended by: All team members.

At the first formal iteration planning meeting, Aimee and Christian developed a product backlog – see document **PB2.1**.

As noted in the Sprint Overview above, the team noted a significant skills deficit with respect to Unity and C#. Therefore, the remainder of 11-12 November 2021 was allocated for the team to practice using Unity and C# for game development and to discuss any issues that arise.

Iteration Planning Meeting 2 – 13 November 2021

Attended by: All team members.

At the second iteration planning meeting, having gained basic experience of using Unity and C#, team members felt better able to assess their abilities to complete development tasks and to estimate the timeframes involved. Therefore, the team developed a sprint backlog and allocated tasks to pairs (where possible) and individuals – see document **SB2.1** – which was then reflected in a Jira board for easier management during the remainder of the sprint.

Stand-up Meeting – 15 November 2021

Attended by: All team members.

At the stand-up meeting, the team discussed the current status of each item on the Jira board/sprint backlog and the team's progress towards the remaining sprint goal (producing a prototype game level for the next customer meeting). No changes were required to the sprint backlog.

A record of the stand-up meeting is appended to this sprint, as document **SM1**.

Sprint Retrospective Meeting – 16 November 2021

Attended by: All team members.

At the sprint retrospective meeting, the team first reflected generally on the sprint (see Sprint Review below), before reviewing the acceptance tests documentation (**ATM.1**) and then updating the sprint backlog (**SB2.2**) and product backlog (**PB2.2**).

A record of the sprint retrospective meeting is appended to this sprint, as document **SR2**.

SPRINT REVIEW

At the sprint retrospective meeting, the team discussed and reviewed the team's progress.

General comments and velocity

The team considered that the team had satisfied each of the sprint goals identified at the start of the sprint – in particular:

1. the team had produced a detailed set of user stories, which formed a strong basis for the production of the product and sprint backlogs and the management of tasks during this and future sprints;
2. the team had gained experience and basic skills in using Unity and C# for game development, which they had applied (particularly through pair programming) to complete development tasks in this sprint; and
3. the team had satisfied the deliverable for the next customer meeting – a functional prototype of the 3x3 square grid tutorial level.

During this sprint, 12 tasks were allocated, of which 9 were prioritised and completed. Therefore, the team has achieved a task completion rate of 75% and a team velocity of 18. The remaining tasks currently in the product backlog require a total velocity of 22. Therefore, a minimum of 2 sprints is required to complete the current set of tasks within the product backlog.

Reflecting on team progress, the team was generally pleased that a significant number of tasks were completed during this sprint. However, the team observed that the majority of tasks undertaken were relatively simple. As a result, upcoming sprints may likely incorporate more complex tasks, which may result in lower task completion for a similar level of velocity.

Difficulties faced

The most significant difficulty that the team faced in this sprint was our lack of experience with Unity and C#. As noted in the Sprint Overview, only Aimee and Abel had any significant programming experience prior to this project. The team considered that building-in two days early in the sprint to

practice with Unity/C#, as well as using formal code inspections for testing, were useful to ensure code quality and for inexperienced developers to learn new skills.

Inexperienced team members also noted that pair programming with more experienced programmers was a very useful exercise for their skill development, although our ability to utilise this tool was limited due to the short development period and the time allocated to learning Unity/C#. The team noted that, in future iterations, we will be able to use pair programming more often, as development time will make up a larger proportion of the iteration.

Exception handling

The team did not consider that there were any unexpected events which had to be overcome in this sprint. The team's lack of experience with Unity/C# had been identified at the outset and properly managed. Several team members observed that effective documentation and pair programming had greatly improved their capabilities to complete development tasks on time, which had not been clear before this iteration.

The team agreed that, for future iterations, the team would focus again on concise, simple documentation and pair programming (where practicable). In particular, the team considered that it would be useful to build a more detailed description of requirements through use cases, corresponding to the current set of user stories. The team also agreed that, as inexperienced developers were still picking up Unity/C#, testing in the next iteration should again take the form of code inspections from experienced developers and formal acceptance testing.

Sprint 3

Subject to the customer's approval, the team planned for the next iteration to focus upon the development of question mechanics and scoring.

SPRINT DOCUMENTATION

Date	ID	Document
10/11/21	CM2	Minutes of a Customer Meeting
10/11/21	USA1	User Stories – Initial set and allocation between team members
11/11/21	PB2.1	Product Backlog – Iteration Planning Meeting 1
13/11/21	SB2.1	Sprint Backlog – Iteration Planning Meeting 2
14/11/21	USM.1	User Stories – Master Document (Version 1)
15/11/21	SM1	Record of a Stand-up Meeting
16/11/21	SR2	Record of a Sprint Retrospective Meeting
16/11/21	ATM.1	Acceptance Testing – Master Document (Version 1)
16/11/21	SB2.2	Sprint Backlog – Sprint Retrospective Meeting
16/11/21	PB2.2	Product Backlog – Sprint Retrospective Meeting
16/11/21	UIDN1	User Interface Design Notes 1

CM2

MINUTES OF CUSTOMER MEETING – 10:45AM, 10 NOVEMBER 2021

Attendees: All team members, customer.

Scribe: Christian Bentley.

Presentation of storyboards and proposed functionalities

- The team presented SB1 (simple 3x3 tutorial grid) and SB2 (higher difficulty 7x7 grid) and CD3 (more detailed fruit and vegetable functionalities) to the customer.
- The customer was pleased with the progress made since the last meeting and happy with our proposals.

Next steps in development

- The team expressed their intention to start development of a simple 3x3 tutorial grid in the next iteration.
- The customer agreed that this would be useful.
- The team asked what the customer considers to be core functionalities ("Must Haves") that should be incorporated into this next iteration.
- The customer agreed that the 3x3 proposal as presented had a good game structure and provided a strong basis for further development (larger grids, varied vegetable and fruit functionalities, question packages – each of which could be "plugged in" within later iterations).

Deliverables

- Develop a 3x3 tutorial grid with very simple functionality for the next customer meeting.

USA1

USER STORIES ALLOCATION

Sprint: 2.

Date: 10/11/2021.

Timing: Planning Meeting.

Created/Last updated by: Christian Bentley, working with all team members.

	Summary of Functionality	**Allocation**
Main Menu Functionalities		
US1	Main menu on start-up (Start game, choose question package/difficulty, load game, close game)	Christian
US2	Start game clicked on	Aimee
US3	Choosing question package	Oscar
US4	Choosing difficulty	Vishnu
US5	Loading a saved game	Abel
US6	Closing the game from the main menu	Justin
Mid-Level Menu Functionalities		
US7	Mid-level menu (when “Esc” pressed, showing: resume game, save game, quit to Main Menu)	Rohith
US8	Resume game clicked	Jaafar
US9	Save game clicked	Abel
US10	Quit to Main Menu clicked	Christian
US22	Warning message (progress loss) on Quit to Main Menu	Christian
Basic In-Level Functionalities		
US11	Positioning of carrots on level start	Abel
US12	Highlighting square on click	Aimee
US13	Question pop-up	Oscar
US14	Correct answer	Vishnu
US16	Incorrect answer	Rohith
US15	Carrot revealed	Justin
US23	Carrot not revealed	Christian
US17	Movement of carrots after each correct answer	Jaafar
US18	Strawberry interaction between questions	Christian
US19	Level completed	Aimee
US20	Level failed	Oscar
US21	Scoring (correct answers)	Jaafar

PB2.1

PRODUCT BACKLOG

Sprint: 2.

Version: 1.

Date: 11/11/2021.

Timing: Iteration Planning Meeting 1.

Created/Last updated by: Christian Bentley and Aimee Dowell.

PRIORITY	UNSATISFIED USER STORIES AND OTHER TASKS
Must Have	~~Develop a set of user stories for the approved game proposal~~ **US11 –** Positioning of carrots on level start **US12 –** Highlighting square on click **US15 –** Carrot revealed **US23 –** Carrot not revealed
Should Have	**US1 –** Main Menu interface **US2 –** Start Game from Main Menu **US19 –** Completion of level
Could Have	**US7 –** Mid-Level Menu interface **US8 –** Resume Game from Mid-Level Menu **US13 –** Question pop-up **US17 –** Movement of carrots **US21 –** Scoring for correct answers
Won't Have This Time	**US3-6 –** Other Main Menu functionalities (Choose Question Package, Choose Difficulty, Load a Saved Game, Close the Game) **US9-10 –** Other Mid-Level functionalities (Save Game, Quit to Main Menu) **US14/16 –** Correct and incorrect answers to questions **US18 –** Steve interactions between questions **US20 –** Failure of level **US22 –** Quit to Main Menu warning message

SPRINT BACKLOG

Sprint: 2.

Version: 1.

Date: 13/11/2021.

Timing: Iteration Planning Meeting 2.

Created/Last updated by: Christian Bentley, working with all team members.

SPRINT GOAL				
Produce a functional prototype of the 3x3 square grid tutorial level, to be presented at the customer meeting on 17/11/2021.				
SELECTED PRODUCT BACKLOG ITEMS				
MUST HAVE	~~Develop a set of user stories for the approved game proposal~~ **US11 –** Positioning of carrots on level start **US12 –** Highlighting square on click **US15 –** Carrot revealed **US23 –** Carrot not revealed			
SHOULD HAVE	**US1 –** Main Menu interface **US2 –** Start Game from Main Menu **US19 –** Completion of level			
COULD HAVE	**US7 –** Mid-Level Menu interface **US8 –** Resume Game from Mid-Level Menu **US17 –** Movement of carrots			
SPRINT TASKS				
Priority	**Tasks (ordered)**	**Timeframe (hours)**	**Individual/Pair**	**Status**
COMPLETED	Develop a set of user stories for the approved game proposal	1 (per person)	As allocated in USA1	Completed
	Create Main Menu and 3x3 grid scenes	-	Aimee	Completed
MUST HAVE	Create 3x3 board of square tiles	3	Jaafar	Not started
	Highlight tiles on click	2	Aimee and Christian	Not started
	Position carrots at level start	5	Abel and Rohith	Not started
	Check if carrot underneath tile	1	Abel and Rohith	Not started
	If carrot underneath tile, reveal carrot	2	Oscar and Abel	Not started
	If no carrot underneath tile/carrot revealed, turn tile grey	4	Vishnu and Justin	Not started
SHOULD HAVE	Create UI box to track number of carrots remaining	2	Aimee and Christian	Not started
	Level complete pop-up	2	Jaafar	Not started
	Create Main Menu interface and Start Game	2	Christian	Not started

COULD HAVE	Movement of carrots after each guess	5	Abel	Not started
	Create Mid-Level Menu interface and Resume Game	2	Christian	Not started

USER STORIES: MASTER DOCUMENTATION

Version: 1.

Date: 14/11/2021.

Created/Last updated by: Christian Bentley, working with all team members.

US1	**User Story:** As a **player** I want a **Main Menu** so that **I can choose the ways in which I will play the game.**
Comments: Main Menu to appear on start-up and when selected from the Mid-Level Menu. Menu options should include “Start game”, “Choose question package”, “Choose difficulty level”, “Load game” and “Close game”. The Main Menu may have artwork, music and interactions with the game characters.	
Acceptance criteria: 1. Upon the player loading up the game, the Main Menu is opened. 2. After the player clicks on “Quit to Main Menu” from the Mid-Level Menu (and any warning message is accepted – see US22), the Main Menu is opened.	
Status (10/11/2021): Created/Last updated by: Christian Bentley. Version: 1. Development/Testing: Not developed or tested.	
Connected User Stories: US2-US6 (Main Menu functionalities), US10/22 (Quit to Main Menu and warning message).	

US2	**User Story:** As a **player**, I want a **start button for each puzzle type** so that I can **begin a current or new game level**.
Comments: Start button will appear after the puzzle type is selected from the main menu. The button should correspond to the current level number of the game and difficulty.	
Acceptance criteria: Every time the puzzle type button is clicked from the Main Menu, or a level from the selected puzzle type has been completed (win or lose), the start button should appear, programmed for the next level (win), or the same level (lose/current).	
Status (10/11/2021): Created/Last updated by: Aimee Dowell. Version: 1. Development/Testing: Not developed or tested.	
Connected User Stories: US1 (Main Menu interface)	

US3	**User Story:** As a **player** I want a **Question Package** so that **I can choose the category of questions before I start playing the game.**
Comments:	

Sub-menu within the Main Menu. Options within “Choose Question Package” will include 4 categories (yet to be decided properly). Could include “Arithmetic”, “Geography”, “History” and “Biology”. Fundamental menu options outside of categories includes “Return to Main Menu”.

Acceptance criteria:
The question category chosen by the user should be implemented within the question mechanics and remain the same throughout the game. The category options should be clickable as a tick-box or drop-down sub-menu of Main Menu.

Status (10/11/2021):
Created/Last Updated By: Oscar Gee.
Version: 1.
Development/Testing: Not developed or tested.

Connected User Stories:
US1 (Main Menu interface), US2 (Start Game)

US4	**User Story:** As a **player** I want **to choose the difficulty level before starting the game** so that **I can tailor the gameplay.**

Comments:
There should be a “level of difficulty” option in the Main/Start Game Menu, which allows the player to change the difficulty level. If the player wishes to change the difficulty during a game, then further features may be implemented.

Acceptance criteria:
The difficulty level chosen by the player should be implemented in the question mechanics and remain same for the entire game. The difficulty options should be clickable as a tick-box or drop-down sub-menu of Main Menu.

Status (10/11/2021)
Created/Last Updated By: Vishnu Vardhan.
Version: 1.
Development/Testing: Not developed or tested.

Connected User Stories:
US1/US2 (Main Menu and Start Game interfaces), US3 (Question Packages), US13 (Question Pop-up)

US5	**User Story:** As a **player**, I want to **load a previously saved game** so that **I can carry on playing from the last time**.

Comments:
There should be a “Load Game” button which allows user to load a previously saved game.

Acceptance criteria:
1. There should be a “Load Game” button above the grid/board.
2. Once the button is clicked, the board should be updated with the contents of the previous game.
3. The score should be updated
4. The player should be informed that the game has been loaded successfully
5. The player should be prompted to make a move.

Status (10/11/2021)
Created/Last Updated By: Abel Tom Varghese.
Version: 1.
Development/Testing: Not developed or tested.

Connected User Stories: US1 (Main menu on start-up), US7 (Mid-level menu – saving a game), US12 (All previously selected squares should be highlighted), US21 (Must load all previous scores)

US6	**User Story:** As a **player** I want to **close the game from the main menu** so that **I don't have to switch to desktop or use task manager to force close it**.
Comments: A "Quit to Desktop" button should be in the Main Menu screen allowing the player to close the game.	
Acceptance criteria: When the "Quit to Desktop" button is clicked. The game should ask the player "Are you sure you want to quit?" and, if accepted, then the game application should close.	
Status (14/11/2021) Created/Last Updated By: Justin Lam Version: 1. Development/Testing: Not developed or tested.	
Connected User Stories: US1 (Main Menu interface)	

US7	**User Story:** As a **player** I want **a mid-level menu** so that **I can take a break, save my game progress or go back to the main menu.**
Comments: The player should be in an active game. It must not be game over/any other menu. During a level, when the player presses the "escape" button, the ongoing game pauses and a Mid-Level Menu pops up. It should have 3 options in the following order – Resume Game, Save Game and Quit to Main Menu buttons. Also after saving the progress, it should be returned to the mid-level menu.	
Acceptance criteria: After pressing the escape button during a game level, the Mid-Level Menu must open.	
Status: 11/11/21 Created/Last Updated By: Rohith Kanjirappara. Version: 1. Development/Testing: Not developed or tested.	
Connected User Stories: US10 and US22 (Quit to Main Menu and warning message), US9 (Save Game), US8 (Resume Game)	

US8	**User Story:** As a **player**, I want a **resume game button** so that I can **continue playing the game once the mid-game menu is clicked.**
Comments: The resume game button should appear as part of the in-game menu. Once clicked the game should continue from the where the player last left off.	
Acceptance criteria: Once the player clicks the resume game button in the in-game menu the game should resume where it was left off.	
Status (10/11/2021):	

Created/Last updated by: Jaafar Ghaddar. Version: 1. Development/Testing: Not developed or tested.
Connected User Stories: US7 (Mid-Level Menu interface)

US9	**User Story:** As a **player**, I want to **save a game in progress** so that **I can return to it later**.
Comments: There should be a “Save Game” button which allows user to save the progress of the current game.	
Acceptance criteria: 1. There should be a “Save Game” button above the grid/board. 2. Once the button is clicked, the game should save the contents of the board & the current score 3. The user should be prompted that either the game was successfully or unsuccessfully saved. 4. The user then has the option to carry on playing the game.	
Status (10/11/2021) Created/Last Updated By: Abel Tom Varghese. Version: 1. Development/Testing: Not developed or tested.	
Connected User Stories: US7 (Mid-Level Menu interface), US5 (Load Game), US21 (Scoring), US11/17 (Positioning and Movement of Carrots)	

US10	**User Story:** As a **user** I want an **option during level gameplay to return to the Main Menu** so that **after having started a game, I can start a new game, load a saved game or quit the program.**
Comments: “Quit to Main Menu” should be an option from the Mid-Level Menu. If the user clicks on this option, the user should be taken to the Main Menu and the current game should be ended and not saved. *See US22 (warning message) for alternative stories concerning a warning message for the loss of current game progress.*	
Acceptance criteria: 1. “Quit to Main Menu” is an option in the Mid-Level Menu. 2. If the user selects this option, the Main Menu is opened and the current game is ended.	
Status (10/11/2021): Created/Last updated by: Christian Bentley. Version: 1. Development/Testing: Not developed or tested.	
Connected User Stories: US1 (Main Menu), US22 (Quit to Main Menu – warning message).	

US11	**User Story:** As a **developer**, I need to **randomly position the carrots on the board so that at minimum it would require 2+ moves to reach Steve the Strawberry (main character).** Having this functionality, would **make the game engaging & fun to play for the player.**
Comments:	

The carrots & strawberry should be randomly positioned on the board so that all carrots would require two or more moves to reach the strawberry.
Acceptance criteria: 1. There should be a fixed number of carrots for each level 2. Unit tests should determine each carrot has been added to the board. 3. Ensure all carrots are at minimum more than two steps away from Steve
Status (10/11/2021) Created/Last Updated By: Abel Tom Varghese. Version: 1. Development/Testing: Not developed or tested.
Connected User Stories: US2 (Start Game), US4 (Difficulty), US5 (Load Game), US7/9 (Mid-Level Menu and Save Game), US17 (Movement of Carrots), US15/23 (Carrots Revealed/Not Revealed)

US12	**User Story:** As a **player**, I want a **clicked square to be highlighted** so that I can **see which square I have selected instead of using muscle memory**.
Comments: Square can only be highlighted if the game is currently awaiting a selection. This will be when a level has first started, after a previous question has been answered incorrectly, or after a previous square has been uncovered.	
Acceptance criteria: Every time a square is clicked (provided there is no current pop-up, such as a question, or an animation showing what is underneath a selected square) the clicked square should be clearly highlighted.	
Status (10/11/2021): Created/Last updated by: Aimee Dowell. Version: 1. Development/Testing: Not developed or tested.	
Connected User Stories: US13 (Question Pop-up)	

US13	**User Story:** As a **player** I want **questions to pop up** so that **I can answer the questions to progress the game.**
Comments: Questions are to pop up depending on which tile the player clicks on. The questions that will be revealed will be relevant to the category selected prior to the start of the game.	
Acceptance criteria: Once a tile has been clicked on by the player, a question must pop-up.	
Status (10/11/2021): Created/Last Updated By: Oscar Gee. Version: 1. Development/Testing: Not developed or tested.	
Connected User Stories: US3 (Question Package), US12 (Highlighting Tiles), US14/16 (Correct and Incorrect Answers)	

US14	**User Story:**

	As a **player** I want **the question pop-up to confirm that I have made a correct answer** so that **I can understand my progress in the game.**
Comments: Once a question has popped-up and a the user has input a correct answer, the pop-up should confirm that the answer is correct.	
Acceptance criteria: When a question is answered correctly, the question pop-up visually confirms that the answer was correct.	
Status (14/11/2021) Created/Last Updated By: Christian Bentley. Version: 1. Development/Testing: Not developed or tested.	
Connected User Stories: US13 (Question pop-up), US15 (Carrot revealed), US16 (Incorrect answer), US23 (No carrot on tile), US21 (Scoring)	

US15	**User Story:** As a **player** I want **the carrots to be revealed when I clicked the correct square that the carrots are on** so that **the player will have visual information of where and how many carrots have been found.**
Comments: Once a tile has been selected and a question has been answered correctly, then if there is a carrot on that tile then the carrot should be revealed.	
Acceptance criteria: 1. When a question is answered correctly, if a carrot is on the selected tile, then the carrot is revealed. 2. However, if a carrot is not on the selected tile, then the carrot is not revealed.	
Status (14/11/2021) Created/Last Updated By: Justin Lam. Version: 1. Development/Testing: Not developed or tested.	
Connected User Stories: US12 (Highlighting square on click), US13 (Question pop-up), US14 (Correct answer)	

US16	**User Story:** As a **player** I want **an incorrect answer pop-up** so that **I can know if my answer is correct or not.**
Comments: When a player gives an incorrect answer to a question, there should be a pop-up informing the user that his/her answer to the question is incorrect. The pop-up should have the following text- “Oops! Your answer is incorrect – let’s try again!” along with the incorrect answer Steve image. Alternatively, the player may be permitted to try a different question.	
Acceptance criteria: When a question is answered incorrectly, the question pop-up visually confirms that the answer was incorrect and prompts the player to try a different answer or skip to a different question.	
Status: 11/11/21 Created/Last Updated By: Rohith Kanjirappara. Version: 1.	

Development/Testing: Not developed or tested.
Connected User Stories: US13 (Question Pop Up), US14 (Correct Answer)

US17	**User Story:** As a **player**, I want the **carrots to move after each correct answer** so that I can **understand how they will approach me in other levels.**
Comments: Carrots will move randomly after each correct answer, in further rounds they will move closer to the strawberry in order to eat him.	
Acceptance criteria: Every time the player answers a question correctly the carrot moves randomly in the board.	
Status (10/11/2021): Created/Last updated by: Jaafar Ghaddar. Version: 1. Development/Testing: Not developed or tested.	
Connected User Stories: US11 (Positioning of carrots at level start), US14 (Correct Answer)	

US18	**User Story:** As a **player** I want **Steve to interact with me between questions** so that **I am engaged with and guided by the main character.**
Comments: Whilst the user is playing a game level and is not answering a question, after a short period of inactivity Steve should display a message, guiding the player's next action (selecting a tile).	
Acceptance criteria: When a user is playing a game level, is not answering a question and after a short period of inactivity, a message is displayed instructing the player to select the next tile.	
Status (10/11/2021): Created/Last updated by: Christian Bentley. Version: 1. Development/Testing: Not developed or tested.	
Connected User Stories: US12-16 (Tile Selection and Questions).	

US19	**User Story:** As a **player**, I want to **successfully complete a level once I have found all the vegetables** so that I can **return to the main menu and complete the next level or save and quit**.
Comments: Level is not deemed 'complete' if all lives are lost, or if a vegetable reaches the strawberry before player catches them.	
Acceptance criteria: If all the vegetables have been found before they reach the strawberry, the level is deemed complete and should return the main menu where the player can either save and quit the game or continue to the next level.	
Status (10/11/2021): Created/Last updated by: Aimee Dowell.	

Version: 1. Development/Testing: Not developed or tested.
Connected User Stories: US20 (Level failed), US21 (Scoring)

US20	**User Story:** As a **player** I want a **level failed** notification so that **I can restart the game and play again.**
Comments: Pop up to appear when failing the game. This can occur when vegetables reach Steve the Strawberry. Pop up informs the player that they have lost the level and will give the player an option to either return to the main menu or restart the level.	
Acceptance criteria: Pop up to occur when vegetable reaches Strawberry. Pop up will contain buttons “Return to Main menu” and “Restart Level”.	
Status (10/11/2021): Created/Last Updated By: Oscar Gee. Version: 1. Development/Testing: Not developed or tested.	
Connected User Stories: US2-US6 (Main Menu functionalities), US10 (Quit to Main Menu clicked), US19 (Level Completed), US21 (Scoring).	

US21	**User Story:** As a **player**, I want to **be able to see my score as the game progresses** so that I can **be motivated to do better**.
Comments: The player will receive a 100 points on every correct answer and a half the points on each consecutive attempt of the same question.	
Acceptance criteria: Once a correct answer has been made the points go up. If the attempt was right on the first try the player receives a 100 points, if it was his second attempt: 50, third: 25, etc…	
Status (10/11/2021): Created/Last updated by: Jaafar Ghaddar. Version: 1. Development/Testing: Not developed or tested.	
Connected User Stories: US14/16 (Correct and Incorrect Answers), US19/20 (Level Completed/Failed).	

US22	**User Story:** As a **user** I want **to receive a message warning me that my current level progress will be lost if I quit to the Main Menu without saving** so that **I do not accidentally lose my level progress.**
Comments: When the “Quit to Main Menu” option is selected from the Mid-Level Menu, the current level progress is closed and not saved. In order to avoid accidental losses of progress, then *if the user has progressed since their last save*, then the user should receive a warning message, stating that their progress will be lost, and be given the options to proceed to the Main Menu or to return to the Mid-Level Menu.	

Acceptance criteria:

1. If the user has progressed since the last save and "Quit to Main Menu" is selected, a warning message is displayed with two options – proceed to Main Menu and return to the Mid-Level Menu.
2. If the user selects to proceed to the Main Menu from the warning message, or if they select "Quit to Main Menu" in the Mid-Level Menu and they have not progressed since the last save, US10 is continued (the Main Menu is opened and current level progress is not saved).
3. If the user selects to return to the Mid-Level Menu, they are returned to the Mid-Level Menu.

Status (10/11/2021):
Created/Last updated by: Christian Bentley.
Version: 1.
Development/Testing: Not developed or tested.

Connected User Stories:
US1 (Main Menu), US9 (Game saves), US10 (Quit to Main Menu)

US23	**User Story:** As a **user** I want **to receive a notification that there was no carrot underneath the revealed tile** so that **I can track my level progress.**

Comments:
When a question is answered correctly, the tile is revealed (US14) and the tile disappears.
If there is no carrot on that tile, then a message from Steve should appear stating "Unlucky, there are no vegetables behind that tile – let's try another one!".

Acceptance criteria:
If the player has answered a question correctly and there is no carrot on that tile, then the above message appears and the tile disappears.

Status (10/11/2021):
Created/Last updated by: Christian Bentley.
Version: 1.
Development/Testing: Not developed or tested.

Connected User Stories:
US13 (Question Pop-up), US14 (Correct Answer), US15 (Carrot Revealed), US11/17 (Positioning and Movement of Carrots).

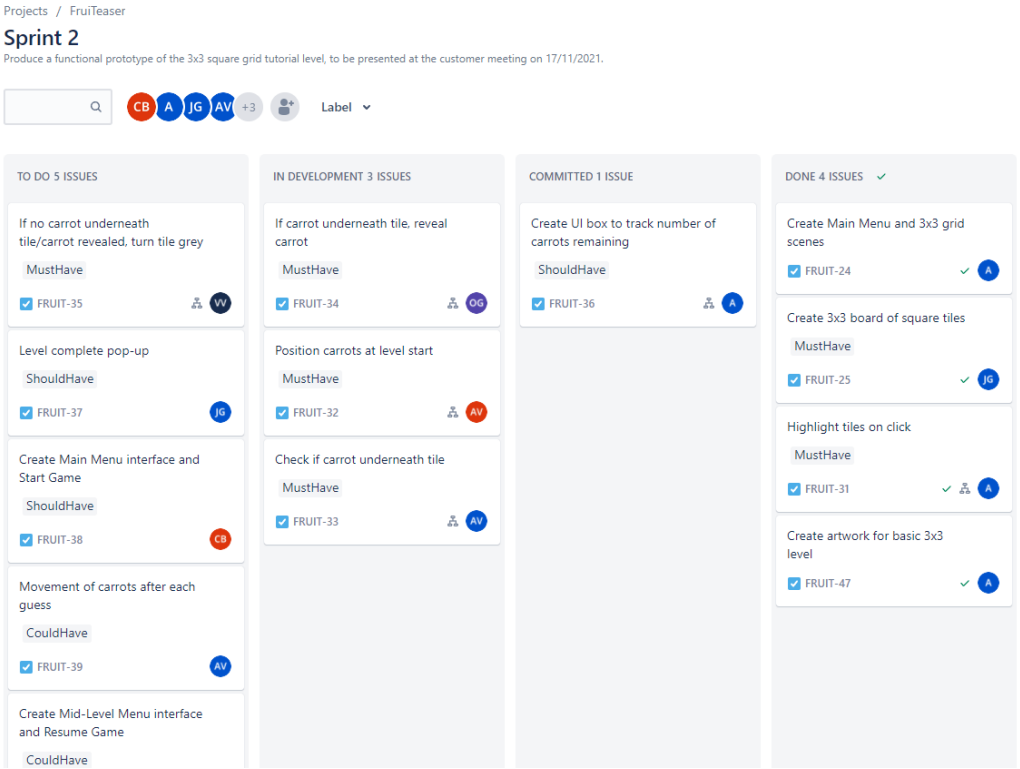
STAND-UP MEETING

Date: 15/11/2021

Attendees: All team members.

Document created by: Christian Bentley, working with all team members.

Sprint 2 - Jira Board



SPRINT RETROSPECTIVE

Sprint: 2.

Date: 16/11/2021.

Attendees: All team members.

Document created by: Christian Bentley, working with all team members.

GENERAL COMMENTS

1. The team was pleased with the progress made on the product, given our collective lack of experience with Unity/C#.
2. The most significant difficulty that the team faced in this sprint was our lack of experience with Unity and C#. As noted at earlier meetings, only Aimee had previous experience of using Unity and only Abel had any significant programming experience.
3. The team considered that building-in two days early in the sprint to practice with Unity/C#, as well as using formal code inspections for testing, were useful to ensure code quality and for inexperienced developers to learn new skills. Inexperienced team members also noted that pair programming with more experienced programmers was a very useful exercise for their skill development, although our ability to utilise this tool was limited due to the short development period and the time allocated to learning Unity/C#.
4. The team noted that, in future iterations, we will be able to use pair programming more often, as development time will make up a larger proportion of the iteration.
5. The team did not consider that there were any unexpected events which had to be overcome in this sprint, although several team members observed that effective documentation and pair programming had greatly improved their capabilities to complete development tasks on time, which had not been clear before this iteration. The team considered that it would be useful to build a more detailed description of requirements through use cases, corresponding to the current set of user stories, in the next sprint.
6. The next sprint should, provided that the customer agrees, target the question mechanics and scoring.

REVIEW OF ACCEPTANCE TESTS

The team reviewed the acceptance tests master (**ATM.1**), observing that of the acceptance tests which were relevant to the user stories implemented in this sprint, several were only partially passed or failed. The team noted such acceptance tests for incorporation into the product backlog.

REVIEW OF, AND UPDATES TO, SPRINT BACKLOG

The team reviewed and updated the sprint backlog (**SB2.2**).

During this sprint, 12 tasks were allocated, of which 9 were prioritised and completed. Therefore, the team has achieved a task completion rate of 75% and a team velocity of 18. The remaining tasks

currently in the product backlog require a total velocity of 22. Therefore, a minimum of 2 sprints is required to complete the current set of tasks within the product backlog.

Reflecting on team progress, the team was generally pleased that a significant number of tasks were completed during this sprint. However, the team observed that the majority of tasks undertaken were relatively simple. As a result, upcoming sprints may likely incorporate more complex tasks, which may result in lower task completion for a similar level of velocity.

REVIEW OF, AND UPDATES TO, PRODUCT BACKLOG

The team reviewed and updated the product backlog (**PB2.2**) to reflect the completed items in the updated sprint backlog and the failed acceptance tests.

UPDATES TO EXISTING USER STORIES

Updates reflected in **USM.2** (*which is not appended to this submission, to avoid unnecessary duplication*).

US1	**User Story:** As a **player** I want a **Main Menu** so that **I can choose the ways in which I will play the game.**
Comments: Main Menu to appear on start-up and when selected from the Mid-Level Menu. Menu options should include “Start game”, “Choose question package”, “Choose difficulty level”, “Load game” and “Close game”. The Main Menu may have artwork, music and interactions with the game characters.	
Acceptance criteria: 1. Upon the player loading up the game, the Main Menu is opened. 2. After the player clicks on “Quit to Main Menu” from the Mid-Level Menu (and any warning message is accepted – see US22), the Main Menu is opened.	
Status (16/11/2021): Created/Last updated by: Christian Bentley. Version: 2. Development/Testing: Developed and tested. Test #2 to be implemented as part of US10 (Mid-Level Menu option to return to the Main Menu).	
Connected User Stories: US2-US6 (Main Menu functionalities), US10/22 (Quit to Main Menu and warning message).	

US2	**User Story:** As a **player**, I want a **start button for each puzzle type** so that I can **begin a current or new game level**.
Comments: Start button will appear after the puzzle type is selected from the main menu. The button should correspond to the current level number of the game and difficulty.	
Acceptance criteria: Every time the puzzle type button is clicked from the Main Menu, or a level from the selected puzzle type has been completed (win or lose), the start button should appear, programmed for the next level (win), or the same level (lose/current).	
Status (16/11/2021):	

Created/Last updated by: Aimee Dowell. Version: 2. Development/Testing: Developed and tested.
Connected User Stories: US1 (Main Menu interface)

US6	**User Story:** As a **player** I want to **close the game from the main menu** so that **I don't have to switch to desktop or use task manager to force close it**.
Comments: A "Quit to Desktop" button should be in the Main Menu screen allowing the player to close the game.	
Acceptance criteria: When the "Quit to Desktop" button is clicked. The game should ask the player "Are you sure you want to quit?" and, if accepted, then the game application should close.	
Status (16/11/2021) Created/Last Updated By: Justin Lam Version: 2. Development/Testing: Developed and tested. Warning message not implemented after further discussion within the team.	
Connected User Stories: US1 (Main Menu interface)	

US11	**User Story:** As a **developer**, I need to **randomly position the carrots on the board so that at minimum it would require 2+ moves to reach Steve the Strawberry (main character).** Having this functionality, would **make the game engaging & fun to play for the player.**
Comments: The carrots & strawberry should be randomly positioned on the board so that all carrots would require two or more moves to reach the strawberry.	
Acceptance criteria: 1. There should be a fixed number of carrots for each level 2. Unit tests should determine each carrot has been added to the board. 3. Ensure all carrots are at minimum more than two steps away from Steve.	
Status (16/11/2021) Created/Last Updated By: Abel Tom Varghese. Version: 2. Development/Testing: Developed and tested for 3x3 tile level, will require further development for alternative tile sets.	
Connected User Stories: US2 (Start Game), US4 (Difficulty), US5 (Load Game), US7/9 (Mid-Level Menu and Save Game), US17 (Movement of Carrots), US15/23 (Carrots Revealed/Not Revealed)	

US12	**User Story:** As a **player**, I want a **clicked square to be highlighted** so that I can **see which square I have selected instead of using muscle memory**.
Comments:	

Square can only be highlighted if the game is currently awaiting a selection. This will be when a level has first started, after a previous question has been answered incorrectly, or after a previous square has been uncovered.
Acceptance criteria: Every time a square is clicked (provided there is no current pop-up, such as a question, or an animation showing what is underneath a selected square) the clicked square should be clearly highlighted.
Status (10/11/2021): Created/Last updated by: Aimee Dowell. Version: 2. Development/Testing: Developed and tested.
Connected User Stories: US13 (Question Pop-up)

US15	**User Story:** As a **player** I want **the carrots to be revealed when I clicked the correct square that the carrots are on** so that **the player will have visual information of where and how many carrots have been found.**
Comments: Once a tile has been selected and a question has been answered correctly, then if there is a carrot on that tile then the carrot should be revealed.	
Acceptance criteria: 1. When a question is answered correctly, if a carrot is on the selected tile, then the carrot is revealed. 2. However, if a carrot is not on the selected tile, then the carrot is not revealed.	
Status (17/11/2021) Created/Last Updated By: Justin Lam. Version: 2. Development/Testing: Developed and tested for an assumed correct answer, further development required to integrate question mechanics.	
Connected User Stories: US12 (Highlighting square on click), US13 (Question pop-up), US14 (Correct answer)	

US19	**User Story:** As a **player**, I want to **successfully complete a level once I have found all the vegetables** so that I can **return to the main menu and complete the next level or save and quit**.
Comments: Level is not deemed 'complete' if all lives are lost, or if a vegetable reaches the strawberry before player catches them.	
Acceptance criteria: If all the vegetables have been found before they reach the strawberry, the level is deemed complete and should return the main menu where the player can either save and quit the game or continue to the next level.	
Status (16/11/2021): Created/Last updated by: Aimee Dowell. Version: 2.	

Development/Testing: Developed and tested, save that the player is not returned to the Main Menu. This feature will be implemented in a later iteration when the level completion mechanics are added.
Connected User Stories: US20 (Level failed), US21 (Scoring)

US23	**User Story:** As a **user** I want **to receive a notification that there was no carrot underneath the revealed tile** so that **I can track my level progress.**
Comments: When a question is answered correctly, the tile is revealed (US14) and the tile disappears. If there is no carrot on that tile, then a message from Steve should appear stating "Unlucky, there are no vegetables behind that tile – let's try another one!".	
Acceptance criteria: If the player has answered a question correctly and there is no carrot on that tile, then the above message appears and the tile disappears.	
Status (17/11/2021): Created/Last updated by: Christian Bentley. Version: 2. Development/Testing: Developed and tested for an assumed correct answer, further development required to integrate question mechanics and messages from Steve.	
Connected User Stories: US13 (Question Pop-up), US14 (Correct Answer), US15 (Carrot Revealed), US11/17 (Positioning and Movement of Carrots).	

ACCEPTANCE TESTING: MASTER DOCUMENTATION

Version: 1.

Date: 16/11/2021.

Document created by: Christian Bentley, working with all team members.

ID	Vers	User Story	Acceptance Tests	Developer/ Pair	Tester	Date	Comments
AT1	1	US1	1. Upon the player loading up the game, the Main Menu is opened. 2. After the player clicks on "Quit to Main Menu" from the Mid-Level Menu (and any warning message is accepted – see US22), the Main Menu is opened.	Aimee	Christian	16/11/2021	Test #1 passed. Test #2 to be implemented as part of US10 (Mid-Level Menu option to return to the Main Menu)
AT2	1	US2	Every time the puzzle type button is clicked from the Main Menu, or a level from the selected puzzle type has been completed (win or lose), the start button should appear, programmed for the next level (win), or the same level (lose/current).	Christian and Aimee	Abel	16/11/2021	Test passed in relation to the Main Menu start game button. A further intermediary menu may be required to implement US3/4 (Difficulties and Question Packages).
AT6	1	US6	When the "Quit to Desktop" button is clicked. The game should ask the player "Are you sure you want to quit?" and, if accepted, then the game application should close.	Christian	Aimee	16/11/2021	Test passed, save that no warning message appears. After discussion, this feature was not regarded as necessary and will not be implemented.
AT11	1	US11	The carrots & strawberry should be randomly positioned on the board so that all carrots would require two or more moves to reach the strawberry.	Abel and Rohith	Christian	16/11/2021	Test passed.

AT12	1	US12	Every time a square is clicked (provided there is no current pop-up, such as a question, or an animation showing what is underneath a selected square) the clicked square should be clearly highlighted.	Christian and Aimee	Abel	16/11/2021	Test passed.
AT15	1	US15	1. When a question is answered correctly, if a carrot is on the selected tile, then the carrot is revealed. 2. However, if a carrot is not on the selected tile, then the carrot is not revealed.	Oscar and Abel	Aimee	16/11/2021	Tests passed.
AT19	1	US19	If all the vegetables have been found before they reach the strawberry, the level is deemed complete and should return the main menu where the player can either save and quit the game or continue to the next level.	Aimee and Jaafar	Christian	16/11/2021	Test passed, save that the player is not returned to the Main Menu. This feature will be implemented in a later iteration when the level completion mechanics are added.
AT23	1	US23	When a question is answered correctly, the tile is revealed (US14) and the tile disappears. If there is no carrot on that tile, then a message from Steve should appear stating “Unlucky, there are no vegetables behind that tile – let’s try another one!”.	Vishnu and Justin	Christian	16/11/2021	Test passed, save that there is no message from Steve. This feature will be implemented as part of US18 (Steve interactions during levels).

SB2.2

SPRINT BACKLOG

Sprint: 2.

Version: 2.

Date: 16/11/2021.

Timing: Sprint Retrospective Meeting.

Created/Last updated by: Christian Bentley, working with all team members.

SPRINT GOAL				
Produce a functional prototype of the 3x3 square grid tutorial level, to be presented at the customer meeting on 17/11/2021.				
SELECTED PRODUCT BACKLOG ITEMS				
MUST HAVE	~~Develop a set of user stories for the approved game proposal~~ ~~**US11 –** Positioning of carrots on level start~~ ~~**US12 –** Highlighting square on click~~ ~~**US15 –** Carrot revealed~~ ~~**US23 –** Carrot not revealed~~			
SHOULD HAVE	~~**US1 –** Main Menu interface~~ ~~**US2 –** Start Game from Main Menu~~ ~~**US19 –** Completion of level~~			
COULD HAVE	**US7 –** Mid-Level Menu interface **US8 –** Resume Game from Mid-Level Menu **US17 –** Movement of carrots			
SPRINT TASKS				
Priority	**Tasks (ordered)**	**Timeframe (hours)**	**Individual/Pair**	**Status**
COMPLETED	Develop a set of user stories for the approved game proposal	1 (per person)	As allocated in USA1	Completed
	Create Main Menu and 3x3 grid scenes	-	Aimee	Completed pre-iteration
MUST HAVE	Create 3x3 board of square tiles	3	Jaafar	Completed and tested
	Highlight tiles on click	2	Aimee and Christian	Completed and tested
	Position carrots at level start	5	Abel and Rohith	Completed and tested for 3x3 grid only
	Check if carrot underneath tile	1	Abel and Rohith	Completed and tested
	If carrot underneath tile, reveal carrot	2	Oscar and Abel	Completed and tested
	If no carrot underneath tile/carrot revealed, turn tile grey	4	Vishnu and Justin	Completed and tested to make tile disappear, not to turn grey

SHOULD HAVE	Create UI box to track number of carrots remaining	2	Aimee and Christian	Completed and tested
	Level complete pop-up	2	Jaafar	Completed and tested
	Create Main Menu interface and Start Game	2	Christian	Completed and tested
COULD HAVE	Movement of carrots after each guess	5	Abel	Not started
	Create Mid-Level Menu interface and Resume Game	2	Christian	Not started

PB2.2

PRODUCT BACKLOG

Sprint: 2.

Version: 2.

Date: 16/11/2021.

Timing: Sprint Retrospective Meeting.

Created/Last updated by: Christian Bentley and Aimee Dowell.

