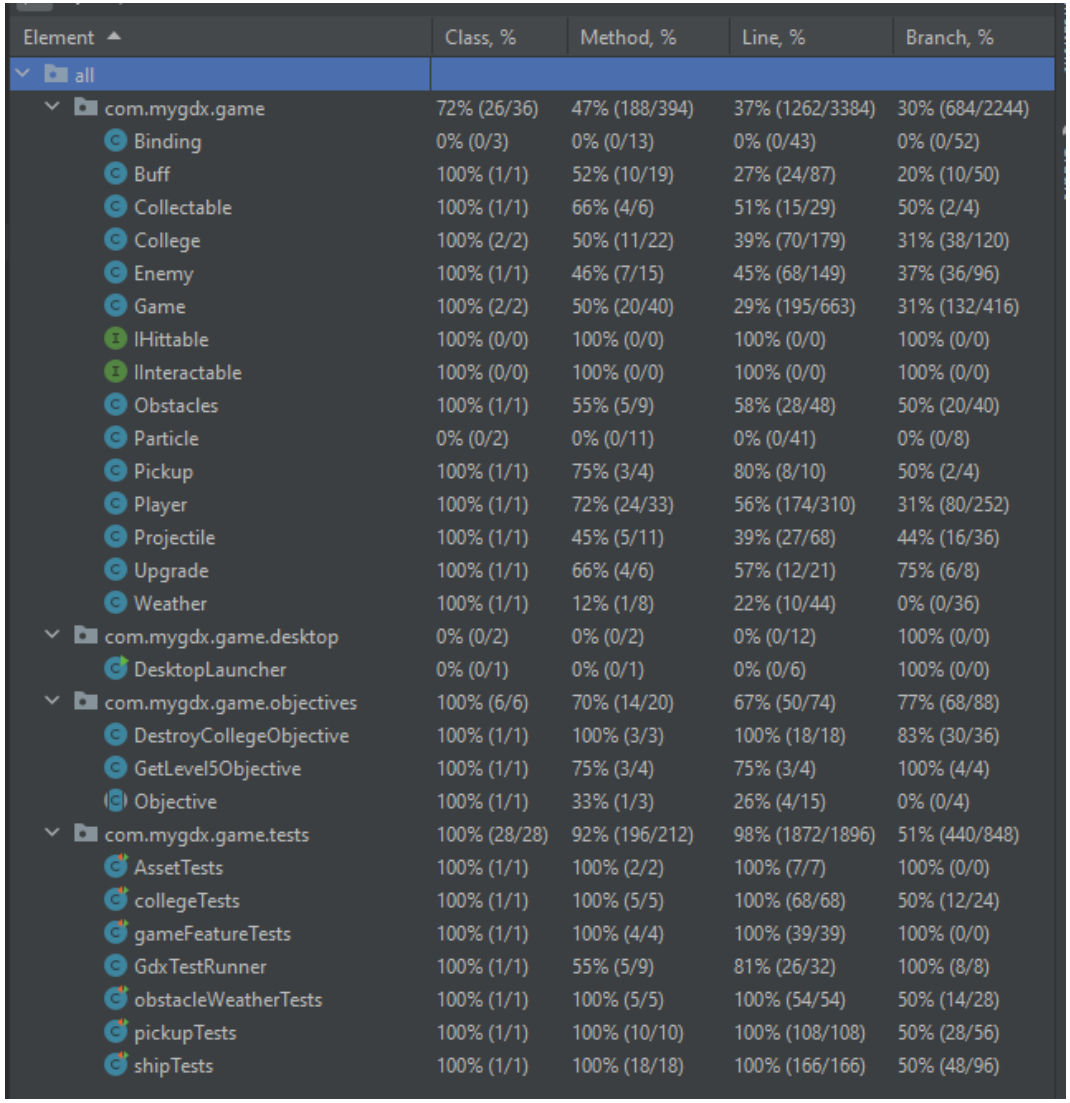
Automated Tests

We set out to test the complex logic of our code against the requirements elicited in the requirements table. Simple getters and setters were not tested. These tests were conducted using JUnit testing. We ensured every test passed before making the final merge with the main git branch.



