**Team 7 (Tony and the ABCDs) “Bermuda” Test Plan**

**Note: Find (ctrl/cmd + ‘f’) “(Milestone 4)” notations for M4-specific test plan additions.**

**If a section header labeled M4, all described features are new**

# Game Start:

cmake ..

make (make clean first if needed)

./bermuda

# Gameplay:

**‘Space’** - Start Game

**‘r’** - Restart the game, with randomized enemy and oxygen tank placements.

**‘p’** - If paused, unpause, and vice versa.

**‘p + s’** - Saves current game (See Game Saving Test Cases)

**‘p + l’** - Loads from last save (See Game Saving Test Cases)

# Movement:

**‘w’** - Move Up

**‘a’**- Move Left

**‘s’** - Move Down

**‘d’** - Move Right

**Shift** - Increases the player’s maximum movement speed and acceleration.

**Space + (at least one of) ‘w’, ‘a’, ‘s’, ‘d’**- Gives player a short velocity burst in the direction of the move key

**Mouse Move** - Aim current weapon; the gun’s direction will point in the direction of the cursor.

**Mouse Left Click** - Fire current weapon in the direction of the cursor

* The gun will not fire if it’s in the wall, when a projectile has already been fired, or when the player is dying
* The projectile will collide with walls and enemies.

**Mouse Scroll Wheel Up** - Switch to next higher numbered weapon with count > 0 **(Milestone 4)**

**Mouse Scroll Wheel down** - Switch to next lower numbered weapon with count > 0 **(Milestone 4)**

**‘1’** - Switch to harpoon gun.

**‘2’** - Switch to net gun.

**‘3’** - Switch to concussive gun.

**‘4’** - Switch to torpedo gun.

**‘5’** - Switch to pistol shrimp.

Note: You cannot switch to a weapon if it has no more consumable projectiles

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# Test Cases - Shooting/Weapons:

Firing a harpoon projectile should deal damage on collision with any enemy or crate.

**Action:** Press **‘1’**. Aim at an enemy or crate with the crosshair. Press left-click. After the health bar appears, shoot at it again.

**Expected Results:** A health bar should render above the entity being shot, and it should not be full. Upon being shot again, the health bar should visibly decrease further. If the struck entity is an enemy, it should flash red upon taking damage. The projectile should vanish on impact. Firing should drain some oxygen.

Firing a net projectile should stun moving enemies

**Action:** Press **‘2’**. Aim at an enemy or crate with the crosshair. Press left-click. After the health bar appears, shoot at it again.

**Expected Results:** Upon collision between the enemy and net projectile, the enemy should turn blue, and should stop moving temporarily. No damage is taken by the enemies. The projectile should vanish on impact. Firing should drain more oxygen than firing the harpoon gun.

Firing a concussive projectile should push back enemies.

**Action:** Press **‘3’**. Move relatively close to an enemy, and left click with the cursor on it.

**Expected Results:** Upon collision, enemies should be pushed away from the player (or in the direction of the projectile). The projectile should not vanish on impact. Ensure no damage is taken by the enemies impacted by the projectile. Upon firing, it should drain slightly more oxygen than shooting out a net.

Firing a torpedo should deal damage in a radius made by the collision of the projectile.

**Action:** Press **‘4’**. Position the cursor such that at the point of impact, there is at least one enemy nearby. Shoot with left click.

**Expected Result:** Upon collision (only with an enemy), all damageable enemies/crates within a 150 pixel radius should take damage, less than that of a harpoon projectile. The projectile should vanish on impact. It should drain more oxygen than the concussive.

Firing a pistol shrimp should deal damage to everything in its path

**Actions:** Press **‘5’**. Fire the projectile on any path with enemies. Left click to shoot.

**Expected Results:** Upon collision with an enemy, the projectile should not disappear (it should when colliding with a wall or crate). It should deal damage greater than the harpoon to all enemies in its path.. Ensure that this action drains more oxygen than any other gun. The pistol shrimp projectile should be visually faster than all the other shootable projectiles.

Cannot use a weapon with no consumable projectiles left

**Actions:** Switch to any non-harpoon weapon. Fire the weapon until the projectile count reaches zero.

**Expected Results:** Upon firing the last projectile, the weapon should automatically switch back to the harpoon gun. You should no longer be able to switch to that weapon afterwards.

Firing a projectile, then switching to another weapon should not change the already fired projectile.

**Actions**: In one swift motion, fire any weapon’s projectile (preferably positioning your cursor in a

direction where it won’t immediately collide) by left clicking, and press any valid number key

(1-5) to switch to another gun, and fire again with the new weapon.

**Expected Results**: The weapon itself should change, and the first projectile fired shouldn’t

change when switching (and certainly shouldn’t disappear). The new projectile should be

different from the first, and both should have their own effects when colliding.

Quickswitching after firing should not reload the weapon if the original projectile hasn’t collided yet.

**Actions**: In one swift motion, fire any weapon’s projectile (preferably positioning your cursor in a

direction where it won’t immediately collide) by left clicking, and press any valid number key

(1-5) to switch to another gun, then switch back to the original weapon.