PRIORITY	UNSATISFIED USER STORIES, FAILED TESTS AND OTHER TASKS
Must Have	~~Develop a set of user stories for the approved game proposal~~ ~~**US11 –** Positioning of carrots on level start~~ ~~**US12 –** Highlighting square on click~~ ~~**US15 –** Carrot revealed~~ ~~**US23 –** Carrot not revealed~~
Should Have	~~**US1 –** Main Menu interface~~ ~~**US2 –** Start Game from Main Menu~~ ~~**US19 –** Completion of level~~
Could Have	**US7 –** Mid-Level Menu interface **US8 –** Resume Game from Mid-Level Menu **US13 –** Question pop-up **US17 –** Movement of carrots **US21 –** Scoring for correct answers
Won't Have This Time	**US3-6/AT2.1 –** Other Main Menu functionalities (Choose Question Package, Choose Difficulty, Load a Saved Game, Close the Game) **US9-10/AT1.1 –** Other Mid-Level functionalities (Save Game, Quit to Main Menu) **US14/16 –** Correct and incorrect answers to questions **US18/AT23.1 –** Steve interactions between questions and on incorrect answers **AT19.1 –** Return to Main Menu on level completion **US20 –** Failure of level **US22 –** Quit to Main Menu warning message

USER INTERFACE: DESIGN NOTES 1

Sprint: 2.

Date: 16/11/2021.

Created/Last updated by: Aimee Dowell.

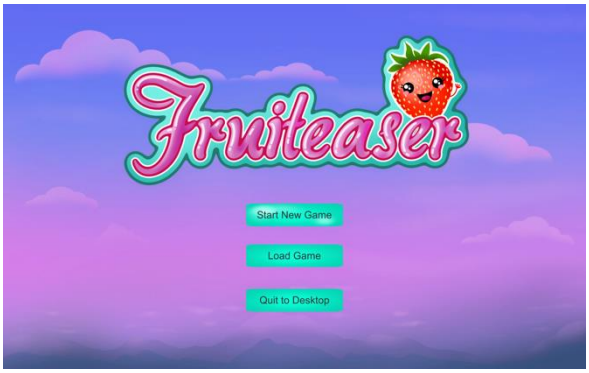
This sprint, the main bulk of the artwork required to create a simple 3x3 prototype level was made. All artwork in the game was designed and created by Aimee Dowell using an iPad Pro, Apple Pencil, and Procreate.

The following assets were created this sprint and added to the game in a new folder labelled 'UI', added to the assets folder of the project:

- Steve the Strawberry (variations of expressions)
- Cruella the Carrot
- Game backdrop
- Game logo
- Button design
- Square tiles (various colours)
- Highlighted tile outline
- Level Complete popup

We agreed an opening scene and main menu were key to give the user control over how the game starts, showing the logo so the user is immediately aware of the game they have opened. Although only the 'Start New Game' button was developed this week, we felt it important to shape the future paths of starting a game for the user, specifically, do they want to load their previous game data or start afresh. A way to exit the application was also needed for user friendliness.

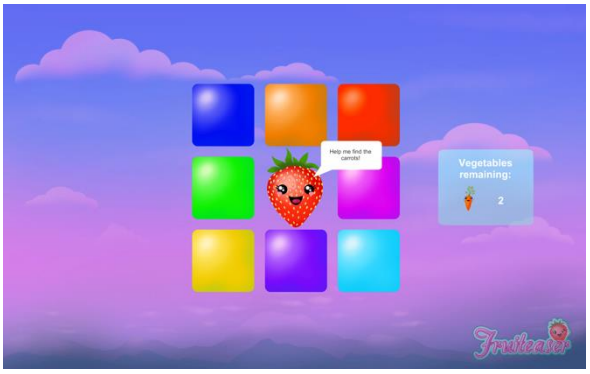
Opening scene shown when the game is first opened by the user.



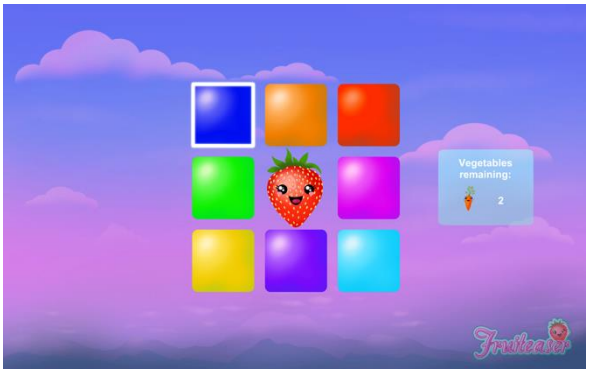
Main Menu of the game, allowing the user to start a new game, quit the application (developed this sprint), and load a previous game (in place for future development)

Once a new game is started, the prototype 3x3 level should appear, clearly showing the grid in a fun and visually exciting manner. Steve will inform the user of their task via a speech bubble which, for this level, is to find the carrots. Adding the 'Vegetables remaining' box allows the user immediate

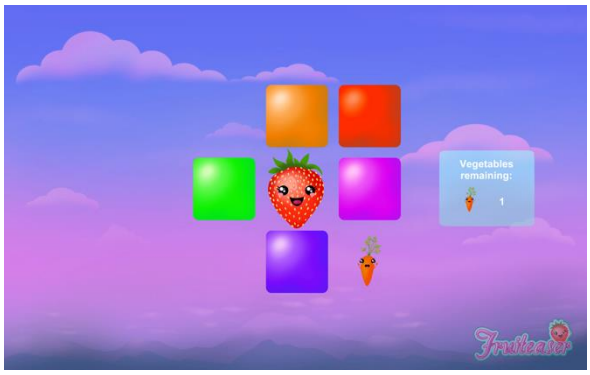
awareness of the aim of the game and how many and which type of vegetables they need to find for success. If a tile is empty, it is removed from the board so the user cannot click on it twice. If a vegetable is underneath, the tile will be removed, and a sprite will appear of the vegetable they caught. Once all the vegetables are found, a level complete popup is shown so the user is aware of the game status and cannot click any further tiles.



Start of the 3x3 board level, showing the user the tiles, and how many vegetables are remaining in the game.



The highlight sprite being activated once the user has selected a tile they wish to uncover.



Mid game screenshot of the 3x3 board, showing empty tiles and one found vegetable.

Level complete popup which appears once the level has been completed, i.e., all the vegetables have been found.

SPRINT 3

Dates: 17-23 November 2021.

Product Owner: Christian Bentley.

Scrum Master: Abel Tom Varghese.

SPRINT OVERVIEW

Key Documentation

User Stories: **Updated – US13-16, 21 (see document SR3)**

Use Cases: **New – UC1-23 (see document UCM.1)**

Acc. Tests: **New – AT13-14, 16, 21 (see document ATM.2)**

UI Design: **UIDN2**

The goals for Sprint 3 were:

1. to develop a detailed set of use cases for the proposed game product, corresponding to the current set of user stories; and
2. to continue the development of the 3x3 game level by incorporating arithmetic question functionalities – including the generation of semi-random questions, answer checking and UI interfaces – to be presented at the customer meeting on 24 November 2021 (at the start of Sprint 4).

At the start of Sprint 3, the team presented a playthrough of the 3x3 square grid product demo to the customer, discussing key features and proposals for future development. In particular, the team and the customer discussed the implementation of question and scoring mechanics into the 3x3 level, which the customer approved as the main goal for this sprint.

At the sprint retrospective meeting in Sprint 2, the team considered that it would be useful to further refine the customer's requirements through use cases, corresponding to the current set of user stories. Immediately following the Sprint 3 customer meeting, the team allocated use cases among the team members, which were then produced ahead of the team's iteration planning meeting.

At the iteration planning meeting, the team discussed the initial set of use cases and then discussed and produced a product backlog and sprint backlog for Sprint 3. As the team had observed during Sprint 2 that the inexperienced team members learned well from more experienced team members during pair programming sessions, this was prioritised through the sprint backlog.

The team again managed workflows throughout the sprint using a Jira board (replicating the sprint backlog) and a stand-up meeting, at which the team discussed the Jira board and organised sub-meetings for developers working on co-dependent tasks.

The team also continued with the testing methodology of Sprint 2, given the uneven balance of programming experience which subsisted amongst team members:

1. formal code inspections by experienced programmers, implemented through the review of pull requests on GitHub; and
2. acceptance testing during the sprint retrospective meeting.

At the end of the iteration, the team held a sprint retrospective meeting, at which the team reflected on the sprint and the team's progress towards the sprint goals (see the Sprint Review, below), reviewed acceptance tests for relevant user stories and updated the sprint and product backlogs and existing user stories in light of the team's progress.

SUMMARY OF SPRINT EVENTS AND DOCUMENTATION

Customer Meeting – 17 November 2021

Attended by: All team members, except Jaafar, and the customer.

The team presented a playthrough of the current build of the game – the Opening Menu and Main Menu interfaces and the prototype 3x3 grid level – to the customer and discussed the artwork, UI features and simple gameplay mechanics.

The team and the customer discussed the next steps in development and agreed that the priority for Sprint 3 should be the introduction of question mechanics – the generation of unique, arithmetic-based questions and the creation of UI interfaces to display questions and manage players' inputs – and scoring mechanics. The parties also discussed the movement of vegetables on the board and pre-packed question packages, although it was agreed that neither of these features were priorities at this stage.

The deliverable for the next customer meeting (24 November 2021) was a further build of the game prototype, which incorporates arithmetic-based question functionalities and scoring.

The minutes of the customer meeting are appended to this sprint, as document **CM3**. There were no new user stories, nor updates to existing user stories, required after this meeting.

Use Cases Planning Meeting – 17 November 2021

Attended by: All team members.

Immediately after the customer meeting, the team discussed individual capacities and developed an initial plan for the iteration. Following the sprint retrospective meeting in Sprint 2, the team's first task was to develop detailed use cases, corresponding to the current set of user stories.

The team allocated the use cases between the team members using the same allocation as developed for the user stories in Sprint 2 – see **USA1** in Sprint 2. The individual use cases were then collated into a master document – see document **UCM.1**.

Iteration Planning Meeting – 18 November 2021

Attended by: All team members.

At the iteration planning meeting, the team discussed the use cases and then Abel and Christian developed a product backlog (**PB3.1**) and the team collaborated to develop a sprint backlog (**SB3.1 –** which was then reflected in a Jira board) for this sprint. Having reflected on the effectiveness of pair programming in Sprint 2, the team prioritised more pair programming in this sprint.

Stand-up Meeting – 22 November 2021

Attended by: All team members.

At the stand-up meeting, each team member explained the current status of their allocated tasks and the team discussed the progress made, and required, towards the sprint goals. Several team members arranged a sub-meeting to discuss the coordination of back-end and front-end scripts, and the team also discussed the scoring mechanics and the state of technical documentation. No changes were required to the sprint backlog.

A record of the stand-up meeting is appended to this sprint, as document **SM2**.

Sprint Retrospective Meeting – 23 November 2021

Attended by: All team members.

At the sprint retrospective meeting, the team first reflected generally on the sprint (see Sprint Review below), before reviewing the updated acceptance tests documentation (**ATM.2**) and then updating the sprint backlog (**SB3.2**) and product backlog (**PB3.2**).

A record of the sprint retrospective meeting is appended to this sprint, as document **SR3**.

SPRINT REVIEW

At the sprint retrospective meeting, the team discussed and reviewed the team's progress.

General comments and velocity

The team considered that the team had satisfied each of the sprint goals identified at the start of the sprint – in particular:

1. the team had developed a detailed set of use cases, which built on user stories to provide greater clarity on requirements;
2. the team incorporated new functionalities – in particular, arithmetic question and scoring mechanics – into the 3x3 game level, to be presented at the customer meeting on 24 November 2021.

During this sprint, 10 tasks were allocated, of which 7 were prioritised and completed. Therefore, the team has achieved a task completion rate of 70% and a team velocity of 22.

Reflecting on team progress, the team observed that the task completion score was slightly lower than that of Sprint 2 (75%). The team considered that this was due to the greater complexity of the tasks developed involved, which was reflected in the increased velocity in this sprint– from 18 to 22. For future sprints, the team considered that a mixture of high- and low-complexity tasks should be prioritised in order to balance both the task completion rate and the team's velocity.

Difficulties faced

The most significant difficulty that the team faced in this sprint was the increased complexity of the development tasks, in particular due to the team's subsisting lack of experience with Unity/C#. However, as team members undertook such complex tasks, in particular utilising extensive pair programming (as identified in Sprint 2) and regular communication in stand-up and other meetings, the team managed this difficulty well and team members have rapidly developed their skills and experience with Unity/C#. The team considered that regular meetings should be prioritised in future sprints, although it was noted that team capacity is likely to be an issue as coursework deadlines get closer.

Exception handling

The sole unexpected event that happened in this sprint was that Jaafar was unable to attend the customer meeting due to travel issues. The team handled this exception well because, through the stand-up meeting and sprint retrospectives in Sprint 2, the team generally (and, in particular, the Scrum Master) was well aware of Jaafar's task allocation and progress and was able to communicate effectively with the customer.

Sprint 4

For Sprint 4, the team will propose that the game in its current form is scaled up to a 5x5 square tile grid level, with additional functionalities implemented if the team has surplus capacity. This will involve more complex tasks, so the emphasis on regular, effective communication and pair programming will remain.

In addition, the team also intends to implement two changes to the current sprint process in Sprint 4:

1. **CRC cards –** Due to the increasing complexity of the game system and the tasks involved, the team intends to use CRC cards to complement the detailed use cases by visualising the design of the game system, which will be particularly relevant as we scale-up to a 5x5 grid size in Sprint 4; and
2. **Unit testing –** Until the end of Sprint 3, due to the imbalance of Unity/C# experience across the team, testing has been undertaken through formal code inspections (by the more experienced team members) and acceptance testing. As the team has developed a more balanced skillset during Sprints 2 and 3, the team intends to implement unit testing as a more consistent and efficient testing methodology, in place of formal code inspections, whilst retaining the requirements-specific acceptance testing.

SPRINT DOCUMENTATION

Date	ID	Document
17/11/21	CM3	Minutes of a Customer Meeting
18/11/21	UCM.1	Use Cases – Master Document (Version 1)
18/11/21	PB3.1	Product Backlog – Iteration Planning Meeting
18/11/21	SB3.1	Sprint Backlog – Iteration Planning Meeting
22/11/21	SM2	Record of a Stand-up Meeting
23/11/21	SR3	Record of a Sprint Retrospective Meeting
23/11/21	ATM.2	Acceptance Testing – Master Document (Version 2)
23/11/21	SB3.2	Sprint Backlog – Sprint Retrospective Meeting
23/11/21	PB3.2	Product Backlog – Sprint Retrospective Meeting
23/11/21	UIDN2	User Interface Design Notes 2

CM3

MINUTES OF CUSTOMER MEETING – 10:45AM, 17 NOVEMBER 2021

Attendees: All team members other than Jaafar, customer.

Scribe: Christian Bentley.

Product prototype demo

- The team demonstrated to the customer a playthrough of the game product prototype – discussing the artwork, menu interfaces, UI features and simple gameplay mechanics.
- The customer was pleased with the progress made on the product – in particular, the customer was pleased that a level could be played to successful completion.
    - The customer explained that, for the remaining iterations, he would consider the maintenance of a working, demonstrable prototype to be a "should" deliverable.
    - The customer asked that additional functionalities be added in each iteration, but that the player should always be capable of undertaking a successful play-through.

Next steps in development – questions and scoring

- The team proposed that the next steps in the development of the product could be the introduction of:
    - question mechanics – the generation of unique, arithmetic-based questions and the creation of UI interfaces to display questions and manage players' inputs; and
    - scoring mechanics – scoring increments for correct answers and UI features to display the player's current score in game.
- The customer approved these proposed next steps.

Movement of vegetables on the board

- The customer asked when and how the vegetables would move on the board.
    - The team answered that the vegetables will move when a question is answered correctly (which is when a tile is revealed) – although the team noted that it had not yet been decided whether the remaining vegetables would move in the case where a vegetable has had been found at that time.
    - The team proposed that the movement of vegetables would be implemented in a later iteration, which the customer approved.

Pre-packed question packages

- The customer asked whether the team had investigated if pub quiz-style question packages were available that could be implemented in our game.
    - The team explained that this had not yet been investigated, but that the team could investigate this in a later iteration if the customer so wished.
    - The priority for this iteration is the development of the back-end question generation and front-end UI mechanics, using simple arithmetic questions to test these functionalities.
    - The customer agreed with this approach at this stage.

Unity experience

- The customer asked how the team was getting on with using Unity to develop the game.
    - The team explained that time had been allocated in Sprint 2 for team members to gain experience in using Unity/C# and to discuss any issues, and pair programming had been prioritised to ensure that team members with less experience were able to learn from those with more experience.

Documentation

- The customer asked how the team was progressing the documentation and whether the team would be able to deliver the documentation for Sprints 1 and 2 immediately/in short order.
    - The team explained that they could deliver the documentation very quickly, as the substantive documentation had been completed and only need to be brought together into a single document with a brief covering explanation.
- The customer asked the team to ensure that there is a production process for the documentation for each sprint.
    - The team explained that an informal process was in place, but that the team would prioritise this for the next sprint.

Deliverables

- Continue the development of the current product prototype by incorporating arithmetic-based question functionalities for the next customer meeting.

USE CASES: MASTER DOCUMENTATION

Version: 1.

Date: 18/11/2021.

Created/Last updated by: Christian Bentley, working with all team members.

UC1	**Use Case:** Main Menu Interface.
	Version: 1. **Creator/Updater:** Christian Bentley. **Last updated:** 18/11/2021.
User Story: As a player I want a Main Menu so that I can choose the ways in which I will play the game. **ID:** US1	
UC1 -1	**Control Flow:** Alternative Path #1 – Opening on Start-up The Main Menu is opened on start-up. Alternative Path #2 – Player Selection from Mid-Level Menu If the player is in a game level, opens the Mid-Level Menu and selects "Quit to Main Menu" (and proceeds after any warning message), the Main Menu is opened.
UC1-2	**Actors:** Player.
UC1-3	**Pre-Condition:** Alternative Path #1 – Opening on Start-up The player opens the game program. Alternative Path #2 – Player Selection from Mid-Level Menu The player selects "Quit to Main Menu" (or similar) from the Mid-Level Menu and accepts any warning message (see UC10/22).
UC1-4	**Post-Condition:** Alternative Path #1 – Opening on Start-up None. Alternative Path #2 – Player Selection from Mid-Level Menu The player's current level progress is deleted and not saved (see UC10/22).
UC1-5	**Connected Use Cases:** UC2-6 (Main Menu functionalities), UC10/22 (Quit to Main Menu from Mid-Level Menu and warning message).

UC2	**Use Case:** Start New Game button
	Version: 1 **Creator/Updater:** Aimee Dowell. **Last updated:** 18/11/2021
User Story: As a player, I want a start button for each puzzle type so that I can begin a current or new game level. **ID:** US2	
UC2 -1	**Control Flow:** • The Main Menu is opened on start-up, which shows the Start New Game button. • The player selects the game settings that they require.

	• The player selects the Start New Game button. • The game level is loaded with the settings selected by the player.
UC2-2	**Actors:** Player.
UC2-3	**Pre-Condition:** • The player opens the game application, and the Main Menu is displayed. • The player selects the game settings that they require.
UC2-4	**Post-Condition:** • The game level is loaded with the settings selected by the player.
UC2-5	**Connected Use Cases:** UC1 (Main Menu), UC3/4 (Question Package/Difficulty)

UC3	**Use Case:** Choosing Question Package
	Version: 1. **Creator/Updater:** Oscar Gee **Last updated:** 18/11/2021.
User Story: As a player I want a Question Package so that I can choose the category of questions before I start playing the game. **ID:** US3	
UC3 -1	**Control Flow:** • Player accesses question packages through the Main Menu or a sub-menu. • Player selects a question package from a dropdown.
UC3-2	**Actors:** Player.
UC3-3	**Pre-Condition:** Player has started the game and has accessed the Main Menu/sub-menu.
U3-4	**Post-Condition:** • Question package is selected and stays as that package unless a different package is selected. • Question package selection is saved with a game save and is reloaded when a game save is loaded.
U3-5	**Connected Use Cases:** UC1 (Main Menu interface), UC5 (Loading a Saved Game)

UC4	**Use Case:** Difficulty Levels
	Version: 1. **Creator/Updater:** Vishnu Vardhan. **Last updated:** 18/11/2021
User Story: As a player I want to choose the difficulty level before starting the game so that I can tailor the gameplay. **ID:** US4	
UC4-1	**Control Flow:** • The player is at the Main Menu/Start Game sub-menu. • The player can select the level of difficulty from a dropdown menu.
UC4-2	**Actors:** Player.
UC4-3	**Pre-Condition:**

	The player is at the Main Menu/Start Game sub-menu
UC4-4	**Post-Condition:** The selected level of difficulty is reflected in the questions arising during the next game.
UC4-5	**Connected Use Cases:** US13 (Question Pop-up).

UC5	**Use Case:** Load a saved game
	Version: 1. **Creator/Updater:** Abel Tom Varghese. **Last updated:** 18/11/2021.
User Story: As a player, I want to load a previously saved game so that I can carry on playing from the last time. **ID:** US5	
UC5-1	**Control Flow:** Alternative Path #1: • The game loads a previously saved game & the view is updated with the previously saved score & board. Alternative Path #2: • An error is displayed to the player which informs them the game was not loaded & the reason why (no previously saved game or error in loading the game)
UC5-2	**Actors:** Player
UC5-3	**Pre-Condition:** • The game must have access to a file with the contents of the previously saved game. • The load game button must be clicked
UC5-4	**Post-Condition:** Alternative Path #1: • The game displays a message to inform the player that the game was successfully loaded • The player can now make further moves Alternative path #2 • Once error is displayed with the reason as to why a previous game cannot be loaded, the player is free to carry on playing the current game or close the game down.
UC5-5	**Connected Use Cases:** UC1 (Main Menu interface), UC9 (Save Game).

UC6	**Use Case:** Quit to Desktop
	Version: 1. **Creator/Updater:** Justin Lam. **Last updated:** 18/11/2021.
User Story: As a player I want to close the game from the main menu so that I don't have to switch to desktop or use task manager to force close it. **ID:** US6	
UC6-1	**Control Flow:** • Player selects "Quit to Desktop" button from the Main Menu.

	• The application is closed.
UC6-2	**Actors:** Player.
UC6-3	**Pre-Condition:** • Player is at the Main Menu and selects the “Quit to Desktop” button.
UC6-4	**Post-Condition:** • The game must be closed completely without running in the background.
UC6-5	**Connected Use Cases:** UC1 (Main Menu interface)

UC7	**Use Case:** Mid-Level Menu
	Version: 1. **Creator/Updater:** Rohith. **Last updated:** 18/11/21.
User Story: As a player I want a Mid-Level Menu so that I can take a break, save my game progress or go back to the Main Menu. **ID:** US7	
UC7-1	**Control Flow:** Alternative Path #1: • The player presses “Esc” key during the game level, the Mid-Level Menu is opened. Alternative Path #2: • On clicking the save button in the Mid-Level Menu, after the game is saved the Mid-Level Menu is showed again.
UC7-2	**Actors:** Player [on pressing the “Esc” key], Developer [in saving game level progress]
UC7-3	**Pre-Condition:** Alternative Path #1: • Player is in a game level. • Player has pressed the “Esc” key. Alternative Path #2: • The player has saved the game from the Mid-Level Menu. Alternative Path #3: • The player selects to return to the Mid-Level Menu following the “lost progress” warning messages (see UC22).
UC7-4	**Post-Condition:** None.
UC7-5	**Connected Use Cases:** UC8-10 (Mid-Level Menu functionalities), UC22 (Warning Message)

UC8	**Use Case:** Resume Game from Mid-Level Menu
	Version: 1. **Creator/Updater:** Jaafar Ghaddar. **Last updated:** 18/11/2021
User Story: As a player, I want a resume game button so that I can continue playing the game once the Mid-Level Menu has been opened. **ID:** US8	

UC8 -1	**Control Flow:** • The player is in a game level and has opened the Mid-Level Menu. • Resume Game button is clicked in the Mid-Level Menu. • The game level is resumed in the same state as when the Mid-Level Menu was opened.
UC8-2	**Actors:** Player.
UC8-3	**Pre-Condition:** The Mid-Level Menu is opened.
UC8-4	**Post-Condition:** The game level is resumed in the same state as when the Mid-Level Menu was opened.
UC8-5	**Connected Use Cases:** US7 (Mid-Level Menu interface)

UC9	**Use Case:** Save current game
	Version: 1. **Creator/Updater:** Abel Tom Varghese. **Last updated:** 18/11/2021
User Story: As a player, I want to save a game in progress so that I can return to it later. **ID:** US9	
UC9-1	**Control Flow:** Alternative Path #1: • The application saves the current game (contents of the board & score) to a file. • A message is displayed to inform the player that the game was successfully saved. Alternative Path #2: • A message is displayed to inform the player that the was unsuccessfully saved & the reasons as to why.
UC9-2	**Actors:** Player
UC9-3	**Pre-Condition:** • The save game button must be clicked
UC9-4	**Post-Condition:** Alternative Path #1: • A message is displayed to inform the player that the game was successfully saved. • The player can now make further moves. Alternative path #2 • A message is displayed to inform the player that the was unsuccessfully saved & the reasons as to why. • The player is free to carry on playing the current game or close the game down.
UC9-5	**Connected Use Cases:** UC5 (Load Saved Game).

UC10	**Use Case:** Quit to Main Menu from Mid-Level Menu
	Version: 1. **Creator/Updater:** Christian Bentley.

	Last updated: 18/11/2021.
User Story: As a player I want an option during level gameplay to return to the Main Menu so that after having started a game, I can start a new game, load a saved game or quit the program. **ID:** US10	
UC10-1	**Control Flow:** • "Quit to Main Menu" is an option from the Mid-Level Menu. • If the player clicks on "Quit to Main Menu", the current game should be closed and not saved and the Main Menu should be opened. *See UC22 (warning message) for alternative paths.*
UC10-2	**Actors:** Player.
UC10-3	**Pre-Condition:** The player opens the Mid-Level Menu.
UC10-4	**Post-Condition:** The current level progress is closed and not saved.
UC10-5	**Connected Use Cases:** UC1 (Main Menu), UC22 (Quit to Main Menu – warning message).

UC11	**Use Case:** Positioning carrots when the game starts
	Version: 1. **Creator/Updater:** Abel Tom Varghese **Last updated:** 18/11/2021
User Story: As a developer, I need to randomly position the carrots on the board so that at minimum it would require 2+ moves to reach Steve the strawberry (main character). **ID:** US11	
UC11-1	**Control Flow:** Alternative Path #1: • The application places all carrots randomly given that the distance from the chosen cell is two or more moves away from reaching the main character. Alternative Path #2: • The application crashes & a stack trace error is printed informing the developer the reason for the crash.
UC11-2	**Actors:** Developer
UC11-3	**Pre-Condition:** • A new game must be started
UC11-4	**Post-Condition:** Alternative Path #1: • The application calls the positioning method to place all pieces on the board. Alternative path #2 • The application crashes & a stack trace error is printed
UC11-5	**Connected Use Cases:** UC2 (Start Game), UC17 (Movement of vegetables), UC15 (Carrot revealed), UC23 (Carrot not revealed)

UC12	**Use Case:** Tile highlighted on click
	Version: 1.

	Creator/Updater: Aimee Dowell. **Last updated:** 18/11/2021.
User Story: As a player, I want a clicked square to be highlighted so that I can see which square I have selected instead of using muscle memory. **ID:** US12	
UC12 -1	**Control Flow:** A tile (not greyed out/disappeared) from the board has been selected using a trackpad or mouse and is then highlighted with a white outer square.
UC12-2	**Actors:** Player.
UC12-3	**Pre-Condition:** Alternative Path #1 • A new game or level has been started with the 3x3 board showing and the game waiting for a square to be selected. Alternative Path #2 • A previous square has been revealed and there are remaining vegetables which have not yet reached Steve.
UC12-4	**Post-Condition:** • A question pop up will be revealed overlaying the board.
UC12-5	**Connected Use Cases:** UC13 (Question Pop-up)

UC13	**Use Case:** Question Pop-up
	Version: 1. **Creator/Updater:** Oscar Gee. **Last updated:** 18/11/2021.
User Story: As a player I want questions to pop up so that I can answer the questions to progress the game. **ID:** US13	
UC13-1	**Control Flow:** • Player highlights a tile and mouse clicks on it. • A question text box will become visible, stating the question and including a text box for the player's input.
UC13-2	**Actors:** Player.
UC13-3	**Pre-Condition:** Player has selected a tile during a game level.
U13-4	**Post-Condition:** *See UC14/16 for more detail on answer mechanics.* • Question box pop-up disappears after a correct answer has been submitted. • The score is incremented and updated. • The player is then able to select another tile, for which a different question pops up.
U13-5	**Connected Use Cases:** UC12 (Highlight tile on click), UC14 (Correct answer), UC16 (Incorrect answer)

UC14	**Use Case:** Correct Answer

	Version: 1. **Creator/Updater:** Christian Bentley. **Last updated:** 18/11/2021.
User Story: As a player I want the question pop-up to confirm that I have made a correct answer so that I can understand my progress in the game. **ID:** US14	
UC14-1	**Control Flow:** • The game is in a question pop-up and the player inputs a correct answer into the answer box. Alternative Path #1: • If the player answers correctly, the question pop-up confirms that the answer was correct. Alternative Path #2: • If the player answers incorrectly, then UC16.
UC14-2	**Actors:** Player.
UC14-3	**Pre-Condition:** The game is in a question pop-up.
UC14-4	**Post-Condition:** • The score is increased (see UC21). Alternative Path #1: • If a vegetable is on the selected tile, then UC15. Alternative Path #2: • If a vegetable is not on the selected tile, then UC23.
UC14-5	**Connected Use Cases:** UC13 (Question pop-up), UC15 (Carrot revealed), UC16 (Incorrect answer), UC23 (No carrot on tile), UC21 (Scoring).

UC15	**Use Case:** Carrot Revealed
	Version: 1. **Creator/Updater:** Justin Lam. **Last updated:** 18/11/2021.
User Story: As a player I want the carrots to be revealed when I clicked the correct square that the carrots are on so that the player will have visual information of where and how many carrots have been found. **ID:** US15	
UC15-1	**Control Flow:** • Player selects a tile and answers a question correctly. • If a carrot is on that tile, then a carrot is revealed and does not move thereafter. • The number of carrots remaining UI counter is reduced by 1.
UC15-2	**Actors:** Player.
UC15-3	**Pre-Condition:** The player selects a tile and answers a question correctly.
UC15-4	**Post-Condition:** • The carrot remains at the location of the tile. • The tile disappears from the board. • The number of carrots remaining UI counter is reduced by 1. • If the number of carrots remaining is 0, then UC19.

UC15-5	**Connected Use Cases:** UC12 (Highlighting square on click), UC13 (Question Pop-up), UC14 (Correct Answer), UC19 (Level Complete).

UC16	**Use Case:** Incorrect Answer
	Version: 1. **Creator/Updater:** Rohith. **Last updated:** 18/11/21.
User Story: As a player I want an incorrect answer pop-up so that I can know if my answer was incorrect. **ID:** US16	
UC1 -1	**Control Flow:** • The game is in a question pop-up and the player inputs a correct answer into the answer box. Alternative Path #1: • If the player answers incorrectly, the question pop-up confirms that the answer was incorrect. • The player may choose whether to try another question or to retry this question. • If the player chooses to try another question, then another question is generated. Alternative Path #2: • If the player answers correctly, then UC14.
UC1-2	**Actors:** Player
UC1-3	**Pre-Condition:** The game is in a question pop-up.
UC1-4	**Post-Condition:** • If the player chooses to try another question, then another question is generated. • The scoring for any subsequent correct answer is reduced (see UC21).
UC1-5	**Connected Use Cases:** UC13 (Question pop-up), UC14 (Correct answer), UC21 (Scoring).

UC17	**Use Case:** Movement of vegetables
	Version: 1. **Creator/Updater:** Jaafar Ghaddar. **Last updated:** 18/11/2021.
User Story: As a player, I want the carrots to move after each correct answer so that I can understand how they will approach me in other levels. **ID:** US17	
UC17-1	**Control Flow:** • Player answers a question correctly. • The vegetables move semi-randomly around the tile board (see functionality concept documentation). Alternative Path: • If a vegetable moves to the centre, the level is over.
UC17-2	**Actors:** Player
UC17-3	**Pre-Condition:**

	The player answers a question correctly.
UC17-4	**Post-Condition:** If a vegetable moves to the centre, the Level Failed pop-up appears.
UC17-5	**Connected Use Cases:** US14 (Correct answer), US20 (Level Failed)

UC18	**Use Case:** Steve Interactions
	Version: 1. **Creator/Updater:** Christian Bentley. **Last updated:** 18/11/2021.
User Story: As a player I want Steve to interact with me between questions so that I am engaged with and guided by the main character. **ID:** US18	
UC18-1	**Control Flow:** • If a player is playing a game level, is not answering a question and after a period of inactivity (20secs), a message is displayed, directing the player to select the next tile. • If the player clicks anywhere on the screen, the message disappears and the inactivity timer is refreshed.
UC18-2	**Actors:** Player.
UC18-3	**Pre-Condition:** • The player is playing a game level. • The player is not answering a question. • The player has been inactive for at least 20secs.
UC18-4	**Post-Condition:** The inactivity timer is refreshed if the player clicks.
UC18-5	**Connected Use Cases:** UC12-16 (Tile Selection and Questions).

UC19	**Use Case:** Level completed
	Version: 1. **Creator/Updater:** Aimee Dowell. **Last updated:** 18/11/2021.
User Story: As a player, I want to successfully complete a level once I have found all the vegetables so that I can return to the main menu and complete the next level or save and quit. **ID:** US19	
UC19 -1	**Control Flow:** • Once all the vegetables have been found, before they reach the strawberry, a level complete pop-up should appear. • The pop-up should show the player's final score and have a button to save the game, return to the Main Menu or continue to the next level.
UC19-2	**Actors:** Player.
UC19-3	**Pre-Condition:** <u>Alternative Path #1</u> • A square has been revealed containing the last remaining vegetable.

	Alternative Path #2 • A square has been revealed containing a watermelon, who removes the last remaining vegetable
UC19-4	**Post-Condition:** • A level complete pop up will be revealed overlaying the board. • The pop-up shows the player's final score and has buttons to return to the Main Menu, save the game or continue to the next level.
UC19-5	**Connected Use Cases:** UC20 (Level Failed), UC21 (Scoring), UC9 (Save Game), US2 (Start Game)

UC20	**Use Case:** Level Failed
	Version: 1. **Creator/Updater:** Oscar Gee. **Last updated:** 18/11/2021.
User Story: As a player I want a level failed notification so that I can restart the game and play again. **ID:** US20	
UC20-1	**Control Flow:** Alternative Path #1: • If lives are implemented, player has incorrectly answered the question and lost their final life. Alternative path #2 • Player has answered a question correctly but a vegetable has reached Steve. • A notification pops-up, stating that the level has been failed and giving the player's final score. • The player may click on a button to return to the Main Menu.
UC20-2	**Actors:** Player.
UC20-3	**Pre-Condition:** • Player is in a game level and has answered a question. Alternative Path #1: • Player has 1 life remaining and answered the question incorrectly. Alternative Path #2: • Player has answered the question correctly but a vegetable has reached Steve
U20-4	**Post-Condition:** If the player clicks a button to do so, the game will return to the Main Menu.
U20-5	**Connected Use Cases:** US14/16 (Correct and Incorrect Answers), US17 (Movement of vegetables), US19 (Level completed), US21 (Scoring)

UC21	**Use Case:** Scoring
	Version: 1. **Creator/Updater:** Jaafar Ghaddar. **Last updated:** 18/11/2021.

User Story: As a player, I want to be able to see my score as the game progresses so that I can be motivated to do better. **ID:** US21	
UC21-1	**Control Flow:** • A player answers a question correctly. • The player's score is incremented and updated on screen. • The amount of the increment is dependent upon how many attempts were required by the player – first try = 100, every subsequent try = 50% of previous. • At the end of the level (whether failed or completed), the score is shown on-screen.
UC21-2	**Actors:** Player
UC21-3	**Pre-Condition:** The player answers a question correctly.
UC21-4	**Post-Condition:** None
UC21-5	**Connected Use Cases:** US14/US16 (Correct and Incorrect Answers), US19/US20 (Level Completed/Failed)

UC22	**Use Case:** Quit to Main Menu – Warning Message
	Version: 1. **Creator/Updater:** Christian Bentley. **Last updated:** 18/11/2021.
User Story: As a player I want to receive a message warning me that my current level progress will be lost if I quit to the Main Menu without saving so that I do not accidentally lose my level progress. **ID:** US22	
UC22 -1	**Control Flow:** • The player selects "Quit to Main Menu" from the Mid-Level Menu. *Alternative Path #1 – No progress since last save* • Proceed with UC10 (Quit to Main Menu) – the Main Menu is opened and the current level progress is closed and not saved. *Alternative Path #2 – Player has "progressed" since last save* • Display a warning message that any unsaved progress will be lost and listing two options – proceed to Main Menu and return to the Mid-Level Menu. • If the player selects proceed to Main Menu, proceed with UC10 (Quit to Main Menu) – the Main Menu is opened and the current level progress is closed and not saved. • If the player selects return to Mid-Level Menu, return to Mid-Level Menu. "Progress" for the purpose of this use case may be the player clicking on a tile or answering a question. Upon saving a game, a "saved" status may be turned on, which is then turned off when the player next makes such progress.
UC22-2	**Actors:** Player.
UC22-3	**Pre-Condition:** • The player selects "Quit to Main Menu" from the Mid-Level Menu. • The player has (or has not) made progress since the last game save.
UC22-4	**Post-Condition:** None.
UC22-5	**Connected Use Cases:**

	UC1 (Main Menu), UC9 (Game saves), UC10 (Quit to Main Menu)

UC23	**Use Case:** No Carrot Revealed
	Version: 1. **Creator/Updater:** Christian Bentley. **Last updated:** 18/11/2021.
User Story: As a player I want to receive a notification that there was no carrot underneath the revealed tile so that I can track my level progress. **ID:** US23	
UC23-1	**Control Flow:** • The player answers a question correctly but there was no carrot allocated to the selected tile. • The tile disappears (or turns grey) and no carrot is shown on screen. • A speech bubble appears from Steve with the text “Unlucky, there are no vegetables behind that tile – let’s try another one!”.
UC23-2	**Actors:** Player.
UC23-3	**Pre-Condition:** • The player has answered a question correctly. • No carrot is allocated to the selected tile.
UC23-4	**Post-Condition:** None.
UC23-5	**Connected Use Cases:** UC13 (Question Pop-up), UC14 (Correct Answer), UC15 (Carrot Revealed), UC11/17 (Positioning and Movement of Carrots).

PB3.1

PRODUCT BACKLOG

Sprint: 3.

Version: 1.

Date: 18/11/2021.

Timing: Iteration Planning Meeting.

Created/Last updated by: Abel Tom Varghese and Christian Bentley.

PRIORITY	UNSATISFIED USER STORIES, FAILED TESTS AND OTHER TASKS
Must Have	~~Develop a set of use cases for the proposed product~~ Finalise Sprint 1 and Sprint 2 documentation **US13 –** Question pop-up **US14/16 –** Correct and incorrect answers to questions
Should Have	**US21 –** Scoring for correct answers
Could Have	**US7 –** Mid-Level Menu interface **US8 –** Resume Game from Mid-Level Menu **US3 –** Choose the Question Package **US17 –** Movement of carrots **AT2.1 –** New Game Menu interface
Won't Have This Time	**US4 –** Choose the Difficulty Level from the Main Menu **US5 –** Load a Saved Game from the Main Menu **US9-10/AT1.1 –** Other Mid-Level functionalities (Save Game, Quit to Main Menu) **US18/AT23.1 –** Steve interactions between questions and on incorrect answers **AT19.1 –** Return to Main Menu on level completion **US20 –** Failure of level **US22 –** Quit to Main Menu warning message

SB3.1

SPRINT BACKLOG

Sprint: 3.

Version: 1.

Date: 18/11/2021.

Timing: Iteration Planning Meeting.

Created/Last updated by: Abel Tom Varghese, working with all team members.

SPRINT GOAL				
Continue the development of the 3x3 prototype by building-in arithmetic question functionalities – question generation, answer checking and UI interfaces. If time permits, build additional menu UIs and movement of carrots in backend model.				
SELECTED PRODUCT BACKLOG ITEMS				
MUST HAVE	Finalise Sprint 1 and Sprint 2 documentation **US13 –** Question pop-up **US14/16 –** Correct and incorrect answers to questions			
SHOULD HAVE	**US21 –** Scoring for correct answers			
COULD HAVE	**US7 –** Mid-Level Menu interface **US8 –** Resume Game from Mid-Level Menu **US3 –** Choose the Question Package **US17 –** Movement of carrots **AT2.1 –** New Game Menu interface			
SPRINT TASKS				
Priority	**Tasks (ordered)**	**Timeframe (hours)**	**Individual/Pair**	**Status**
COMPLETED	Develop a set of use cases for the proposed product	1 (per person)	As allocated in USA	Completed
MUST HAVE	Finalise Sprint 1 and Sprint 2 documentation	5	Christian, Abel and Aimee	Mostly completed pre-iteration
	Build UI question pop-up	3	Oscar and Vishnu	Not started
	Build question and answer generation algorithm	5	Abel and Rohith	Not started
	Build UI correct/incorrect answer notifications	2	Jaafar and Aimee	Not started
	Build incorrect answer UI options – retry/new question	3	Jaafar and Aimee	Not started
SHOULD HAVE	Build scoring box UI and integrate with correct answers	3	Justin and Vishnu	Not started
COULD HAVE	Build Mid-Level Menu interface	3	Christian	Not started
	Build New Game Menu interface	3	Aimee	Not started
	Build movement of carrots in backend model	3	Abel and Vishnu	Not started

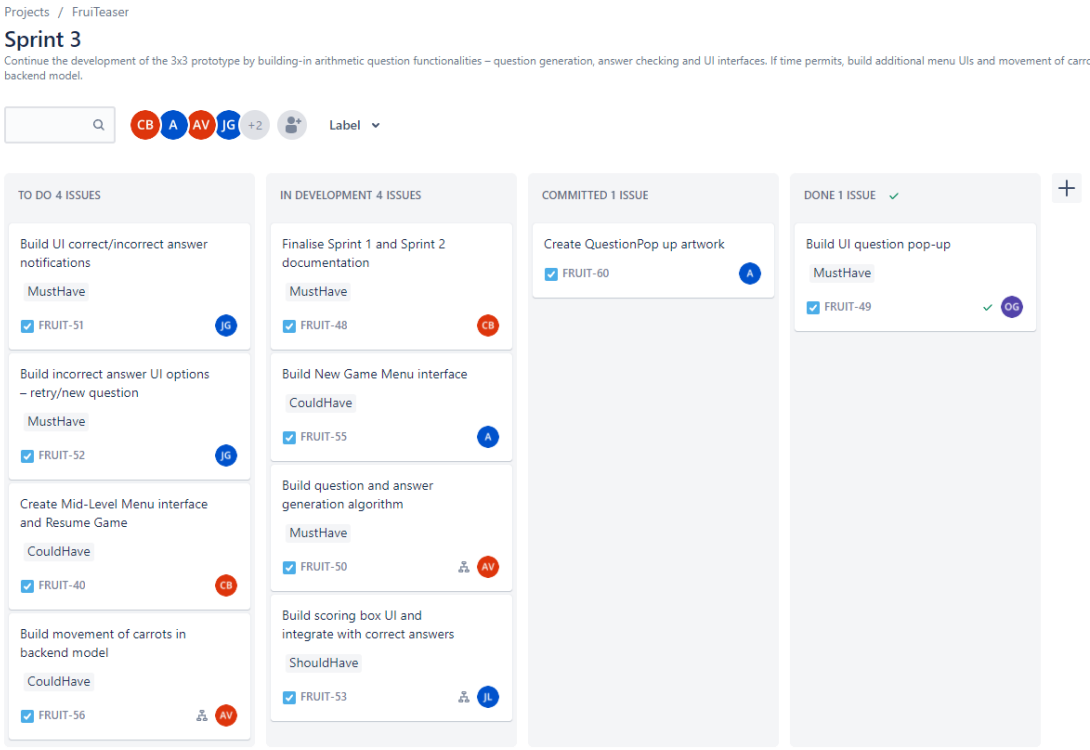
STAND-UP MEETING

Date: 22/11/2021

Attendees: All team members.