Element	Class, %	Method, %	Line, %	Branch, %
all				
com.mygdx.game	72% (26/36)	47% (188/394)	37% (1262/3384)	30% (684/2244)
Binding	0% (0/3)	0% (0/13)	0% (0/43)	0% (0/52)
Buff	100% (1/1)	52% (10/19)	27% (24/87)	20% (10/50)
Collectable	100% (1/1)	66% (4/6)	51% (15/29)	50% (2/4)
College	100% (2/2)	50% (11/22)	39% (70/179)	31% (38/120)
Enemy	100% (1/1)	46% (7/15)	45% (68/149)	37% (36/96)
Game	100% (2/2)	50% (20/40)	29% (195/663)	31% (132/416)
IHittable	100% (0/0)	100% (0/0)	100% (0/0)	100% (0/0)
IInteractable	100% (0/0)	100% (0/0)	100% (0/0)	100% (0/0)
Obstacles	100% (1/1)	55% (5/9)	58% (28/48)	50% (20/40)
Particle	0% (0/2)	0% (0/11)	0% (0/41)	0% (0/8)
Pickup	100% (1/1)	75% (3/4)	80% (8/10)	50% (2/4)
Player	100% (1/1)	72% (24/33)	56% (174/310)	31% (80/252)
Projectile	100% (1/1)	45% (5/11)	39% (27/68)	44% (16/36)
Upgrade	100% (1/1)	66% (4/6)	57% (12/21)	75% (6/8)
Weather	100% (1/1)	12% (1/8)	22% (10/44)	0% (0/36)
com.mygdx.game.desktop	0% (0/2)	0% (0/2)	0% (0/12)	100% (0/0)
DesktopLauncher	0% (0/1)	0% (0/1)	0% (0/6)	100% (0/0)
com.mygdx.game.objectives	100% (6/6)	70% (14/20)	67% (50/74)	77% (68/88)
DestroyCollegeObjective	100% (1/1)	100% (3/3)	100% (18/18)	83% (30/36)
GetLevel5Objective	100% (1/1)	75% (3/4)	75% (3/4)	100% (4/4)
Objective	100% (1/1)	33% (1/3)	26% (4/15)	0% (0/4)
com.mygdx.game.tests	100% (28/28)	92% (196/212)	98% (1872/1896)	51% (440/848)
AssetTests	100% (1/1)	100% (2/2)	100% (7/7)	100% (0/0)
collegeTests	100% (1/1)	100% (5/5)	100% (68/68)	50% (12/24)
gameFeatureTests	100% (1/1)	100% (4/4)	100% (39/39)	100% (0/0)
GdxTestRunner	100% (1/1)	55% (5/9)	81% (26/32)	100% (8/8)
obstacleWeatherTests	100% (1/1)	100% (5/5)	100% (54/54)	50% (14/28)
pickupTests	100% (1/1)	100% (10/10)	100% (108/108)	50% (28/56)
shipTests	100% (1/1)	100% (18/18)	100% (166/166)	50% (48/96)

This image shows the code coverage report generated by IntelliJ. This report shows that our tests provide a good class coverage but a relatively poor method, line and branch coverage. However this is to be expected due to the use of LibGDX. The LibGDX functionality cannot be tested using JUnit tests and with this making up a significant portion of the overall code, the code coverage percentage is reduced.

The code for these tests can be found in our git repository under core/tests/src/**Tests.java.**

Manual Tests

Manual tests were conducted to test the parts that JUnit could not. Manual tests also ensure that the logic tested in the automated tests translates correctly to gameplay.

For Manual tests see bottom of document

See Functional requirements for most of the automated tests

Requirements and Tests

The following is a variation of our non-functional requirements tables with notes stating whether they have been satisfied and if any of our manual or automatic tests relate to them.

Non-Functional					
ID	**Description**	**Requirement Type**	**Priority**	**Env. ID**	**Notes**
NF_Audience	Target the demographic of the open day.	User	Medium	E_Demographic	Does meet demographic
NF_Timing	Game should be 5-10m long	System	Medium	E_OpenDay	Cannot be sure, we are very experienced with the game.
NF_Difficulty	Difficulty shouldn't be too challenging	User	Medium	E_OpenDay	Difficulty settings account for this

NF_Players	Single player	User	High	N/A	Is single player
NF_Map	Map is user friendly / easy to navigate	User	Medium	E_OpenDay	Map was designed to be straightforward.
NF_Colour	Accommodate for colour-blindness	User	High	E_Disability	Colours are not important to distinguish icons or objectives. Should be colour-blind friendly.
NF_Seizure	Ensure seizure-friendliness	User	Med	E_Disability	No flashing images and no sound should ensure seizure-friendliness.
NF_scale	Graphics need to support between a 13” and 27” monitor whilst looking good proportionally to resolution	User	High	E_System	Game scales and looks good at different screen sizes.
NF_Reliable	Game needs to run reliably, accounting for problems such as memory leak.	User	High	E_System	See manual test for F_Restart_Consisitent
NF_Win	Game needs to be able to finish and restart with no transition screen	System	High	E_OpenDay	See manual tests

NF_Help	User needs to learn controls in such a way that doesn't open a separate menu	User	High	E_Demographic E_OpenDay	Controls displayed on game start.
NF_Stats	Can see stats of the ship on-screen	User	Low	E_OpenDay	See manual test for F_Powers.

The following is a variation of our functional requirements tables with notes stating whether they have been satisfied and if any of our manual or automatic tests relate to them. Some requirements may be tested by both manual and automated tests, and are signalled as such with a A + M in the final column.