**Expected Results**: When switching back, the gun should not be loaded (until the originally fired

projectile collides with something), and left-clicking again should not fire another projectile.

Scroll wheel weapon switching shouldn’t swap to a consumable the player doesn’t have. **(Milestone 4)**

**Actions**: Preferably receive a consumable first by killing enemies. Then, scroll the mouse wheel.

**Expected Results**: If no consumables have been picked up, the weapon should remain as the

harpoon. Otherwise, it should skip over all consumables with a count of 0 to switch to the weapon

that’s been picked up.

# Test Cases - Rendering:

If a player takes damage or an enemy is hit by a player projectile, they should flash red.

**Actions:** Press **‘1’**. Shoot a harpoon at any enemy by pointing at it and left clicking. Afterwards, have the player collide with any enemy.

**Expected Results:** Upon the enemy taking damage, the enemy should turn red. Upon the player colliding with an enemy, the player should flash red. Ensure that this effect fades over time (about half a second).

A stunned enemy turns blue.

**Actions:** Press **‘2’**. Shoot a net at any enemy by pointing at it and left clicking.

**Expected Results:** Upon the enemy being stunned, the enemy should turn blue. The enemy will return to normal colours after the stun duration is over.

A stunned player turns blue.

**Actions:** Find a jellyfish enemy and collide with it.

**Expected Results:** The player will be briefly stunned and will turn blue for the duration.

Bubbles should come out of geysers at regular intervals.

**Actions:** Observe the geyser in the tutorial room (Or any room with a geyser in it)

**Expected Results:** A bubble should come out of the geyser every half-second, floating upwards but accelerating downwards. When acceleration stops each bubble, they should disappear.

A torpedo or O2 canister exploding should cause an explosion effect. **(Milestone 4)**

**Actions:** Obtain a torpedo, and fire it at anything, or shoot the O2 canister in the tutorial room.

**Expected Results:** Upon collision, an explosion visual should appear for 0.2s, starting with a small size and expanding to its explosion radius before disappearing.

Explosions will cause chain reactions with nearby O2 canisters exploding. **(Milestone 4)**

**Actions:** Create an explosion near an O2 canister

**Expected Results:** When the explosion is triggered, notice that oxygen canisters caught in it will also explode, causing a chain reaction

# **Test Cases - Movement:**

Dash indicator is grayed out and slowly becomes more visible while the dash is on cooldown.

**Actions:** Use the dash with space. Observe the dash indicator underneath the oxygen tank on the left side, that looks like the player dashing

**Expected Results:** The dash indicator is initially blue when it is off cooldown. When it’s on cooldown (unavailable), it is grayed out, and the opacity increases as it’s cooldown gets closer to being able to use

A player dashes in a direction when the dash is not on cooldown.

**Actions:** Dash indicator below the oxygen tank is glowing. Press at least one of “w”, “a”, “s”, “d”, and space.

**Expected Results:** Upon pressing the combination of keys, the player will get a burst of velocity in the directions they pressed.

A player tries to dash in a direction when the dash is on cooldown.

**Actions:** Dash indicator below the oxygen tank is not glowing. Press at least one of “w”, “a”, “s”, “d”, and space.

**Expected Results:** Upon pressing the combination of keys, the player will not dash in any direction.

A player tries to dash without pressing a movement direction.

**Actions:** Dash indicator below the oxygen tank is glowing. Press space without any movement key.

**Expected Results:** Upon pressing space, the player will not dash and the dash will not go on cooldown.

A player glides.

**Actions:** Press shift and a movement key.

**Expected Results:** Upon pressing the combination of keys, the player’s acceleration and max speed increases. Player’s oxygen will decrease slightly faster.

# Test Cases - Inventory:

Selected weapon is reflected in inventory (bottom of the HUD).

**Actions:** Press **‘2’**. You can test this with other projectiles by pressing **‘3’**, **‘4’**, or **‘5’** instead.

**Expected Results:** The counter of nets (weapon 2) will light up green and the counter for

harpoons will turn white like the other unselected weapons.

Firing consumable projectiles will reflect in the inventory (bottom of the HUD).

**Actions:** Press **‘2’**. Shoot a net at anything by left clicking. You can test this with other projectiles

by pressing **‘3’**, **‘4’**, or **‘5’** instead.

**Expected Results:** After firing a consumable projectile, the numerical display in the inventory will update to show how many you have left.

Picking up a key will render it in your inventory (bottom of the HUD).

**Actions:** Find a key randomly spawned in a room.

**Expected Results:** After picking up the key you will see it render in its corresponding coloured

box in the player inventory.

# Test Cases - World:

The map, including door locations, room connections, key locations, room door colors, and enemy placements are randomly generated every time the game is built.

**Actions:** Rebuild the game and open it again. Explore the rooms.

**Expected Results:** You should notice that the aforementioned elements should not stay entirely

consistent.

The tutorial has been updated to its final version after player feedback. **(Milestone 4)**

**Actions:** Start a new game and wait for the intro cutscene to end.

**Expected Results:** The player will spawn in the new tutorial room.

Coloured keys that unlock doors can be found throughout the map.