Document created by: Abel Tom Varghese, working with all team members.

Sprint 3 - Jira Board



Stand-up Meeting Discussions

Jira Board

- Each team member spoke about their allocated tasks in the sprint backlog and their current progress.
- The team discussed the state of the Jira board and the path to completion of the Must Have items, as well as the team's capacity to complete Should Have and Could Have items.

Developer meetings

- Justin, Jaafar and Vishnu requested a meeting with Abel and Rohith to understand better how the back-end board model and question generation scripts work and how their outputs should be implemented in the front-end UI interfaces.

Scoring

- The team discussed how scoring would be recorded – through a UI counter, which is incremented on each correct answer.

Technical documentation

- Abel and Rohith explained that technical documentation had been started in relation to the question generator and board model class scripts – further updates would be provided regularly on their progress.

SR3

SPRINT RETROSPECTIVE

Sprint: 3.

Date: 23/11/2021.

Attendees: All team members.

Document created by: Christian Bentley, working with all team members.

GENERAL COMMENTS

1. The team was again pleased with the progress made on the product in this iteration. In particular, with the implementation of question and scoring mechanics, it was now clear how our game would be played and how additional functionalities could complement our current version.
2. The most significant difficulty that the team faced in this sprint was the increased complexity of the development tasks, in particular due to the team's subsisting lack of experience with Unity/C#.
3. However, several team members, whom had previously been concerned by their inexperience with Unity/C#, considered that the extensive pair programming in this sprint had led to them feeling more comfortable with these technologies and better able to manage more complex development tasks. The team observed that this had been recognised in the sprint retrospective meeting in Sprint 2 and had been effectively implemented in this sprint.
4. In addition, several team members explained that the stand-up meeting and follow-up meeting concerning the interplay of front-end and back-end scripts had facilitated effective communication among pairs working on related tasks, whilst the use cases had clarified the requirements of specific product aspects in greater detail than the user stories in Sprint 2. The team considered that regular meetings should be prioritised in future sprints, although it was noted that team capacity is likely to be an issue as coursework deadlines get closer.
5. The sole unexpected event that happened in this sprint was that Jaafar was unable to attend the customer meeting due to travel issues. The team considered that this exception had been handled well because, through the stand-up meeting and sprint retrospectives in Sprint 2, the team generally (and, in particular, the Scrum Master) was well aware of Jaafar's task allocation and progress and was able to communicate effectively with the customer.
6. In the next sprint, the team agreed to propose to the customer that the game in its current form is scaled up to a 5x5 square tile grid level, with additional functionalities implemented if the team has surplus capacity.
7. The team considered that, as a result, Sprint 4 would likely involve the most complex tasks of the project so far. Therefore, the team proposed that, in addition to the use cases developed in this sprint, the team should undertake a CRC cards exercise in order to map-out the structure and process of the product, before scaling-up the current build to the 5x5 grid size. The team also proposed the implementation of unit testing, as the team had achieved a greater balance of Unity/C# skills and experience through effective pair programming.

REVIEW OF ACCEPTANCE TESTS

The team reviewed the acceptance tests master (**ATM.2**), observing that, of the acceptance tests which were relevant to the user stories implemented in this sprint, no new acceptance tests were failed in this sprint.

REVIEW OF, AND UPDATES TO, SPRINT BACKLOG

The team reviewed and updated the sprint backlog (**SB3.2**).

During this sprint, 10 tasks were allocated, of which 7 were prioritised and completed. Therefore, the team has achieved a task completion rate of 70% and a team velocity of 22.

Reflecting on team progress, the team observed that the task completion score was slightly lower than that of Sprint 2 (75%). The team considered that this was due to the greater complexity of the tasks developed involved, which was reflected in the increased velocity in this sprint– from 18 to 22. For future sprints, the team considered that a mixture of high- and low-complexity tasks should be prioritised in order to balance both the task completion rate and the team's velocity.

REVIEW OF, AND UPDATES TO, PRODUCT BACKLOG

The team reviewed and updated the product backlog (**PB3.2**) to reflect the completed items in the updated sprint backlog.

UPDATES TO EXISTING USER STORIES

Updates reflected in **USM.3** (*which is not appended to this submission, to avoid unnecessary duplication*).

US13	**User Story:** As a **player** I want **questions to pop up** so that **I can answer the questions to progress the game.**
Comments: Questions are to pop up depending on which tile the player clicks on. The questions that will be revealed will be relevant to the category selected prior to the start of the game.	
Acceptance criteria: Once a tile has been clicked on by the player, a question must pop-up.	
Status (23/11/2021): Created/Last Updated By: Abel Tom Varghese. Version: 2. Development/Testing: Developed and tested for the numerical question package. Later iterations may include different question packages, at which this user story may be revisited.	
Connected User Stories: US3 (Question Package), US12 (Highlighting Tiles), US14/16 (Correct and Incorrect Answers)	

US14	**User Story:** As a **player** I want **the question pop-up to confirm that I have made a correct answer** so that **I can understand my progress in the game.**

Comments: Once a question has popped-up and the player has input a correct answer, the pop-up should confirm that the answer is correct.
Acceptance criteria: When a question is answered correctly, the question pop-up visually confirms that the answer was correct.
Status (23/11/2021) Created/Last Updated By: Abel Tom Varghese. Version: 2. Development/Testing: Developed and tested in relation to the numerical question package, may require testing in later iterations in relation to other question packages as implemented.
Connected User Stories: US13 (Question pop-up), US15 (Carrot revealed), US16 (Incorrect answer), US23 (No carrot on tile), US21 (Scoring)

US15	**User Story:** As a **player** I want **the carrots to be revealed when I clicked the correct square that the carrots are on** so that **the player will have visual information of where and how many carrots have been found.**
Comments: Once a tile has been selected and a question has been answered correctly, then if there is a carrot on that tile then the carrot should be revealed.	
Acceptance criteria: 1. When a question is answered correctly, if a carrot is on the selected tile, then the carrot is revealed. 2. However, if a carrot is not on the selected tile, then the carrot is not revealed.	
Status (23/11/2021) Created/Last Updated By: Christian Bentley. Version: 3. Development/Testing: Developed and tested.	
Connected User Stories: US12 (Highlighting square on click), US13 (Question pop-up), US14 (Correct answer)	

US16	**User Story:** As a **player** I want **an incorrect answer pop-up** so that **I can know if my answer is correct or not.**
Comments: When a player gives an incorrect answer to a question, there should be a pop-up informing the user that his/her answer to the question is incorrect. The pop-up should have the following text- “Oops! Your answer is incorrect – let’s try again!” along with the incorrect answer Steve image. Alternatively, the player may be permitted to try a different question.	
Acceptance criteria: When a question is answered incorrectly, the question pop-up visually confirms that the answer was incorrect and prompts the player to try a different answer or skip to a different question.	
Status: (23/11/21) Created/Last Updated By: Abel Tom Varghese. Version: 2.	

Development/Testing: Developed and tested in relation to the numerical question package, may require testing in later iterations in relation to other question packages as implemented.
Connected User Stories: US13 (Question Pop Up), US14 (Correct Answer)

US21	**User Story:** As a **player**, I want to **be able to see my score as the game progresses** so that I can **be motivated to do better**.
Comments: The player will receive a 100 points on every correct answer and a half the points on each consecutive attempt of the same question.	
Acceptance criteria: Once a correct answer has been made the points go up. If the attempt was right on the first try the player receives a 100 points, if it was his second attempt: 50, third: 25, etc…	
Status (23/11/2021): Created/Last updated by: Abel Tom Varghese. Version: 2. Development/Testing: Developed and tested.	
Connected User Stories: US14/16 (Correct and Incorrect Answers), US19/20 (Level Completed/Failed).	

ACCEPTANCE TESTING: MASTER DOCUMENTATION

Version: 2.

Date: 23/11/2021.

Document created/last updated by: Abel Tom Varghese, working with all team members.

ID	Vers	User Story	Acceptance Tests	Developer/ Pair	Tester	Date	Comments
AT1	1	US1	1. Upon the player loading up the game, the Main Menu is opened. 2. After the player clicks on "Quit to Main Menu" from the Mid-Level Menu (and any warning message is accepted – see US22), the Main Menu is opened.	Aimee	Christian	16/11/2021	Test #1 passed. Test #2 to be implemented as part of US10 (Mid-Level Menu option to return to the Main Menu)
AT2	1	US2	Every time the puzzle type button is clicked from the Main Menu, or a level from the selected puzzle type has been completed (win or lose), the start button should appear, programmed for the next level (win), or the same level (lose/current).	Christian and Aimee	Abel	16/11/2021	Test passed in relation to the Main Menu start game button. A further intermediary menu may be required to implement US3/4 (Difficulties and Question Packages).
AT6	1	US6	When the "Quit to Desktop" button is clicked. The game should ask the player "Are you sure you want to quit?" and, if accepted, then the game application should close.	Christian	Aimee	16/11/2021	Test passed, save that no warning message appears. After discussion, this feature was not regarded as necessary and will not be implemented.
AT11	1	US11	The carrots & strawberry should be randomly positioned on the board so that all carrots would require two or more moves to reach the strawberry.	Abel and Rohith	Christian	16/11/2021	Test passed.

ID	Vers	User Story	Acceptance Tests	Developer/ Pair	Tester	Date	Comments
AT12	1	US12	Every time a square is clicked (provided there is no current pop-up, such as a question, or an animation showing what is underneath a selected square) the clicked square should be clearly highlighted.	Christian and Aimee	Abel	16/11/2021	Test passed.
AT13	1	US13	Once a tile has been clicked on by the player, a question must pop-up.	Aimee, Rohith & Abel	Christian	23/11/2021	Test passed.
AT14	1	US14	When a question is answered correctly, the question pop-up visually confirms that the answer was correct.	Justin and Vishnu	Aimee	23/11/2021	Test passed.
AT15	1	US15	1. When a question is answered correctly, if a carrot is on the selected tile, then the carrot is revealed. 2. However, if a carrot is not on the selected tile, then the carrot is not revealed.	Oscar and Abel	Aimee	16/11/2021	Tests passed.
AT16	1	US16	1. When a player gives an incorrect answer to a question, there should be a pop-up informing the user that his/her answer to the question is incorrect. 2. The pop-up should enable the player to retry the question or to try a different question.	Jaafar and Oscar	Aimee	23/11/2021	Tests passed.
AT19	1	US19	If all the vegetables have been found before they reach the strawberry, the level is deemed complete and should return the main menu where the player can either save and quit the game or continue to the next level.	Aimee and Jaafar	Christian	16/11/2021	Test passed, save that the player is not returned to the Main Menu. This feature will be implemented in a later iteration when the level completion mechanics are added.
AT21	1	US21	Once a correct answer has been made the points go up. If the attempt was right on the first try the	Rohith, Abel & Aimee	Christian	23/11/2021	Test passed.

ID	Vers	User Story	Acceptance Tests	Developer/ Pair	Tester	Date	Comments
			player receives 100 points, if it was his second attempt: 50, third: 25, etc…				
AT23	1	US23	When a question is answered correctly, the tile is revealed (US14) and the tile disappears. If there is no carrot on that tile, then a message from Steve should appear stating “Unlucky, there are no vegetables behind that tile – let’s try another one!”.	Vishnu and Justin	Christian	16/11/2021	Test passed, save that there is no message from Steve. This feature will be implemented as part of US18 (Steve interactions during levels).

SB3.2

SPRINT BACKLOG

Sprint: 3.

Version: 2.

Date: 23/11/2021.

Timing: Sprint Retrospective Meeting.

Created/Last updated by: Abel Tom Varghese, working with all team members.

SPRINT GOAL				
Continue the development of the 3x3 prototype by building-in arithmetic question functionalities – question generation, answer checking and UI interfaces. If time permits, build additional menu UIs and movement of carrots in backend model.				
SELECTED PRODUCT BACKLOG ITEMS				
MUST HAVE	~~Finalise Sprint 1 and Sprint 2 documentation~~ ~~**US13 –** Question pop-up~~ ~~**US14/16 –** Correct and incorrect answers to questions~~			
SHOULD HAVE	~~**US21 –** Scoring for correct answers~~			
COULD HAVE	**US7 –** Mid-Level Menu interface **US8 –** Resume Game from Mid-Level Menu **US3 –** Choose the Question Package **US17 –** Movement of carrots **AT2.1 –** New Game Menu interface			
SPRINT TASKS				
Priority	**Tasks (ordered)**	**Timeframe (hours)**	**Individual/Pair**	**Status**
COMPLETED	Develop a set of use cases for the proposed product	1 (per person)	As allocated in USA	Completed
MUST HAVE	Finalise Sprint 1 and Sprint 2 documentation	5	Christian, Abel and Aimee	Completed
	Build UI question pop-up	3	Oscar and Vishnu	Completed and tested
	Build question and answer generation algorithm	5	Abel and Rohith	Completed and tested
	Build UI correct/incorrect answer notifications	2	Jaafar and Aimee	Completed and tested
	Build incorrect answer UI options – retry/new question	3	Jaafar and Aimee	Completed and tested
SHOULD HAVE	Build scoring box UI and integrate with correct answers	3	Justin and Vishnu	Completed and tested
COULD HAVE	Build Mid-Level Menu interface	3	Christian	Not started
	Build New Game Menu interface	3	Aimee	Not started
	Build movement of carrots in backend model	3	Abel and Vishnu	Not started

PB3.2

PRODUCT BACKLOG

Sprint: 3.

Version: 2.

Date: 23/11/2021.

Timing: Sprint Retrospective Meeting.

Created/Last updated by: Abel Tom Varghese and Christian Bentley.

PRIORITY	UNSATISFIED USER STORIES, FAILED TESTS AND OTHER TASKS
Must Have	~~Develop a set of use cases for the proposed product~~ ~~Finalise Sprint 1 and Sprint 2 documentation~~ ~~**US13 –** Question pop-up~~ ~~**US14/16 –** Correct and incorrect answers to questions~~
Should Have	~~**US21 –** Scoring for correct answers~~
Could Have	**US7 –** Mid-Level Menu interface **US8 –** Resume Game from Mid-Level Menu **US3 –** Choose the Question Package **US17 –** Movement of carrots **AT2.1 –** New Game Menu interface
Won't Have This Time	**US4 –** Choose the Difficulty Level from the Main Menu **US5 –** Load a Saved Game from the Main Menu **US9-10/AT1.1 –** Other Mid-Level functionalities (Save Game, Quit to Main Menu) **US18/AT23.1 –** Steve interactions between questions and on incorrect answers **AT19.1 –** Return to Main Menu on level completion **US20 –** Failure of level **US22 –** Quit to Main Menu warning message

USER INTERFACE: DESIGN NOTES 2

Sprint: 3.

Date: 23/11/2021.

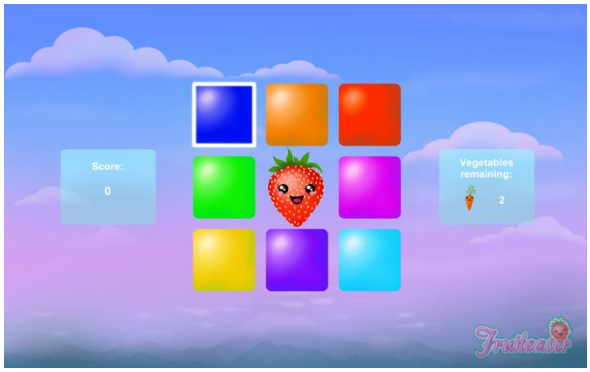
Created/Last updated by: Aimee Dowell.

For this sprint, further development of the 3x3 level was implemented. For the user interface, the assets developed this week by Aimee were as follows:

- Question popup
- Incorrect answer pop up background
- Redesign of menu buttons
- Redesign level complete pop-up graphic
- Game build/executable application icon
- Change background hue

Opening scene and main menu, showing redesigned button graphics

The main development task for this week, in terms of the user interface, was implementing the question popup. Once a user has selected a tile they wish to uncover, they must first answer a question correctly to reveal what lies underneath. Adding individual child elements to one 'QuestionPopUp' game object allowed for easy hiding and revealing of the question, and sorting layers were utilised in order to prioritise the popup over the other game elements, like the tiles. It was decided if the user incorrectly answers a question, they may keep trying to guess the answer, or they may keep requesting new questions until one is answered correctly.



Level 1, showing a user selecting a dark blue tile which they wish to uncover.

The question popup is shown which a fresh generated question and an InputField allowing the user to type in their answer.

User incorrectly answering the question, being given the option to retry the same question, or generate a new one.

The other main development task was incorporating a scoring mechanism, based on the number of attempts it took the user to answer a question correctly. For the user to be able to track their success, a UI element was created to constantly show the game score and is updated every time they answer a question.

Score tracking UI element of the game updating based upon the user's success of question answering.

Updated level complete popup, with a new background, outline, and text overlayed upon a banner.

Application icon of the game, showing the main character, Steve the Strawberry, and his fruit helper friends. The background is fun and bright reflecting the target audience and style of the game.

SPRINT 4

Dates: 24-30 November 2021.

Product Owner: Oscar Gee.

Scrum Master: Vishnu Vardhan.

SPRINT OVERVIEW

Key Documentation

User Stories: **New – US24-29 (see document SR4)**

Updated – US17, 26-29 (see document SR4)

Use Cases: **New – UC24-25, 27-29 (see document SR4)**

CRC Cards: **New – CRC1-10 (see document CRC.1)**

Acc. Tests: **New – AT17, 26-28 (see document ATM.3)**

UI Design: **UIDN3**

The goals for Sprint 4 were:

1. to produce CRC cards in relation to the current game system;
2. to scale-up the game to a 5x5 square tile grid level, playable after the 3x3 tutorial level;
3. to implement unit testing; and
4. if time permits, to develop minor additional functionalities, including carrot movement and/or Barry the Banana.

At the start of Sprint 4, the team presented the current product prototype to the customer and provided an update on the process documentation. The team and the customer agreed that, for the next customer meeting on 1 December 2021 (which, due to unforeseen strike action, was later cancelled), the team would implement the development proposals outlined in the sprint goals above.

At the sprint retrospective meeting in Sprint 3, the team considered that it would be useful to implement two main changes to the sprint process: CRC cards and unit testing. Therefore, at the iteration planning meeting, the team scheduled a further meeting to develop and discuss CRC cards and added the implementation of unit testing to the product and sprint backlogs.

At the iteration planning meeting, the team observed that several new user stories and use cases were required – relating to new game functionalities proposed at the customer meeting. The user stories and use cases were allocated to team members and, once completed, incorporated into the master documentation.

The team also noted that, in comparison to the remaining sprints, team capacity in this sprint would be substantially greater, due to there being a lull in coursework deadlines. Therefore, the team decided to front-load the remaining complex development work in this sprint, whilst prioritising pair programming to manage this complexity, which was reflected in the updated product and sprint backlogs.

The team again managed workflows throughout the sprint using a Jira board (replicating the sprint backlog) and a stand-up meeting, at which the team discussed the Jira board and progress on the various tasks. Although additional stand-up meetings were discussed in the Sprint 3 retrospective meeting, the team did not consider additional meetings to be sufficiently beneficial in this sprint.

The team completed a range of complex, time-intensive development tasks in this sprint. Although the team was not able to fully implement unit testing, this was implemented in relation to the critical BoardModel script, with further implementation to follow in Sprint 5. Acceptance testing remained as an effective, requirements-specific testing regime.

At the end of the iteration, the team held a sprint retrospective meeting, at which the team reflected on the sprint and the team's progress towards the sprint goals (see the Sprint Review, below), reviewed acceptance tests for relevant user stories and updated the sprint and product backlogs and existing user stories in light of the team's progress.

SUMMARY OF SPRINT EVENTS AND DOCUMENTATION

Customer Meeting – 24 November 2021

Attended by: All team members, except Jaafar, and the customer.

The team presented a playthrough of the current build of the game – in particular, the question and scoring functionalities – to the customer and provided an update on the process documentation.

The team and the customer discussed the next steps in development and agreed that the priorities for Sprint 4 should be scaling-up the 3x3 game level to a 5x5 game level, as well as the implementation of unit testing. As lower priority items, the parties also agreed to develop a new fruit functionality (Barry the Banana) and the movement of carrots on the board. The customer again raised the use of external question banks (see CM3), but it was agreed that this would not be prioritised at this stage.

The deliverable for the next customer meeting (1 December 2021) was a further build of the game, incorporating the development priorities outlined above. The proposed customer meeting on 1 December 2021 was later cancelled due to unforeseen strike action – see Sprint 5.

The minutes of the customer meeting are appended to this sprint, as document **CM4**.

User Stories/Use Cases Planning Meeting – 24 November 2021

Attended by: All team members.

Immediately after the customer meeting, the team discussed individual capacities and developed an initial plan for the iteration. The team allocated the new user stories and use cases arising from the customer meeting among the team members – see document **USA2**.

The completed user stories and use cases were then incorporated into the master documents (USM.4 and UCM.2) – for the purposes of this submission and to avoid duplication, the new user stories and use cases are incorporated into the record of the sprint retrospective meeting – see document **SR4**.

Iteration Planning Meeting – 24 November 2021

Attended by: All team members.

At the iteration planning meeting, the team discussed the new user stories and use cases and then Oscar and Christian developed a product backlog (**PB4.1**) and the team collaborated to develop a sprint backlog (**SB4.1 –** which was then reflected in a Jira board) for this sprint. The team also scheduled the CRC cards meeting.

CRC Cards Meeting – 25 November 2021

Attended by: All team members.

At a meeting at an early stage in this sprint, the team produced and discussed CRC cards for the current game system. The CRC cards produced at the meeting (CRC1-10) are appended to this sprint as document **CRC.1.**

Stand-up Meeting – 28 November 2021

Attended by: All team members.

At the stand-up meeting, each team member explained the current status of their allocated tasks and the team discussed the progress made, and required, towards the sprint goals. No changes were required to the sprint backlog.

A record of the stand-up meeting is appended to this sprint, as document **SM3**.

Sprint Retrospective Meeting – 30 November 2021

Attended by: All team members.

At the sprint retrospective meeting, the team first reflected generally on the sprint (see Sprint Review below), before reviewing the updated acceptance tests documentation (**ATM.3**) and then updating the sprint backlog (**SB4.2**) and product backlog (**PB4.2**).

A record of the sprint retrospective meeting is appended to this sprint, as document **SR4**.

SPRINT REVIEW

At the sprint retrospective meeting, the team discussed and reviewed the team's progress.

General comments and velocity

The team considered that the team had satisfied each of the sprint goals identified at the start of the sprint – in particular:

1. the team produced and discussed CRC cards in relation to the current game system;
2. the team scaled-up the game to a playable 5x5 square tile grid level;
3. although the team had not fully implemented unit testing, the team had implemented this in relation to the critical BoardModel script;
4. the team also implemented carrot movement and end of level functionalities, and had started the development of Barry the Banana's functionalities.

During this sprint, 13 tasks were allocated, of which 8 were prioritised and completed. Therefore, the team has achieved a task completion rate of 62% and a team velocity of 25.

Reflecting on team progress, the team observed that the team velocity increased by 14% from that of Sprint 3. The team considered that this was due to the fact that higher complexity tasks were

prioritised in this sprint and (as noted at the iteration planning meeting) the team decided to front-load this sprint with such development tasks in order to better manage the documentation to be produced in the following sprints, when other coursework deadlines would likely impact team capacity. Therefore, the team expects to see a sharp decrease in team velocity in future sprints, due to the diversion of team capacity to other coursework projects.

The team observed that only one stand-up meeting had been held, although at the Sprint 3 retrospective meeting the team had suggested that additional meetings should be prioritised. The team considered that, whilst further meetings could have further improved the team's efficiency in this sprint, many team members had contacted others *ad hoc* during this sprint and that, as considered at the stand-up meeting, an additional team-level meeting was not necessary.

Difficulties faced

The most significant difficulty that the team faced in this sprint was, as was the case in Sprint 3, the increased complexity of the development tasks. Whilst the 3x3 grid level had been developed in both Sprint 2 and Sprint 3, this sprint involved scaling-up the UI and back-end scripts developed in both sprints to a 5x5 level, which involved significant complexity and work volume.

However, the team considered that the early discussion of the CRC cards had clarified and equalised team members' understandings of the system as a whole, which minimised confusion and downtime early in the development process in this sprint. Furthermore, several team members again praised the extensive pair programming in this sprint, which enabled pairs to produce effective, clean code (on both UI and back-end tasks) and to leverage our growing experience and skills in Unity/C# to undertake more complex tasks.

Given the complexity and volume of tasks undertaken in this sprint, the team considered that this difficulty had been effectively managed and the team was pleased with the progress made on development ahead of the remaining sprints, for which team capacity will likely be more limited.

Exception handling

The team considered that the sole unexpected event in this sprint was the fact that unit testing (a Must Have item) had not been fully implemented for the existing software. Abel and Rohith, the allocated pair, considered that they had taken on too much complex work in the iteration planning meeting, which led to this incomplete task. The team agreed that, as a whole, the team should consider the balance of task allocations at the iteration planning meeting in future sprints, to mitigate the risk of incomplete, Must Have items. In this case, the team agreed that there was no significant delay caused by this incompletion and the task (as a failed acceptance test) will be added to the product backlog for Sprint 5.

Sprint 5

For Sprint 5, the team will discuss with the customer new game functionalities – in particular, additional fruit and vegetable functionalities. However, the team observed that team capacity is likely to be reduced for the remainder of the project due to the increasing demands of other coursework projects. Therefore, the team intends to discuss the progress of documentation with the customer and to prioritise such documentation, noting in particular the significant development progress made in this sprint. The team also intends to prioritise the implementation of further unit testing.

SPRINT DOCUMENTATION

Date	ID	Document
24/11/21	CM4	Minutes of a Customer Meeting
24/11/21	USA2	User Stories and Use Cases – Allocation between team members
24/11/21	PB4.1	Product Backlog – Iteration Planning Meeting
24/11/21	SB4.1	Sprint Backlog – Iteration Planning Meeting
25/11/21	CRC.1	CRC Cards (Version 1)
28/11/21	SM3	Record of a Stand-up Meeting
30/11/21	SR4	Record of a Sprint Retrospective Meeting
30/11/21	ATM.3	Acceptance Testing – Master Document (Version 3)
30/11/21	SB4.2	Sprint Backlog – Sprint Retrospective Meeting
30/11/21	PB4.2	Product Backlog – Sprint Retrospective Meeting
30/11/21	UIDN3	User Interface Design Notes 3

MINUTES OF CUSTOMER MEETING – 10:45AM, 24 NOVEMBER 2021

Attendees: All team members other than Jaafar, customer.

Scribe: Christian Bentley.

Product prototype demo and process documentation update

- The team demonstrated to the customer a playthrough of the game product prototype – focussing on question and scoring functionalities.
    - Aimee flagged to the customer a bug in the question mechanics – the answer box takes the first integer input, rather than accepting a multi-digit answer.
    - The customer was pleased with the progress made in this Sprint and that, as in Sprints 2 and 3, a viable game product was presented.
- The team also provided an update on the process documentation – Sprint 1 and Sprint 2 had been fully written-up to submission quality.
    - The customer was pleased that there was a reliable documentation process in place.
    - The team also discussed the rotation of Scrum roles and the allocation of process documentation tasks, which the customer approved.

Proposals for Sprint 4

- The team proposed that, for Sprint 4, the team will:
    - scale-up the 3x3 grid level (post-bug-fixes) into a more complex 5x5 level;
    - implement unit testing; and
    - as secondary priorities:
        - develop a fruit functionality – Barry the Banana; and
        - implement the movement of carrots on the board.
- The customer approved these proposals for Sprint 4.
- The customer raised the use of external question banks (which had been discussed in CM3).
    - Oscar and the customer discussed Oscar's networking experience and a RESTful API/localhost methodology for implementing external question banks.
    - It was agreed that, for this sprint, the simple arithmetic question scheme should remain as the other core functionalities are developed.

Timeline to delivery

- The customer asked about the status of our timeline to product delivery at the submission deadline.
    - The team explained that a good baseline game had been developed in the first three sprints, with exciting core functionalities expected to be implemented in Sprint 4.
    - Therefore, the team was well-placed to produce a well-rounded product at submission, having bolted-on minor functionalities in later sprints.

Deliverables

- Implement the agreed development proposals outlined above, for the next customer meeting on 1 December 2021.

USER STORIES/USE CASES ALLOCATION

Sprint: 4.

Date: 24/11/2021.

Timing: Iteration Planning Meeting.

Created/Last updated by: Christian Bentley, working with all team members.

	Summary of Functionality	**Allocation**
US24	Integration of online question resources	Oscar
US25	Saving of scores offline	Aimee
US26	Unit testing	Abel
US27	5x5 grid size	Jaafar
US28	End of level buttons (Continue/Return to Main Menu)	Oscar
US29	Barry the Banana	Aimee

PB4.1

PRODUCT BACKLOG

Sprint: 4.

Version: 1.

Date: 24/11/2021.

Timing: Iteration Planning Meeting.

Created/Last updated by: Oscar Gee and Christian Bentley.

PRIORITY	UNSATISFIED USER STORIES, FAILED TESTS AND OTHER TASKS
Must Have	Development of new user stories and use cases Development of CRC cards **US26 –** Unit testing **US27 –** 5x5 grid size **US28/AT19.1** – End of level buttons (Continue/Return to Main Menu)
Should Have	**US29** – Barry the Banana **US17 –** Movement of carrots
Could Have	**US7 –** Mid-Level Menu interface **US8 –** Resume Game from Mid-Level Menu **AT2.1 –** New Game Menu interface **US18/AT23.1 –** Steve interactions between questions and on incorrect answers **US20 –** Failure of level
Won't Have This Time	**US4 –** Choose the Difficulty Level from the Main Menu **US5 –** Load a Saved Game from the Main Menu **US9-10/AT1.1 –** Other Mid-Level Menu functionalities (Save Game, Quit to Main Menu) **US22 –** Quit to Main Menu warning message **US24 –** Integration of online question resources **US25** – Saving of scores offline **US3 –** Choose the Question Package

SB4.1

SPRINT BACKLOG

Sprint: 4.

Version: 1.

Date: 24/11/2021.

Timing: Iteration Planning Meeting.

Created/Last updated by: Christian Bentley, working with all team members.

SPRINT GOAL				
To scale-up the game to a 5x5 square tile grid, using CRC cards to visualise the system, and, if possible, develop minor functionalities, including carrot movement and/or Barry the Banana.				
SELECTED PRODUCT BACKLOG ITEMS				
MUST HAVE	Development of new user stories and use cases Development of CRC cards **US26 –** Unit testing **US27 –** 5x5 grid size **US28/AT19.1** – End of level buttons (Continue/Return to Main Menu)			
SHOULD HAVE	**US29** – Barry the Banana **US17 –** Movement of carrots			
COULD HAVE	**US7 –** Mid-Level Menu interface **US8 –** Resume Game from Mid-Level Menu **AT2.1 –** New Game Menu interface **US18/AT23.1 –** Steve interactions between questions and on incorrect answers **US20 –** Failure of level			
SPRINT TASKS				
Priority	**Tasks (ordered)**	**Timeframe (hours)**	**Individual/Pair**	**Status**
MUST HAVE	Develop CRC cards	1	All team	Not started
	Develop new user stories (US24-29) and use cases (UC24-29)	0.5 (per person)	As allocated in USA2	Not started
	Finalise Sprint 3 documentation	5	Christian	Not started
	Develop unit testing	5	Abel and Rohith	Not started
	Create 5x5 grid UI	1	Jaafar	Not started
	Develop carrot placement for 5x5 grid	4	Abel and Vishnu	Not started
	Develop end of level buttons	2	Oscar and Aimee	Not started
SHOULD HAVE	Develop Barry the Banana functionalities	4	Aimee and Jaafar	Not started
	Develop movement of carrots after correct answers	4	Rohith and Justin	Not started

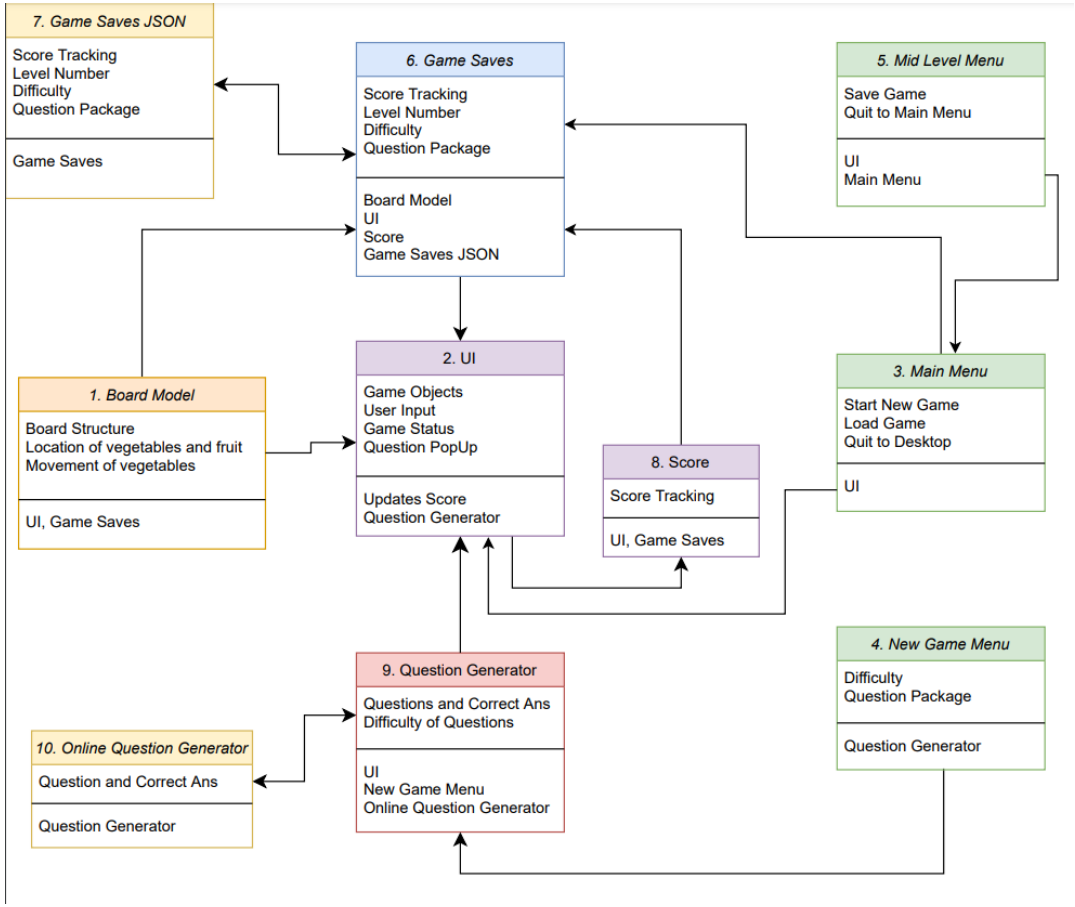
COULD HAVE	Develop Mid-level Menu interface and Resume Game button	3	Justin	Not started
	Develop New Game Menu interface	2	Aimee and Christian	
	Develop Steve interactions	2	Aimee	Not started
	Develop level failure mechanics	3	Vishnu	Not started

CRC CARDS

Version: 1.

Date: 25 November 2021.

Document created/last updated by: Aimee Dowell, working with all team members.



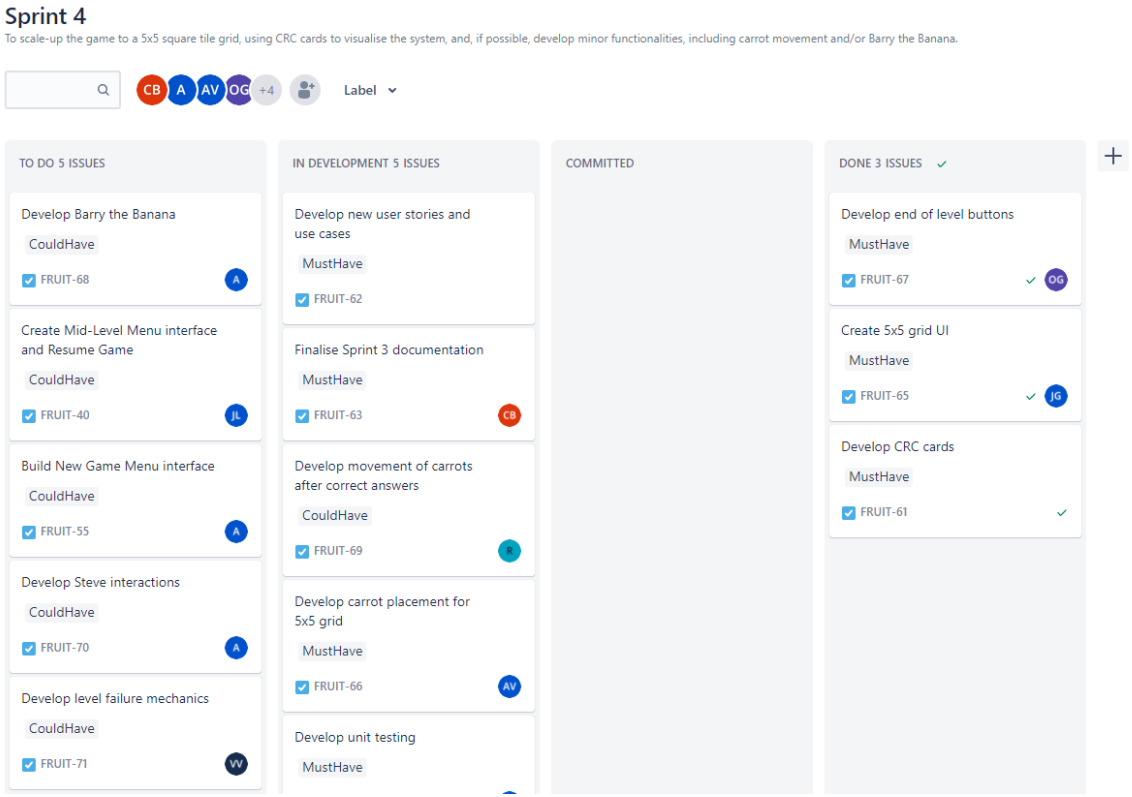
STAND-UP MEETING

Date: 28/11/2021

Attendees: All team members.

Document created by: Christian Bentley, working with all team members.

Sprint 4 - Jira Board



Stand-up Meeting Discussions

Jira Board

- Each team member spoke about their allocated tasks in the sprint backlog and their current progress.
- The team discussed the state of the Jira board and the path to completion of the Must Have items, as well as the team's capacity to complete Should Have and Could Have items.

Additional meetings

- The team discussed whether a further stand-up meeting would be beneficial. The team considered that it would not, so no further stand-up meeting was scheduled.

SPRINT RETROSPECTIVE

Sprint: 4.

Date: 30/11/2021.

Attendees: All team members.

Document created by: Christian Bentley, working with all team members.

GENERAL COMMENTS

1. The team was pleased with the broad range of complex features that were implemented in this sprint – in particular, unit testing for the BoardModel and scaling-up the UI and game mechanics for a 5x5 grid level.
2. Reflecting on the time invested into this week's tasks, the team noted that each member had spent more time working on the project this week than in any previous sprint, but observed that significant progress had been made and the team was prepared for lower-capacity sprints as other coursework deadlines became closer.
3. The most significant difficulty that the team faced in this sprint was, as was the case in Sprint 3, the increased complexity of the development tasks. Whilst the 3x3 grid level had been developed in both Sprint 2 and Sprint 3, this sprint involved scaling-up the UI and back-end scripts developed in both sprints to a 5x5 level, which involved significant complexity and work volume.
4. However, the team considered that the early discussion of the CRC cards had clarified and equalised team members' understandings of the system as a whole, which minimised confusion and downtime early in the development process in this sprint. Furthermore, several team members again praised the extensive pair programming in this sprint, which enabled pairs to produce effective, clean code (on both UI and back-end tasks) and to leverage our growing experience and skills in Unity/C# to undertake more complex tasks.
5. The team observed that only one stand-up meeting had been held, although at the Sprint 3 retrospective meeting the team had suggested that additional meetings should be prioritised. The team considered that, whilst further meetings could have further improved the team's efficiency in this sprint, many team members had contacted others *ad hoc* during this sprint and that an additional team-level meeting was not necessary.
6. The team also reflected on the incorporation of unit testing in this sprint. Although the unit testing was not fully implemented, the team recognised the efficiency of automated, regular unit tests over formal code inspections by a small number of team members and expressed their intention to prioritise the remainder of the unit testing implementation in Sprint 5.
7. The team considered the incomplete implementation of unit testing to be the sole unexpected event in this sprint. Abel and Rohith, the pair responsible for this task, considered that they had taken on too much complex work in the iteration planning meeting. The team agreed that, as a whole, the team should consider the balance of task allocations at the iteration planning meeting in future sprints, to mitigate the risk of incomplete, Must Have items.

8. The team proposed that, in Sprint 5, the team will discuss with the customer new game functionalities (in particular, additional fruit/vegetable functionalities), the progress of documentation and the implementation of further unit testing.

REVIEW OF ACCEPTANCE TESTS

The team reviewed the acceptance tests master (**ATM.3**), observing that, of the acceptance tests which were relevant to the user stories implemented in this sprint, AT26.1 was partially failed but all other new acceptance tests were passed. The team made note of the failed acceptance test to be added to the updated product backlog.