Where a requirement has a relevant automated test, their tests and original test document are listed in the “Tested in” column.
The code for these tests can be found in our git repository under core/tests/src/**Tests.java.**

Functional					
ID	**Description**	**Requirement Type**	**Priority**	**Tested in**	**Automated or manually tested**
F_Restart_Capable	Restart the game to the start on “tab”	User	High		M
F_Restart_Consisitent	Reset state and ensure no memory leak on restart or close	System	High		M
F_WASD	“Wasd” moves the ship in the 4 cardinal directions	User	High	In ShipTests testMoveLeft() testMoveUp() testMoveDown() testMoveRight()	A
F_WASD_Diagonal	Combining “wasd” moves in diagonal directions	User	High	In ShipTests testMoveDiagonalNW() testMoveDiagonalNE() testMoveDiagonalSE() testMoveDiagonalSW()	A

F_Rewards	When a college is destroyed, the user should be rewarded gold / XP	System	Med	In CollegeTests: testCollegeRewardXPAndGold() - Tests if gold and XP increase after college is destroyed by player bullet	M + A
F_XP	As you play the game, you gain XP over time	System	High	In shipTest: testXPoverTime() - runs one tick and observes if XP increases testLevelUp() - sets xp to a tiny bit less than what is needed to level up. Then updates one tick of passive XP gain and observes if level increases	M + A
F_Collision	The ship cannot move into walls	User	High		M
F_College_Attack	Colleges attack the ship when nearby	System	High	In collegeTests: testPlayerDies() - fires projectile at player, player takes fatal damage and then test whether gamestate changes to Finished as it is game over collegeFireAtPlayerInRange() - Checks if college fires two projectiles at player, does not check if projectiles hit player (really struggled to test it to work as colleges send to projectiles at weird angles)	M + A
F_Player_Death	Player ship dies when their health hits 0	System	High	In ShipTests: testEnemyShootPlayer() (Could not figure out how to position enemy and player to get the projectile to collide in one tick, so for now, don't measure if player takes damage)	M + A

F_College_Death	Colleges die when their health hits 0	System	High	In collegeTests: testCollegeDamages() - fires a bullet at the college from the player and it takes damage testCollegeDies() - fires bullet at college, dealing enough damage to kill college, tests if it has been “disabled” by testing if updateAI() fires a cannonball after reaching 0 health	M + A
F_End	When the player ship dies, a game over overlay appears	System	Low		M
F_Attack	With “lmb” or “rmb” the ship attacks in the mouses direction	User	High	In ShipTests: testShipBulletCreated() - Checks bullet is created by shoot() method	M + A
F_Particles	Various particles generated while playing, for: behind boat, projectile break	System	Low		M
F_OBJ_Comp	When the objective is complete the game will end to a victory overlay	System	High	In gameFeatureTests(): testLevel5ObjectiveComplete() - tests objective does not complete at level 4 but does at level 5 testCollegeObjectiveComplete() - tests objective is not complete when enemy colleges exist, then checks it completes when no enemy colleges exist	M + A

F_Restart_End	When on the victory screen, game can be restarted using “Space”	User	High		M
F_OBJ_Track	As the player plays the objective will update and keep track of the players progress	User	High	See F_OBJ_COMP tests	M
F_Close	Game window closes on escape	System	Med		M
F_Regen	Players health regenerates over time while outside of combat	System	High	In ShipTests: testPlayerRegen() - Tests one tick to see if the players health increases out of combat	M + A
F_Repair	Players health regenerates quickly while near home	System	High	In ShipTests: testPlayerRegenQuickerAtHome() - Puts a college next to the player to see if it regens faster than normal	M + A
F_Ship_Attack	Enemy ships attack the player ship when nearby	System	High	In ShipTests: testPlayerShootsEnemy() - Fires at enemy and if they take damage, the test passes	M + A
F_Ship_Death	Player gains experience and plunder from defeating enemy ships.	System	High	In ShipTests: TestPlayerDestroysEnemyAndGetsPlunderXP() - Fires at enemy on 1 health, kills it, checks enemy is removed and XP and Gold is gained	M + A
F_Plunder	Player can spend their plunder in order to purchase upgrades for their ship	System	High	In ShipTests: testInteractsWithUpgrade() -tests player interacting with upgrade, ensuring gold is spent, upgrade is removed from world and gold is reduced	M + A

				testNotEnoughPlunderForUpgrade() - tests player interacts with upgrade with not enough gold and stats/gold remain unchanged	
F_Obstacles	There will be obstacles around the map and bad weather for players to sail through.	System	High	In ObstacleWeatherTests: testIcebergObstacle() testSeamineObstacle() testRockObstacle() testRandomWeather() Each obstacle test checks whether the player has been affected by each of the obstacles unique effects	M + A
F_Powers	There will be at least five special power-ups around the map that the player can obtain for a temporary boost.	System	High	In PickupTests: TestPickupCollect() - Tests pickup applies to player 6 Tests exist for each of the types of pickup, see file	M + A
F_Levels	There should be different levels of difficulty the player can choose from	System	High		M
F_Saving	Allow the player to save the state of their game at any time so that it can be resumed even after the game is closed.	System	High	testSaveLoadGameNoError() - passes if save and load happen with no error, any more complex testing would take major code restructuring.	M + A

Manual testing log:

Any images (e.g fig 1) can be found in the appendix of this document.

Function ID	Manual test done:
F_Restart_Capable	**The game does restart upon pressing the tap button, all progress is reset and buffs respawn in different random locations as intended. The UI displays this function on the left side of the screen.**
F_Restart_Consisitent	**No memory leaks have been observed and the save function works perfectly by being able to save all progress and load it easily and safely by pressing 'enter'.**
F_WASD	**The player ship correctly moves up when W is pressed, down when S is pressed, left when A is pressed, and right when D is pressed.**
F_WASD_Diagonal	**The player ship correctly responds to combined movements inputs to allow for diagonal movement.**
F_Rewards	**Gold and XP is being rewarded to the player whenever a college is destroyed and the counter UI displays it at the bottom corner (see fig 1)**
F_XP	**XP is gained by time, and is displayed at the bottom corner (see fig 2)**
F_Collision	**Ship collides with map walls and can't go through them, have been tested with different walls around the map**
F_College_Attack	**Enemy colleges do attack the players ship when they're in the vicinity. Was tested with every enemy college. (see fig 3)**
F_Player_Death	**The player ship gets destroyed once the HP bar reaches zero, the game over screen is then displayed with the option to restart (see fig 4)**
F_College_Death	**Colleges get destroyed whenever their HP reaches zero, their sprites also change to the destroyed version of the college (see fig 5)**

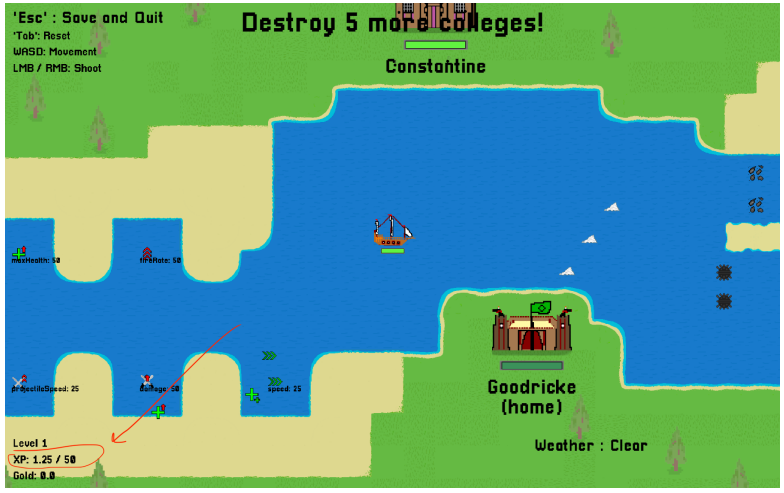
F_End	**After the player dies the game displays a game over screen that displays the ability to restart by pressing ‘space’ (see fig 6)**
F_Ship_Attack	**The ship does fire when “lmb” or “rmb” is pressed and towards the pointers direction, all directions where tested (see fig 7)**
F_Particles	**Particles do appear behind the ship when it moves (see fig 8)**
F_OBJ_Comp	**When objective has been completed the game stops and displays a victory message that displays that the player won and that they can restart by pressing ‘space’ (see fig 9)**
F_Levels	**Different levels of difficulties can be changed by pressing the left or the right arrow keys to change the difficulty respectively. All the different difficulty levels have been tested and the game has been finished on all difficulties. (see fig 10)**
F_Restart_End	**After the game ends a defeat/victory screen will be displayed stating to press ‘space’ to restart. Upon pressing ‘space’ the game does restart. (see fig 11)**
F_OBJ_Track	**The main objective of the game will be displayed at the top of the screen, the object will continue to update as the player progresses through the game. (see fig 12)**
F_Close	**Upon pressing ‘esc’ the game closes**
F_Regen	**Player’s health regenerates when away from combat, this is displayed by the ‘+’ symbol beside the health bar (see fig 13)**
F_Repair	**Player’s Health regenerates much faster when the player is in the vicinity of the home college. Two ‘+’ symbols are displayed beside the health bar when the player is in the vicinity of the home college signifying a stronger health regen. (see fig 14)**
F_Ship_Attack	**Enemy ships will attack the player if the player is in range, this was tested with every ship. (see fig 15)**
F_Ship_Death	**Plunder and xp are gained and displayed at the bottom corner upon destroying an enemy ship.(see fig 16)**