REVIEW OF, AND UPDATES TO, SPRINT BACKLOG

The team reviewed and updated the sprint backlog (**SB4.2**).

During this sprint, 13 tasks were allocated, of which 8 were prioritised and completed. Therefore, the team has achieved a task completion rate of 62% and a team velocity of 25.

Reflecting on team progress, the team observed that the team velocity increased by 14% from that of Sprint 3. The team considered that this was due to the fact that higher complexity tasks were prioritised in this sprint and (as noted at the iteration planning meeting) the team decided to front-load this sprint with such development tasks in order to better manage the documentation to be produced in the following sprints, when other coursework deadlines would likely impact team capacity. Therefore, the team expects to see a sharp decrease in team velocity in future sprints, due to the diversion of team capacity to other coursework projects.

REVIEW OF, AND UPDATES TO, PRODUCT BACKLOG

The team reviewed and updated the product backlog (**PB4.2**) to reflect the completed items in the updated sprint backlog and the failed acceptance test.

NEW, AND UPDATES TO EXISTING, USER STORIES

New user stories reflected in **USM.4** (*which is not appended to this submission, to avoid unnecessary duplication*).

US24	**User Story:** As a **player** I want my **question data to be stored and retrieved from an online location and used in the questions that pop up in game**.
Comments: Implementing this requirement should use the customer suggestion of a RESTful API. Question data that is manipulated using the API is called from an online database. Due to network constraints, it makes sense for the database to be local to the machine and transmitted through the API from LocalHost to UnityWebRespose (HTTP).	
Acceptance criteria: Questions that pop up throughout the game should have their question data populated directly from the “online” database and streamed **either:**	

- prior to the game loading; or
- on “highlight square”.

Status (27/11/2021)
Created/Last updated by: Oscar Gee.
Version: 1.
Development/Testing: Not developed or tested.

Connected User Stories:
US12 (Highlight Square) US13 (Question Pop-up)

US25	**User Story:** As a **player**, I want **my score to be saved once I quit the game** so that I can **continue my progress and my score isn’t lost when I re-open the game**.

Comments:
Save button will appear during the Main Menu once new score data has been added or during the Mid-Level Menu (when the player is currently playing a level).

Acceptance criteria:
Every time the save button is clicked from either the Main Menu or Mid-Level Menu, the new score data should be written to a corresponding JSON file within the game project files.

Status (27/11/2021):
Created/Last updated by: Aimee Dowell.
Version: 1.
Development/Testing: Not developed or tested.

Connected User Stories:
US9 (Save Button), US1/7 (Main Menu and Mid-Level Menu), US5 (Load Game)

US26	**User Story:** As a **Developer** I want a develop **unit tests for each method** so that **I can ensure all code written in the backend is well tested & free of hidden bugs.**

Comments:
Unit tests will be written for each method that is defined in the backend scripts. If alterations are made to existing methods, new unit tests will be developed which examine if the method works as expected with the new changes. Once a new functionality is developed, I.E new classes are generated, unit tests must immediately be developed after the code development.

Acceptance criteria:
All methods should have 1 or more corresponding unit test which examine how the method performs for a given input. Additionally, all unit tests must pass before new functionality is added to the game.

Status (27/11/2021):
Created/Last Updated By: Abel Tom Varghese.
Version: 1.
Development/Testing: Not developed or tested.

Connected User Stories:
US5 (Loading a previously saved game), US9 (Saving a current game), US11 (Placement of carrots), US13 (Question generation), US17 (Movement of carrots), US21 (Scoring functionality)

US27	**User Story:** As a **player**, I want a level with a **5x5 grid** so that the game **can progress and become more difficult.**

Comments: A new level will be available where the player can play on a 5x5 grid.
Acceptance criteria: When a player completes the first level (3x3) they can progress to the 5x5 grid and continue playing through the end of level pop-up.
Status (27/11/2021): Created/Last updated by: Jaafar Ghaddar. Version: 1. Development/Testing: Not developed or tested.
Connected User Stories: US5 (Load game), US9 (Save game), US28 (Level Complete Buttons).

US28	**User Story:** As a **player** I want to be able to **either continue on to the next level after completing the level or return back to the main menu**.
Comments: Should be implemented with buttons “Continue” or “Return to Main Menu”, appearing at the end of each game level through the end of level pop-up. The Continue button will change the current level to the next level. “Return to Main Menu” will return the user to the “Main Menu” Scene.	
Acceptance criteria: In the end of level pop-up, the player must be able to either Continue or Return to Main Menu through pressing buttons.	
Status (27/11/2021) Created/Last updated by: Oscar Gee. Version: 1. Development/Testing: Not developed or tested.	
Connected User Stories: US1 (Main Menu interface), US19/20 (Level Completed/Failed), US27 (5x5 grid)	

US29	**User Story:** As a **player**, I want **a fruit helper, Barry the Banana, within my game level**, so that I can **push vegetables back a place and increase my chances of winning.**
Comments: Bananas and all fruit helpers will remain static within the grid. A fruit and vegetable cannot occupy the same tile. The vegetables can only be pushed backwards if they are greater than 1 square away from the edge of the grid.	
Acceptance criteria: Every time a banana is revealed underneath a selected tile, the remaining vegetables will be moved backwards by one square to their previous tile.	
Status (27/11/2021): Created/Last updated by: Aimee Dowell. Version: 1. Development/Testing: Not developed or tested.	
Connected User Stories: US11/17 (Positioning and Movement of Carrots)	

Updates reflected in **USM.5** (*which is not appended to this submission, to avoid unnecessary duplication*).

US17	**User Story:** As a **player**, I want the **carrots to move after each correct answer** so that I can **understand how they will approach me in other levels.**
Comments: Carrots will move randomly after each correct answer, in further rounds they will move closer to the strawberry in order to eat him.	
Acceptance criteria: Every time the player answers a question correctly the carrot moves randomly in the board.	
Status (30/11/2021): Created/Last updated by: Christian Bentley. Version: 2. Development/Testing: Developed and tested.	
Connected User Stories: US11 (Positioning of carrots at level start), US14 (Correct Answer)	

US26	**User Story:** As a **Developer** I want a develop **unit tests for each method** so that **I can ensure all code written in the backend is well tested & free of hidden bugs.**
Comments: Unit tests will be written for each method that is defined in the backend scripts. If alterations are made to existing methods, new unit tests will be developed which examine if the method works as expected with the new changes. Once a new functionality is developed, I.E new classes are generated, unit tests must immediately be developed after the code development.	
Acceptance criteria: All methods should have 1 or more corresponding unit test which examine how the method performs for a given input. Additionally, all unit tests must pass before new functionality is added to the game.	
Status (30/11/2021): Created/Last Updated By: Abel Tom Varghese. Version: 2. Development/Testing: Developed and tested in relation to the BoardModel, requires further implementation for Question Generation and Scoring.	
Connected User Stories: US5 (Loading a previously saved game), US9 (Saving a current game), US11 (Placement of carrots), US13 (Question generation), US17 (Movement of carrots), US21 (Scoring functionality)	

US27	**User Story:** As a **player**, I want a level with a **5x5 grid** so that the game **can progress and become more difficult.**
Comments: A new level will be available where the player can play on a 5x5 grid.	
Acceptance criteria: When a player completes the first level (3x3) they can progress to the 5x5 grid and continue playing through the end of level pop-up.	
Status (30/11/2021): Created/Last updated by: Aimee Dowell.	

Version: 2. Development/Testing: Developed and tested.
Connected User Stories: US5 (Load game), US9 (Save game), US28 (Level Complete Buttons).

US28	**User Story:** As a **player** I want to be able to **either continue on to the next level after completing the level or return back to the main menu**.
Comments: Should be implemented with buttons “Continue” or “Return to Main Menu”, appearing at the end of each game level through the end of level pop-up. The Continue button will change the current level to the next level. “Return to Main Menu” will return the user to the “Main Menu” Scene.	
Acceptance criteria: In the end of level pop-up, the player must be able to either Continue or Return to Main Menu through pressing buttons.	
Status (30/11/2021) Created/Last updated by: Justin Lam. Version: 2. Development/Testing: Developed and tested.	
Connected User Stories: US1 (Main Menu interface), US19/20 (Level Completed/Failed), US27 (5x5 grid)	

US29	**User Story:** As a **player**, I want **a fruit helper, Barry the Banana, within my game level**, so that I can **push vegetables back a place and increase my chances of winning.**
Comments: Bananas and all fruit helpers will remain static within the grid. A fruit and vegetable cannot occupy the same tile. The vegetables can only be pushed backwards if they are greater than 1 square away from the edge of the grid.	
Acceptance criteria: Every time a banana is revealed underneath a selected tile, the remaining vegetables will be moved backwards by one square to their previous tile.	
Status (30/11/2021): Created/Last updated by: Aimee Dowell. Version: 2. Development/Testing: Partially developed but not ready for acceptance testing or deployment.	
Connected User Stories: US11/17 (Positioning and Movement of Carrots)	

NEW USE CASES

New use cases reflected in **UCM.2** (*which is not appended to this submission, to avoid unnecessary duplication*).

UC24	**Use Case:** Network streaming for question data
	Version: 1. **Creator/Updater:** Oscar Gee.

	Last updated: 27/11/2021.
User Story: As a player I want my question data to be stored and retrieved from an online location and used in the questions that pop up in game. **ID:** US24	
UC24-1	**Control Flow:** • A tile is selected during a game level. • Unity's HTTPWebRequest function calls a RESTful API. • API Key is accepted from API Server (127.0.0.1 LOCALHOST) and question and answer data is streamed from JSON File/Database to Question() within Unity. • QuestionPopUp() takes the data streamed and implements the downloaded question and answer into the question pop up.
UC24-2	**Actors:** Player.
UC24-3	**Pre-Condition:** • The player clicks on a tile. • Question and answer data is contained in the "online" source.
UC24-4	**Post-Condition:** The player either gets the answer correct or incorrect and this is reflected in the UI.
UC24-5	**Connected Use Cases:** UC12 (Highlight Square) UC13 (Question Pop-up)

UC25	**Use Case:** Saving Scores
	Version: 1. **Creator/Updater:** Aimee Dowell. **Last updated:** 26/11/2021.
User Story: As a player, I want my score to be saved once I quit the game so that I can continue my progress and my score isn't lost when I re-open the game. **ID:** US25	
UC25 -1	**Control Flow:** • The Save button is been selected from either the Main Menu or the Mid-Level Menu. • The player score is written to a corresponding JSON file within the game project files.
UC25-2	**Actors:** Player.
UC25-3	**Pre-Condition:** The player has pressed a Save button.
UC25-4	**Post-Condition:** The current score of the player is collected and written to a JSON file.
UC25-5	**Connected Use Cases:** UC9 (Save Button), UC1/7 (Main Menu and Mid-Level Menu), UC5 (Load Game)

UC27	**Use Case:** 5x5 Grid Level
	Version: 1. **Creator/Updater:** Jaafar Ghaddar. **Last updated:** 27/11/2021.

User Story: As a player, I want a level with a 5x5 grid so that the game can progress and become more difficult. **ID:** US27	
UC27-1	**Control Flow:** Alternative path #1 • Player presses "Continue" after completing the 3x3 level. (UC28) • The 5x5 grid level is loaded. Alternative path #2 • Player loads the game after having saved a game where he completed the 3x3 level. • The 5x5 grid level is loaded.
UC27-2	**Actors:** Player
UC27-3	**Pre-Condition:** Alternative path #1 Player completes the 3x3 level and presses the "Continue" button in the Level Complete pop-up (US28). Alternative path #2 Player saves the game (US9) after completing the 3x3 level and then loads it again. (US5)
UC27-4	**Post-Condition:** Alternative path #1 The 5x5 game level starts. Alternative path #2 The 5x5 level picks up from where the player left off.
UC27-5	**Connected Use Cases:** UC5 (Load game), UC9 (Save game), UC8 (Level Complete Buttons).

UC28	**Use Case:** End of Level Buttons.
	Version: 1. **Creator/Updater:** Oscar Gee. **Last updated:** 27/11/2021.
User Story: As a player I want to be able to either continue on to the next level after completing the level or return back to the main menu. **ID:** US28	
UC28-1	**Control Flow:** • All Carrots have been found/all tiles revealed. • The Level Complete pop-up appears. • "Continue" and "Return to Main Menu" buttons are added to the bottom of the Level Complete pop up. • Pressing on "Continue" changes the scene to "5x5Level" and continues the game. • Pressing on "Return to Main Menu" changes the scene to "MainMenu".
UC28-2	**Actors:** Player.
UC28-3	**Pre-Condition:** The player has completed the level.
UC28-4	**Post-Condition:** Player must be able to either: continue to the next level (on "Continue") or return to the Main Menu (on "Return to Main Menu").

UC28-5	**Connected Use Cases:** UC1 (Main Menu interface), UC19/20 (Level Completed/Failed), UC27 (5x5 grid)

UC29	**Use Case:** Barry the Banana
	Version: 1. **Creator/Updater:** Aimee Dowell. **Last updated:** 26/11/2021.
User Story: As a player, I want a fruit helper, Barry the Banana, within my game level, so that I can push vegetables back a place and increase my chances of winning. **ID:** US29	
UC29 -1	**Control Flow:** If a tile is revealed and it contains Barry the Banana, he is revealed, and the remaining vegetables are pushed backwards by one square.
UC29-2	**Actors:** Player.
UC29-3	**Pre-Condition:** A tile has been selected and a question is answered correctly.
UC29-4	**Post-Condition:** Barry is revealed and the remaining vegetables are pushed backwards by one square as long as they are greater than 1 square from the edge of the board.
UC29-5	**Connected Use Cases:** UC11/17 (Positioning and Movement of Carrots)

ACCEPTANCE TESTING: MASTER DOCUMENTATION

Version: 3.

Date: 30/11/2021.

Document created/last updated by: Abel Tom Varghese, working with all team members.

ID	Vers	User Story	Acceptance Tests	Developer/ Pair	Tester	Date	Comments
AT1	1	US1	1. Upon the player loading up the game, the Main Menu is opened. 2. After the player clicks on "Quit to Main Menu" from the Mid-Level Menu (and any warning message is accepted – see US22), the Main Menu is opened.	Aimee	Christian	16/11/2021	Test #1 passed. Test #2 to be implemented as part of US10 (Mid-Level Menu option to return to the Main Menu)
AT2	1	US2	Every time the puzzle type button is clicked from the Main Menu, or a level from the selected puzzle type has been completed (win or lose), the start button should appear, programmed for the next level (win), or the same level (lose/current).	Christian and Aimee	Abel	16/11/2021	Test passed in relation to the Main Menu start game button. A further intermediary menu may be required to implement US3/4 (Difficulties and Question Packages).
AT6	1	US6	When the "Quit to Desktop" button is clicked. The game should ask the player "Are you sure you want to quit?" and, if accepted, then the game application should close.	Christian	Aimee	16/11/2021	Test passed, save that no warning message appears. After discussion, this feature was not regarded as necessary and will not be implemented.
AT11	1	US11	The carrots & strawberry should be randomly positioned on the board so that all carrots would require two or more moves to reach the strawberry.	Abel and Rohith	Christian	16/11/2021	Test passed.

ID	Vers	User Story	Acceptance Tests	Developer/ Pair	Tester	Date	Comments
AT12	1	US12	Every time a square is clicked (provided there is no current pop-up, such as a question, or an animation showing what is underneath a selected square) the clicked square should be clearly highlighted.	Christian and Aimee	Abel	16/11/2021	Test passed.
AT13	1	US13	Once a tile has been clicked on by the player, a question must pop-up.	Aimee, Rohith & Abel	Christian	23/11/2021	Test passed.
AT14	1	US14	When a question is answered correctly, the question pop-up visually confirms that the answer was correct.	Justin and Vishnu	Aimee	23/11/2021	Test passed.
AT15	1	US15	1. When a question is answered correctly, if a carrot is on the selected tile, then the carrot is revealed. 2. However, if a carrot is not on the selected tile, then the carrot is not revealed.	Oscar and Abel	Aimee	16/11/2021	Tests passed.
AT16	1	US16	1. When a player gives an incorrect answer to a question, there should be a pop-up informing the user that his/her answer to the question is incorrect. 2. The pop-up should enable the player to retry the question or to try a different question.	Jaafar and Oscar	Aimee	23/11/2021	Tests passed.
AT17	1	US17	Every time the player answers a question correctly the carrot moves randomly in the board.	Rohith	Aimee	30/11/2021	Test passed.
AT19	1	US19	If all the vegetables have been found before they reach the strawberry, the level is deemed complete and should return the main menu where the player can either save and quit the game or continue to the next level.	Aimee and Jaafar	Christian	16/11/2021	Test passed, save that the player is not returned to the Main Menu. This feature will be implemented in a later iteration when the level completion mechanics are added.

ID	Vers	User Story	Acceptance Tests	Developer/ Pair	Tester	Date	Comments
AT21	1	US21	Once a correct answer has been made the points go up. If the attempt was right on the first try the player receives 100 points, if it was his second attempt: 50, third: 25, etc…	Rohith, Abel & Aimee	Christian	23/11/2021	Test passed.
AT23	1	US23	When a question is answered correctly, the tile is revealed (US14) and the tile disappears. If there is no carrot on that tile, then a message from Steve should appear stating “Unlucky, there are no vegetables behind that tile – let’s try another one!”.	Vishnu and Justin	Christian	16/11/2021	Test passed, save that there is no message from Steve. This feature will be implemented as part of US18 (Steve interactions during levels).
AT26	1	US26	All methods should have 1 or more corresponding unit test which examine how the method performs for a given input. Additionally, all unit tests must pass before new functionality is added to the game.	Abel	Christian	30/11/2021	Tests passed in relation to the BoardModel, requires further implementation for Question Generation and Scoring.
AT27	1	US27	When a player completes the first level (3x3) they can progress to the 5x5 grid and continue playing through the end of level pop-up.	Jaafar	Aimee	30/11/2021	Test passed.
AT28	1	US28	The player must be able to either continue or return to main menu. This allows the 5x5 scene to be reachable in game. Must be separate buttons.	Oscar	Justin	30/11/2021	All tests passed.

SB4.2

SPRINT BACKLOG

Sprint: 4.

Version: 2.

Date: 30/11/2021.

Timing: Sprint Retrospective Meeting.

Created/Last updated by: Abel Tom Varghese, working with all team members.

SPRINT GOAL				
To scale-up the game to a 5x5 square tile grid, using CRC cards to visualise the system, and, if possible, develop minor functionalities, including carrot movement and/or Barry the Banana.				
SELECTED PRODUCT BACKLOG ITEMS				
MUST HAVE	~~**US24,25,26,27,28,29 –** Develop new user stories & use cases~~ **US26 –** Unit testing ~~**US27 –** 5x5 grid size~~ ~~**US28/AT19.1** – End of level buttons (Continue/Return to Main Menu)~~			
SHOULD HAVE	**US29** – Barry the Banana ~~**US17 –** Movement of carrots~~			
COULD HAVE	**US7 –** Mid-Level Menu interface **US8 –** Resume Game from Mid-Level Menu **AT2.1 –** New Game Menu interface **US18/AT23.1 –** Steve interactions between questions and on incorrect answers **US20 –** Failure of level			
SPRINT TASKS				
Priority	**Tasks (ordered)**	**Timeframe (hours)**	**Individual/Pair**	**Status**
MUST HAVE	Develop CRC cards	1	All team	Completed
	Develop new user stories (US24-29) and use cases (UC24-29)	0.5 (per person) Total: 3	As allocated in USA2	Completed
	Finalise Sprint 3 documentation	5	Christian	Completed
	Develop unit testing	5	Abel and Rohith	Completed for BoardModel only
	Create 5x5 grid UI	1	Jaafar	Completed and tested
	Develop carrot placement for 5x5 grid	4	Abel and Vishnu	Completed and tested
	Develop end of level buttons	2	Oscar and Aimee	Completed and tested
SHOULD HAVE	Develop Barry the Banana functionalities	4	Aimee and Jaafar	Partially developed
	Develop movement of carrots after correct answers	4	Rohith and Justin	Completed and tested

COULD HAVE	Develop Mid-level Menu interface and Resume Game button	3	Justin	Not started
	Develop New Game Menu interface	2	Aimee and Christian	Not started
	Develop Steve interactions	2	Aimee	Not started
	Develop level failure mechanics	3	Vishnu	Not started

PB4.2

PRODUCT BACKLOG

Sprint: 4.

Version: 2.

Date: 30/11/2021.

Timing: Sprint Retrospective Meeting.

Created/Last updated by: Oscar Gee and Abel Tom Varghese.

PRIORITY	UNSATISFIED USER STORIES, FAILED TESTS AND OTHER TASKS
Must Have	~~**US24,25,26,27,28,29** – Develop new user stories & use cases~~ **US26/AT26.1 –** Unit testing (Scoring and Question Generation) ~~**US27 –** 5x5 grid size~~ ~~**US28/AT19.1** – End of level buttons (Continue/Return to Main Menu)~~
Should Have	**US29** – Barry the Banana ~~**US17 –** Movement of carrots~~
Could Have	**US7 –** Mid-Level Menu interface **US8 –** Resume Game from Mid-Level Menu **AT2.1 –** New Game Menu interface **US18/AT23.1 –** Steve interactions between questions and on incorrect answers **US20 –** Failure of level
Won't Have This Time	**US4 –** Choose the Difficulty Level from the Main Menu **US5 –** Load a Saved Game from the Main Menu **US9-10/AT1.1 –** Other Mid-Level Menu functionalities (Save Game, Quit to Main Menu) **US22 –** Quit to Main Menu warning message **US24 –** Integration of online question resources **US25** – Saving of scores offline **US3 –** Choose the Question Package

USER INTERFACE: DESIGN NOTES 3

Sprint: 4.

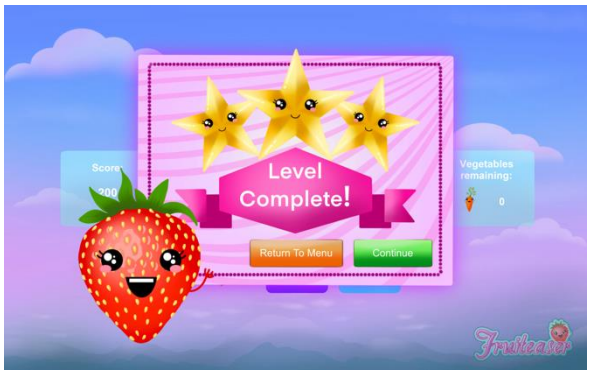
Date: 30/11/2021.

Created/Last updated by: Aimee Dowell.

During this sprint, the question popups were updated to show a green or red ring around the input field object appearing when the question is answered, correctly (green) or incorrectly (red). We felt incorporating this visual indicator would reduce cognitive load, reducing the need for reading text to find out the results of their input. Green has positive connotations of success, used throughout many games, classically displayed as a green tick, and red has more negative connotations, classically displayed as a red X.

Example question popup scenarios from the game where a user has answered a question correctly (left), and incorrectly (right). The green and red rings show immediate status of the input.

The main development task this week was adding a new level to the game. For the user to navigate to this new level, once the level 1 complete popup is shown, buttons appear giving the user the option to continue the game (progress to the next level) or return to the main menu, allowing them to either quit the game, or start afresh.



End of level buttons shown when Level 1 has been completing by the user, allowing them to continue to the next level, or return to the main menu.

The new 5x5 level is shown below, it features the same scoring mechanism and vegetables remaining UI, with the score continuing from Level 1. Once this level is complete, the Level Complete UI shows without the buttons to signal the game has ended and there are no more levels, this can be changed in later sprints if a new level is added.

Start of the 5x5 Level after the player has completed Level 1.

Level Complete popup shown once the player has successfully completed Level 2.

SPRINT 5

Dates: 1-7 December 2021.

Product Owner: Vishnu Vardhan.

Scrum Master: Christian Bentley.

SPRINT OVERVIEW

Key Documentation

User Stories: **New – US30 (see document SR5)**

Updated – US1, 7-8, 10, 18-20, 23, 26, 29-30 (see document SR5)

Use Cases: **New – UC30 (see document SR5)**

CRC Cards: **No changes**

Acc. Tests: **New – AT7-8, 10, 18-20, 23, 26, 29 (see document ATM.4)**

Updated – AT1 (see document ATM.4)

UI Design: **UIDN4**

The goals for Sprint 5 were:

1. to implement additional fruit and vegetable functionalities (Barry the Banana and Boris the Broccoli);
2. to start the production (up to first drafts) of the product documentation (the Installation Guide, the Maintenance Guide and the User Manual); and
3. to implement unit testing in relation to the question generation and scoring scripts.

Due to strike action, no customer meeting was held on 1 December 2021.

At the iteration planning meeting, the team discussed the outstanding customer requirements – set out in the user stories/use cases and acceptance tests master documentation (USM.5, UCM.2 and ATM.3). The team also discussed the customer's priorities at the last customer meeting (24 November 2021 – CM4) and prioritised the outstanding product backlog and sprint backlog items accordingly. The team also discussed team capacity in detail, observing that a number of competing coursework projects were falling due.

As in previous sprints, the team managed workflows during the sprint using a Jira board and a stand-up meeting, at which the team discussed progress in relation to the various tasks and exchanged outline ideas for the structuring of the product documentation.

At the end of the iteration, the team held a sprint retrospective meeting, at which the team reflected on the sprint and the team's progress towards the sprint goals (see the Sprint Review, below), reviewed acceptance tests for relevant user stories and updated the sprint and product backlogs and existing user stories in light of the team's progress.

SUMMARY OF SPRINT EVENTS AND DOCUMENTATION

Iteration Planning Meeting – 2 December 2021

Attended by: All team members.

As there was no customer meeting in this iteration, the team initially reviewed and discussed the outstanding requirements and customer priorities - reviewing the user stories/use cases and acceptance tests master documentation (USM.5, UCM.2 and ATM.3) and the minutes of the last customer meeting (CM4).

The team discussed in detail individual capacities and the team's capacity for development and documentation tasks – the team chose to prioritise documentation tasks and smaller development tasks in this sprint, given limited team capacity due to competing coursework priorities (as identified in Sprint 4).

Following that discussion, Vishnu and Christian developed the product backlog (**PB5.1**) and the team collaborated to develop the sprint backlog (**SB5.1 –** which was then reflected in a Jira board) for this sprint.

The team considered that additional user story and use case was required in relation to the functionality of Boris the Broccoli. These were produced and then incorporated into the master documentation (USM.6 and UCM.3) - for the purposes of this submission and to avoid duplication, the new user story and use case are incorporated into the record of the sprint retrospective meeting – see document **SR5**.

Stand-up Meeting – 5 December 2021

Attended by: All team members.

At the stand-up meeting, each team member explained the current status of their allocated tasks and the team discussed the progress made, and required, towards the sprint goals. The team also discussed in detail individual work capacities, although no changes were required to the sprint backlog.

In addition, Oscar and Jaafar outlined their proposed structures for the User Manual and the Installation Guide, respectively. The team discussed and agreed the proposed structures for these documents.

A record of the stand-up meeting is appended to this sprint, as document **SM4**.

Sprint Retrospective Meeting – 7 December 2021

Attended by: All team members.

At the sprint retrospective meeting, the team first reflected generally on the sprint (see Sprint Review below), before reviewing the updated acceptance tests documentation (**ATM.4**) and then updating the sprint backlog (**SB5.2**) and product backlog (**PB5.2**).

A record of the sprint retrospective meeting is appended to this sprint, as document **SR5**.

SPRINT REVIEW

At the sprint retrospective meeting, the team discussed and reviewed the team's progress.

General comments and velocity

The team considered that the team had satisfied each of the sprint goals identified at the start of the sprint – in particular:

1. the team implemented additional fruit and vegetable functionalities into the game (Barry the Banana and Boris the Broccoli);
2. the team produced first drafts of the product documentation (the Installation Guide, the Maintenance Guide and the User Manual); and
3. the team implemented unit testing in relation to the question generation and scoring scripts.

During this sprint, 12 tasks were allocated, of which 11 were prioritised and 7 were completed. Therefore, the team has achieved a task completion rate of 58% and a team velocity of 22.5.

Reflecting on team progress, the team observed that the team velocity had decreased by 10% from that of Sprint 4, whilst the task completion rate only slightly decreased. The team considered that this was due to the fact that, as anticipated at the iteration planning meeting, several key documentation tasks were not absolutely completed in this sprint. The team considered that significant progress had been made on these tasks and a strong level of velocity had been maintained, in spite of work capacity issues, and that the team was well-placed ahead of a number of coursework deadlines falling within the final two sprints.

Difficulties faced

The team faced two significant difficulties in this sprint:

1. lower team work capacity, as compared with previous sprints, due to competing coursework deadlines; and
2. a shift from solely development activity towards documentation tasks.

The team managed these difficulties well. There was a frank discussion of team capacity at both the iteration planning meeting and the stand-up meeting, from which team members pitched-in to take on tasks and to assist others where appropriate – this led to a task completion rate consistent with that of previous sprints, notwithstanding such capacity issues. Team capacity had been identified as a forthcoming issue in Sprint 4, so the team was well-prepared to operate with limited workflows and this issue was not unanticipated.

In addition, the team discussed and agreed in outline the proposed structure of each of the product documents at those meetings, which Oscar, Justin and Jaafar praised as a useful exercise ahead of their drafting tasks. The team was generally pleased with the first drafts of these complex documents, which could then be reviewed and updated in subsequent sprints without disrupting team velocity.

Exception handling

The team considered that the sole exceptional event in Sprint 5 was the cancellation of the customer meeting at the start of the sprint. In previous sprints, the customer meeting was an essential sprint

event – the team demonstrated the current state of the product, sought feedback and proposed priorities for the next sprint.

However, the team handled this exception very well. At the iteration planning meeting, the team reviewed current versions of the requirements documentation (the user stories and use cases master, as well as the acceptance tests master) to identify outstanding tasks, and the minutes of the previous customer meeting, to identify the customer's most recently-expressed priorities. The team was then able to effectively identify and prioritise tasks for this sprint, notwithstanding the lack of customer engagement. Therefore, the cancellation of the customer meeting did not significantly impact the team's workflow or product progress in this sprint.

Sprint 6

For Sprint 6, the team expects individual work capacities to remain suppressed, due to competing coursework demands as the semester closes. Therefore, the team intends to propose to the customer that the team will focus upon finalising the product documentation and completing smaller functionalities (fruit/vegetable functionalities and quality-of-life), rather than taking on significant development tasks as in Sprints 2-4.

SPRINT DOCUMENTATION

Date	ID	Document
02/12/21	PB5.1	Product Backlog – Iteration Planning Meeting
02/12/21	SB5.1	Sprint Backlog – Iteration Planning Meeting
05/12/21	SM4	Record of a Stand-up Meeting
07/12/21	SR5	Record of a Sprint Retrospective Meeting
07/12/21	ATM.4	Acceptance Testing – Master Document (Version 4)
07/12/21	SB5.2	Sprint Backlog – Sprint Retrospective Meeting
07/12/21	PB5.2	Product Backlog – Sprint Retrospective Meeting
07/12/21	UIDN4	User Interface Design Notes 4

PRODUCT BACKLOG

Sprint: 5.

Version: 1.

Date: 02/12/2021.

Timing: Iteration Planning Meeting.

Created/Last updated by: Vishnu Vardhan and Christian Bentley.

PRIORITY	UNSATISFIED USER STORIES, FAILED TESTS AND OTHER TASKS
Must Have	**US26/AT26.1 –** Unit testing (Scoring and Question Generation) **US29** – Barry the Banana **US30** – Boris the Broccoli Installation Guide Maintenance Guide
Should Have	**US18/AT23.1 –** Steve interactions between questions and on incorrect answers **US20 –** Failure of level User Manual
Could Have	**US7 –** Mid-Level Menu interface **US8 –** Resume Game from Mid-Level Menu **AT2.1 –** New Game Menu interface
Won't Have This Time	**US4 –** Choose the Difficulty Level from the Main Menu **US5 –** Load a Saved Game from the Main Menu **US9-10/AT1.1 –** Other Mid-Level Menu functionalities (Save Game, Quit to Main Menu) **US22 –** Quit to Main Menu warning message **US24 –** Integration of online question resources **US25** – Saving of scores offline **US3 –** Choose the Question Package

SPRINT BACKLOG

Sprint: 5.

Version: 1.

Date: 02/12/2021.

Timing: Iteration Planning Meeting.

Created/Last updated by: Christian Bentley, working with all team members.

SPRINT GOAL				
To expand unit testing to scoring and question generation mechanics, to implement additional fruit and vegetable functionalities and to produce first drafts of key product documentation.				
SELECTED PRODUCT BACKLOG ITEMS				
MUST HAVE	**US26/AT26.1 –** Unit testing (Scoring and Question Generation) **US29** – Barry the Banana **US30** – Boris the Broccoli Installation Guide Maintenance Guide			
SHOULD HAVE	**US18/AT23.1 –** Steve interactions between questions and on incorrect answers **US20 –** Failure of level User Manual			
COULD HAVE	**US7 –** Mid-Level Menu interface **US8 –** Resume Game from Mid-Level Menu **AT2.1 –** New Game Menu interface			
SPRINT TASKS				
Priority	**Tasks (ordered)**	**Timeframe (hours)**	**Individual/Pair**	**Status**
MUST HAVE	Develop new user story (US30) and use case (UC30)	0.5	Aimee	Not started
	Finalise Sprint 4 documentation	5	Christian	Not started
	Develop unit testing for scoring and question generation	5	Abel and Rohith	Not started
	Develop Barry the Banana functionalities	4	Aimee	Partially developed in Sprint 4
	Develop Boris the Broccoli functionalities	3	Aimee	Not started
	Produce first draft Installation Guide	5	Jaafar	Not started
	Produce first draft Maintenance Guide	5	Abel and Rohith	Not started
SHOULD HAVE	Develop Steve interactions	2	Aimee	Not started
	Develop level failure mechanics	3	Vishnu	Not started
	Produce first draft User Manual	5	Oscar	Not started

COULD HAVE	Develop Mid-level Menu interface and Resume Game button	3	Justin	Not started
	Develop New Game Menu interface	2	Christian	Not started

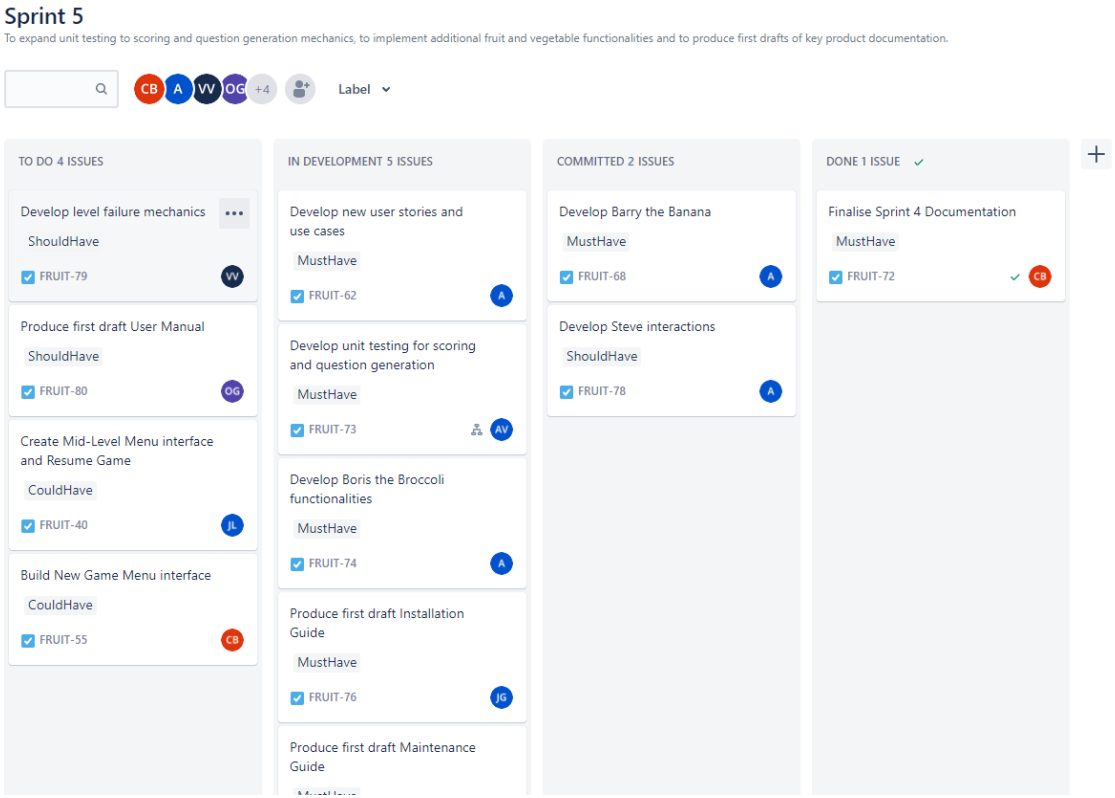
STAND-UP MEETING

Date: 05/12/2021

Attendees: All team members.

Document created by: Christian Bentley, working with all team members.

Sprint 5 - Jira Board



Stand-up Meeting Discussions

Jira Board

- Each team member spoke about their allocated tasks in the sprint backlog and their current progress.
- The team discussed the state of the Jira board and the path to completion of the Must Have items, as well as the team's capacity to complete Should Have and Could Have items.

Individual capacities

- The team discussed individual work capacities.
- The team decided not to re-allocate any tasks in the sprint backlog, but that the team would continue to monitor task progress to ensure that task completions are not unnecessarily delayed.
- Several team members also offered to help others with their tasks.

Product Documentation

- Oscar and Jaafar outlined their proposed structures for the User Manual and the Installation Guide, respectively.
- The team discussed and agreed the proposed structures for these documents.

SR5

SPRINT RETROSPECTIVE

Sprint: 5.

Date: 07/12/2021.

Attendees: All team members.

Document created by: Christian Bentley, working with all team members.

GENERAL COMMENTS

1. The team was pleased with the progress made in this sprint, in spite of challenging circumstances. The team developed a small number of additional features that complimented the existing gameplay and made good progress on the product documentation. In addition, several team members finalised the implementation of unit testing, which was considered a key milestone in the development of a consistent, reliable product output.
2. The team considered that the most significant difficulties faced in this sprint were:
    a. lower team capacity due to coursework deadlines, as had been anticipated during Sprint 4; and
    b. a shift from solely development activity towards documentation tasks.
3. The team considered that, as a team, we managed these difficulties well. In particular, there was a frank discussion of team capacity at both the iteration planning meeting and the stand-up meeting, from which team members pitched-in to take on tasks and to assist others where appropriate – this led to a task completion rate consistent with that of previous sprints, notwithstanding such capacity issues. In addition, the team discussed and agreed in outline the proposed structure of each of the product documents at those meetings, which team members praised as a useful exercise ahead of the drafting.
4. Furthermore, at the iteration planning meeting, the team chose *not* to prioritise pair programming in this sprint, for the first time during this project. The team considered that this was a good decision, given the team's growing experience and skills and the reduced capacity in this sprint - programming as individuals, and collaborating when appropriate, reduced the overall time invested by the team into each task, which thereby enabled more tasks to be completed in this sprint.
5. The team observed that team capacity issues would subsist in both of the final sprints, so the team decided to maintain the current sprint structure (a planning meeting at the start, a stand-up meeting in the middle, and a retrospective meeting at the end) but to limit the new development tasks to be undertaken – the team proposed to focus on the outstanding documentation tasks, as required for the coursework submission.
6. The team noted that the sole unexpected event in this sprint was the cancellation of the customer meeting at the start of the sprint. However, this did not cause any issues for the team, as we had effective, up-to-date requirements (in user stories and use cases) and were able to continue the development in line with those requirements without requiring a further meeting.

7. The team proposed that, in Sprint 6, the team will focus upon finalising the product documentation and completing smaller, quality-of-life functionalities (rather than significant development tasks).

REVIEW OF ACCEPTANCE TESTS

The team reviewed the acceptance tests master (**ATM.4**), observing that, of the acceptance tests which were relevant to the user stories implemented in this sprint, the sole failed acceptance test was AT30.1 (movement of Boris the Broccoli). The team made note of the failed acceptance test to be added to the updated product backlog.

REVIEW OF, AND UPDATES TO, SPRINT BACKLOG

The team reviewed and updated the sprint backlog (**SB5.2**).

During this sprint, 12 tasks were allocated, of which 11 were prioritised and 7 were completed. Therefore, the team has achieved a task completion rate of 58% and a team velocity of 22.5.

Reflecting on team progress, the team observed that the team velocity had decreased by 10% from that of Sprint 4, whilst the task completion rate only slightly decreased. The team considered that this was due to the fact that, as anticipated at the iteration planning meeting, several key documentation tasks were not absolutely completed in this sprint. The team considered that significant progress had been made on these tasks and a strong level of velocity had been maintained, in spite of work capacity issues, and that the team was well-placed ahead of a number of coursework deadlines falling within the final two sprints.

REVIEW OF, AND UPDATES TO, PRODUCT BACKLOG

The team reviewed and updated the product backlog (**PB5.2**) to reflect the completed items in the updated sprint backlog and the failed acceptance test AT30.1.

NEW, AND UPDATES TO EXISTING, USER STORIES

New user story reflected in **USM.6** (*which is not appended to this submission, to avoid unnecessary duplication*).

US30	**User Story:** As a **player**, I want **broccoli vegetables, Boris, which move towards Steve the Strawberry diagonally, within my game level**, so that I can **add an extra level of challenge and make the game more exciting.**
Comments: Broccolis must be randomly positioned on the grid, but they cannot occupy the same tile as other fruit and vegetables. The broccolis can be pushed backwards by bananas if they are greater than 1 square away from the edge of the grid.	
Acceptance criteria: 1. There should be a fixed number of broccolis for each level.	

2. All broccolis must start at a minimum of more than two steps away from Steve the Strawberry.
3. The broccolis must move diagonally.
4. If a broccoli is revealed, the number of broccolis remaining must reduce by 1.

Status (03/12/2021):
Created/Last updated by: Aimee Dowell.
Version: 1.
Development/Testing: Not developed or tested.

Connected User Stories:
US11/17 (Positioning and Movement of Carrots, US20 (Level Failure)

Updates reflected in **USM.7** (*which is not appended to this submission, to avoid unnecessary duplication*).

US1	**User Story:** As a **player** I want a **Main Menu** so that **I can choose the ways in which I will play the game.**

Comments:
Main Menu to appear on start-up and when selected from the Mid-Level Menu. Menu options should include "Start game", "Choose question package", "Choose difficulty level", "Load game" and "Close game". The Main Menu may have artwork, music and interactions with the game characters.

Acceptance criteria:
1. Upon the player loading up the game, the Main Menu is opened.
2. After the player clicks on "Quit to Main Menu" from the Mid-Level Menu (and any warning message is accepted – see US22), the Main Menu is opened.

Status (07/12/2021):
Created/Last updated by: Christian Bentley.
Version: 3.
Development/Testing: Developed and tested.