F_Plunder	**Permanent Power ups can be purchased from the shop by pressing ‘E’ and spending plunder when near the chosen power up. The name and price of the power up is displayed below each one. (see fig 17)**
F_Obstacles	**Obstacles are placed around the map and respawn after each reset, each obstacle affects the ship differently and all the obstacles have been tested. Weather has a chance of happening upon destroying a college and will last for a certain amount of time. All weather conditions were tested (see fig 18)**
F_Powers	**Different power ups will spawn randomly on the map, players can pick them up simply by sailing through them. Each power up has a special buff that will aid the player for a limited time, time will be displayed on the top right corner of the screen . All power ups have been tested.(see fig 19)**
F_Saving	**Upon pressing ‘esc’ the game will close and will save all the progress done so far. Upon restarting the game pressing ‘enter’ will load the most recent save.**

Appendix

fig1:

fig2:



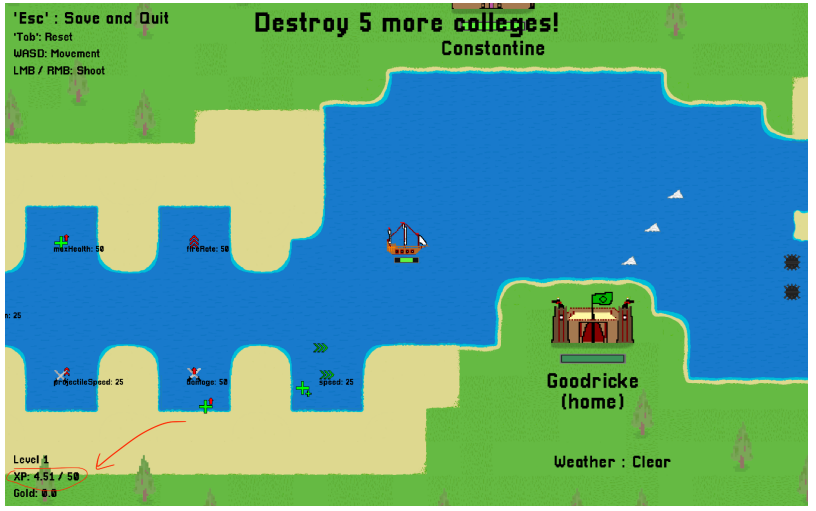


Fig3:


'Esc' : Save and Quit
'Tab': Reset
WASD: Movement
LMB / RMB: Shoot
Reach Level 5!
Constantine
Goodricke
(home)
Weather : Clear
Level 1
XP: 1.75 / 50
Gold: 0.0

Fig4:


'Esc' : Save and Quit
'Tab': Reset
WASD: Movement
LMB / RMB: Shoot
Reach Level 5!
Constantine
Goodricke
(home)
Weather : Clear
Level 1
XP: 1.75 / 50
Gold: 0.0


'Esc' : Save and Quit
'Tab': Reset
WASD: Movement
LMB / RMB: Shoot
Constantine
YOU LOST!
PRESS 'SPACE' TO RESTART
Goodricke
(home)
Weather : Clear
Level 1
XP: 1.83 / 50
Gold: 0.0

Fig5:


'Esc' : Save and Quit
'Tab': Reset
WASD: Movement
LMB / RMB: Shoot
Reach Level 5!
Constantine

Fig 6:


'Esc' : Save and Quit
'Tab': Reset
WASD: Movement
LMB / RMB: Shoot
Constantine
YOU LOST!
PRESS 'SPACE' TO RESTART
Weather : Clear
Goodricke
(home)

Fig 7:

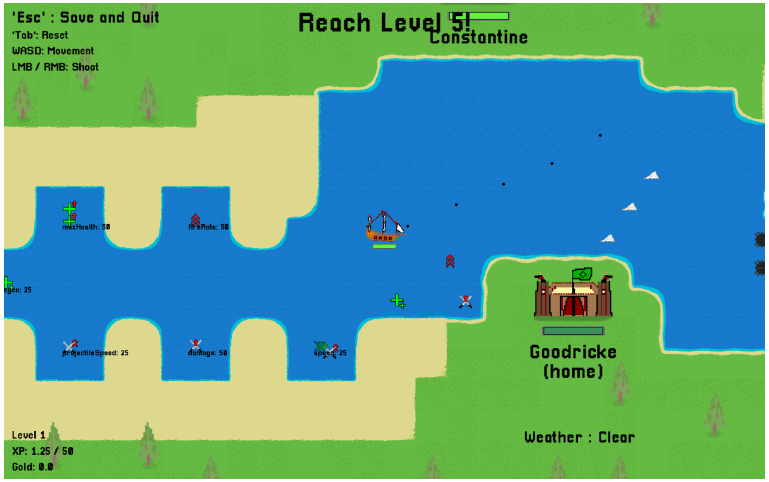

'Esc' : Save and Quit
'Tab': Reset
WASD: Movement
LMB / RMB: Shoot
Reach Level 5!
Constantine
Goodricke
(home)
Weather : Clear
Level 1
XP: 1.25 / 50
Gold: 0.0

Fig 8:

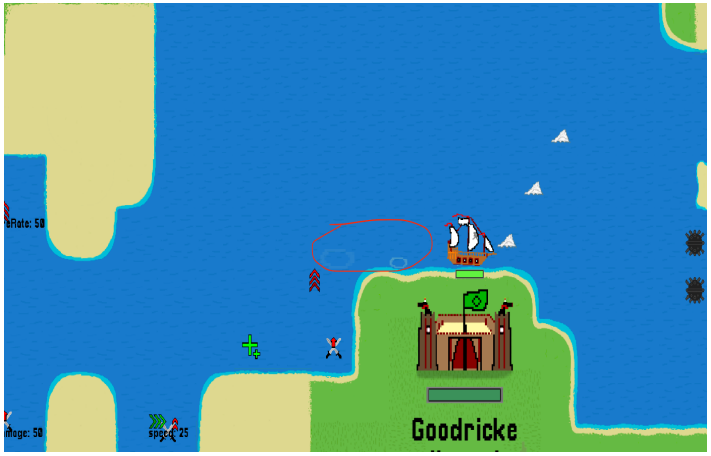

Goodricke

Fig 9:

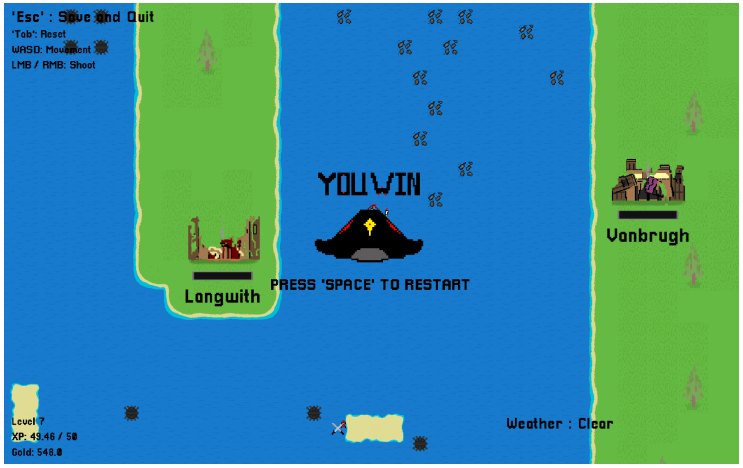
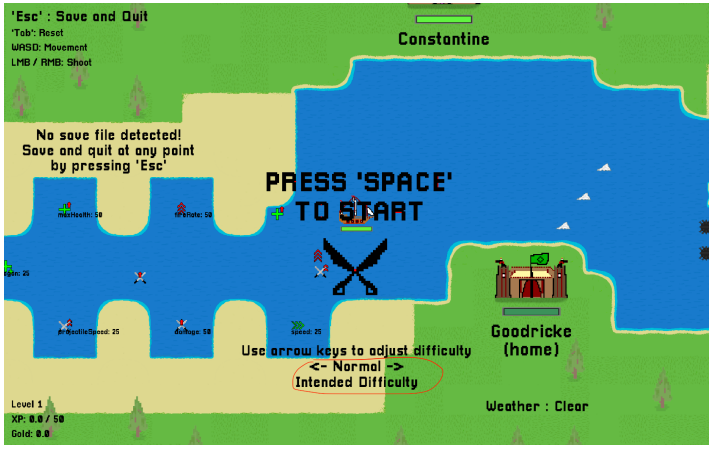

'Esc' : Save and Quit
'Tab': Reset
WASD: Movement
LMB / RMB: Shoot
YOU WIN
Vanbrugh
Langwith
PRESS 'SPACE' TO RESTART
Level 7
XP: 43.46 / 50
Gold: 548.0
Weather : Clear

Fig 10:


'Esc' : Save and Quit
'Tab': Reset
WASD: Movement
LMB / RMB: Shoot
Constantine
No save file detected!
Save and quit at any point
by pressing 'Esc'
PRESS 'SPACE'
TO START
Goodricke
(home)
Use arrow keys to adjust difficulty
<- Normal ->
Intended Difficulty
Weather : Clear
Level 1
XP: 0.0 / 50
Gold: 0.0