Connected User Stories:
US2-US6 (Main Menu functionalities), US10/22 (Quit to Main Menu and warning message).

US7	**User Story:** As a **player** I want **a mid-level menu** so that **I can take a break, save my game progress or go back to the main menu.**

Comments:
The player should be in an active game. It must not be game over/any other menu.
During a level, when the player presses the "escape" button, the ongoing game pauses and a Mid-Level Menu pops up. It should have 3 options in the following order – Resume Game, Save Game and Quit to Main Menu buttons.
Also after saving the progress, it should be returned to the mid-level menu.

Acceptance criteria:
After pressing the escape button during a game level, the Mid-Level Menu must open.

Status (07/12/21):
Created/Last Updated By: Rohith Kanjirappara.
Version: 2.
Development/Testing: Developed and tested.

Connected User Stories:
US10 and US22 (Quit to Main Menu and warning message), US9 (Save Game), US8 (Resume Game)

US8	**User Story:** As a **player**, I want a **resume game button** so that I can **continue playing the game once the mid-game menu is clicked.**
Comments: The resume game button should appear as part of the in-game menu. Once clicked the game should continue from the where the player last left off.	
Acceptance criteria: Once the player clicks the resume game button in the in-game menu the game should resume where it was left off.	
Status (07/12/2021): Created/Last updated by: Jaafar Ghaddar. Version: 2. Development/Testing: Developed and tested.	
Connected User Stories: US7 (Mid-Level Menu interface)	

US10	**User Story:** As a **user** I want an **option during level gameplay to return to the Main Menu** so that **after having started a game, I can start a new game, load a saved game or quit the program.**
Comments: "Quit to Main Menu" should be an option from the Mid-Level Menu. If the user clicks on this option, the user should be taken to the Main Menu and the current game should be ended and not saved. *See US22 (warning message) for alternative stories concerning a warning message for the loss of current game progress.*	
Acceptance criteria: 1. "Quit to Main Menu" is an option in the Mid-Level Menu. 2. If the user selects this option, the Main Menu is opened and the current game is ended.	
Status (07/12/2021): Created/Last updated by: Christian Bentley. Version: 2. Development/Testing: Developed and tested.	
Connected User Stories: US1 (Main Menu), US22 (Quit to Main Menu – warning message).	

US18	**User Story:** As a **player** I want **Steve to interact with me between questions** so that **I am engaged with and guided by the main character.**
Comments: Whilst the user is playing a game level and is not answering a question, after a short period of inactivity Steve should display a message, guiding the player's next action (selecting a tile).	
Acceptance criteria: When a user is playing a game level, is not answering a question and after a short period of inactivity, a message is displayed instructing the player to select the next tile.	
Status (07/12/2021): Created/Last updated by: Christian Bentley. Version: 2. Development/Testing: Developed and tested.	
Connected User Stories:	

US12-16 (Tile Selection and Questions).

US19	**User Story:** As a **player**, I want to **successfully complete a level once I have found all the vegetables** so that I can **return to the main menu and complete the next level or save and quit**.
Comments: Level is not deemed 'complete' if all lives are lost, or if a vegetable reaches the strawberry before player catches them.	
Acceptance criteria: If all the vegetables have been found before they reach the strawberry, the level is deemed complete and should return the main menu where the player can either save and quit the game or continue to the next level.	
Status (07/12/2021): Created/Last updated by: Aimee Dowell. Version: 3. Development/Testing: Developed and tested.	
Connected User Stories: US20 (Level failed), US21 (Scoring)	

US20	**User Story:** As a **player** I want a **level failed** notification so that **I can restart the game and play again.**
Comments: Pop up to appear when failing the game. This can occur when vegetables reach Steve the Strawberry. Pop up informs the player that they have lost the level and will give the player an option to either return to the main menu or restart the level.	
Acceptance criteria: Pop up to occur when vegetable reaches Strawberry. Pop up will contain buttons "Return to Main menu" and "Restart Level".	
Status (07/12/2021): Created/Last Updated By: Oscar Gee. Version: 2. Development/Testing: Developed and tested.	
Connected User Stories: US2-US6 (Main Menu functionalities), US10 (Quit to Main Menu clicked), US19 (Level Completed), US21 (Scoring).	

US23	**User Story:** As a **user** I want **to receive a notification that there was no carrot underneath the revealed tile** so that **I can track my level progress.**
Comments: When a question is answered correctly, the tile is revealed (US14) and the tile disappears. If there is no carrot on that tile, then a message from Steve should appear stating "Unlucky, there are no vegetables behind that tile – let's try another one!".	
Acceptance criteria: If the player has answered a question correctly and there is no carrot on that tile, then the above message appears and the tile disappears.	
Status (07/12/2021):	

Created/Last updated by: Christian Bentley. Version: 3. Development/Testing: Developed and tested.
Connected User Stories: US13 (Question Pop-up), US14 (Correct Answer), US15 (Carrot Revealed), US11/17 (Positioning and Movement of Carrots).

US26	**User Story:** As a **Developer** I want a develop **unit tests for each method** so that **I can ensure all code written in the backend is well tested & free of hidden bugs.**
Comments: Unit tests will be written for each method that is defined in the backend scripts. If alterations are made to existing methods, new unit tests will be developed which examine if the method works as expected with the new changes. Once a new functionality is developed, I.E new classes are generated, unit tests must immediately be developed after the code development.	
Acceptance criteria: All methods should have 1 or more corresponding unit test which examine how the method performs for a given input. Additionally, all unit tests must pass before new functionality is added to the game.	
Status (07/12/2021): Created/Last Updated By: Abel Tom Varghese. Version: 3. Development/Testing: Developed and tested in relation to the BoardModel, Question Generation and Scoring.	
Connected User Stories: US5 (Loading a previously saved game), US9 (Saving a current game), US11 (Placement of carrots), US13 (Question generation), US17 (Movement of carrots), US21 (Scoring functionality)	

US29	**User Story:** As a **player**, I want **a fruit helper, Barry the Banana, within my game level**, so that I can **push vegetables back a place and increase my chances of winning.**
Comments: Bananas and all fruit helpers will remain static within the grid. A fruit and vegetable cannot occupy the same tile. The vegetables can only be pushed backwards if they are greater than 1 square away from the edge of the grid.	
Acceptance criteria: Every time a banana is revealed underneath a selected tile, the remaining vegetables will be moved backwards by one square to their previous tile.	
Status (07/12/2021): Created/Last updated by: Aimee Dowell. Version: 3. Development/Testing: Developed and tested.	
Connected User Stories: US11/17 (Positioning and Movement of Carrots)	

US30	**User Story:** As a **player**, I want **broccoli vegetables, Boris, which move towards Steve the Strawberry diagonally, within my game level**, so that I can **add an extra level of challenge and make the game more exciting.**

Comments: Broccolis must be randomly positioned on the grid, but they cannot occupy the same tile as other fruit and vegetables. The broccolis can be pushed backwards by bananas if they are greater than 1 square away from the edge of the grid.
Acceptance criteria: 1. There should be a fixed number of broccolis for each level. 2. All broccolis must start at a minimum of more than two steps away from Steve the Strawberry. 3. The broccolis must move diagonally. 4. If a broccoli is revealed, the number of broccolis remaining must reduce by 1.
Status (07/12/2021): Created/Last updated by: Aimee Dowell. Version: 2. Development/Testing: Partially developed and tested – movement of Boris the Broccoli not yet implemented.
Connected User Stories: US11/17 (Positioning and Movement of Carrots, US20 (Level Failure)

NEW USE CASE

New use case reflected in **UCM.3** (*which is not appended to this submission, to avoid unnecessary duplication*).

UC30	**Use Case:** Boris the Broccoli
	Version: 1. **Creator/Updater:** Aimee Dowell. **Last updated:** 03/12/2021.
User Story: As a **player**, I want **broccoli vegetables, Boris, which move towards Steve the Strawberry diagonally, within my game level**, so that I can **add an extra level of challenge and make the game more exciting.** **ID:** US30	
UC30-1	**Control Flow:** If the tile does not reveal a broccoli, then the broccoli will move towards the strawberry diagonally. If the broccoli is revealed the number of broccolis in the level reduces by one. If a banana is revealed, the broccoli will be pushed backwards.
UC30-2	**Actors:** Player.
UC30-3	**Pre-Condition:** • The broccoli has been positioned randomly at the start of the level, at least 2 positions from Steve the Strawberry and it does not occupy the same tile as other fruit and vegetables. • A question has been answered correctly.
UC30-4	**Post-Condition:** Alternative Path #1: • If the tile is revealed but there is no vegetable underneath, the broccoli moves one place diagonally towards the strawberry. Alternative Path #2: • If the tile is revealed and it contains Boris the Broccoli, he is revealed, and the remaining broccoli vegetables is reduced by one. Alternative Path #3:

	• If a tile is revealed but there is no vegetable underneath, and the broccoli moves one place diagonally landing on the strawberry, the level is failed. Alternative Path #4: • If a tile is revealed but there is a banana underneath, the broccoli moves backwards one place (unless it is on the edge of the grid, in which case it does not move).
UC30-5	**Connected Use Cases:** UC11/17 (Positioning and Movement of Carrots, UC20 (Level Failure)

ACCEPTANCE TESTING: MASTER DOCUMENTATION

Version: 4.

Date: 07/12/2021.

Document created/last updated by: Abel Tom Varghese, working with all team members.

ID	Vers	User Story	Acceptance Tests	Developer/ Pair	Tester	Date	Comments
AT1	2	US1	1. Upon the player loading up the game, the Main Menu is opened. 2. After the player clicks on "Quit to Main Menu" from the Mid-Level Menu (and any warning message is accepted – see US22), the Main Menu is opened.	Aimee	Christian	07/12/2021	Tests #1 and 2 passed.
AT2	1	US2	Every time the puzzle type button is clicked from the Main Menu, or a level from the selected puzzle type has been completed (win or lose), the start button should appear, programmed for the next level (win), or the same level (lose/current).	Christian and Aimee	Abel	16/11/2021	Test passed in relation to the Main Menu start game button. A further intermediary menu may be required to implement US3/4 (Difficulties and Question Packages).
AT6	1	US6	When the "Quit to Desktop" button is clicked. The game should ask the player "Are you sure you want to quit?" and, if accepted, then the game application should close.	Christian	Aimee	16/11/2021	Test passed, save that no warning message appears. After discussion, this feature was not regarded as necessary and will not be implemented.
AT7	1	US7	After pressing the escape button during a game level, the Mid-Level Menu must open.	Jaafar	Justin	07/12/2021	Test passed. Following discussion within the team, this requirement was changed from "on pressing the escape button" to "on pressing an on-

ID	Vers	User Story	Acceptance Tests	Developer/ Pair	Tester	Date	Comments
							screen button, for additional user-friendliness.
AT8	1	US8	Once the player clicks the resume game button in the in-game menu the game should resume where it was left off.	Jaafar	Justin	07/12/2021	Test passed.
AT10	1	US10	1. "Quit to Main Menu" is an option in the Mid-Level Menu. 2. If the user selects this option, the Main Menu is opened and the current game is ended.	Justin	Christian	07/12/2021	Tests passed.
AT11	1	US11	The carrots & strawberry should be randomly positioned on the board so that all carrots would require two or more moves to reach the strawberry.	Abel and Rohith	Christian	16/11/2021	Test passed.
AT12	1	US12	Every time a square is clicked (provided there is no current pop-up, such as a question, or an animation showing what is underneath a selected square) the clicked square should be clearly highlighted.	Christian and Aimee	Abel	16/11/2021	Test passed.
AT13	1	US13	Once a tile has been clicked on by the player, a question must pop-up.	Aimee, Rohith & Abel	Christian	23/11/2021	Test passed.
AT14	1	US14	When a question is answered correctly, the question pop-up visually confirms that the answer was correct.	Justin and Vishnu	Aimee	23/11/2021	Test passed.
AT15	1	US15	1. When a question is answered correctly, if a carrot is on the selected tile, then the carrot is revealed. 2. However, if a carrot is not on the selected tile, then the carrot is not revealed.	Oscar and Abel	Aimee	16/11/2021	Tests passed.
AT16	1	US16	1. When a player gives an incorrect answer to a question, there should be a pop-up	Jaafar and Oscar	Aimee	23/11/2021	Tests passed.

ID	Vers	User Story	Acceptance Tests	Developer/ Pair	Tester	Date	Comments
			informing the user that his/her answer to the question is incorrect. 2. The pop-up should enable the player to retry the question or to try a different question.				
AT17	1	US17	Every time the player answers a question correctly the carrot moves randomly in the board.	Rohith	Aimee	30/11/2021	Test passed.
AT18	1	US18	When a user is playing a game level, is not answering a question and after a short period of inactivity, a message is displayed instructing the player to select the next tile.	Aimee	Rohith	07/12/2021	Test passed.
AT19	1	US19	If all the vegetables have been found before they reach the strawberry, the level is deemed complete and should return the main menu where the player can either save and quit the game or continue to the next level.	Aimee and Jaafar	Christian	07/12/2021	Test passed.
AT20	1	US20	Pop up to occur when vegetable reaches Strawberry. Pop up will contain buttons “Return to Main menu” and “Restart Level”.	Vishnu	Oscar	07/12/2021	Test passed.
AT21	1	US21	Once a correct answer has been made the points go up. If the attempt was right on the first try the player receives 100 points, if it was his second attempt: 50, third: 25, etc…	Rohith, Abel & Aimee	Christian	23/11/2021	Test passed.
AT23	1	US23	When a question is answered correctly, the tile is revealed (US14) and the tile disappears. If there is no carrot on that tile, then a message from Steve should appear stating “Unlucky, there are no vegetables behind that tile – let’s try another one!”.	Vishnu and Justin	Christian	07/12/2021	Test passed.
AT26	1	US26	All methods should have 1 or more corresponding unit test which examine how the method performs	Abel	Christian	07/12/2021	Tests passed.

ID	Vers	User Story	Acceptance Tests	Developer/ Pair	Tester	Date	Comments
			for a given input. Additionally, all unit tests must pass before new functionality is added to the game.				
AT27	1	US27	When a player completes the first level (3x3) they can progress to the 5x5 grid and continue playing through the end of level pop-up.	Jaafar	Aimee	30/11/2021	Test passed.
AT28	1	US28	The player must be able to either continue or return to main menu. This allows the 5x5 scene to be reachable in game. Must be separate buttons.	Oscar	Justin	30/11/2021	Tests passed.
AT29	1	US29	Every time a banana is revealed underneath a selected tile, the remaining vegetables will be moved backwards by one square to their previous tile.	Aimee	Oscar	07/12/2021	Test passed.
AT30	1	US30	1. There should be a fixed number of broccolis for each level. 2. All broccolis must start at a minimum of more than two steps away from Steve the Strawberry. 3. The broccolis must move diagonally. 4. If a broccoli is revealed, the number of broccolis remaining must reduce by 1.	Aimee and Rohith	Abel	07/12/2021	Tests 1, 2 and 4 passed. Test 3 not yet implemented.

SB5.2

SPRINT BACKLOG

Sprint: 5.

Version: 2.

Date: 07/12/2021.

Timing: Sprint Retrospective Meeting.

Created/Last updated by: Abel Tom Varghese, working with all team members.

SPRINT GOAL				
To expand unit testing to scoring and question generation mechanics, to implement additional fruit and vegetable functionalities and to produce first drafts of key product documentation.				
SELECTED PRODUCT BACKLOG ITEMS				
MUST HAVE	~~**US26/AT26.1 –** Unit testing (Scoring and Question Generation)~~ ~~**US29** – Barry the Banana~~ **US30/AT30.1** – (Movement of) Boris the Broccoli Installation Guide Maintenance Guide			
SHOULD HAVE	~~**US18/AT23.1 –** Steve interactions between questions and on incorrect answers~~ ~~**US20 –** Failure of level~~ User Manual			
COULD HAVE	~~**US7 –** Mid-Level Menu interface~~ ~~**US8 –** Resume Game from Mid-Level Menu~~ **AT2.1 –** New Game Menu interface			
SPRINT TASKS				
Priority	**Tasks (ordered)**	**Timeframe (hours)**	**Individual/Pair**	**Status**
MUST HAVE	Develop new user story (US30) and use case (UC30)	0.5	Aimee	Completed
	Finalise Sprint 4 documentation	5	Christian	Completed
	Develop unit testing for scoring and question generation	5	Abel and Rohith	Completed
	Develop Barry the Banana functionalities	4	Aimee	Completed and tested
	Develop Boris the Broccoli functionalities	3	Aimee and Rohith	Partially developed and tested
	Produce first draft Installation Guide	5	Jaafar	Partially developed
	Produce first draft Maintenance Guide	5	Abel and Rohith	Partially developed
SHOULD HAVE	Develop Steve interactions	2	Aimee	Completed and tested

	Develop level failure mechanics	3	Vishnu	Completed and tested
	Produce first draft User Manual	5	Oscar	Partially developed
COULD HAVE	Develop Mid-level Menu interface and Resume Game button	3	Justin	Completed and tested
	Develop New Game Menu interface	2	Christian	Not started

PRODUCT BACKLOG

Sprint: 5.

Version: 2.

Date: 07/12/2021.

Timing: Sprint Retrospective Meeting.

Created/Last updated by: Vishnu Vardhan and Abel Tom Varghese.

PRIORITY	UNSATISFIED USER STORIES, FAILED TESTS AND OTHER TASKS
Must Have	~~**US26/AT26.1 –** Unit testing (Scoring and Question Generation)~~ ~~**US29** – Barry the Banana~~ **US30/AT30.1** – (Movement of) Boris the Broccoli Installation Guide Maintenance Guide
Should Have	~~**US18/AT23.1 –** Steve interactions between questions and on incorrect answers~~ ~~**US20 –** Failure of level~~ User Manual
Could Have	~~**US7 –** Mid-Level Menu interface~~ ~~**US8 –** Resume Game from Mid-Level Menu~~ **AT2.1 –** New Game Menu interface
Won't Have This Time	**US4 –** Choose the Difficulty Level from the Main Menu **US5 –** Load a Saved Game from the Main Menu **US9~~ 10/AT1.1 –** Other Mid-Level Menu functionalities (Save Game~~,~~ ~~Quit to Main Menu~~) **US22 –** Quit to Main Menu warning message **US24 –** Integration of online question resources **US25** – Saving of scores offline **US3 –** Choose the Question Package

USER INTERFACE: DESIGN NOTES 4

Sprint: 5.

Date: 07/12/2021.

Created/Last updated by: Aimee Dowell.

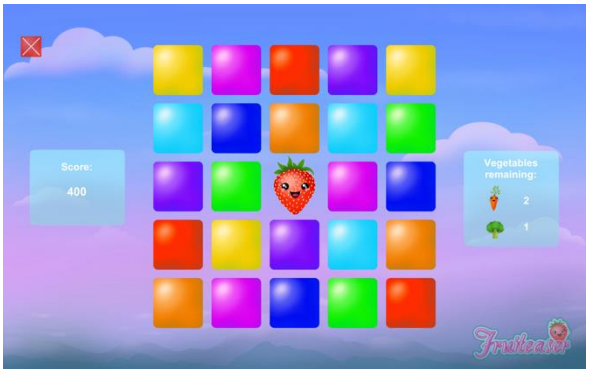
For this sprint, further development of the 5x5 level was implemented as well as an exit button with a mid-level menu for all levels. For the user interface, the assets developed this week by Aimee were as follows:

- Level failure popup
- Mid-Level Menu popup
- Exit button
- Barry the Banana
- Boris the Broccoli

Firstly, the Steve interactions with the user were increased, showing a message after each tile selection relating to the current game status. E.g., if the player has revealed an empty square Steve may warn the player that the vegetables are getting closer. This allows real time commentary of the game, making the user aware of the game status. Each bubble message fades after 1 second to avoid visual clutter.

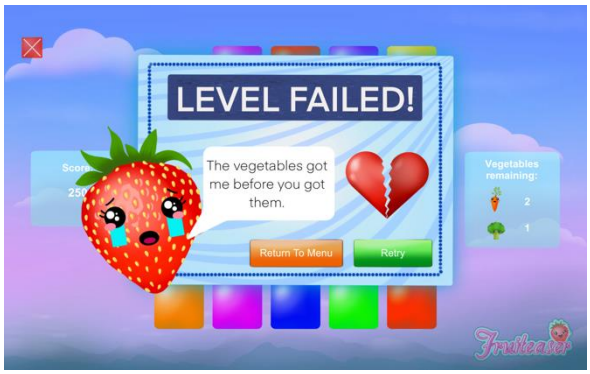
Boris the Broccoli was added as an alternate type of vegetable which moves diagonally. This was added to the 5x5 level to make it more challenging for the user. If either of the vegetables reach Steve the Strawberry, the game has failed. To portray this to the user, a Level Failed popup appears. As this level can be failed, as well as being able to return to the main menu, we decided to include a 'Retry' button, allowing the user to retry the level, resetting the tiles, vegetables and setting score to its initial value when this level was started.

To make the game more exciting, and easier to complete, Barry the Banana was created and added to the game. Once found, he pushes the vegetables back by one tile.



Start of Level 2, showing the inclusion of a Boris the Broccoli into the game.

Barry the Banana - as one vegetable has already been discovered, only vegetables available to catch get pushed back one place.



Level Failed popup, which allows the player to return to the main menu or retry the level.

When the player is mid-level, there was previously no option to quit to the main menu or pause the game. To allow the user to quit before a level is over, an exit button was added to each level. If this is selected a mid-level menu appears, as seen in the image below, enabling the user to resume the game, retry the level (they may not be happy with their current progress), or return to the main menu. When returning to the main menu, currently their progress will not be saved. Further development could allow a warning menu allowing the player to save progress or quit without saving.

Mid Level Menu which appears once a user has selected the exit button (seen in the top left), allowing them to resume, retry the level, or quit back to the Main Menu.

SPRINT 6

Dates: 8-14 December 2021.

Product Owner: Christian Bentley.

Scrum Master: Aimee Dowell.

SPRINT OVERVIEW

Key Documentation

User Stories: **New – US31-32 (see document SR6)**

Updated – US5, 9, 14, 22, 25, 30-32 (see document SR6)

Use Cases: **New – UC31-32 (see document SR6)**

CRC Cards: **No changes**

Acc. Tests: **New – AT5, 9, 22, 25, 31-32 (see document ATM.5)**

Updated – AT14, 30 (see document ATM.5)

UI Design: **UIDN5**

The goals for Sprint 6 were:

1. to finalise, so far as is possible with development occurring simultaneously, the product documentation;
2. to implement Winnie the Watermelon – a new fruit functionality;
3. to scale-up the game again to a 7x3 game level; and
4. to make further, small development changes and refactor the Level Controller scripts.

This was the final full-length sprint in our project, and was the last in which development activity was undertaken.

At the customer meeting, the team presented the current build of the product and proposed scaling-up to one further grid level, as well as implementing an additional fruit functionality and score saving. We also discussed with the customer the proposed audiences for the product documentation.

At the iteration planning meeting, the team discussed the outstanding product backlog items and the team's capacity for development – acknowledging that documentation tasks remained outstanding and this would be the final development sprint. The team prioritised those documentation tasks, with surplus capacity used to implement smaller, simple functionalities to improve the overall game quality and user experience.

As in previous sprints, the team managed workflows during the sprint using a Jira board and a stand-up meeting, at which the team discussed progress in relation to the various tasks and exchanged outline ideas for the structuring of the product documentation. Due to an illness in the team, the team reprioritised backlog items and shifted task allocation in order to effectively deliver key priority

items. Nonetheless, the team's productivity was exceptionally high, driven by the team's desire to produce a great product as the project draws to a close.

At the end of the iteration, the team held a sprint retrospective meeting, at which the team reflected on the sprint and the team's progress towards the sprint goals (see the Sprint Review, below), reviewed acceptance tests for relevant user stories and updated the sprint and product backlogs and existing user stories in light of the team's progress.

SUMMARY OF SPRINT EVENTS AND DOCUMENTATION

Customer Meeting – 8 December 2021

Attended by: All team members and the customer.

The team presented the current build of the product to the customer – focusing on the 5x5 grid level, Barry the Banana, the Mid-Level Menu and level failure, as well as discussing unit testing. The team also provided an update on the product documentation.

The team proposed that one further grid level is added, as well as several smaller functionalities – in particular, an additional fruit or vegetable and score saving between sessions – which the customer agreed with. The parties also discussed in detail the target audiences for the product documentation and the implications of this for the structure and content of those documents.

Iteration Planning Meeting – 9 December 2021

Attended by: All team members.

At the iteration planning meeting, the team reviewed the outstanding product backlog items from Sprint 5 and the agreed proposals from the customer meeting. The team also discussed individual work capacities, noting that competing coursework demands would again restrict capacity.

Following that discussion, Aimee and Christian developed the product backlog (**PB6.1**) and the team collaborated to develop the sprint backlog (**SB6.1 –** which was then reflected in a Jira board) for this sprint. The tasks included the development of two new user story and use cases (US/UC31-32), derived from the new functionalities discussed at the customer meeting, and the production of a video supplement to the User Manual document. The new user stories and use cases were produced and then incorporated into the master documentation (USM.8, which to avoid duplication, is not appended to this submission) – see document **SR6**.

Stand-up Meeting – 12 December 2021

Attended by: All team members, other than Jaafar (illness) and Oscar (prior commitment).

At the stand-up meeting, each team member explained the current status of their allocated tasks and the team discussed the progress made, and required, towards the sprint goals.

The sole exceptional event in this sprint was that Jaafar fell ill and was unable to complete his task – the production of the video supplement to the User Manual document. The team discussed in detail individual work capacities and the team considered that there was not sufficient capacity for the production of that video. Therefore, the team decided to press on with other tasks and to reallocate and drop certain low-priority tasks to focus on the User Manual document, which would now stand alone.

A record of the stand-up meeting is appended to this sprint, as document **SM5**.

Sprint Retrospective Meeting – 14 December 2021

Attended by: All team members.

At the sprint retrospective meeting, the team first reflected generally on the sprint (see Sprint Review below), before reviewing the updated acceptance tests documentation (**ATM.5**) and then updating the sprint backlog (**SB6.2**) and product backlog (**PB6.2**).

A record of the sprint retrospective meeting is appended to this sprint, as document **SR6**.

SPRINT REVIEW

At the sprint retrospective meeting, the team discussed and reviewed the team's progress.

General comments and velocity

The team considered that the team had satisfied each of the sprint goals identified at the start of the sprint – in particular:

1. the team had produced near-final drafts of the product documentation, to be reviewed in detail and submitted in Sprint 7;
2. the team had implemented and tested a new fruit functionality – Winnie the Watermelon;
3. the team had scaled-up and tested a new 7x3 grid game level; and
4. the team had implemented several further, small functionalities – including score saving between sessions and the movement of Boris the Broccoli.

The team considered that the product was now in a strong final state – the current build incorporates the core functionalities that we envisaged in Sprint 1, as well as other functionalities that we discussed with the customer throughout the process. There are some small bugs, recorded in the acceptance tests master documentation (**ATM.5**), and some user stories/use cases that we would like to have implemented (in particular, saving game status), but the team was pleased with the current state of the game.

During this sprint, 14 tasks were allocated, of which 12 were prioritised and completed. Therefore, the team has achieved a task completion rate of 86% and a team velocity of 31.5.

Reflecting on team progress, the team observed that both the team velocity and the task completion rate has significantly increased from that of Sprint 5, demonstrating exceptionally high productivity across the team in this sprint.

The team considered that this was due to several reasons:

1. Pair programming was only leveraged for tasks where the implementation seemed unclear or difficult – increasing team capacity to undertake a greater number of smaller, simpler tasks.
2. As this was the last development sprint, the team limited development tasks to smaller, simpler functionalities than those undertaken in previous sprints.
3. In addition, as this was the final full-length sprint, the team put significant time and effort into getting "Should Have" and "Could Have" items completed, notwithstanding some capacity issues arising during the sprint (as noted above).

The team felt that, whilst pleased to have completed a large number of tasks in this sprint, this velocity and task completion rate was an anomaly (arising due to the circumstances noted above) and would not be sustainable if the project were to carry on. In particular, pair programming had been an effective tool used throughout the project in order to manage more complex tasks, and this was only deprioritised in this sprint due to the simplicity of the tasks involved.

Difficulties faced

The sole significant difficulty that the team faced in this sprint was the breadth of tasks that the team set out to complete at the iteration planning meeting. Although it was not a strict requirement raised by the customer, the team wanted to complete a broad range of smaller tasks in this sprint to produce a strong final product.

In order to effectively manage the volume of tasks involved, the team deprioritised pair programming (as team members felt sufficiently experienced to manage smaller tasks on their own – as was the case in Sprint 5) and invested significant time and effort to complete their allocated tasks. The team considered that, whilst this was not sustainable, in the circumstances of this sprint the team managed this difficulty well.

Exception handling

The team considered that the sole exceptional event in this sprint was the illness of Jaafar. Jaafar fell ill around halfway-through the sprint and was unable to complete his task (creating a video supplement to the User Manual – taking advantage of Jaafar's experience in video production).

The team handled this exception very well – the issue was highlighted to the team early through MS Teams and, at the stand-up meeting, the team revisited the prioritisation of the sprint backlog tasks in order to determine a proper management solution.

The team decided that, because Jaafar's task was a "Should Have" item and only a supplement to the main User Manual document, the best solution would be to cancel that task and to devote more resources to the User Manual document – team members did not feel that they had the specialist skills to develop a submission-quality video. To free-up capacity for another team member to work on the User Manual document, the team also decided to drop a "Could Have" item (the development of the New Game Menu interface) in order to allow Aimee to assist Oscar with the User Manual document. This was an effective solution to this unexpected problem, as a strong draft of the User Manual document was produced and only low-priority items were impacted.

Sprint 7

For Sprint 7, the team's sole focus will be the finalisation of the product and process documentation – no development tasks will be undertaken.

SPRINT DOCUMENTATION

Date	ID	Document
08/12/21	CM5	Minutes of a Customer Meeting
09/12/21	PB6.1	Product Backlog – Iteration Planning Meeting
09/12/21	SB6.1	Sprint Backlog – Iteration Planning Meeting
12/12/21	SM5	Record of a Stand-up Meeting
14/12/21	SR6	Record of a Sprint Retrospective Meeting
14/12/21	ATM.5	Acceptance Testing – Master Document (Version 5)
14/12/21	SB6.2	Sprint Backlog – Sprint Retrospective Meeting
14/12/21	PB6.2	Product Backlog – Sprint Retrospective Meeting
14/12/21	UIDN5	User Interface Design Notes 5

CM5

MINUTES OF CUSTOMER MEETING – 10:45AM, 8 DECEMBER 2021

Attendees: All team members other than Jaafar, customer.

Scribe: Christian Bentley.

Product demo

- The team demonstrated to the customer a playthrough of the game product prototype – focusing on the 5x5 grid level, Barry the Banana, the Mid-Level Menu and level failure, as well as unit testing.
    - The customer asked about the movement of carrots and the role of Barry the Banana – the team explained these mechanics and the customer understood and agreed.

Next steps

- The customer asked how much further the team wishes to develop the game, given that the current build presents a clear and complete structure for successful gameplay.
    - The team proposed the creation of one further square grid-based level, observing that it may be difficult to implement a non-square grid level within the time remaining whilst also implementing other core functionalities.
    - The core functionalities that the team proposed were – additional fruit and vegetable functionalities and score saving between sessions.
- The customer agreed with these proposals.

Product documentation update

- The team provided an update on product documentation – first drafts of the User Manual, Installation Guide and Maintenance Guide had been written. Although reviews and updates for subsequent development would be required, the team was well-placed for the final sprints.
    - The customer flagged that the documents should have different audiences – in particular, the User Manual should be targeted at users of the game, whilst the Maintenance Guide should be targeted at developers intending to maintain and develop the game.
    - The team made note of this – whilst it had been considered to differing degrees by those writing the documents, the team considered this to be a key priority.
- The customer suggested that the User Manual could take a different form – any form of media, such as a video or poster, could be suitable.
    - The key element is that the User Manual walks the user through the different features of the game.

<u>Deliverables</u>

- Implement some of the agreed development proposals outlined above, and continue to progress the product documentation, for the next customer meeting on 15 December 2021.

PB6.1

PRODUCT BACKLOG

Sprint: 6.

Version: 1.

Date: 09/12/2021.

Timing: Iteration Planning Meeting.

Created/Last updated by: Christian Bentley.

PRIORITY	UNSATISFIED USER STORIES, FAILED TESTS AND OTHER TASKS
Must Have	Refactoring Level Controller scripts **US31 –** Winnie the Watermelon **US22 –** Quit to Main Menu warning message Installation Guide Maintenance Guide
Should Have	User Manual Document User Manual Video
Could Have	**AT2.1 –** New Game Menu interface **US25** – Saving of scores offline **US30/AT30.1** – Boris the Broccoli (Movement) **US32 –** 7x3 Game Level
Won't Have This Time	**US4 –** Choose the Difficulty Level from the Main Menu **US5 –** Load a Saved Game from the Main Menu **US9 –** Save Game from Mid-Level Menu **US24 –** Integration of online question resources **US3 –** Choose the Question Package

SPRINT BACKLOG

Sprint: 6.

Version: 1.

Date: 09/12/2021.

Timing: Iteration Planning Meeting.

Created/Last updated by: Christian Bentley, working with all team members.

SPRINT GOAL				
To finalise (so far as possible) the product documentation – Installation Guide, Maintenance Guide, User Manual (document and video) – to implement Winnie the Watermelon and to make further quality-of-life updates and refactoring.				
SELECTED PRODUCT BACKLOG ITEMS				
MUST HAVE	Refactoring Level Controller scripts **US31 –** Winnie the Watermelon **US22 –** Quit to Main Menu warning message Installation Guide Maintenance Guide			
SHOULD HAVE	User Manual Document User Manual Video			
COULD HAVE	**AT2.1 –** New Game Menu interface **US25** – Saving of scores offline **US30/AT30.1** – Boris the Broccoli (Movement) **US32 –** 7x3 Game Level			
SPRINT TASKS				
Priority	**Tasks (ordered)**	**Timeframe (hours)**	**Individual/Pair**	**Status**
MUST HAVE	Refactoring Level Controller scripts	1	Aimee	Completed at start of iteration
	Develop new user story (US31) and use case (UC31)	0.5	Aimee	Not started
	Develop new user story (US32) and use case (UC32)	0.5	Christian	Not started
	Finalise Sprint 5 documentation	5	Christian	Not started
	Develop Winnie the Watermelon functionalities	2	Aimee	Not started
	Develop Quit to Main Menu warning message	1	Aimee	Not started
	Draft Installation Guide	3	Justin and Jaafar	First draft produced in Sprint 5
	Draft Maintenance Guide	5	Abel, Rohith and Aimee	First draft produced in Sprint 5

SHOULD HAVE	Draft User Manual Document	4	Oscar	First draft produced in Sprint 5
	Produce User Manual Video	3	Jaafar	Not started
COULD HAVE	Develop New Game Menu interface	1	Aimee	Not started
	Implement saving of scores offline	4	Vishnu	Not started
	Develop movement of Boris the Broccoli	5	Rohith	Not started
	Develop 7x3 game level	5	Aimee	Not started

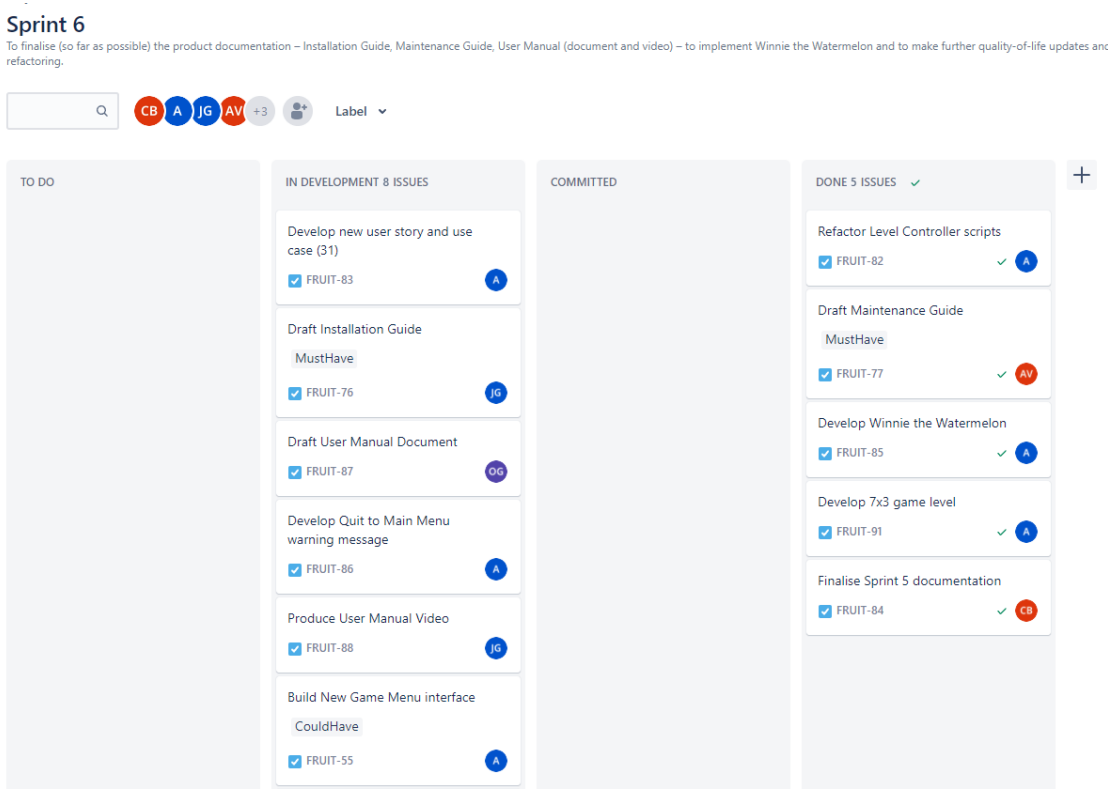
STAND-UP MEETING

Date: 12/12/2021

Attendees: All team members.

Document created by: Christian Bentley, working with all team members.

Sprint 6 - Jira Board



Stand-up Meeting Discussions

Jira Board

- Each team member spoke about their allocated tasks in the sprint backlog and their current progress.
- The team discussed the state of the Jira board and the path to completion of the Must Have items, as well as the team's capacity to complete Should Have and Could Have items.

Individual capacities and illness

- The team discussed individual work capacities, in light of Jaafar being unwell.
- The team considered that there was not sufficient capacity for the production of the user manual video, which was not considered a "Must Have" item, to be allocated to another person.
    - Therefore, the team decided not to proceed with the user manual video and instead to focus upon the user manual document.
    - In order to better progress that document, the team decided not to progress the New Game Menu interface task (a "Could Have" allocated to Aimee), so that Aimee could assist with reviewing the user manual document.
- These changes were reflected in the sprint backlog.

SPRINT RETROSPECTIVE

Sprint: 6.

Date: 14/12/2021.

Attendees: All team members.

Document created by: Christian Bentley, working with all team members.

GENERAL COMMENTS

1. The team was very pleased with the exceptional progress made in this sprint, in spite of an unexpected event and challenging circumstances. The team made substantial progress in relation to the process and product documentation and implemented a range of small functionalities, showcasing the team's skill progression through individual (and not pair) programming.
2. The team considered that the game was now in a strong final state – the current build incorporates the core functionalities that we envisaged in Sprint 1, as well as other functionalities that we discussed with the customer throughout the process. There are some small bugs, recorded in the acceptance tests master documentation (**ATM.5**), and some user stories/use cases that we would like to have implemented (in particular, saving game status), but the team was pleased with the current state of the game.
3. The team considered that the most significant difficulty in this sprint was the breadth of tasks that the team set out to complete at the iteration planning meeting. Although it was not a strict requirement raised by the customer, the team wanted to complete a broad range of smaller tasks in this sprint to produce a strong final product. In order to effectively manage the volume of tasks involved, the team deprioritised pair programming (as team members felt sufficiently experienced to manage smaller tasks on their own – as was the case in Sprint 5) and invested significant time and effort to complete their allocated tasks. The team considered that, whilst this was not sustainable, in the circumstances of this sprint the team managed this difficulty well.
4. The team considered that the sole unexpected event in this sprint was the illness of Jaafar. Jaafar fell ill around halfway-through the sprint and was unable to complete his task (creating a video supplement to the User Manual). The team handled this exception very well – the issue was highlighted to the team early through MS Teams and, at the stand-up meeting, the team revisited the prioritisation of the sprint backlog tasks in order to determine a proper management solution. The team decided that, because Jaafar's task was a "Should Have" item and only a supplement to the main User Manual document, the task could be dropped. As there would no longer be a video supplement, the team also decided to drop a "Could Have" item (the development of the New Game Menu interface) in order to allow Aimee to assist Oscar with the User Manual document. This was an effective solution to this unexpected problem, as a strong draft of the User Manual document was produced and only low-priority items were impacted.
5. The team proposed that, in Sprint 7, no development tasks would be undertaken – the sole focus would be finalising the process and product documentation for submission.

REVIEW OF ACCEPTANCE TESTS

The team reviewed the acceptance tests master (**ATM.5**), although it was noted that no further development would be undertaken during Sprint 7.

REVIEW OF, AND UPDATES TO, SPRINT BACKLOG

The team reviewed and updated the sprint backlog (**SB6.2**).

During this sprint, 14 tasks were allocated, of which 12 were prioritised and completed. Therefore, the team has achieved a task completion rate of 86% and a team velocity of 31.5.

Reflecting on team progress, the team observed that both the team velocity and the task completion rate has significantly increased from that of Sprint 5, demonstrating exceptionally high productivity across the team in this sprint.

The team considered that this was due to several reasons:

1. Pair programming was only leveraged for tasks where the implementation seemed unclear or difficult – increasing team capacity to undertake a greater number of smaller, simpler tasks.
2. As this was the last development sprint, the team limited development tasks to smaller, simpler functionalities than those undertaken in previous sprints.
3. In addition, as this was the final full-length sprint, the team put significant time and effort into getting "Should Have" and "Could Have" items completed, notwithstanding some capacity issues arising during the sprint (as noted above).

The team felt that, whilst pleased to have completed a large number of tasks in this sprint, this velocity and task completion rate was an anomaly (arising due to the circumstances noted above) and would not be sustainable if the project were to carry on. In particular, pair programming had been an effective tool used throughout the project in order to manage more complex tasks, and this was only deprioritised in this sprint due to the simplicity of the tasks involved.

REVIEW OF, AND UPDATES TO, PRODUCT BACKLOG

The team reviewed and updated the product backlog (**PB6.2**) to reflect the completed items in the updated sprint backlog and to remove non-development tasks ahead of the final sprint.

NEW, AND UPDATES TO EXISTING, USER STORIES

New user stories reflected in **USM.8** (*which is not appended to this submission, to avoid unnecessary duplication*).