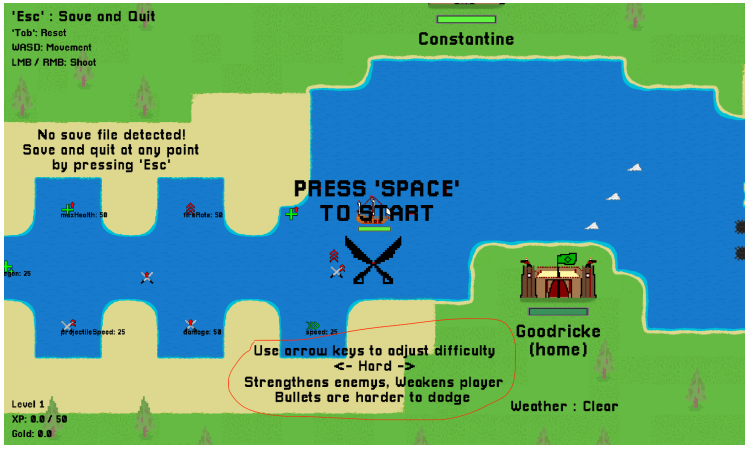

'Esc' : Save and Quit
'Tab': Reset
WASD: Movement
LMB / RMB: Shoot
Constantine
No save file detected!
Save and quit at any point
by pressing 'Esc'
PRESS 'SPACE'
TO START
Goodricke
(home)
Use arrow keys to adjust difficulty
<- Hard ->
Strengthens enemys, Weakens player
Bullets are harder to dodge
Weather : Clear
Level 1
XP: 0.0 / 50
Gold: 0.0

Fig 11:


'Esc' : Save and Quit
'Tab': Reset
WASD: Movement
LMB / RMB: Shoot
Constantine
YOU LOST!
PRESS 'SPACE' TO RESTART
Goodricke
(home)
Weather : Clear


'Esc' : Save and Quit
'Tab': Reset
LMB / RMB: Shoot
YOU WIN
Vanbrugh
Langwith
PRESS 'SPACE' TO RESTART
Weather : Clear

Fig 12:


'Esc' : Save and Quit
'Tab': Reset
WASD: Movement
LMB / RMB: Shoot
Destroy 5 more colleges!
Constantine

Fig 13:

Fig 14:

Fig 15:

Fig 16:


'Esc' : Save and Quit
'Tab': Reset
WASD: Movement
LMB / RMB: Shoot
Reach Level 5!
EvilGoodricke
Weather : Clear
Level 1
XP: 49.58 / 50
Gold: 71.0

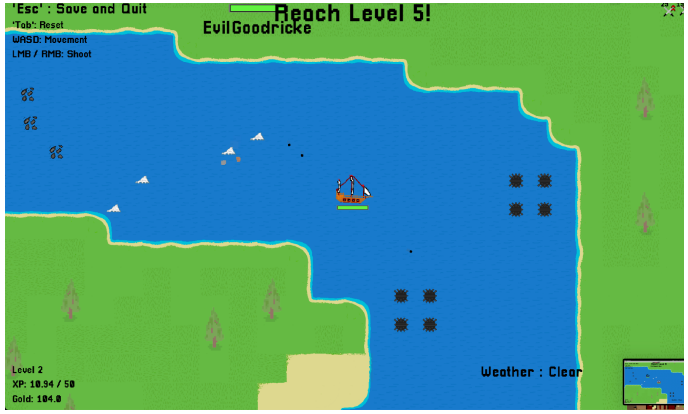
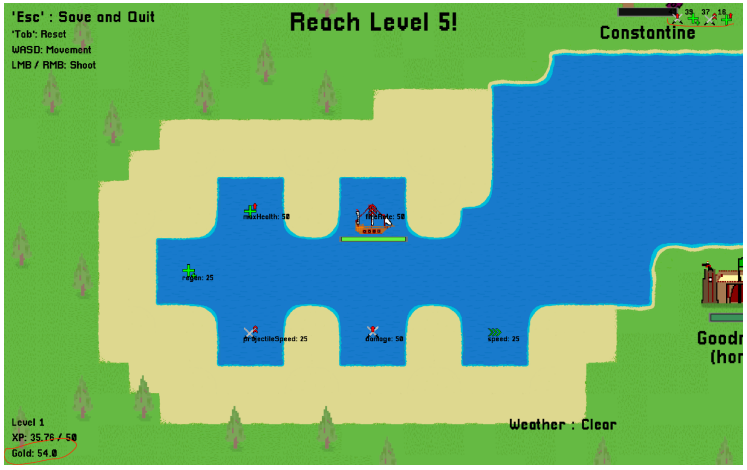

'Esc' : Save and Quit
'Tab': Reset
WASD: Movement
LMB / RMB: Shoot
Reach Level 5!
EvilGoodricke
Weather : Clear
Level 2
XP: 10.94 / 50
Gold: 104.0

Fig 17:


'Esc' : Save and Quit
'Tab': Reset
WASD: Movement
LMB / RMB: Shoot
Reach Level 5!
Constantine
Weather : Clear
Level 1
XP: 35.76 / 50
Gold: 54.0

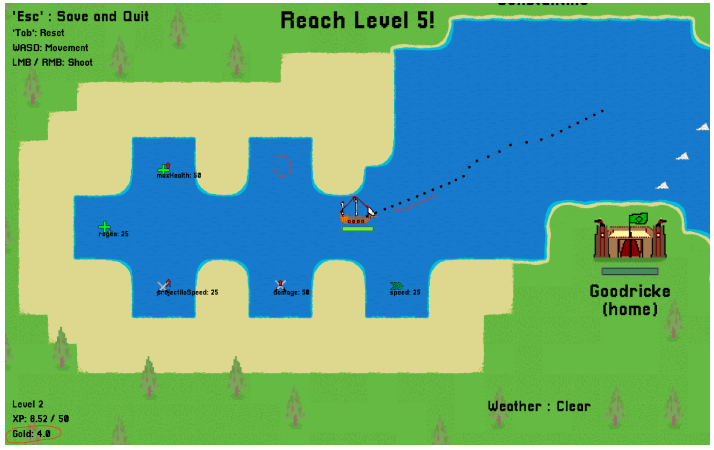
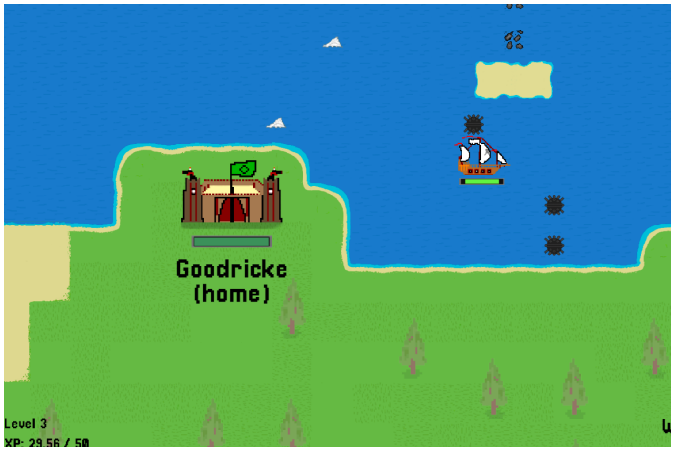
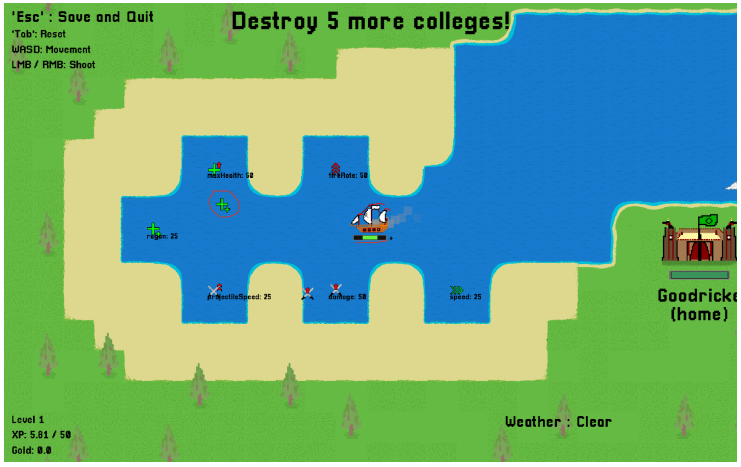

'Esc' : Save and Quit
'Tab': Reset
WASD: Movement
LMB / RMB: Shoot
Reach Level 5!
Goodricke
(home)
Weather : Clear
Level 2
XP: 8.52 / 50
Gold: 4.0

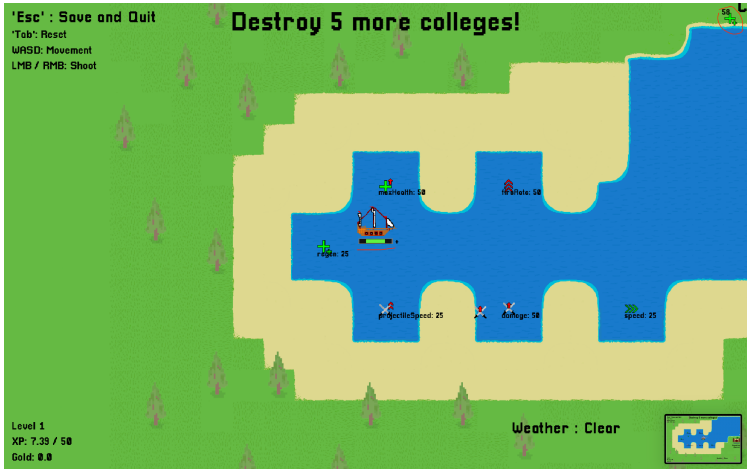
Fig 18:


Goodricke
(home)
Level 3
XP: 29.56 / 50


'Esc' : Save and Quit
'Tab': Reset
WASD: Movement
LMB / RMB: Shoot
Reach Level 5!
Langwith
Level 4
XP: 6.87 / 50
Gold: 63.0
Weather : foggy for 11 seconds

Fig 19:


'Esc' : Save and Quit
'Tab': Reset
WASD: Movement
LMB / RMB: Shoot
Destroy 5 more colleges!
Goodricke
(home)
Level 1
XP: 5.81 / 50
Gold: 0.0
Weather : Clear


'Esc' : Save and Quit
'Tab': Reset
WASD: Movement
LMB / RMB: Shoot
Destroy 5 more colleges!
Level 1
XP: 7.39 / 50
Gold: 0.0
Weather : Clear