US31	**User Story:** As a **player**, I want **Winnie the Watermelon to remove a vegetable when I have selected 4 empty tiles in a row,** so that I **won't get bored and quit the game**.
Comments: Winnie is not positioned on the board but rather appears on the 4th selected tile which is empty. It only removes one vegetable from the board.	

Acceptance criteria: 1. Every time that 3 consecutive tiles selected by the user are revealed to be empty, underneath the 4th tile Winnie should appear. 2. One random vegetable should be removed, revealing its position on the board and removing the tile hiding it. 3. The number of vegetables remaining should be reduced.
Status (10/12/2021): Created/Last updated by: Aimee Dowell. Version: 1. Development/Testing: Not developed or tested.
Connected User Stories: US11/17 (Positioning and Movement of Carrots), US12 (Tile Highlighted), US15 (Carrots Revealed), US23 (No Carrot Revealed)

US32	**User Story:** As a **player**, I want a level with a **7x3 grid** so that the game **can progress and become more difficult.**
Comments: A new level will be available where the player can play on a 7x3 grid, after completing the 5x5 grid.	
Acceptance criteria: When a player completes the second level (5x5) they can progress to the 7x3 grid and continue playing through the end of level pop-up.	
Status (10/12/2021): Created/Last updated by: Christian Bentley. Version: 1. Development/Testing: Not developed or tested.	
Connected User Stories: US5 (Load game), US9 (Save game), US28 (Level Complete Buttons).	

Updates reflected in **USM.9** (*which is appended to this submission, as the final version of that document*).

US5	**User Story:** As a **player**, I want to **load a previously saved game** so that **I can carry on playing from the last time**.
Comments: There should be a “Load Game” button which allows user to load a previously saved game.	
Acceptance criteria: 1. There should be a “Load Game” button above the grid/board. 2. Once the button is clicked, the board should be updated with the contents of the previous game. 3. The score should be updated. 4. The player should be informed that the game has been loaded successfully 5. The player should be prompted to make a move.	
Status (14/12/2021) Created/Last Updated By: Abel Tom Varghese. Version: 2. Development/Testing: Partially developed and tested – score saving only. Further development required to save and load the board status. Acceptance criteria 4 and 5 not considered necessary, following team discussion.	

Connected User Stories: US1 (Main menu on start-up), US7 (Mid-level menu – saving a game), US12 (All previously selected squares should be highlighted), US21 (Must load all previous scores)

US9	**User Story:** As a **player**, I want to **save a game in progress** so that **I can return to it later**.
Comments: There should be a "Save Game" button which allows user to save the progress of the current game.	
Acceptance criteria: 1. There should be a "Save Game" button above the grid/board. 2. Once the button is clicked, the game should save the contents of the board and the current score. 3. The user should be prompted that either the game was successfully or unsuccessfully saved. 4. The user then has the option to carry on playing the game.	
Status (14/12/2021) Created/Last Updated By: Christian Bentley. Version: 2. Development/Testing: Partially developed and tested – implemented through the Mid-Level Menu, rather than a button on the board. Further development required to save the contents of the board.	
Connected User Stories: US7 (Mid-Level Menu interface), US5 (Load Game), US21 (Scoring), US11/17 (Positioning and Movement of Carrots)	

US14	**User Story:** As a **player** I want **the question pop-up to confirm that I have made a correct answer** so that **I can understand my progress in the game.**
Comments: Once a question has popped-up and the player has input a correct answer, the pop-up should confirm that the answer is correct.	
Acceptance criteria: When a question is answered correctly, the question pop-up visually confirms that the answer was correct.	
Status (14/12/2021) Created/Last Updated By: Christian Bentley. Version: 3. Development/Testing: Developed and tested in relation to the numerical question package, may require testing in later iterations in relation to other question packages as implemented. Small bug in relation to irrational numbers – no rounding for correct answers.	
Connected User Stories: US13 (Question pop-up), US15 (Carrot revealed), US16 (Incorrect answer), US23 (No carrot on tile), US21 (Scoring)	

US22	**User Story:** As a **user** I want **to receive a message warning me that my current level progress will be lost if I quit to the Main Menu without saving** so that **I do not accidentally lose my level progress.**
Comments: When the "Quit to Main Menu" option is selected from the Mid-Level Menu, the current level progress is closed and not saved. In order to avoid accidental losses of progress, then *if the user has progressed since their last save*, then the user should receive a warning message, stating that their progress will be lost, and be given the options to proceed to the Main Menu or to return to the Mid-Level Menu.	
Acceptance criteria: 1. If the user has progressed since the last save and "Quit to Main Menu" is selected, a warning message is displayed with two options – proceed to Main Menu and return to the Mid-Level Menu. 2. If the user selects to proceed to the Main Menu from the warning message, or if they select "Quit to Main Menu" in the Mid-Level Menu and they have not progressed since the last save, US10 is continued (the Main Menu is opened and current level progress is not saved). 3. If the user selects to return to the Mid-Level Menu, they are returned to the Mid-Level Menu.	
Status (14/12/2021): Created/Last updated by: Christian Bentley. Version: 2. Development/Testing: Developed and tested. Following team discussions, warning message is always displayed (not only if progress has been made).	
Connected User Stories: US1 (Main Menu), US9 (Game saves), US10 (Quit to Main Menu)	

US25	**User Story:** As a **player**, I want **my score to be saved once I quit the game** so that I can **continue my progress and my score isn't lost when I re-open the game**.
Comments: Save button will appear during the Main Menu once new score data has been added or during the Mid-Level Menu (when the player is currently playing a level).	
Acceptance criteria: Every time the save button is clicked from either the Main Menu or Mid-Level Menu, the new score data should be written to a corresponding JSON file within the game project files.	
Status (14/12/2021): Created/Last updated by: Aimee Dowell. Version: 2. Development/Testing: Developed and tested.	
Connected User Stories: US9 (Save Button), US1/7 (Main Menu and Mid-Level Menu), US5 (Load Game)	

US30	**User Story:** As a **player**, I want **broccoli vegetables, Boris, which move towards Steve the Strawberry diagonally, within my game level**, so that I can **add an extra level of challenge and make the game more exciting.**

Comments:
Broccolis must be randomly positioned on the grid, but they cannot occupy the same tile as other fruit and vegetables. The broccolis can be pushed backwards by bananas if they are greater than 1 square away from the edge of the grid.

Acceptance criteria:

1. There should be a fixed number of broccolis for each level.
2. All broccolis must start at a minimum of more than two steps away from Steve the Strawberry.
3. The broccolis must move diagonally.
4. If a broccoli is revealed, the number of broccolis remaining must reduce by 1.

Status (14/12/2021):
Created/Last updated by: Christian Bentley.
Version: 3.
Development/Testing: Developed and tested.

Connected User Stories:
US11/17 (Positioning and Movement of Carrots), US20 (Level Failure)

US31	**User Story:** As a **player**, I want **Winnie the Watermelon to remove a vegetable when I have selected 4 empty tiles in a row,** so that I **won't get bored and quit the game**.

Comments:
Winnie is not positioned on the board but rather appears on the 4th selected tile which is empty. It only removes one vegetable from the board.

Acceptance criteria:

1. Every time that 3 consecutive tiles selected by the user are revealed to be empty, underneath the 4th tile Winnie should appear.
2. One random vegetable should be removed, revealing its position on the board and removing the tile hiding it.
3. The number of vegetables remaining should be reduced.

Status (14/12/2021):
Created/Last updated by: Aimee Dowell.
Version: 2.
Development/Testing: Developed and tested.

Connected User Stories:
US11/17 (Positioning and Movement of Carrots), US12 (Tile Highlighted), US15 (Carrots Revealed), US23 (No Carrot Revealed)

US32	**User Story:** As a **player**, I want a level with a **7x3 grid** so that the game **can progress and become more difficult.**

Comments:
A new level will be available where the player can play on a 7x3 grid, after completing the 5x5 grid.

Acceptance criteria:
When a player completes the second level (5x5) they can progress to the 7x3 grid and continue playing through the end of level pop-up.

Status (14/12/2021):
Created/Last updated by: Aimee Dowell.
Version: 2.
Development/Testing: Developed and tested.

Connected User Stories: US5 (Load game), US9 (Save game), US28 (Level Complete Buttons).

NEW USE CASES

New use cases reflected in **UCM.4** (*which is appended to this submission, as the final version of that document*).

UC31	**Use Case:** Winnie The Watermelon
	Version: 1. **Creator/Updater:** Aimee Dowell. **Last updated:** 10/12/2021.
User Story: As a player, I want Winnie the Watermelon to remove a vegetable when I have selected 4 empty tiles in a row, so that I won't get bored and quit the game. **ID:** US31	
UC31-1	**Control Flow:** • The player selects 3 tiles in a row which are empty. • If the 4th tile selected is empty, Winnie the Watermelon is revealed. • One vegetable is revealed, removing the tile hiding it. • The number of vegetables remaining is reduced.
UC31-2	**Actors:** Player.
UC31-3	**Pre-Condition:** • The player has selected 3 tiles in a row, which been revealed as empty. • The player has selected a 4th tile and answered the question correctly. • The 4th tile is also empty.
UC31-4	**Post-Condition:** The number of vegetables remaining in the UI is reduced by 1, corresponding to the revealed vegetable.
UC31-5	**Connected Use Cases:** UC11/17 (Positioning and Movement of Carrots), UC12 (Tile Highlighted), UC15 (Carrots Revealed), UC23 (No Carrot Revealed)

UC32	**Use Case:** 7x3 Grid Level
	Version: 1. **Creator/Updater:** Christian Bentley. **Last updated:** 10/12/2021.
User Story: As a player, I want a level with a 7x3 grid so that the game can progress and become more difficult. **ID:** US32	
UC32-1	**Control Flow:** Alternative path #1 • Player presses "Continue" after completing the 5x5 level. • The 7x3 grid level is loaded. Alternative path #2 • Player loads the game after having saved a game where he completed the 5x5 level.

	• The 7x3 grid level is loaded.
UC32-2	**Actors:** Player
UC32-3	**Pre-Condition:** Alternative path #1 • Player completes the 5x5 level and presses the “Continue” button in the Level Complete pop-up (US28). Alternative path #2 • Player saves the game (US9) after completing the 5x5 level and then loads it again. (US5)
UC32-4	**Post-Condition:** Alternative path #1 • The 5x5 game level starts. Alternative path #2 • The 5x5 level picks up from where the player left off.
UC32-5	**Connected Use Cases:** UC5 (Load game), UC9 (Save game), UC8 (Level Complete Buttons).

ACCEPTANCE TESTING: MASTER DOCUMENTATION

Version: 5.

Date: 14/12/2021.

Document created/last updated by: Abel Tom Varghese, working with all team members.

ID	Vers	User Story	Acceptance Tests	Developer/ Pair	Tester	Date	Comments
AT1	2	US1	1. Upon the player loading up the game, the Main Menu is opened. 2. After the player clicks on "Quit to Main Menu" from the Mid-Level Menu (and any warning message is accepted – see US22), the Main Menu is opened.	Aimee	Christian	07/12/2021	Tests #1 and 2 passed.
AT2	1	US2	Every time the puzzle type button is clicked from the Main Menu, or a level from the selected puzzle type has been completed (win or lose), the start button should appear, programmed for the next level (win), or the same level (lose/current).	Christian and Aimee	Abel	16/11/2021	Test passed in relation to the Main Menu start game button. A further intermediary menu may be required to implement US3/4 (Difficulties and Question Packages).
AT3	-	US3	The question category chosen by the user should be implemented within the question mechanics and remain the same throughout the game. The category options should be clickable as a tick-box or drop-down sub-menu of Main Menu.	-	-	-	Not implemented.
AT4	-	US4	The difficulty level chosen by the player should be implemented in the question mechanics and remain same for the entire game. The difficulty	-	-	-	Not implemented.

ID	Vers	User Story	Acceptance Tests	Developer/ Pair	Tester	Date	Comments
			options should be clickable as a tick-box or drop-down sub-menu of Main Menu.				
AT5	1	US5	1. There should be a “Load Game” button above the grid/board. 2. Once the button is clicked, the board should be updated with the contents of the previous game. 3. The score should be updated 4. The player should be informed that the game has been loaded successfully 5. The player should be prompted to make a move.	Vishnu and Aimee	Abel	14/12/2021	Tests 1 and 3 passed. After further team discussion, tests 4 and 5 were not considered necessary for user-friendliness. Further development is required to save and update the status of the board – test 2.
AT6	1	US6	When the “Quit to Desktop” button is clicked. The game should ask the player “Are you sure you want to quit?” and, if accepted, then the game application should close.	Christian	Aimee	16/11/2021	Test passed, save that no warning message appears. After discussion, this feature was not regarded as necessary and will not be implemented.
AT7	1	US7	After pressing the escape button during a game level, the Mid-Level Menu must open.	Jaafar	Justin	07/12/2021	Test passed. Following discussion within the team, this requirement was changed from “on pressing the escape button” to “on pressing an on-screen button”, for additional user-friendliness.
AT8	1	US8	Once the player clicks the resume game button in the in-game menu the game should resume where it was left off.	Jaafar	Justin	07/12/2021	Test passed.
AT9	1	US9	1. There should be a “Save Game” button above the grid/board.	Vishnu and Justin	Aimee	14/12/2021	Test 4 passed and tests 1 and 2 partially passed.

ID	Vers	User Story	Acceptance Tests	Developer/ Pair	Tester	Date	Comments
			2. Once the button is clicked, the game should save the contents of the board and the current score. 3. The user should be prompted that either the game was successfully or unsuccessfully saved. 4. The user then has the option to carry on playing the game.				The "Save Game" button was instead implemented through the Mid-Level Menu, following discussion at the iteration planning meeting. As noted in AT5.1, further development is required to save the status of the board. Following discussions within the team, tests 3 was not considered necessary for user friendliness.
AT10	1	US10	1. "Quit to Main Menu" is an option in the Mid-Level Menu. 2. If the user selects this option, the Main Menu is opened and the current game is ended.	Justin	Christian	07/12/2021	Tests passed.
AT11	1	US11	The carrots & strawberry should be randomly positioned on the board so that all carrots would require two or more moves to reach the strawberry.	Abel and Rohith	Christian	16/11/2021	Test passed.
AT12	1	US12	Every time a square is clicked (provided there is no current pop-up, such as a question, or an animation showing what is underneath a selected square) the clicked square should be clearly highlighted.	Christian and Aimee	Abel	16/11/2021	Test passed.
AT13	1	US13	Once a tile has been clicked on by the player, a question must pop-up.	Aimee, Rohith & Abel	Christian	23/11/2021	Test passed.

ID	Vers	User Story	Acceptance Tests	Developer/ Pair	Tester	Date	Comments
AT14	2	US14	When a question is answered correctly, the question pop-up visually confirms that the answer was correct.	Justin and Vishnu	Aimee	14/12/2021	Test passed, save that for irrational decimal answers there is no rounding for the correct answer. Further development required to correct this bug – can currently be circumvented by requesting new questions.
AT15	1	US15	1. When a question is answered correctly, if a carrot is on the selected tile, then the carrot is revealed. 2. However, if a carrot is not on the selected tile, then the carrot is not revealed.	Oscar and Abel	Aimee	16/11/2021	Tests passed.
AT16	1	US16	1. When a player gives an incorrect answer to a question, there should be a pop-up informing the user that his/her answer to the question is incorrect. 2. The pop-up should enable the player to retry the question or to try a different question.	Jaafar and Oscar	Aimee	23/11/2021	Tests passed.
AT17	1	US17	Every time the player answers a question correctly the carrot moves randomly in the board.	Rohith	Aimee	30/11/2021	Test passed.
AT18	1	US18	When a user is playing a game level, is not answering a question and after a short period of inactivity, a message is displayed instructing the player to select the next tile.	Aimee	Rohith	07/12/2021	Test passed.
AT19	1	US19	If all the vegetables have been found before they reach the strawberry, the level is deemed complete and should return the main menu where the player can either save and quit the game or continue to the next level.	Aimee and Jaafar	Christian	07/12/2021	Test passed.

ID	Vers	User Story	Acceptance Tests	Developer/ Pair	Tester	Date	Comments
AT20	1	US20	Pop up to occur when vegetable reaches Strawberry. Pop up will contain buttons “Return to Main menu” and “Restart Level”.	Vishnu	Oscar	07/12/2021	Test passed.
AT21	1	US21	Once a correct answer has been made the points go up. If the attempt was right on the first try the player receives 100 points, if it was his second attempt: 50, third: 25, etc…	Rohith, Abel & Aimee	Christian	23/11/2021	Test passed.
AT22	1	US22	1. If the user has progressed since the last save and “Quit to Main Menu” is selected, a warning message is displayed with two options – proceed to Main Menu and return to the Mid-Level Menu. 2. If the user selects to proceed to the Main Menu from the warning message, or if they select “Quit to Main Menu” in the Mid-Level Menu and they have not progressed since the last save, US10 is continued (the Main Menu is opened and current level progress is not saved). 3. If the user selects to return to the Mid-Level Menu, they are returned to the Mid-Level Menu.	Aimee	Christian	14/12/2021	Tests passed, save that the warning message is always displayed, rather than only being displayed if the user has progressed since their last save. Following discussions within the team, this requirement was not considered necessary for additional user-friendliness.
AT23	1	US23	When a question is answered correctly, the tile is revealed (US14) and the tile disappears. If there is no carrot on that tile, then a message from Steve should appear stating “Unlucky, there are no vegetables behind that tile – let’s try another one!”.	Vishnu and Justin	Christian	07/12/2021	Test passed.
AT24	-	US24	Questions that pop up throughout the game should have their question data populated directly from the “online” database and streamed either:	-	-	-	Not implemented.

ID	Vers	User Story	Acceptance Tests	Developer/ Pair	Tester	Date	Comments
			• prior to the game loading; or • on “highlight square”.				
AT25	1	US25	Every time the save button is clicked from either the Main Menu or Mid-Level Menu, the new score data should be written to a corresponding JSON file within the game project files.	Vishnu	Aimee	14/12/2021	Test passed.
AT26	1	US26	All methods should have 1 or more corresponding unit test which examine how the method performs for a given input. Additionally, all unit tests must pass before new functionality is added to the game.	Abel	Christian	07/12/2021	Tests passed.
AT27	1	US27	When a player completes the first level (3x3) they can progress to the 5x5 grid and continue playing through the end of level pop-up.	Jaafar	Aimee	30/11/2021	Test passed.
AT28	1	US28	The player must be able to either continue or return to main menu. This allows the 5x5 scene to be reachable in game. Must be separate buttons.	Oscar	Justin	30/11/2021	Tests passed.
AT29	1	US29	Every time a banana is revealed underneath a selected tile, the remaining vegetables will be moved backwards by one square to their previous tile.	Aimee	Oscar	07/12/2021	Test passed.
AT30	2	US30	1. There should be a fixed number of broccolis for each level. 2. All broccolis must start at a minimum of more than two steps away from Steve the Strawberry. 3. The broccolis must move diagonally. 4. If a broccoli is revealed, the number of broccolis remaining must reduce by 1.	Aimee and Rohith	Abel	14/12/2021	Tests passed.

ID	Vers	User Story	Acceptance Tests	Developer/ Pair	Tester	Date	Comments
AT31	1	US31	1. Every time that 3 consecutive tiles selected by the user are revealed to be empty, underneath the 4th tile Winnie should appear. 2. One random vegetable should be removed, revealing its position on the board and removing the tile hiding it. 3. The number of vegetables remaining should be reduced.	Aimee	Christian	14/12/2021	Tests passed.
AT32	1	US32	When a player completes the second level (5x5) they can progress to the 7x3 grid and continue playing through the end of level pop-up.	Aimee	Christian	14/12/2021	Test passed.

SB6.2

SPRINT BACKLOG

Sprint: 6.

Version: 2.

Date: 14/12/2021.

Timing: Sprint Retrospective Meeting.

Created/Last updated by: Abel Tom Varghese, working with all team members.

SPRINT GOAL				
To finalise (so far as possible) the product documentation – Installation Guide, Maintenance Guide, User Manual (document and video) – to implement Winnie the Watermelon and to make further quality-of-life updates and refactoring.				
SELECTED PRODUCT BACKLOG ITEMS				
MUST HAVE	~~Refactoring Level Controller scripts~~ ~~**US31 –** Winnie the Watermelon~~ ~~**US22 –** Quit to Main Menu warning message~~ Installation Guide Maintenance Guide			
SHOULD HAVE	User Manual Document ~~User Manual Video~~			
COULD HAVE	~~**AT2.1 –** New Game Menu interface~~ ~~**US25 –** Saving of scores offline~~ ~~**US30/AT30.1** – Boris the Broccoli (Movement)~~ ~~**US32 –** 7x3 Game Level~~			
SPRINT TASKS				
Priority	**Tasks (ordered)**	**Timeframe (hours)**	**Individual/Pair**	**Status**
MUST HAVE	Refactoring Level Controller scripts	0.5	Aimee	Completed at start of iteration
	Develop new user story (US31) and use case (UC31)	0.5	Aimee	Completed
	Develop new user story (US32) and use case (UC32)	0.5	Christian	Completed
	Finalise Sprint 5 documentation	5	Christian	Completed
	Develop Winnie the Watermelon functionalities	2	Aimee	Developed and tested
	Develop Quit to Main Menu warning message	1	Aimee	Developed and tested
	Draft Installation Guide	3	Justin and Jaafar	Drafted for review
	Draft Maintenance Guide	5	Abel, Rohith and Aimee	Drafted for review
SHOULD HAVE	Draft User Manual Document	4	Oscar	Drafted for review

	Produce User Manual Video	3	Jaafar	Not started – task dropped due to team illness
COULD HAVE	Develop New Game Menu interface	1	Aimee	Not developed – task dropped due to team illness
	Implement saving of scores offline	3	Vishnu	Developed and tested
	Develop movement of Boris the Broccoli	4	Rohith	Developed and tested
	Develop 7x3 game level	3	Aimee	Developed and tested

PB6.2

PRODUCT BACKLOG

Sprint: 6.

Version: 2.

Date: 14/12/2021.

Timing: Sprint Retrospective Meeting.

Created/Last updated by: Christian Bentley, working with all team members.

PRIORITY	UNSATISFIED USER STORIES, FAILED TESTS AND OTHER TASKS
Must Have	~~Refactoring Level Controller scripts~~ ~~**US31 –** Winnie the Watermelon~~ ~~**US22 –** Quit to Main Menu warning message~~ Installation Guide Maintenance Guide
Should Have	User Manual Document ~~User Manual Video~~
Could Have	~~**AT2.1 –** New Game Menu interface~~ ~~**US25** – Saving of scores offline~~ ~~**US30/AT30.1** – Boris the Broccoli (Movement)~~ ~~**US32 –** 7x3 Game Level~~
Won't Have This Time	~~**US4 –** Choose the Difficulty Level from the Main Menu~~ ~~**US5 –** Load a Saved Game from the Main Menu~~ ~~**US9 –** Save Game from Mid-Level Menu~~ ~~**US24 –** Integration of online question resources~~ ~~**US3 –** Choose the Question Package~~

USER INTERFACE: DESIGN NOTES 5

Sprint: 6.

Date: 14/12/2021.

Created/Last updated by: Aimee Dowell.

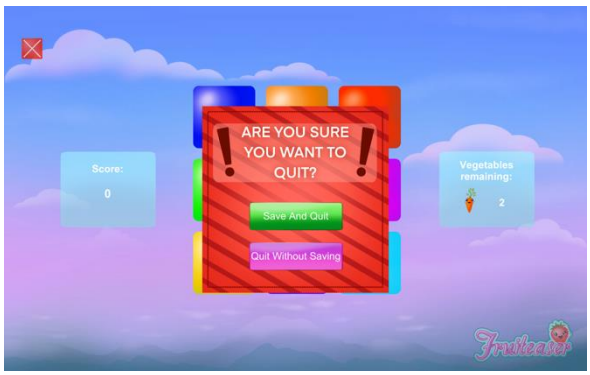
This sprint saw the development of a quit to the main menu warning with progress saving, a new 7x3 level and the implementation of Winnie the Watermelon.

For the user interface, the assets developed this week by Aimee were as follows:

- Redesigned Mid-Level Menu background
- Winnie the Watermelon

As the previous Mid-Level Menu was labelled ‘Are you sure you want to quit?’, it was decided this would better fit as a warning UI once the player had selected the ‘Return to menu’ button from the Mid-Level Menu. It allows the user to save their progress (score and level number) using the ‘Save and Quit’ button or lose their progress using the ‘Quit without Saving button’. This gives the user control over which level progress is saved. Due to this reuse of the previous Mid-Level menu sprite, a new mid-level menu sprite was created to better suit the application, labelled ‘Game paused’.

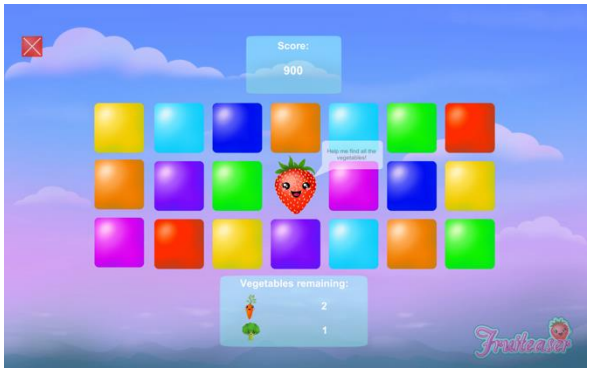
New Mid-Level Menu sprite with buttons, showing once the user clicks the exit button (top left corner).



Quit to Main Menu warning pop up, shown once 'Return to Menu' is selected from the Mid-Level Menu, allowing the user to save their current progress or lose their changes.

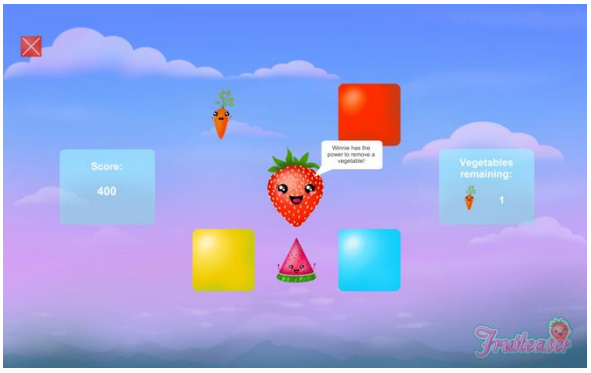
As a new level has been developed, once Level 2 is completed, a continue and return to menu button was added to enable the user to continue to the next (new) level. Once Level 3 is completed the only option for the user will be to return to the main menu as this is the last level. For Level 3, the score tracker and vegetable remaining UI were repositioned to reduce horizontal visual clutter and make them easier to view.

Level Complete popup once Level 2 is completed, showing a return to menu button and continue button.



New Level 3 with a 7x3 board.

To reduce failure of levels and keep the user interested in the game, Winnie the Watermelon was introduced. If the player selects four empty tiles in a row, Winnie will appear and find and reveal the location of one vegetable in the game, helping the user to successfully complete the level.



Winnie the Watermelon appearing in Level 1, as the user has selected four empty tiles. Winnie has revealed the location of a carrot.

SPRINT 7

Dates: 15-19 December 2021.

Product Owner: Oscar Gee.

Scrum Master: Christian Bentley.

SPRINT OVERVIEW

Key Documentation

User Stories: **No changes**

Use Cases: **No changes**

CRC Cards: **No changes**

Acc. Tests: **No changes**

UI Design: **No changes**

The sole goal for Sprint 7 was to finalise the process and product documentation for submission. As this was a shorter sprint, the team decided not to undertake any further development activity.

The team attended short meetings with the tutors and the customer to discuss the current drafts of the documentation and the team's use of agile tools. Observing that several of the team's uses of such tools was non-traditional, a key point identified in those meetings was the need to explain how we have adapted and used agile tools in our project – that is reflected in the Introduction section of this submission.

At the iteration planning meeting, the team discussed the outstanding tasks ahead of submission – each of which were considered "Must Haves". The team allocated those tasks in the sprint backlog, with all team members reviewing and providing comments on the draft documentation.

In order to collate and implement team members' comments on the draft documentation, the team held two stand-up meetings – one for the product documentation and one for the process documentation. The documents were finalised and approved for submission at the end of each of those meetings, subject to the addition of the sprint retrospective (document **SR7**) and associated documentation.

At the end of the iteration, the team held a sprint retrospective meeting, at which the team reflected on this short sprint and updated the sprint and product backlogs, confirming that all tasks had been completed and that the documentation was ready for submission.

SUMMARY OF SPRINT EVENTS AND DOCUMENTATION

Tutor and Customer Meetings – 15 December 2021

Attended by: All team members, other than Jaafar (illness) and Rohith (illness), and the customer.

The team attended meetings with both the tutors and the customer to discuss the outstanding documentation. As both of those meetings were very short, separate minutes of those meetings have not been prepared – the summary below effectively encapsulates the discussions had there.

At the tutor meeting, the team outlined the team's utilisation of use cases, which the tutor team considered to be non-traditional. The team resolved to explain in the Introduction section of this document how the team has adapted and used agile tools during this project. The tutors also reviewed (at a high-level) and approved the typical chapter structure used in this document.

At the customer meeting, the team provided an update on the production of the documentation and discussed the outstanding steps to submission.

Iteration Planning Meeting – 16 December 2021

Attended by: All team members, other than Jaafar (illness).

At the iteration planning meeting, the team discussed the outstanding tasks prior to submission and individual work capacities. The team also reviewed the submission guidelines – populating the product and sprint backlogs with the outstanding tasks (**PB7.1** and **SB7.1**), before allocating them between team members according to their work capacities.

The team considered that the most efficient method of collating and implementing team members' comments on the draft documentation would be two stand-up meetings – one for the product documentation and one for the process documentation (which would take slightly more time to finalise, observing that this sprint was ongoing).

Stand-up Meeting: Product Documentation – 17 December 2021

Attended by: All team members.

At the first stand-up meeting, team members presented their comments (if any) on the User Manual and the Maintenance Guide, which were then discussed and implemented into the current drafts of those documents. The documents were then approved for submission.

A record of the stand-up meeting is appended to this sprint, as document **SM6**.

Stand-up Meeting: Process Documentation – 19 December 2021

Attended by: All team members.

At the second stand-up meeting, team members presented their comments (if any) on the process documentation, which were then discussed and implemented into the current draft. The process documentation was then approved for submission, subject to the addition of the record of the sprint retrospective meeting (and associated documents).

A record of the stand-up meeting is appended to this sprint, as document **SM7**.

Sprint Retrospective Meeting – 19 December 2021

Attended by: All team members.

At the sprint retrospective meeting (held immediately after the second stand-up meeting), the team reflected briefly on this sprint, before updating the sprint backlog (**SB7.2**) and product backlog (**PB7.2**) and confirming that there were no outstanding tasks prior to submission.

A record of the sprint retrospective meeting is appended to this sprint, as document **SR7**.

SPRINT REVIEW

At the sprint retrospective meeting, the team discussed and reviewed the team's progress.

General comments

The team considered that the team had satisfied the sprint goal identified at the start of the sprint – the team had finalised the product and process documentation for submission.

The team praised all team members' organisational skills during this project, in particular concerning the documentation. As the team had been effective in drafting the process documentation at the end of each sprint (after Sprint 2) and had prioritised the product documentation in previous sprints, the team was well-placed to finalise the documentation in this sprint.

Difficulties faced

The team considered that the sole significant difficulty in this sprint was the organisation of multiple people reviewing and providing comments on the documentation prior to submission, in the midst of other coursework demands. However, the team effectively managed this issue through the stand-up meetings, which enabled everyone to discuss their comments and to finalise the documents together onscreen in short, efficient meetings.

Exception handling

The team considered that there were no unexpected events in this sprint – due to the team's exemplary organisation in previous sprints, the team was well-prepared to finalise the documentation.

SPRINT DOCUMENTATION

Date	ID	Document
16/12/21	PB7.1	Product Backlog – Iteration Planning Meeting
16/12/21	SB7.1	Sprint Backlog – Iteration Planning Meeting
17/12/21	SM6	Record of a Stand-up Meeting
19/12/21	SM7	Record of a Stand-up Meeting
19/12/21	SR7	Record of a Sprint Retrospective Meeting
19/12/21	SB7.2	Sprint Backlog – Sprint Retrospective Meeting
19/12/21	PB7.2	Product Backlog – Sprint Retrospective Meeting

PRODUCT BACKLOG

Sprint: 7.

Version: 1.

Date: 16/12/2021.

Timing: Iteration Planning Meeting.

Created/Last updated by: Oscar Gee and Christian Bentley.

PRIORITY	UNSATISFIED USER STORIES, FAILED TESTS AND OTHER TASKS
Must Have	Finalise Sprint 6 and Sprint 7 documentation Arrange GitHub repository “Delivery” and “Production” branches Add UI design progression into process documentation Finalise Maintenance Guide Finalise User Manual
Should Have	
Could Have	
Won’t Have This Time	

SPRINT BACKLOG

Sprint: 7.

Version: 1.

Date: 16/12/2021.

Timing: Iteration Planning Meeting.

Created/Last updated by: Christian Bentley, working with all team members.

SPRINT GOAL				
To finalise the process and product documentation for submission.				
SELECTED PRODUCT BACKLOG ITEMS				
MUST HAVE	Finalise Sprint 6 and Sprint 7 documentation Arrange GitHub repository “Delivery” and “Production” branches Add UI design progression into process documentation Finalise Maintenance Guide Finalise User Manual			
SHOULD HAVE				
COULD HAVE				
SPRINT TASKS				
Priority	**Tasks (ordered)**	**Timeframe (hours)**	**Individual/Pair**	**Status**
MUST HAVE	Finalise Sprint 6 and Sprint 7 documentation	8	Christian	Started in Sprint 6
	Arrange GitHub repository “Delivery” and “Production” branches	1	Justin	Started in Sprint 6
	Add UI design progression into process documentation	2	Aimee and Christian	Partially completed in various sprints
	Finalise Maintenance Guide	2	Aimee and Abel	Drafted for review
	Finalise User Manual	2	Oscar and Justin	Drafted for review
	Review and provide comments on documentation	-	All team members	Not started
SHOULD HAVE				
COULD HAVE				

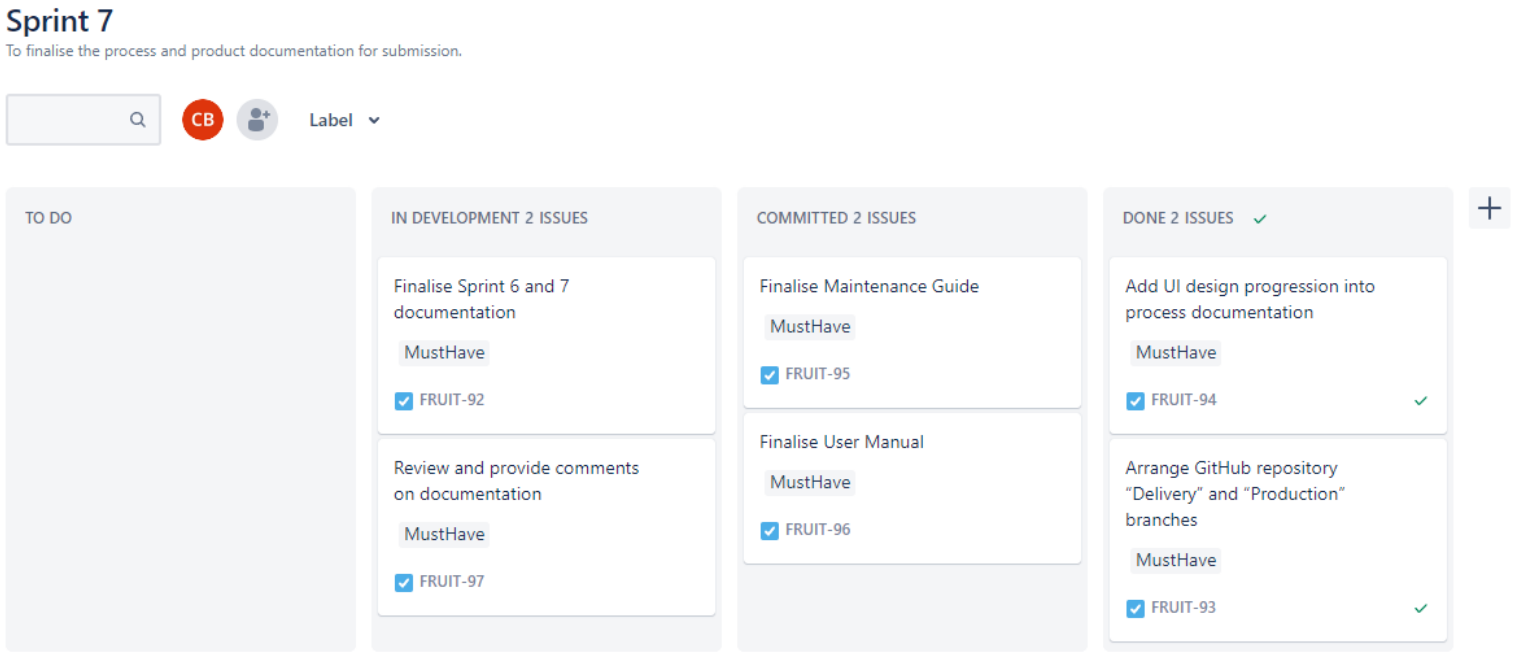
STAND-UP MEETING

Date: 17/12/2021

Attendees: All team members.

Document created by: Christian Bentley, working with all team members.

Sprint 7 - Jira Board



Stand-up Meeting Discussions

Discussion of, and updates to, product documentation

- Team members presented their comments (if any) on the User Manual and the Maintenance Guide.
    - Christian shared his screen with the team and made updates to those documents.
- The team approved the documents for submission.

Update on process documentation

- Christian provided an update on the process documentation:
    - All sprint sections had been finalised and the Introduction section was being drafted.
    - Aimee had prepared the UI design progression, which had been implemented into the process documentation.
- The team agreed to have a further stand-up meeting to review and approve the process documentation.

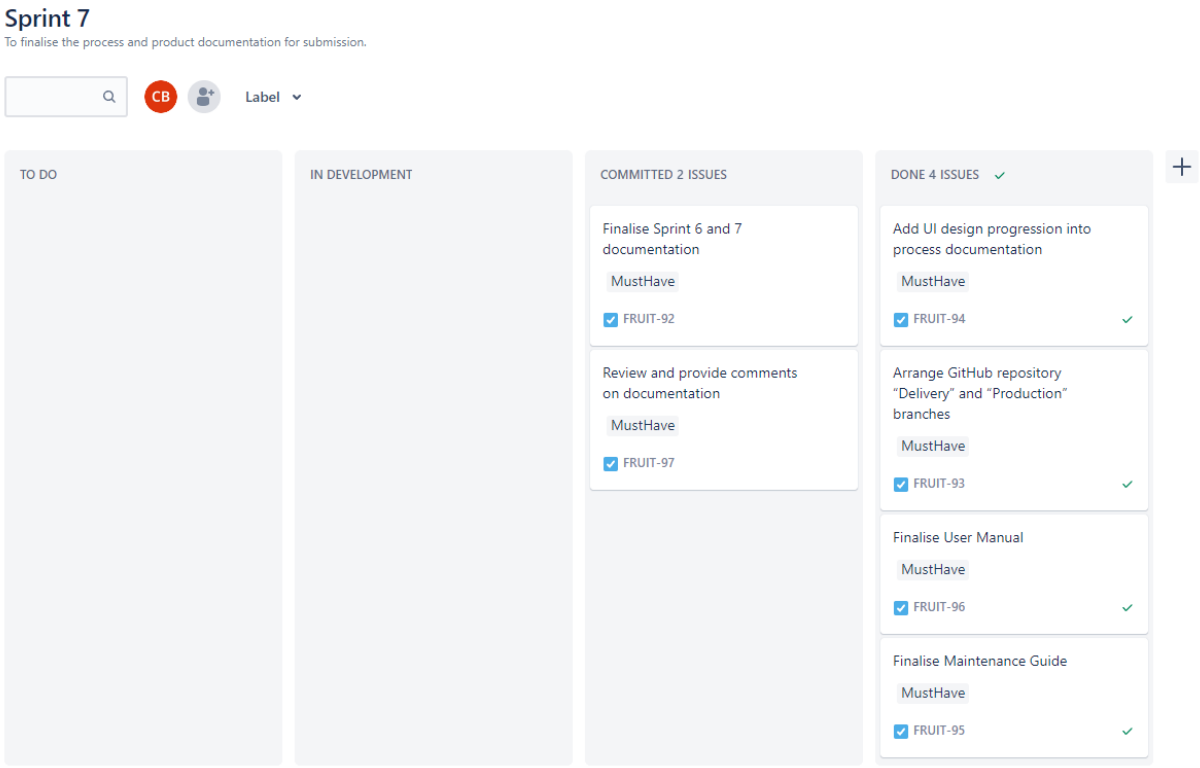
STAND-UP MEETING

Date: 19/12/2021

Attendees: All team members.

Document created by: Christian Bentley, working with all team members.

Sprint 7 - Jira Board



Stand-up Meeting Discussions

Discussion of, and updates to, process documentation

- Team members presented their comments (if any) on the process documentation.
    - Christian shared his screen with the team and made updates to those documents.
- The team approved the process documentation for submission, subject to the insertion of the Sprint Retrospective and associated backlog documents.

SPRINT RETROSPECTIVE

Sprint: 7.

Date: 19/12/2021.

Attendees: All team members.

Document created by: Christian Bentley, working with all team members.

GENERAL COMMENTS

1. In this shorter Sprint 7, the team's sole tasks were to complete the documentation for submission. As the team had been effective in drafting the process documentation at the end of each sprint (after Sprint 2) and had prioritised the product documentation in previous sprints, the team was well-placed to finalise the documentation in this sprint.
2. The team considered that the most significant difficulty in this sprint was the organisation of multiple people reviewing and providing comments on the documentation prior to submission, in the midst of other coursework demands. However, the team effectively managed this issue through the stand-up meetings, which enabled everyone to discuss their comments and to finalise the documents together onscreen in short, efficient meetings.
3. The team considered that there were no unexpected events in this sprint – due to the team's exemplary organisation in previous sprints, the team was well-prepared to finalise the documentation.

REVIEW OF, AND UPDATES TO, SPRINT BACKLOG

The team reviewed and updated the sprint backlog (**SB7.2**), confirming that all tasks had been completed.

REVIEW OF, AND UPDATES TO, PRODUCT BACKLOG

The team reviewed and updated the product backlog (**PB7.2**) to reflect the completed items in the updated sprint backlog, confirming that all tasks had been completed.

SB7.2

SPRINT BACKLOG

Sprint: 7.

Version: 2.

Date: 19/12/2021.

Timing: Sprint Retrospective Meeting.

Created/Last updated by: Christian Bentley, working with all team members.

SPRINT GOAL				
To finalise the process and product documentation for submission.				
SELECTED PRODUCT BACKLOG ITEMS				
MUST HAVE	~~Finalise Sprint 6 and Sprint 7 documentation~~ ~~Arrange GitHub repository "Delivery" and "Production" branches~~ ~~Add UI design progression into process documentation~~ ~~Finalise Maintenance Guide~~ ~~Finalise User Manual~~			
SHOULD HAVE				
COULD HAVE				
SPRINT TASKS				
Priority	**Tasks (ordered)**	**Timeframe (hours)**	**Individual/Pair**	**Status**
MUST HAVE	Finalise Sprint 6 and Sprint 7 documentation	8	Christian	Reviewed and completed
	Arrange GitHub repository "Delivery" and "Production" branches	1	Justin	Completed
	Add UI design progression into process documentation	2	Aimee and Christian	Reviewed and completed
	Finalise Maintenance Guide	2	Aimee and Abel	Reviewed and completed
	Finalise User Manual	2	Oscar and Justin	Reviewed and completed
	Review and provide comments on documentation	-	All team members	Completed
SHOULD HAVE				
COULD HAVE				

PB7.2

PRODUCT BACKLOG

Sprint: 7.

Version: 2.

Date: 19/12/2021.

Timing: Sprint Retrospective Meeting.

Created/Last updated by: Oscar Gee and Christian Bentley.

PRIORITY	UNSATISFIED USER STORIES, FAILED TESTS AND OTHER TASKS
Must Have	~~Finalise Sprint 6 and Sprint 7 documentation~~ ~~Arrange GitHub repository "Delivery" and "Production" branches~~ ~~Add UI design progression into process documentation~~ ~~Finalise Maintenance Guide~~ ~~Finalise User Manual~~
Should Have	
Could Have	
Won't Have This Time	

FINAL DOCUMENTATION

This section contains the final versions (as at the end of Sprint 7) of our master documentation files, as set out in the table below.

Date	ID	Document
14/12/21	USM.9	User Stories – Master Documentation (Version 9)
10/12/21	UCM.4	Use Cases – Master Documentation (Version 4)
25/11/21	CRC.1	CRC Cards (Version 1)
14/12/21	ATM.5	Acceptance Testing – Master Documentation (Version 5)
17/12/21	UIDNM	User Interface Design Notes: Master Documentation

USER STORIES: MASTER DOCUMENTATION

USM.9

Version: 9.

Date: 14/12/2021.

Created/Last updated by: Christian Bentley, working with all team members.

US1	**User Story:** As a **player** I want a **Main Menu** so that **I can choose the ways in which I will play the game.**
Comments: Main Menu to appear on start-up and when selected from the Mid-Level Menu. Menu options should include “Start game”, “Choose question package”, “Choose difficulty level”, “Load game” and “Close game”. The Main Menu may have artwork, music and interactions with the game characters.	
Acceptance criteria: 1. Upon the player loading up the game, the Main Menu is opened. 2. After the player clicks on “Quit to Main Menu” from the Mid-Level Menu (and any warning message is accepted – see US22), the Main Menu is opened.	
Status (07/12/2021): Created/Last updated by: Christian Bentley. Version: 3. Development/Testing: Developed and tested.	
Connected User Stories: US2-US6 (Main Menu functionalities), US10/22 (Quit to Main Menu and warning message).	

US2	**User Story:** As a **player**, I want a **start button for each puzzle type** so that I can **begin a current or new game level**.
Comments: Start button will appear after the puzzle type is selected from the main menu. The button should correspond to the current level number of the game and difficulty.	
Acceptance criteria: Every time the puzzle type button is clicked from the Main Menu, or a level from the selected puzzle type has been completed (win or lose), the start button should appear, programmed for the next level (win), or the same level (lose/current).	
Status (16/11/2021): Created/Last updated by: Aimee Dowell. Version: 2. Development/Testing: Developed and tested.	
Connected User Stories: US1 (Main Menu interface)	

US3	**User Story:** As a **player** I want a **Question Package** so that **I can choose the category of questions before I start playing the game.**
Comments:	

Sub-menu within the Main Menu. Options within “Choose Question Package” will include 4 categories (yet to be decided properly). Could include “Arithmetic”, “Geography”, “History” and “Biology”. Fundamental menu options outside of categories includes “Return to Main Menu”.
Acceptance criteria: The question category chosen by the user should be implemented within the question mechanics and remain the same throughout the game. The category options should be clickable as a tick-box or drop-down sub-menu of Main Menu.
Status (10/11/2021): Created/Last Updated By: Oscar Gee. Version: 1. Development/Testing: Not developed or tested.
Connected User Stories: US1 (Main Menu interface), US2 (Start Game)

US4	**User Story:** As a **player** I want **to choose the difficulty level before starting the game** so that **I can tailor the gameplay.**
Comments: There should be a “level of difficulty” option in the Main/Start Game Menu, which allows the player to change the difficulty level. If the player wishes to change the difficulty during a game, then further features may be implemented.	
Acceptance criteria: The difficulty level chosen by the player should be implemented in the question mechanics and remain same for the entire game. The difficulty options should be clickable as a tick-box or drop-down sub-menu of Main Menu.	
Status (10/11/2021) Created/Last Updated By: Vishnu Vardhan. Version: 1. Development/Testing: Not developed or tested.	
Connected User Stories: US1/US2 (Main Menu and Start Game interfaces), US3 (Question Packages), US13 (Question Pop-up)	

US5	**User Story:** As a **player**, I want to **load a previously saved game** so that **I can carry on playing from the last time**.
Comments: There should be a “Load Game” button which allows user to load a previously saved game.	
Acceptance criteria: 1. There should be a “Load Game” button above the grid/board. 2. Once the button is clicked, the board should be updated with the contents of the previous game. 3. The score should be updated. 4. The player should be informed that the game has been loaded successfully 5. The player should be prompted to make a move.	
Status (14/12/2021) Created/Last Updated By: Abel Tom Varghese. Version: 2.	

Development/Testing: Partially developed and tested – score saving only. Further development required to save and load the board status. Acceptance criteria 4 and 5 not considered necessary, following team discussion.
Connected User Stories: US1 (Main menu on start-up), US7 (Mid-level menu – saving a game), US12 (All previously selected squares should be highlighted), US21 (Must load all previous scores)

US6	**User Story:** As a **player** I want to **close the game from the main menu** so that **I don't have to switch to desktop or use task manager to force close it**.
Comments: A "Quit to Desktop" button should be in the Main Menu screen allowing the player to close the game.	
Acceptance criteria: When the "Quit to Desktop" button is clicked. The game should ask the player "Are you sure you want to quit?" and, if accepted, then the game application should close.	
Status (16/11/2021) Created/Last Updated By: Justin Lam Version: 2. Development/Testing: Developed and tested. Warning message not implemented after further discussion within the team.	
Connected User Stories: US1 (Main Menu interface)	

US7	**User Story:** As a **player** I want **a mid-level menu** so that **I can take a break, save my game progress or go back to the main menu.**
Comments: The player should be in an active game. It must not be game over/any other menu. During a level, when the player presses the "escape" button, the ongoing game pauses and a Mid-Level Menu pops up. It should have 3 options in the following order – Resume Game, Save Game and Quit to Main Menu buttons. Also after saving the progress, it should be returned to the mid-level menu.	
Acceptance criteria: After pressing the escape button during a game level, the Mid-Level Menu must open.	
Status (07/12/21): Created/Last Updated By: Rohith Kanjirappara. Version: 2. Development/Testing: Developed and tested.	
Connected User Stories: US10 and US22 (Quit to Main Menu and warning message), US9 (Save Game), US8 (Resume Game)	

US8	**User Story:** As a **player**, I want a **resume game button** so that I can **continue playing the game once the mid-game menu is clicked.**
Comments: The resume game button should appear as part of the in-game menu. Once clicked the game should continue from the where the player last left off.	

Acceptance criteria: Once the player clicks the resume game button in the in-game menu the game should resume where it was left off.
Status (07/12/2021): Created/Last updated by: Jaafar Ghaddar. Version: 2. Development/Testing: Developed and tested.
Connected User Stories: US7 (Mid-Level Menu interface)

US9	**User Story:** As a **player**, I want to **save a game in progress** so that **I can return to it later**.
Comments: There should be a "Save Game" button which allows user to save the progress of the current game.	
Acceptance criteria: 1. There should be a "Save Game" button above the grid/board. 2. Once the button is clicked, the game should save the contents of the board and the current score. 3. The user should be prompted that either the game was successfully or unsuccessfully saved. 4. The user then has the option to carry on playing the game.	
Status (14/12/2021) Created/Last Updated By: Christian Bentley. Version: 2. Development/Testing: Partially developed and tested – implemented through the Mid-Level Menu, rather than a button on the board. Further development required to save the contents of the board.	
Connected User Stories: US7 (Mid-Level Menu interface), US5 (Load Game), US21 (Scoring), US11/17 (Positioning and Movement of Carrots)	

US10	**User Story:** As a **user** I want an **option during level gameplay to return to the Main Menu** so that **after having started a game, I can start a new game, load a saved game or quit the program.**
Comments: "Quit to Main Menu" should be an option from the Mid-Level Menu. If the user clicks on this option, the user should be taken to the Main Menu and the current game should be ended and not saved. *See US22 (warning message) for alternative stories concerning a warning message for the loss of current game progress.*	
Acceptance criteria: 1. "Quit to Main Menu" is an option in the Mid-Level Menu. 2. If the user selects this option, the Main Menu is opened and the current game is ended.	
Status (07/12/2021): Created/Last updated by: Christian Bentley. Version: 2. Development/Testing: Developed and tested.	
Connected User Stories: US1 (Main Menu), US22 (Quit to Main Menu – warning message).	

US11	**User Story:** As a **developer**, I need to **randomly position the carrots on the board so that at minimum it would require 2+ moves to reach Steve the Strawberry (main character).** Having this functionality, would **make the game engaging & fun to play for the player.**
Comments: The carrots & strawberry should be randomly positioned on the board so that all carrots would require two or more moves to reach the strawberry.	
Acceptance criteria: 1. There should be a fixed number of carrots for each level 2. Unit tests should determine each carrot has been added to the board. 3. Ensure all carrots are at minimum more than two steps away from Steve.	
Status (16/11/2021) Created/Last Updated By: Abel Tom Varghese. Version: 2. Development/Testing: Developed and tested for 3x3 tile level, may require further development for alternative tile sets.	
Connected User Stories: US2 (Start Game), US4 (Difficulty), US5 (Load Game), US7/9 (Mid-Level Menu and Save Game), US17 (Movement of Carrots), US15/23 (Carrots Revealed/Not Revealed)	

US12	**User Story:** As a **player**, I want a **clicked square to be highlighted** so that I can **see which square I have selected instead of using muscle memory**.
Comments: Square can only be highlighted if the game is currently awaiting a selection. This will be when a level has first started, after a previous question has been answered incorrectly, or after a previous square has been uncovered.	
Acceptance criteria: Every time a square is clicked (provided there is no current pop-up, such as a question, or an animation showing what is underneath a selected square) the clicked square should be clearly highlighted.	
Status (10/11/2021): Created/Last updated by: Aimee Dowell. Version: 2. Development/Testing: Developed and tested.	
Connected User Stories: US13 (Question Pop-up)	

US13	**User Story:** As a **player** I want **questions to pop up** so that **I can answer the questions to progress the game.**
Comments: Questions are to pop up depending on which tile the player clicks on. The questions that will be revealed will be relevant to the category selected prior to the start of the game.	
Acceptance criteria: Once a tile has been clicked on by the player, a question must pop-up.	
Status (23/11/2021): Created/Last Updated By: Abel Tom Varghese.	

Version: 2. Development/Testing: Developed and tested for the numerical question package. Later iterations may include different question packages, at which this user story may be revisited.
Connected User Stories: US3 (Question Package), US12 (Highlighting Tiles), US14/16 (Correct and Incorrect Answers)

US14	**User Story:** As a **player** I want **the question pop-up to confirm that I have made a correct answer** so that **I can understand my progress in the game.**
Comments: Once a question has popped-up and the player has input a correct answer, the pop-up should confirm that the answer is correct.	
Acceptance criteria: When a question is answered correctly, the question pop-up visually confirms that the answer was correct.	
Status (14/12/2021) Created/Last Updated By: Christian Bentley. Version: 3. Development/Testing: Developed and tested in relation to the numerical question package, may require testing in later iterations in relation to other question packages as implemented. Small bug in relation to irrational numbers – no rounding for correct answers.	
Connected User Stories: US13 (Question pop-up), US15 (Carrot revealed), US16 (Incorrect answer), US23 (No carrot on tile), US21 (Scoring)	

US15	**User Story:** As a **player** I want **the carrots to be revealed when I clicked the correct square that the carrots are on** so that **the player will have visual information of where and how many carrots have been found.**
Comments: Once a tile has been selected and a question has been answered correctly, then if there is a carrot on that tile then the carrot should be revealed.	
Acceptance criteria: 1. When a question is answered correctly, if a carrot is on the selected tile, then the carrot is revealed. 2. However, if a carrot is not on the selected tile, then the carrot is not revealed.	
Status (23/11/2021) Created/Last Updated By: Christian Bentley. Version: 3. Development/Testing: Developed and tested.	
Connected User Stories: US12 (Highlighting square on click), US13 (Question pop-up), US14 (Correct answer)	

US16	**User Story:** As a **player** I want **an incorrect answer pop-up** so that **I can know if my answer is correct or not.**
Comments: When a player gives an incorrect answer to a question, there should be a pop-up informing the user that his/her answer to the question is incorrect.	

The pop-up should have the following text- “Oops! Your answer is incorrect – let’s try again!” along with the incorrect answer Steve image. Alternatively, the player may be permitted to try a different question.
Acceptance criteria: When a question is answered incorrectly, the question pop-up visually confirms that the answer was incorrect and prompts the player to try a different answer or skip to a different question.
Status: (23/11/21) Created/Last Updated By: Abel Tom Varghese. Version: 2. Development/Testing: Developed and tested in relation to the numerical question package, may require testing in later iterations in relation to other question packages as implemented.
Connected User Stories: US13 (Question Pop Up), US14 (Correct Answer)

US17	**User Story:** As a **player**, I want the **carrots to move after each correct answer** so that I can **understand how they will approach me in other levels.**
Comments: Carrots will move randomly after each correct answer, in further rounds they will move closer to the strawberry in order to eat him.	
Acceptance criteria: Every time the player answers a question correctly the carrot moves randomly in the board.	
Status (30/11/2021): Created/Last updated by: Christian Bentley. Version: 2. Development/Testing: Developed and tested.	
Connected User Stories: US11 (Positioning of carrots at level start), US14 (Correct Answer)	

US18	**User Story:** As a **player** I want **Steve to interact with me between questions** so that **I am engaged with and guided by the main character.**
Comments: Whilst the user is playing a game level and is not answering a question, after a short period of inactivity Steve should display a message, guiding the player’s next action (selecting a tile).	
Acceptance criteria: When a user is playing a game level, is not answering a question and after a short period of inactivity, a message is displayed instructing the player to select the next tile.	
Status (07/12/2021): Created/Last updated by: Christian Bentley. Version: 2. Development/Testing: Developed and tested.	
Connected User Stories: US12-16 (Tile Selection and Questions).	

US19	**User Story:**

	As a **player**, I want to **successfully complete a level once I have found all the vegetables** so that I can **return to the main menu and complete the next level or save and quit**.
Comments: Level is not deemed 'complete' if all lives are lost, or if a vegetable reaches the strawberry before player catches them.	
Acceptance criteria: If all the vegetables have been found before they reach the strawberry, the level is deemed complete and should return the main menu where the player can either save and quit the game or continue to the next level.	
Status (07/12/2021): Created/Last updated by: Aimee Dowell. Version: 3. Development/Testing: Developed and tested.	
Connected User Stories: US20 (Level failed), US21 (Scoring)	

US20	**User Story:** As a **player** I want a **level failed** notification so that **I can restart the game and play again.**
Comments: Pop up to appear when failing the game. This can occur when vegetables reach Steve the Strawberry. Pop up informs the player that they have lost the level and will give the player an option to either return to the main menu or restart the level.	
Acceptance criteria: Pop up to occur when vegetable reaches Strawberry. Pop up will contain buttons "Return to Main menu" and "Restart Level".	
Status (07/12/2021): Created/Last Updated By: Oscar Gee. Version: 2. Development/Testing: Developed and tested.	
Connected User Stories: US2-US6 (Main Menu functionalities), US10 (Quit to Main Menu clicked), US19 (Level Completed), US21 (Scoring).	

US21	**User Story:** As a **player**, I want to **be able to see my score as the game progresses** so that I can **be motivated to do better**.
Comments: The player will receive a 100 points on every correct answer and a half the points on each consecutive attempt of the same question.	
Acceptance criteria: Once a correct answer has been made the points go up. If the attempt was right on the first try the player receives a 100 points, if it was his second attempt: 50, third: 25, etc…	
Status (23/11/2021): Created/Last updated by: Abel Tom Varghese. Version: 2. Development/Testing: Developed and tested.	
Connected User Stories: US14/16 (Correct and Incorrect Answers), US19/20 (Level Completed/Failed).	

US22	**User Story:** As a **user** I want **to receive a message warning me that my current level progress will be lost if I quit to the Main Menu without saving** so that **I do not accidentally lose my level progress.**
Comments: When the "Quit to Main Menu" option is selected from the Mid-Level Menu, the current level progress is closed and not saved. In order to avoid accidental losses of progress, then *if the user has progressed since their last save*, then the user should receive a warning message, stating that their progress will be lost, and be given the options to proceed to the Main Menu or to return to the Mid-Level Menu.	
Acceptance criteria: 1. If the user has progressed since the last save and "Quit to Main Menu" is selected, a warning message is displayed with two options – proceed to Main Menu and return to the Mid-Level Menu. 2. If the user selects to proceed to the Main Menu from the warning message, or if they select "Quit to Main Menu" in the Mid-Level Menu and they have not progressed since the last save, US10 is continued (the Main Menu is opened and current level progress is not saved). 3. If the user selects to return to the Mid-Level Menu, they are returned to the Mid-Level Menu.	
Status (14/12/2021): Created/Last updated by: Christian Bentley. Version: 2. Development/Testing: Developed and tested. Following team discussions, warning message is always displayed (not only if progress has been made).	
Connected User Stories: US1 (Main Menu), US9 (Game saves), US10 (Quit to Main Menu)	

US23	**User Story:** As a **user** I want **to receive a notification that there was no carrot underneath the revealed tile** so that **I can track my level progress.**
Comments: When a question is answered correctly, the tile is revealed (US14) and the tile disappears. If there is no carrot on that tile, then a message from Steve should appear stating "Unlucky, there are no vegetables behind that tile – let's try another one!".	
Acceptance criteria: If the player has answered a question correctly and there is no carrot on that tile, then the above message appears and the tile disappears.	
Status (07/12/2021): Created/Last updated by: Christian Bentley. Version: 3. Development/Testing: Developed and tested.	
Connected User Stories: US13 (Question Pop-up), US14 (Correct Answer), US15 (Carrot Revealed), US11/17 (Positioning and Movement of Carrots).	

US24	**User Story:** As a **player** I want my **question data to be stored and retrieved from an online location and used in the questions that pop up in game**.

Comments: Implementing this requirement should use the customer suggestion of a RESTful API. Question data that is manipulated using the API is called from an online database. Due to network constraints, it makes sense for the database to be local to the machine and transmitted through the API from LocalHost to UnityWebRespose (HTTP).
Acceptance criteria: Questions that pop up throughout the game should have their question data populated directly from the "online" database and streamed **either:** • prior to the game loading; or • on "highlight square".
Status (27/11/2021) Created/Last updated by: Oscar Gee. Version: 1. Development/Testing: Not developed or tested.
Connected User Stories: US12 (Highlight Square) US13 (Question Pop-up)

US25	**User Story:** As a **player**, I want **my score to be saved once I quit the game** so that I can **continue my progress and my score isn't lost when I re-open the game**.
Comments: Save button will appear during the Main Menu once new score data has been added or during the Mid-Level Menu (when the player is currently playing a level).	
Acceptance criteria: Every time the save button is clicked from either the Main Menu or Mid-Level Menu, the new score data should be written to a corresponding JSON file within the game project files.	
Status (14/12/2021): Created/Last updated by: Aimee Dowell. Version: 2. Development/Testing: Developed and tested.	
Connected User Stories: US9 (Save Button), US1/7 (Main Menu and Mid-Level Menu), US5 (Load Game)	

US26	**User Story:** As a **Developer** I want a develop **unit tests for each method** so that **I can ensure all code written in the backend is well tested & free of hidden bugs.**
Comments: Unit tests will be written for each method that is defined in the backend scripts. If alterations are made to existing methods, new unit tests will be developed which examine if the method works as expected with the new changes. Once a new functionality is developed, I.E new classes are generated, unit tests must immediately be developed after the code development.	
Acceptance criteria: All methods should have 1 or more corresponding unit test which examine how the method performs for a given input. Additionally, all unit tests must pass before new functionality is added to the game.	
Status (07/12/2021): Created/Last Updated By: Abel Tom Varghese. Version: 3.	

Development/Testing: Developed and tested in relation to the BoardModel, Question Generation and Scoring.
Connected User Stories: US5 (Loading a previously saved game), US9 (Saving a current game), US11 (Placement of carrots), US13 (Question generation), US17 (Movement of carrots), US21 (Scoring functionality)

US27	**User Story:** As a **player**, I want a level with a **5x5 grid** so that the game **can progress and become more difficult.**
Comments: A new level will be available where the player can play on a 5x5 grid.	
Acceptance criteria: When a player completes the first level (3x3) they can progress to the 5x5 grid and continue playing through the end of level pop-up.	
Status (30/11/2021): Created/Last updated by: Aimee Dowell. Version: 2. Development/Testing: Developed and tested.	
Connected User Stories: US5 (Load game), US9 (Save game), US28 (Level Complete Buttons).	

US28	**User Story:** As a **player** I want to be able to **either continue on to the next level after completing the level or return back to the main menu**.
Comments: Should be implemented with buttons “Continue” or “Return to Main Menu”, appearing at the end of each game level through the end of level pop-up. The Continue button will change the current level to the next level. “Return to Main Menu” will return the user to the “Main Menu” Scene.	
Acceptance criteria: In the end of level pop-up, the player must be able to either Continue or Return to Main Menu through pressing buttons.	
Status (30/11/2021) Created/Last updated by: Justin Lam. Version: 2. Development/Testing: Developed and tested.	
Connected User Stories: US1 (Main Menu interface), US19/20 (Level Completed/Failed), US27 (5x5 grid)	

US29	**User Story:** As a **player**, I want **a fruit helper, Barry the Banana, within my game level**, so that I can **push vegetables back a place and increase my chances of winning.**
Comments: Bananas and all fruit helpers will remain static within the grid. A fruit and vegetable cannot occupy the same tile. The vegetables can only be pushed backwards if they are greater than 1 square away from the edge of the grid.	
Acceptance criteria:	

Every time a banana is revealed underneath a selected tile, the remaining vegetables will be moved backwards by one square to their previous tile.
Status (07/12/2021): Created/Last updated by: Aimee Dowell. Version: 3. Development/Testing: Developed and tested.
Connected User Stories: US11/17 (Positioning and Movement of Carrots)

US30	**User Story:** As a **player**, I want **broccoli vegetables, Boris, which move towards Steve the Strawberry diagonally, within my game level**, so that I can **add an extra level of challenge and make the game more exciting.**
Comments: Broccolis must be randomly positioned on the grid, but they cannot occupy the same tile as other fruit and vegetables. The broccolis can be pushed backwards by bananas if they are greater than 1 square away from the edge of the grid.	
Acceptance criteria: 1. There should be a fixed number of broccolis for each level. 2. All broccolis must start at a minimum of more than two steps away from Steve the Strawberry. 3. The broccolis must move diagonally. 4. If a broccoli is revealed, the number of broccolis remaining must reduce by 1.	
Status (14/12/2021): Created/Last updated by: Christian Bentley. Version: 3. Development/Testing: Developed and tested.	
Connected User Stories: US11/17 (Positioning and Movement of Carrots), US20 (Level Failure)	

US31	**User Story:** As a **player**, I want **Winnie the Watermelon to remove a vegetable when I have selected 4 empty tiles in a row,** so that I **won't get bored and quit the game**.
Comments: Winnie is not positioned on the board but rather appears on the 4th selected tile which is empty. It only removes one vegetable from the board.	
Acceptance criteria: 1. Every time that 3 consecutive tiles selected by the user are revealed to be empty, underneath the 4th tile Winnie should appear. 2. One random vegetable should be removed, revealing its position on the board and removing the tile hiding it. 3. The number of vegetables remaining should be reduced.	
Status (14/12/2021): Created/Last updated by: Aimee Dowell. Version: 2. Development/Testing: Developed and tested.	
Connected User Stories: US11/17 (Positioning and Movement of Carrots), US12 (Tile Highlighted), US15 (Carrots Revealed), US23 (No Carrot Revealed)	

US32	**User Story:** As a **player**, I want a level with a **7x3 grid** so that the game **can progress and become more difficult.**
Comments: A new level will be available where the player can play on a 7x3 grid, after completing the 5x5 grid.	
Acceptance criteria: When a player completes the second level (5x5) they can progress to the 7x3 grid and continue playing through the end of level pop-up.	
Status (14/12/2021): Created/Last updated by: Aimee Dowell. Version: 2. Development/Testing: Developed and tested.	
Connected User Stories: US5 (Load game), US9 (Save game), US28 (Level Complete Buttons).	

Version: 4.

Date: 10/12/2021.

Created/Last updated by: Christian Bentley, working with all team members.

UC1	**Use Case:** Main Menu Interface.
	Version: 1. **Creator/Updater:** Christian Bentley. **Last updated:** 18/11/2021.
User Story: As a player I want a Main Menu so that I can choose the ways in which I will play the game. **ID:** US1	
UC1 -1	**Control Flow:** Alternative Path #1 – Opening on Start-up The Main Menu is opened on start-up. Alternative Path #2 – Player Selection from Mid-Level Menu If the player is in a game level, opens the Mid-Level Menu and selects "Quit to Main Menu" (and proceeds after any warning message), the Main Menu is opened.
UC1-2	**Actors:** Player.
UC1-3	**Pre-Condition:** Alternative Path #1 – Opening on Start-up The player opens the game program. Alternative Path #2 – Player Selection from Mid-Level Menu The player selects "Quit to Main Menu" (or similar) from the Mid-Level Menu and accepts any warning message (see UC10/22).
UC1-4	**Post-Condition:** Alternative Path #1 – Opening on Start-up None. Alternative Path #2 – Player Selection from Mid-Level Menu The player's current level progress is deleted and not saved (see UC10/22).
UC1-5	**Connected Use Cases:** UC2-6 (Main Menu functionalities), UC10/22 (Quit to Main Menu from Mid-Level Menu and warning message).

UC2	**Use Case:** Start New Game button
	Version: 1 **Creator/Updater:** Aimee Dowell. **Last updated:** 18/11/2021
User Story: As a player, I want a start button for each puzzle type so that I can begin a current or new game level. **ID:** US2	
UC2 -1	**Control Flow:** • The Main Menu is opened on start-up, which shows the Start New Game button. • The player selects the game settings that they require.

	• The player selects the Start New Game button. • The game level is loaded with the settings selected by the player.
UC2-2	**Actors:** Player.
UC2-3	**Pre-Condition:** • The player opens the game application, and the Main Menu is displayed. • The player selects the game settings that they require.
UC2-4	**Post-Condition:** • The game level is loaded with the settings selected by the player.
UC2-5	**Connected Use Cases:** UC1 (Main Menu), UC3/4 (Question Package/Difficulty)

UC3	**Use Case:** Choosing Question Package
	Version: 1. **Creator/Updater:** Oscar Gee **Last updated:** 18/11/2021.
User Story: As a player I want a Question Package so that I can choose the category of questions before I start playing the game. **ID:** US3	
UC3 -1	**Control Flow:** • Player accesses question packages through the Main Menu or a sub-menu. • Player selects a question package from a dropdown.
UC3-2	**Actors:** Player.
UC3-3	**Pre-Condition:** Player has started the game and has accessed the Main Menu/sub-menu.
U3-4	**Post-Condition:** • Question package is selected and stays as that package unless a different package is selected. • Question package selection is saved with a game save and is reloaded when a game save is loaded.
U3-5	**Connected Use Cases:** UC1 (Main Menu interface), UC5 (Loading a Saved Game)

UC4	**Use Case:** Difficulty Levels
	Version: 1. **Creator/Updater:** Vishnu Vardhan. **Last updated:** 18/11/2021
User Story: As a player I want to choose the difficulty level before starting the game so that I can tailor the gameplay. **ID:** US4	
UC4-1	**Control Flow:** • The player is at the Main Menu/Start Game sub-menu. • The player can select the level of difficulty from a dropdown menu.
UC4-2	**Actors:** Player.
UC4-3	**Pre-Condition:**

	The player is at the Main Menu/Start Game sub-menu
UC4-4	**Post-Condition:** The selected level of difficulty is reflected in the questions arising during the next game.
UC4-5	**Connected Use Cases:** US13 (Question Pop-up).

UC5	**Use Case:** Load a saved game
	Version: 1. **Creator/Updater:** Abel Tom Varghese. **Last updated:** 18/11/2021.
User Story: As a player, I want to load a previously saved game so that I can carry on playing from the last time. **ID:** US5	
UC5-1	**Control Flow:** Alternative Path #1: • The game loads a previously saved game & the view is updated with the previously saved score & board. Alternative Path #2: • An error is displayed to the player which informs them the game was not loaded & the reason why (no previously saved game or error in loading the game)
UC5-2	**Actors:** Player
UC5-3	**Pre-Condition:** • The game must have access to a file with the contents of the previously saved game. • The load game button must be clicked
UC5-4	**Post-Condition:** Alternative Path #1: • The game displays a message to inform the player that the game was successfully loaded • The player can now make further moves Alternative path #2 • Once error is displayed with the reason as to why a previous game cannot be loaded, the player is free to carry on playing the current game or close the game down.
UC5-5	**Connected Use Cases:** UC1 (Main Menu interface), UC9 (Save Game).

UC6	**Use Case:** Quit to Desktop
	Version: 1. **Creator/Updater:** Justin Lam. **Last updated:** 18/11/2021.
User Story: As a player I want to close the game from the main menu so that I don't have to switch to desktop or use task manager to force close it. **ID:** US6	
UC6-1	**Control Flow:** • Player selects "Quit to Desktop" button from the Main Menu.

	• The application is closed.
UC6-2	**Actors:** Player.
UC6-3	**Pre-Condition:** • Player is at the Main Menu and selects the “Quit to Desktop” button.
UC6-4	**Post-Condition:** • The game must be closed completely without running in the background.
UC6-5	**Connected Use Cases:** UC1 (Main Menu interface)

UC7	**Use Case:** Mid-Level Menu
	Version: 1. **Creator/Updater:** Rohith. **Last updated:** 18/11/21.
User Story: As a player I want a Mid-Level Menu so that I can take a break, save my game progress or go back to the Main Menu. **ID:** US7	
UC7-1	**Control Flow:** Alternative Path #1: • The player presses “Esc” key during the game level, the Mid-Level Menu is opened. Alternative Path #2: • On clicking the save button in the Mid-Level Menu, after the game is saved the Mid-Level Menu is showed again.
UC7-2	**Actors:** Player [on pressing the “Esc” key], Developer [in saving game level progress]
UC7-3	**Pre-Condition:** Alternative Path #1: • Player is in a game level. • Player has pressed the “Esc” key. Alternative Path #2: • The player has saved the game from the Mid-Level Menu. Alternative Path #3: • The player selects to return to the Mid-Level Menu following the “lost progress” warning messages (see UC22).
UC7-4	**Post-Condition:** None.
UC7-5	**Connected Use Cases:** UC8-10 (Mid-Level Menu functionalities), UC22 (Warning Message)

UC8	**Use Case:** Resume Game from Mid-Level Menu
	Version: 1. **Creator/Updater:** Jaafar Ghaddar. **Last updated:** 18/11/2021
User Story: As a player, I want a resume game button so that I can continue playing the game once the Mid-Level Menu has been opened. **ID:** US8	

UC8 -1	**Control Flow:** • The player is in a game level and has opened the Mid-Level Menu. • Resume Game button is clicked in the Mid-Level Menu. • The game level is resumed in the same state as when the Mid-Level Menu was opened.
UC8-2	**Actors:** Player.
UC8-3	**Pre-Condition:** The Mid-Level Menu is opened.
UC8-4	**Post-Condition:** The game level is resumed in the same state as when the Mid-Level Menu was opened.
UC8-5	**Connected Use Cases:** US7 (Mid-Level Menu interface)

UC9	**Use Case:** Save current game
	Version: 1. **Creator/Updater:** Abel Tom Varghese. **Last updated:** 18/11/2021
User Story: As a player, I want to save a game in progress so that I can return to it later. **ID:** US9	
UC9-1	**Control Flow:** Alternative Path #1: • The application saves the current game (contents of the board & score) to a file. • A message is displayed to inform the player that the game was successfully saved. Alternative Path #2: • A message is displayed to inform the player that the was unsuccessfully saved & the reasons as to why.
UC9-2	**Actors:** Player
UC9-3	**Pre-Condition:** • The save game button must be clicked
UC9-4	**Post-Condition:** Alternative Path #1: • A message is displayed to inform the player that the game was successfully saved. • The player can now make further moves. Alternative path #2 • A message is displayed to inform the player that the was unsuccessfully saved & the reasons as to why. • The player is free to carry on playing the current game or close the game down.
UC9-5	**Connected Use Cases:** UC5 (Load Saved Game).

UC10	**Use Case:** Quit to Main Menu from Mid-Level Menu
	Version: 1. **Creator/Updater:** Christian Bentley.

	Last updated: 18/11/2021.
User Story: As a player I want an option during level gameplay to return to the Main Menu so that after having started a game, I can start a new game, load a saved game or quit the program. **ID:** US10	
UC10-1	**Control Flow:** • "Quit to Main Menu" is an option from the Mid-Level Menu. • If the player clicks on "Quit to Main Menu", the current game should be closed and not saved and the Main Menu should be opened. *See UC22 (warning message) for alternative paths.*
UC10-2	**Actors:** Player.
UC10-3	**Pre-Condition:** The player opens the Mid-Level Menu.
UC10-4	**Post-Condition:** The current level progress is closed and not saved.
UC10-5	**Connected Use Cases:** UC1 (Main Menu), UC22 (Quit to Main Menu – warning message).

UC11	**Use Case:** Positioning carrots when the game starts
	Version: 1. **Creator/Updater:** Abel Tom Varghese **Last updated:** 18/11/2021
User Story: As a developer, I need to randomly position the carrots on the board so that at minimum it would require 2+ moves to reach Steve the strawberry (main character). **ID:** US11	
UC11-1	**Control Flow:** Alternative Path #1: • The application places all carrots randomly given that the distance from the chosen cell is two or more moves away from reaching the main character. Alternative Path #2: • The application crashes & a stack trace error is printed informing the developer the reason for the crash.
UC11-2	**Actors:** Developer
UC11-3	**Pre-Condition:** • A new game must be started
UC11-4	**Post-Condition:** Alternative Path #1: • The application calls the positioning method to place all pieces on the board. Alternative path #2 • The application crashes & a stack trace error is printed
UC11-5	**Connected Use Cases:** UC2 (Start Game), UC17 (Movement of vegetables), UC15 (Carrot revealed), UC23 (Carrot not revealed)

UC12	**Use Case:** Tile highlighted on click
	Version: 1.

	Creator/Updater: Aimee Dowell. **Last updated:** 18/11/2021.
User Story: As a player, I want a clicked square to be highlighted so that I can see which square I have selected instead of using muscle memory. **ID:** US12	
UC12 -1	**Control Flow:** A tile (not greyed out/disappeared) from the board has been selected using a trackpad or mouse and is then highlighted with a white outer square.
UC12-2	**Actors:** Player.
UC12-3	**Pre-Condition:** Alternative Path #1 • A new game or level has been started with the 3x3 board showing and the game waiting for a square to be selected. Alternative Path #2 • A previous square has been revealed and there are remaining vegetables which have not yet reached Steve.
UC12-4	**Post-Condition:** • A question pop up will be revealed overlaying the board.
UC12-5	**Connected Use Cases:** UC13 (Question Pop-up)

UC13	**Use Case:** Question Pop-up
	Version: 1. **Creator/Updater:** Oscar Gee. **Last updated:** 18/11/2021.
User Story: As a player I want questions to pop up so that I can answer the questions to progress the game. **ID:** US13	
UC13-1	**Control Flow:** • Player highlights a tile and mouse clicks on it. • A question text box will become visible, stating the question and including a text box for the player's input.
UC13-2	**Actors:** Player.
UC13-3	**Pre-Condition:** Player has selected a tile during a game level.
U13-4	**Post-Condition:** *See UC14/16 for more detail on answer mechanics.* • Question box pop-up disappears after a correct answer has been submitted. • The score is incremented and updated. • The player is then able to select another tile, for which a different question pops up.
U13-5	**Connected Use Cases:** UC12 (Highlight tile on click), UC14 (Correct answer), UC16 (Incorrect answer)

UC14	**Use Case:** Correct Answer

	Version: 1. **Creator/Updater:** Christian Bentley. **Last updated:** 18/11/2021.
User Story: As a player I want the question pop-up to confirm that I have made a correct answer so that I can understand my progress in the game. **ID:** US14	
UC14-1	**Control Flow:** • The game is in a question pop-up and the player inputs a correct answer into the answer box. Alternative Path #1: • If the player answers correctly, the question pop-up confirms that the answer was correct. Alternative Path #2: • If the player answers incorrectly, then UC16.
UC14-2	**Actors:** Player.
UC14-3	**Pre-Condition:** The game is in a question pop-up.
UC14-4	**Post-Condition:** • The score is increased (see UC21). Alternative Path #1: • If a vegetable is on the selected tile, then UC15. Alternative Path #2: • If a vegetable is not on the selected tile, then UC23.
UC14-5	**Connected Use Cases:** UC13 (Question pop-up), UC15 (Carrot revealed), UC16 (Incorrect answer), UC23 (No carrot on tile), UC21 (Scoring).

UC15	**Use Case:** Carrot Revealed
	Version: 1. **Creator/Updater:** Justin Lam. **Last updated:** 18/11/2021.
User Story: As a player I want the carrots to be revealed when I clicked the correct square that the carrots are on so that the player will have visual information of where and how many carrots have been found. **ID:** US15	
UC15-1	**Control Flow:** • Player selects a tile and answers a question correctly. • If a carrot is on that tile, then a carrot is revealed and does not move thereafter. • The number of carrots remaining UI counter is reduced by 1.
UC15-2	**Actors:** Player.
UC15-3	**Pre-Condition:** The player selects a tile and answers a question correctly.
UC15-4	**Post-Condition:** • The carrot remains at the location of the tile. • The tile disappears from the board. • The number of carrots remaining UI counter is reduced by 1. • If the number of carrots remaining is 0, then UC19.

UC15-5	**Connected Use Cases:** UC12 (Highlighting square on click), UC13 (Question Pop-up), UC14 (Correct Answer), UC19 (Level Complete).

UC16	**Use Case:** Incorrect Answer
	Version: 1. **Creator/Updater:** Rohith. **Last updated:** 18/11/21.
User Story: As a player I want an incorrect answer pop-up so that I can know if my answer was incorrect. **ID:** US16	
UC1 -1	**Control Flow:** • The game is in a question pop-up and the player inputs a correct answer into the answer box. Alternative Path #1: • If the player answers incorrectly, the question pop-up confirms that the answer was incorrect. • The player may choose whether to try another question or to retry this question. • If the player chooses to try another question, then another question is generated. Alternative Path #2: • If the player answers correctly, then UC14.
UC1-2	**Actors:** Player
UC1-3	**Pre-Condition:** The game is in a question pop-up.
UC1-4	**Post-Condition:** • If the player chooses to try another question, then another question is generated. • The scoring for any subsequent correct answer is reduced (see UC21).
UC1-5	**Connected Use Cases:** UC13 (Question pop-up), UC14 (Correct answer), UC21 (Scoring).

UC17	**Use Case:** Movement of vegetables
	Version: 1. **Creator/Updater:** Jaafar Ghaddar. **Last updated:** 18/11/2021.
User Story: As a player, I want the carrots to move after each correct answer so that I can understand how they will approach me in other levels. **ID:** US17	
UC17-1	**Control Flow:** • Player answers a question correctly. • The vegetables move semi-randomly around the tile board (see functionality concept documentation). Alternative Path: • If a vegetable moves to the centre, the level is over.
UC17-2	**Actors:** Player
UC17-3	**Pre-Condition:**

	The player answers a question correctly.
UC17-4	**Post-Condition:** If a vegetable moves to the centre, the Level Failed pop-up appears.
UC17-5	**Connected Use Cases:** US14 (Correct answer), US20 (Level Failed)

UC18	**Use Case:** Steve Interactions
	Version: 1. **Creator/Updater:** Christian Bentley. **Last updated:** 18/11/2021.
User Story: As a player I want Steve to interact with me between questions so that I am engaged with and guided by the main character. **ID:** US18	
UC18-1	**Control Flow:** • If a player is playing a game level, is not answering a question and after a period of inactivity (20secs), a message is displayed, directing the player to select the next tile. • If the player clicks anywhere on the screen, the message disappears and the inactivity timer is refreshed.
UC18-2	**Actors:** Player.
UC18-3	**Pre-Condition:** • The player is playing a game level. • The player is not answering a question. • The player has been inactive for at least 20secs.
UC18-4	**Post-Condition:** The inactivity timer is refreshed if the player clicks.
UC18-5	**Connected Use Cases:** UC12-16 (Tile Selection and Questions).

UC19	**Use Case:** Level completed
	Version: 1. **Creator/Updater:** Aimee Dowell. **Last updated:** 18/11/2021.
User Story: As a player, I want to successfully complete a level once I have found all the vegetables so that I can return to the main menu and complete the next level or save and quit. **ID:** US19	
UC19 -1	**Control Flow:** • Once all the vegetables have been found, before they reach the strawberry, a level complete pop-up should appear. • The pop-up should show the player's final score and have a button to save the game, return to the Main Menu or continue to the next level.
UC19-2	**Actors:** Player.
UC19-3	**Pre-Condition:** <u>Alternative Path #1</u> • A square has been revealed containing the last remaining vegetable.

	Alternative Path #2 • A square has been revealed containing a watermelon, who removes the last remaining vegetable
UC19-4	**Post-Condition:** • A level complete pop up will be revealed overlaying the board. • The pop-up shows the player's final score and has buttons to return to the Main Menu, save the game or continue to the next level.
UC19-5	**Connected Use Cases:** UC20 (Level Failed), UC21 (Scoring), UC9 (Save Game), US2 (Start Game)

UC20	**Use Case:** Level Failed
	Version: 1. **Creator/Updater:** Oscar Gee. **Last updated:** 18/11/2021.
User Story: As a player I want a level failed notification so that I can restart the game and play again. **ID:** US20	
UC20-1	**Control Flow:** Alternative Path #1: • If lives are implemented, player has incorrectly answered the question and lost their final life. Alternative path #2 • Player has answered a question correctly but a vegetable has reached Steve. • A notification pops-up, stating that the level has been failed and giving the player's final score. • The player may click on a button to return to the Main Menu.
UC20-2	**Actors:** Player.
UC20-3	**Pre-Condition:** • Player is in a game level and has answered a question. Alternative Path #1: • Player has 1 life remaining and answered the question incorrectly. Alternative Path #2: • Player has answered the question correctly but a vegetable has reached Steve
U20-4	**Post-Condition:** If the player clicks a button to do so, the game will return to the Main Menu.
U20-5	**Connected Use Cases:** US14/16 (Correct and Incorrect Answers), US17 (Movement of vegetables), US19 (Level completed), US21 (Scoring)

UC21	**Use Case:** Scoring
	Version: 1. **Creator/Updater:** Jaafar Ghaddar. **Last updated:** 18/11/2021.

User Story: As a player, I want to be able to see my score as the game progresses so that I can be motivated to do better. **ID:** US21	
UC21-1	**Control Flow:** • A player answers a question correctly. • The player's score is incremented and updated on screen. • The amount of the increment is dependent upon how many attempts were required by the player – first try = 100, every subsequent try = 50% of previous. • At the end of the level (whether failed or completed), the score is shown on-screen.
UC21-2	**Actors:** Player
UC21-3	**Pre-Condition:** The player answers a question correctly.
UC21-4	**Post-Condition:** None
UC21-5	**Connected Use Cases:** US14/US16 (Correct and Incorrect Answers), US19/US20 (Level Completed/Failed)

UC22	**Use Case:** Quit to Main Menu – Warning Message
	Version: 1. **Creator/Updater:** Christian Bentley. **Last updated:** 18/11/2021.
User Story: As a player I want to receive a message warning me that my current level progress will be lost if I quit to the Main Menu without saving so that I do not accidentally lose my level progress. **ID:** US22	
UC22 -1	**Control Flow:** • The player selects "Quit to Main Menu" from the Mid-Level Menu. *Alternative Path #1 – No progress since last save* • Proceed with UC10 (Quit to Main Menu) – the Main Menu is opened and the current level progress is closed and not saved. *Alternative Path #2 – Player has "progressed" since last save* • Display a warning message that any unsaved progress will be lost and listing two options – proceed to Main Menu and return to the Mid-Level Menu. • If the player selects proceed to Main Menu, proceed with UC10 (Quit to Main Menu) – the Main Menu is opened and the current level progress is closed and not saved. • If the player selects return to Mid-Level Menu, return to Mid-Level Menu. "Progress" for the purpose of this use case may be the player clicking on a tile or answering a question. Upon saving a game, a "saved" status may be turned on, which is then turned off when the player next makes such progress.
UC22-2	**Actors:** Player.
UC22-3	**Pre-Condition:** • The player selects "Quit to Main Menu" from the Mid-Level Menu. • The player has (or has not) made progress since the last game save.
UC22-4	**Post-Condition:** None.
UC22-5	**Connected Use Cases:**

	UC1 (Main Menu), UC9 (Game saves), UC10 (Quit to Main Menu)

UC23	**Use Case:** No Carrot Revealed
	Version: 1. **Creator/Updater:** Christian Bentley. **Last updated:** 18/11/2021.
User Story: As a player I want to receive a notification that there was no carrot underneath the revealed tile so that I can track my level progress. **ID:** US23	
UC23-1	**Control Flow:** • The player answers a question correctly but there was no carrot allocated to the selected tile. • The tile disappears (or turns grey) and no carrot is shown on screen. • A speech bubble appears from Steve with the text "Unlucky, there are no vegetables behind that tile – let's try another one!".
UC23-2	**Actors:** Player.
UC23-3	**Pre-Condition:** • The player has answered a question correctly. • No carrot is allocated to the selected tile.
UC23-4	**Post-Condition:** None.
UC23-5	**Connected Use Cases:** UC13 (Question Pop-up), UC14 (Correct Answer), UC15 (Carrot Revealed), UC11/17 (Positioning and Movement of Carrots).

UC24	**Use Case:** Network streaming for question data
	Version: 1. **Creator/Updater:** Oscar Gee. **Last updated:** 27/11/2021.
User Story: As a player I want my question data to be stored and retrieved from an online location and used in the questions that pop up in game. **ID:** US24	
UC24-1	**Control Flow:** • A tile is selected during a game level. • Unity's HTTPWebRequest function calls a RESTful API. • API Key is accepted from API Server (127.0.0.1 LOCALHOST) and question and answer data is streamed from JSON File/Database to Question() within Unity. • QuestionPopUp() takes the data streamed and implements the downloaded question and answer into the question pop up.
UC24-2	**Actors:** Player.
UC24-3	**Pre-Condition:** • The player clicks on a tile. • Question and answer data is contained in the "online" source.
UC24-4	**Post-Condition:** The player either gets the answer correct or incorrect and this is reflected in the UI.

UC24-5	**Connected Use Cases:** UC12 (Highlight Square) UC13 (Question Pop-up)

UC25	**Use Case:** Saving Scores
	Version: 1. **Creator/Updater:** Aimee Dowell. **Last updated:** 26/11/2021.
User Story: As a player, I want my score to be saved once I quit the game so that I can continue my progress and my score isn't lost when I re-open the game. **ID:** US25	
UC25 -1	**Control Flow:** • The Save button is been selected from either the Main Menu or the Mid-Level Menu. • The player score is written to a corresponding JSON file within the game project files.
UC25-2	**Actors:** Player.
UC25-3	**Pre-Condition:** The player has pressed a Save button.
UC25-4	**Post-Condition:** The current score of the player is collected and written to a JSON file.
UC25-5	**Connected Use Cases:** UC9 (Save Button), UC1/7 (Main Menu and Mid-Level Menu), UC5 (Load Game)

UC27	**Use Case:** 5x5 Grid Level
	Version: 1. **Creator/Updater:** Jaafar Ghaddar. **Last updated:** 27/11/2021.
User Story: As a player, I want a level with a 5x5 grid so that the game can progress and become more difficult. **ID:** US27	
UC27-1	**Control Flow:** Alternative path #1 • Player presses "Continue" after completing the 3x3 level. (UC28) • The 5x5 grid level is loaded. Alternative path #2 • Player loads the game after having saved a game where he completed the 3x3 level. • The 5x5 grid level is loaded.
UC27-2	**Actors:** Player
UC27-3	**Pre-Condition:** Alternative path #1 Player completes the 3x3 level and presses the "Continue" button in the Level Complete pop-up (US28). Alternative path #2

	Player saves the game (US9) after completing the 3x3 level and then loads it again. (US5)
UC27-4	**Post-Condition:** Alternative path #1 The 5x5 game level starts. Alternative path #2 The 5x5 level picks up from where the player left off.
UC27-5	**Connected Use Cases:** UC5 (Load game), UC9 (Save game), UC8 (Level Complete Buttons).

UC28	**Use Case:** End of Level Buttons.
	Version: 1. **Creator/Updater:** Oscar Gee. **Last updated:** 27/11/2021.
User Story: As a player I want to be able to either continue on to the next level after completing the level or return back to the main menu. **ID:** US28	
UC28-1	**Control Flow:** • All Carrots have been found/all tiles revealed. • The Level Complete pop-up appears. • "Continue" and "Return to Main Menu" buttons are added to the bottom of the Level Complete pop up. • Pressing on "Continue" changes the scene to "5x5Level" and continues the game. • Pressing on "Return to Main Menu" changes the scene to "MainMenu".
UC28-2	**Actors:** Player.
UC28-3	**Pre-Condition:** The player has completed the level.
UC28-4	**Post-Condition:** Player must be able to either: continue to the next level (on "Continue") or return to the Main Menu (on "Return to Main Menu").
UC28-5	**Connected Use Cases:** UC1 (Main Menu interface), UC19/20 (Level Completed/Failed), UC27 (5x5 grid)

UC29	**Use Case:** Barry the Banana
	Version: 1. **Creator/Updater:** Aimee Dowell. **Last updated:** 26/11/2021.
User Story: As a player, I want a fruit helper, Barry the Banana, within my game level, so that I can push vegetables back a place and increase my chances of winning. **ID:** US29	
UC29 -1	**Control Flow:** If a tile is revealed and it contains Barry the Banana, he is revealed, and the remaining vegetables are pushed backwards by one square.
UC29-2	**Actors:** Player.
UC29-3	**Pre-Condition:** A tile has been selected and a question is answered correctly.

UC29-4	**Post-Condition:** Barry is revealed and the remaining vegetables are pushed backwards by one square as long as they are greater than 1 square from the edge of the board.
UC29-5	**Connected Use Cases:** UC11/17 (Positioning and Movement of Carrots)

UC30	**Use Case:** Boris the Broccoli
	Version: 1. **Creator/Updater:** Aimee Dowell. **Last updated:** 03/12/2021.
User Story: As a player, I want broccoli vegetables, Boris, which move towards Steve the Strawberry diagonally, within my game level, so that I can add an extra level of challenge and make the game more exciting. **ID:** US30	
UC30-1	**Control Flow:** If the tile does not reveal a broccoli, then the broccoli will move towards the strawberry diagonally. If the broccoli is revealed the number of broccolis in the level reduces by one. If a banana is revealed, the broccoli will be pushed backwards.
UC30-2	**Actors:** Player.
UC30-3	**Pre-Condition:** • The broccoli has been positioned randomly at the start of the level, at least 2 positions from Steve the Strawberry and it does not occupy the same tile as other fruit and vegetables. • A question has been answered correctly.
UC30-4	**Post-Condition:** Alternative Path #1: • If the tile is revealed but there is no vegetable underneath, the broccoli moves one place diagonally towards the strawberry. Alternative Path #2: • If the tile is revealed and it contains Boris the Broccoli, he is revealed, and the remaining broccoli vegetables is reduced by one. Alternative Path #3: • If a tile is revealed but there is no vegetable underneath, and the broccoli moves one place diagonally landing on the strawberry, the level is failed. Alternative Path #4: • If a tile is revealed but there is a banana underneath, the broccoli moves backwards one place (unless it is on the edge of the grid, in which case it does not move).
UC30-5	**Connected Use Cases:** UC11/17 (Positioning and Movement of Carrots, UC20 (Level Failure)

UC31	**Use Case:** Winnie The Watermelon
	Version: 1. **Creator/Updater:** Aimee Dowell. **Last updated:** 10/12/2021.

User Story: As a player, I want Winnie the Watermelon to remove a vegetable when I have selected 4 empty tiles in a row, so that I won't get bored and quit the game. **ID:** US31	
UC31-1	**Control Flow:** • The player selects 3 tiles in a row which are empty. • If the 4th tile selected is empty, Winnie the Watermelon is revealed. • One vegetable is revealed, removing the tile hiding it. • The number of vegetables remaining is reduced.
UC31-2	**Actors:** Player.
UC31-3	**Pre-Condition:** • The player has selected 3 tiles in a row, which been revealed as empty. • The player has selected a 4th tile and answered the question correctly. • The 4th tile is also empty.
UC31-4	**Post-Condition:** The number of vegetables remaining in the UI is reduced by 1, corresponding to the revealed vegetable.
UC31-5	**Connected Use Cases:** UC11/17 (Positioning and Movement of Carrots), UC12 (Tile Highlighted), UC15 (Carrots Revealed), UC23 (No Carrot Revealed)

UC32	**Use Case:** 7x3 Grid Level
	Version: 1. **Creator/Updater:** Christian Bentley. **Last updated:** 10/12/2021.
User Story: As a player, I want a level with a 7x3 grid so that the game can progress and become more difficult. **ID:** US32	
UC32-1	**Control Flow:** <u>Alternative path #1</u> • Player presses "Continue" after completing the 5x5 level. • The 7x3 grid level is loaded. <u>Alternative path #2</u> • Player loads the game after having saved a game where he completed the 5x5 level. • The 7x3 grid level is loaded.
UC32-2	**Actors:** Player
UC32-3	**Pre-Condition:** <u>Alternative path #1</u> • Player completes the 5x5 level and presses the "Continue" button in the Level Complete pop-up (US28). <u>Alternative path #2</u> • Player saves the game (US9) after completing the 5x5 level and then loads it again. (US5)
UC32-4	**Post-Condition:** <u>Alternative path #1</u> • The 5x5 game level starts.

	Alternative path #2 • The 5x5 level picks up from where the player left off.
UC32-5	**Connected Use Cases:** UC5 (Load game), UC9 (Save game), UC8 (Level Complete Buttons).

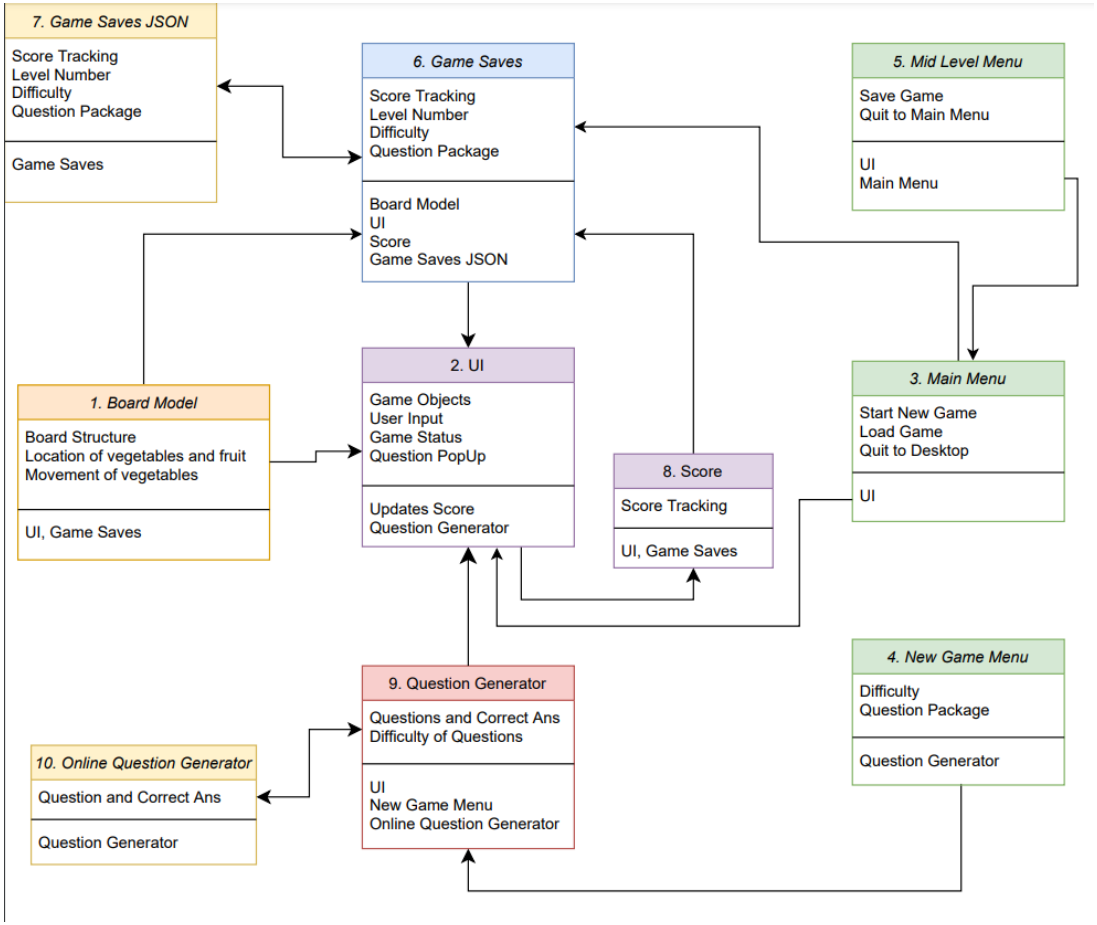
CRC CARDS: MASTER DOCUMENTATION

CRC.1

Version: 1.

Date: 25 November 2021.

Document created/last updated by: Aimee Dowell, working with all team members.



ACCEPTANCE TESTING: MASTER DOCUMENTATION

ATM.5

Version: 5.

Date: 14/12/2021.

Document created/last updated by: Abel Tom Varghese, working with all team members.

ID	Vers	User Story	Acceptance Tests	Developer/ Pair	Tester	Date	Comments
AT1	2	US1	1. Upon the player loading up the game, the Main Menu is opened. 2. After the player clicks on "Quit to Main Menu" from the Mid-Level Menu (and any warning message is accepted – see US22), the Main Menu is opened.	Aimee	Christian	07/12/2021	Tests #1 and 2 passed.
AT2	1	US2	Every time the puzzle type button is clicked from the Main Menu, or a level from the selected puzzle type has been completed (win or lose), the start button should appear, programmed for the next level (win), or the same level (lose/current).	Christian and Aimee	Abel	16/11/2021	Test passed in relation to the Main Menu start game button. A further intermediary menu may be required to implement US3/4 (Difficulties and Question Packages).
AT3	-	US3	The question category chosen by the user should be implemented within the question mechanics and remain the same throughout the game. The category options should be clickable as a tick-box or drop-down sub-menu of Main Menu.	-	-	-	Not implemented.
AT4	-	US4	The difficulty level chosen by the player should be implemented in the question mechanics and remain same for the entire game. The difficulty options should be clickable as a tick-box or drop-down sub-menu of Main Menu.	-	-	-	Not implemented.

ID	Vers	User Story	Acceptance Tests	Developer/ Pair	Tester	Date	Comments
AT5	1	US5	1. There should be a “Load Game” button above the grid/board. 2. Once the button is clicked, the board should be updated with the contents of the previous game. 3. The score should be updated 4. The player should be informed that the game has been loaded successfully 5. The player should be prompted to make a move.	Vishnu and Aimee	Abel	14/12/2021	Tests 1 and 3 passed. After further team discussion, tests 4 and 5 were not considered necessary for user-friendliness. Further development is required to save and update the status of the board – test 2.
AT6	1	US6	When the “Quit to Desktop” button is clicked. The game should ask the player “Are you sure you want to quit?” and, if accepted, then the game application should close.	Christian	Aimee	16/11/2021	Test passed, save that no warning message appears. After discussion, this feature was not regarded as necessary and will not be implemented.
AT7	1	US7	After pressing the escape button during a game level, the Mid-Level Menu must open.	Jaafar	Justin	07/12/2021	Test passed. Following discussion within the team, this requirement was changed from “on pressing the escape button” to “on pressing an on-screen button”, for additional user-friendliness.
AT8	1	US8	Once the player clicks the resume game button in the in-game menu the game should resume where it was left off.	Jaafar	Justin	07/12/2021	Test passed.
AT9	1	US9	1. There should be a “Save Game” button above the grid/board. 2. Once the button is clicked, the game should save the contents of the board and the current score.	Vishnu and Justin	Aimee	14/12/2021	Test 4 passed and tests 1 and 2 partially passed. The “Save Game” button was instead implemented through the Mid-Level Menu, following

ID	Vers	User Story	Acceptance Tests	Developer/ Pair	Tester	Date	Comments
			3. The user should be prompted that either the game was successfully or unsuccessfully saved. 4. The user then has the option to carry on playing the game.				discussion at the iteration planning meeting. As noted in AT5.1, further development is required to save the status of the board. Following discussions within the team, tests 3 was not considered necessary for user friendliness.
AT10	1	US10	1. "Quit to Main Menu" is an option in the Mid-Level Menu. 2. If the user selects this option, the Main Menu is opened and the current game is ended.	Justin	Christian	07/12/2021	Tests passed.
AT11	1	US11	The carrots & strawberry should be randomly positioned on the board so that all carrots would require two or more moves to reach the strawberry.	Abel and Rohith	Christian	16/11/2021	Test passed.
AT12	1	US12	Every time a square is clicked (provided there is no current pop-up, such as a question, or an animation showing what is underneath a selected square) the clicked square should be clearly highlighted.	Christian and Aimee	Abel	16/11/2021	Test passed.
AT13	1	US13	Once a tile has been clicked on by the player, a question must pop-up.	Aimee, Rohith & Abel	Christian	23/11/2021	Test passed.
AT14	2	US14	When a question is answered correctly, the question pop-up visually confirms that the answer was correct.	Justin and Vishnu	Aimee	14/12/2021	Test passed, save that for irrational decimal answers there is no rounding for the correct answer. Further

ID	Vers	User Story	Acceptance Tests	Developer/ Pair	Tester	Date	Comments
							development required to correct this bug – can currently be circumvented by requesting new questions.
AT15	1	US15	1. When a question is answered correctly, if a carrot is on the selected tile, then the carrot is revealed. 2. However, if a carrot is not on the selected tile, then the carrot is not revealed.	Oscar and Abel	Aimee	16/11/2021	Tests passed.
AT16	1	US16	1. When a player gives an incorrect answer to a question, there should be a pop-up informing the user that his/her answer to the question is incorrect. 2. The pop-up should enable the player to retry the question or to try a different question.	Jaafar and Oscar	Aimee	23/11/2021	Tests passed.
AT17	1	US17	Every time the player answers a question correctly the carrot moves randomly in the board.	Rohith	Aimee	30/11/2021	Test passed.
AT18	1	US18	When a user is playing a game level, is not answering a question and after a short period of inactivity, a message is displayed instructing the player to select the next tile.	Aimee	Rohith	07/12/2021	Test passed.
AT19	1	US19	If all the vegetables have been found before they reach the strawberry, the level is deemed complete and should return the main menu where the player can either save and quit the game or continue to the next level.	Aimee and Jaafar	Christian	07/12/2021	Test passed.
AT20	1	US20	Pop up to occur when vegetable reaches Strawberry. Pop up will contain buttons “Return to Main menu” and “Restart Level”.	Vishnu	Oscar	07/12/2021	Test passed.

ID	Vers	User Story	Acceptance Tests	Developer/ Pair	Tester	Date	Comments
AT21	1	US21	Once a correct answer has been made the points go up. If the attempt was right on the first try the player receives 100 points, if it was his second attempt: 50, third: 25, etc…	Rohith, Abel & Aimee	Christian	23/11/2021	Test passed.
AT22	1	US22	1. If the user has progressed since the last save and "Quit to Main Menu" is selected, a warning message is displayed with two options – proceed to Main Menu and return to the Mid-Level Menu. 2. If the user selects to proceed to the Main Menu from the warning message, or if they select "Quit to Main Menu" in the Mid-Level Menu and they have not progressed since the last save, US10 is continued (the Main Menu is opened and current level progress is not saved). 3. If the user selects to return to the Mid-Level Menu, they are returned to the Mid-Level Menu.	Aimee	Christian	14/12/2021	Tests passed, save that the warning message is always displayed, rather than only being displayed if the user has progressed since their last save. Following discussions within the team, this requirement was not considered necessary for additional user-friendliness.
AT23	1	US23	When a question is answered correctly, the tile is revealed (US14) and the tile disappears. If there is no carrot on that tile, then a message from Steve should appear stating "Unlucky, there are no vegetables behind that tile – let's try another one!".	Vishnu and Justin	Christian	07/12/2021	Test passed.
AT24	-	US24	Questions that pop up throughout the game should have their question data populated directly from the "online" database and streamed either: • prior to the game loading; or • on "highlight square".	-	-	-	Not implemented.

ID	Vers	User Story	Acceptance Tests	Developer/ Pair	Tester	Date	Comments
AT25	1	US25	Every time the save button is clicked from either the Main Menu or Mid-Level Menu, the new score data should be written to a corresponding JSON file within the game project files.	Vishnu	Aimee	14/12/2021	Test passed.
AT26	1	US26	All methods should have 1 or more corresponding unit test which examine how the method performs for a given input. Additionally, all unit tests must pass before new functionality is added to the game.	Abel	Christian	07/12/2021	Tests passed.
AT27	1	US27	When a player completes the first level (3x3) they can progress to the 5x5 grid and continue playing through the end of level pop-up.	Jaafar	Aimee	30/11/2021	Test passed.
AT28	1	US28	The player must be able to either continue or return to main menu. This allows the 5x5 scene to be reachable in game. Must be separate buttons.	Oscar	Justin	30/11/2021	Tests passed.
AT29	1	US29	Every time a banana is revealed underneath a selected tile, the remaining vegetables will be moved backwards by one square to their previous tile.	Aimee	Oscar	07/12/2021	Test passed.
AT30	2	US30	1. There should be a fixed number of broccolis for each level. 2. All broccolis must start at a minimum of more than two steps away from Steve the Strawberry. 3. The broccolis must move diagonally. 4. If a broccoli is revealed, the number of broccolis remaining must reduce by 1.	Aimee and Rohith	Abel	14/12/2021	Tests passed.
AT31	1	US31	1. Every time that 3 consecutive tiles selected by the user are revealed to be empty,	Aimee	Christian	14/12/2021	Tests passed.

ID	Vers	User Story	Acceptance Tests	Developer/ Pair	Tester	Date	Comments
			underneath the 4th tile Winnie should appear. 2. One random vegetable should be removed, revealing its position on the board and removing the tile hiding it. 3. The number of vegetables remaining should be reduced.				
AT32	1	US32	When a player completes the second level (5x5) they can progress to the 7x3 grid and continue playing through the end of level pop-up.	Aimee	Christian	14/12/2021	Test passed.

Date: 17/12/2021.

Created/Last updated by: Aimee Dowell.

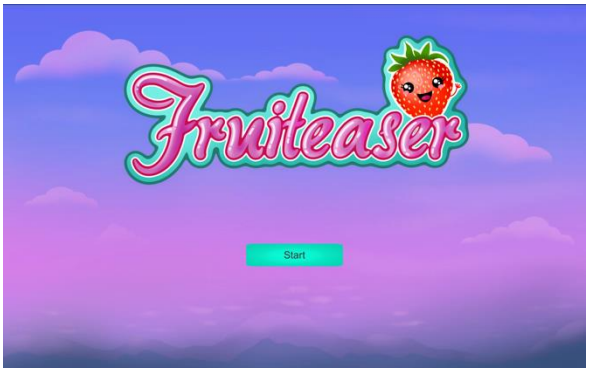
SPRINT 2

This sprint, the main bulk of the artwork required to create a simple 3x3 prototype level was made. All artwork in the game was designed and created by Aimee Dowell using an iPad Pro, Apple Pencil, and Procreate.

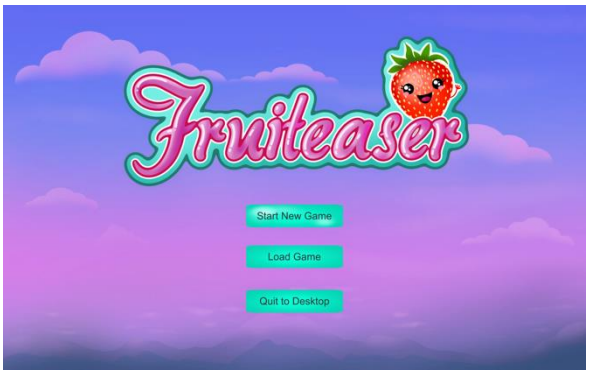
The following assets were created this sprint and added to the game in a new folder labelled 'UI', added to the assets folder of the project:

- Steve the Strawberry (variations of expressions)
- Cruella the Carrot
- Game backdrop
- Game logo
- Button design
- Square tiles (various colours)
- Highlighted tile outline
- Level Complete popup

We agreed an opening scene and main menu were key to give the user control over how the game starts, showing the logo so the user is immediately aware of the game they have opened. Although only the 'Start New Game' button was developed this week, we felt it important to shape the future paths of starting a game for the user, specifically, do they want to load their previous game data or start afresh. A way to exit the application was also needed for user friendliness.

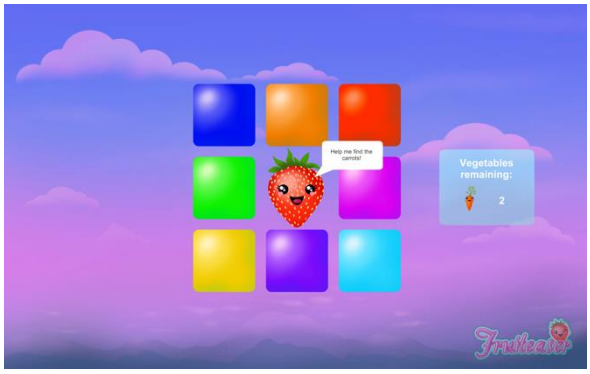


Opening scene shown when the game is first opened by the user.

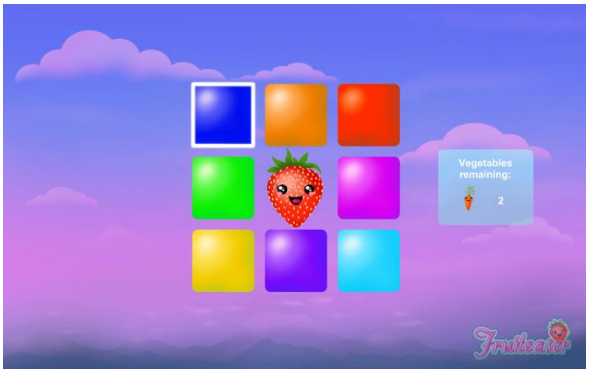


Main Menu of the game, allowing the user to start a new game, quit the application (developed this sprint), and load a previous game (in place for future development)

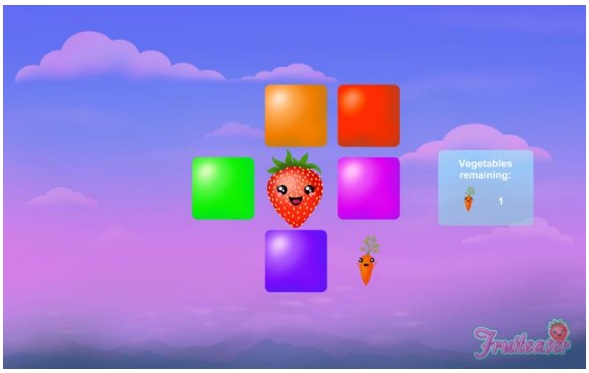
Once a new game is started, the prototype 3x3 level should appear, clearly showing the grid in a fun and visually exciting manner. Steve will inform the user of their task via a speech bubble which, for this level, is to find the carrots. Adding the 'Vegetables remaining' box allows the user immediate awareness of the aim of the game and how many and which type of vegetables they need to find for success. If a tile is empty, it is removed from the board so the user cannot click on it twice. If a vegetable is underneath, the tile will be removed, and a sprite will appear of the vegetable they caught. Once all the vegetables are found, a level complete popup is shown so the user is aware of the game status and cannot click any further tiles.



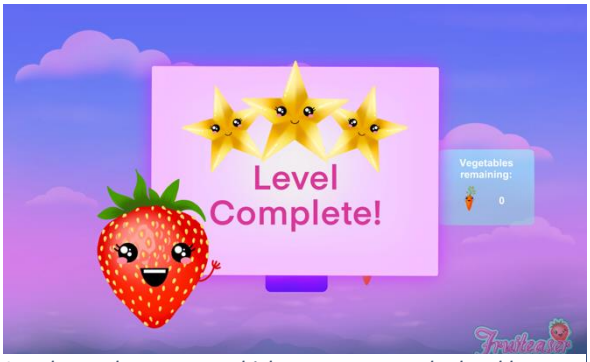
Start of the 3x3 board level, showing the user the tiles, and how many vegetables are remaining in the game.



The highlight sprite being activated one the user has selected a tile they wish to uncover.



Mid game screenshot of the 3x3 board, showing empty tiles and one found vegetable.



Level complete popup which appears once the level has been completed, i.e., all the vegetables have been found.

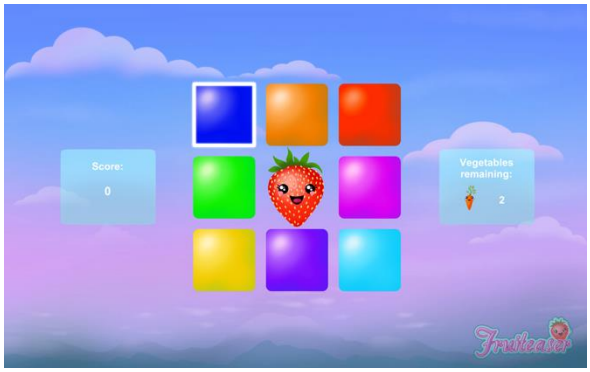
SPRINT 3

For this sprint, further development of the 3x3 level was implemented. For the user interface, the assets developed this week by Aimee were as follows:

- Question popup
- Incorrect answer pop up background
- Redesign of menu buttons
- Redesign level complete pop-up graphic
- Game build/executable application icon
- Change background hue

Opening scene and main menu, showing redesigned button graphics

The main development task for this week, in terms of the user interface, was implementing the question popup. Once a user has selected a tile they wish to uncover, they must first answer a question correctly to reveal what lies underneath. Adding individual child elements to one 'QuestionPopUp' game object allowed for easy hiding and revealing of the question, and sorting layers were utilised in order to prioritise the popup over the other game elements, like the tiles. It was decided if the user incorrectly answers a question, they may keep trying to guess the answer, or they may keep requesting new questions until one is answered correctly.



Level 1, showing a user selecting a dark blue tile which they wish to uncover.

The question popup is shown which a fresh generated question and an InputField allowing the user to type in their answer.

User incorrectly answering the question, being given the option to retry the same question, or generate a new one.

The other main development task was incorporating a scoring mechanism, based on the number of attempts it took the user to answer a question correctly. For the user to be able to track their success, a UI element was created to constantly show the game score and is updated every time they answer a question.

Score tracking UI element of the game updating based upon the user's success of question answering.

Updated level complete popup, with a new background, outline, and text overlayed upon a banner.

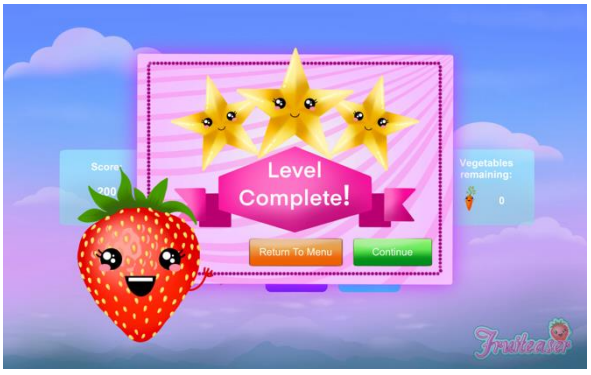
Application icon of the game, showing the main character, Steve the Strawberry, and his fruit helper friends. The background is fun and bright reflecting the target audience and style of the game.

SPRINT 4

During this sprint, the question popups were updated to show a green or red ring around the input field object appearing when the question is answered, correctly (green) or incorrectly (red). We felt incorporating this visual indicator would reduce cognitive load, reducing the need for reading text to find out the results of their input. Green has positive connotations of success, used throughout many games, classically displayed as a green tick, and red has more negative connotations, classically displayed as a red X.

Example question popup scenarios from the game where a user has answered a question correctly (left), and incorrectly (right). The green and red rings show immediate status of the input.

The main development task this week was adding a new level to the game. For the user to navigate to this new level, once the level 1 complete popup is shown, buttons appear giving the user the option to continue the game (progress to the next level) or return to the main menu, allowing them to either quit the game, or start afresh.



End of level buttons shown when Level 1 has been completing by the user, allowing them to continue to the next level, or return to the main menu.

The new 5x5 level is shown below, it features the same scoring mechanism and vegetables remaining UI, with the score continuing from Level 1. Once this level is complete, the Level Complete UI shows without the buttons to signal the game has ended and there are no more levels, this can be changed in later sprints if a new level is added.

Start of the 5x5 Level after the player has completed Level 1.

Level Complete popup shown once the player has successfully completed Level 2.

SPRINT 5

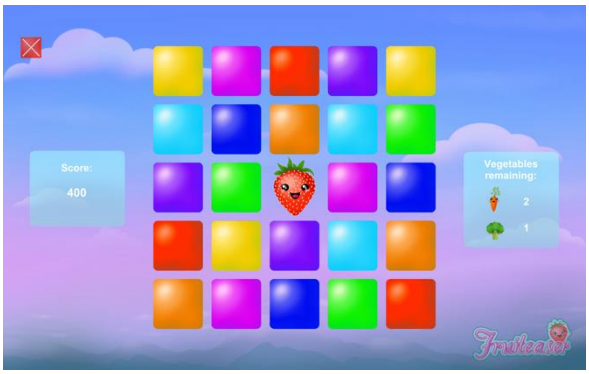
For this sprint, further development of the 5x5 level was implemented as well as an exit button with a mid-level menu for all levels. For the user interface, the assets developed this week by Aimee were as follows:

- Level failure popup
- Mid-Level Menu popup
- Exit button
- Barry the Banana
- Boris the Broccoli

Firstly, the Steve interactions with the user were increased, showing a message after each tile selection relating to the current game status. E.g., if the player has revealed an empty square Steve may warn the player that the vegetables are getting closer. This allows real time commentary of the game, making the user aware of the game status. Each bubble message fades after 1 second to avoid visual clutter.

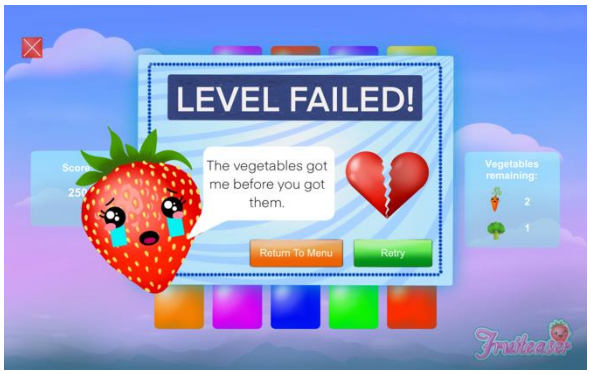
Boris the Broccoli was added as an alternate type of vegetable which moves diagonally. This was added to the 5x5 level to make it more challenging for the user. If either of the vegetables reach Steve the Strawberry, the game has failed. To portray this to the user, a Level Failed popup appears. As this level can be failed, as well as being able to return to the main menu, we decided to include a 'Retry' button, allowing the user to retry the level, resetting the tiles, vegetables and setting score to its initial value when this level was started.

To make the game more exciting, and easier to complete, Barry the Banana was created and added to the game. Once found, he pushes the vegetables back by one tile.



Start of Level 2, showing the inclusion of a Boris the Broccoli into the game.

Barry the Banana - as one vegetable has already been discovered, only vegetables available to catch get pushed back one place.



Level Failed popup which allows the player to return to the main menu or retry the level.

When the player is mid-level, there was previously no option to quit to the main menu or pause the game. To allow the user to quit before a level is over, an exit button was added to each level. If this is selected a mid-level menu appears, as seen in the image below, enabling the user to resume the game, retry the level (they may not be happy with their current progress), or return to the main menu. When returning to the main menu, currently their progress will not be saved. Further development could allow a warning menu allowing the player to save progress or quit without saving.

Mid Level Menu which appears once a user has selected the exit button (seen in the top left), allowing them to resume, retry the level, or quit back to the Main Menu.

SPRINT 6

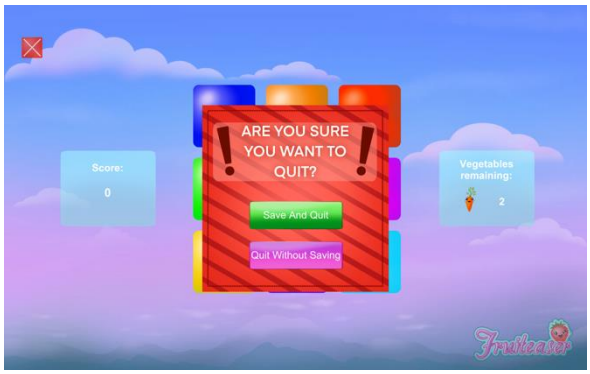
This sprint saw the development of a quit to the main menu warning with progress saving, a new 7x3 level and the implementation of Winnie the Watermelon.

For the user interface, the assets developed this week by Aimee were as follows:

- Redesigned Mid-Level Menu background
- Winnie the Watermelon

As the previous Mid-Level Menu was labelled ‘Are you sure you want to quit?’, it was decided this would better fit as a warning UI once the player had selected the ‘Return to menu’ button from the Mid-Level Menu. It allows the user to save their progress (score and level number) using the ‘Save and Quit’ button or lose their progress using the ‘Quit without Saving button’. This gives the user control over which level progress is saved. Due to this reuse of the previous Mid-Level menu sprite, a new mid-level menu sprite was created to better suit the application, labelled ‘Game paused’.

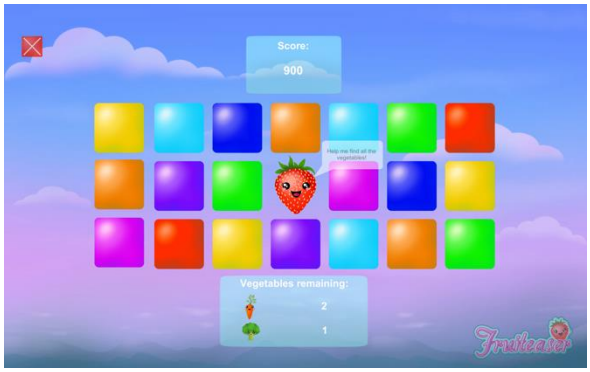
New Mid-Level Menu sprite with buttons, showing once the user clicks the exit button (top left corner).



Quit to Main Menu warning pop up, shown once 'Return to Menu' is selected from the Mid-Level Menu, allowing the user to save their current progress or lose their changes.

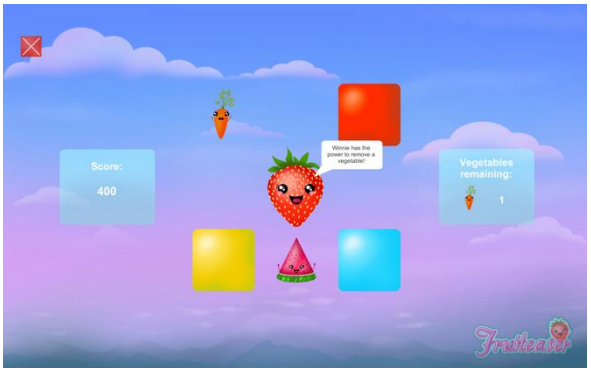
As a new level has been developed, once Level 2 is completed, a continue and return to menu button was added to enable the user to continue to the next (new) level. Once Level 3 is completed the only option for the user will be to return to the main menu as this is the last level. For Level 3, the score tracker and vegetable remaining UI were repositioned to reduce horizontal visual clutter and make them easier to view.

Level Complete popup once Level 2 is completed, showing a return to menu button and continue button.



New Level 3 with a 7x3 board.

To reduce failure of levels and keep the user interested in the game, Winnie the Watermelon was introduced. If the player selects four empty tiles in a row, Winnie will appear and find and reveal the location of one vegetable in the game, helping the user to successfully complete the level.



Winnie the Watermelon appearing in Level 1, as the user has selected four empty tiles. Winnie has revealed the location of a carrot.