**Actions:** Explore the map and find a red, blue, or yellow key on the ground. Swim into the key to

pick it up

**Expected Results:** When you find and pick up a key, it will appear in your inventory on the

player hud. Only one key is required to open all doors of that colour.

Pressure plates that unlock doors can be found throughout the map. **(Milestone 4)**

**Actions:** Explore the map and find a pressure plate in any room. Observe the locked, grated door

and try to swim into it. Then, push a crate or rock onto the pressure plate. Enter the door. Repeat

in this room to the door that you entered.

**Expected Results:** When you try to enter the locked door, you will be rebuffed. When you slide

a crate or rock onto a plate, the corresponding door opens. When you enter a room where you

only solved the puzzle on one side, the door locks behind you. When you solve the pressure plate

puzzle in this new room, the door opens again. When you re-enter the first room, the door

remains unlocked. When you re-enter the second room, the door remains unlocked.

Doors with colors will only open if you have the corresponding color key.

**Actions:** Explore the map and walk into a red, blue, or yellow door without ever having picked

up a key of that color. Then, pick up the corresponding key and walk into that door.

**Expected Results:** You should not be able to enter the next room if you don’t have a key of that

color, while you should be able to enter the next room if you do.

You should not get stuck anywhere in the game, as there is always a possible door you can access.

**Actions:** Play the game a bit, restart by re-launching the binary/executable, play the game, etc.

**Expected Results:** The map should generate in such a way that there is always at least one

possible door you can access. If it does not appear that way, the key might be in a room you

missed, but it should always be attainable.

Room states are saved after you visit them.

**Actions:** Enter a level, interact with what’s inside of it, leave through a door, and then re-enter

from the door you were just in.

**Expected Results:** The contents of the room should be as you left it. All enemies will be in the

same positions they were in before you left, all crates will be where they were last pushed, all

geysers still where they are, all drops (keys, items, oxygen canisters) still on the floor where you

left them, and all damaged entities still have the same amount of damage taken.

Boss rooms are created and placed randomly within the level, and you cannot explore the entirety of bermuda without first going through the boss rooms

**Actions:** Play the game, explore the map, and find the rooms with bosses in them. Boss rooms are

room 0, room 5 and room 10. (The tutorial room behaves like a boss room)

**Expected Results:** When you are within a boss room, you cannot leave until you have defeated

the boss. Run into the doors, and you will not be able to escape until either you or the boss dies.

Miscellaneous ambient objects scattered throughout the level. **(Milestone 4)**

**Actions:** Play the game, explore the map

**Expected Results:** See random things on the ground that just make the floor more interesting to

look at. They should be slightly transparent and non-interactable.

# Test Cases - Crates:

Destroying a wooden crate should occasionally drop an O2 canister.

**Actions:** Find a wooden crate and destroy it (by firing at it). Should an O2 canister sprite appear, swim over and collide with it.

**Expected Results:** With a 25% chance, an O2 canister sprite should appear in the place of the wooden crate. If the player collides with it, the sprite should disappear and the player should regain some O2.

Colliding with a wooden crate should trigger an inelastic Conservation of Momentum collision.

**Actions:** Find a wooden crate and make the player collide with it.

**Expected Results:** Upon collision, the player’s speed should be reduced, and the crate’s speed should match the player’s new speed. If the player stops colliding, the crate should eventually be stopped by water friction.

Crates should act as walls to enemies

**Actions:** Observe an enemy colliding with a crate, or have a shark/krab chase the player, then hide behind a crate

**Expected Results:** Upon collision, the enemy should attempt to move in a different direction.

# Test Cases - Game Saving / Loading (Milestone 4)

You can save on after pausing the game first.

**Actions:** Pause the game using “p”, then press “s” to save. Note: make sure bermuda has write

permissions. This should be the case by default.

**Expected Results:** A message will appear saying “save successful” if the save was successful.

Saves should always be successful unless there are issues with write permissions. If the save was

unsuccessful, it should say it was unsuccessful in the console. If the save was successful, a json

file “bermuda\_save.json” should be created in the same directory as the game. If a

“bermuda\_save.json” already existed, it will be overwritten

You can load a save file if it exists on start

**Actions:** Have a save file, press “L” on the initial starting screen

**Expected Results:** You will immediately jump to where you were in the previous save, with all

entities in the same positions and same hp. Rooms are laid out in the same way, with doors in the

same position.

You can load a save file if it exists while playing the game

**Actions:** Have a save file, press “P” to save the game, press “L” to load.

**Expected Results:** You will immediately jump to where you were in the previous save, with all

entities in the same positions and same hp, and same inventory regardless of what state they were

prior. Rooms are laid out in the same way, with doors in the same position.

You cannot load an invalid save file

**Actions:** Either don’t have a save file or have one that contains junk.

**Expected Results:** The game will behave if you had unpaused/loaded without a valid save file. If

you were paused, it’ll unpause, if you were at the start screen, it’ll start.

You can load the game with a specific seed

**Actions:** Launch the game with the first command line argument being a seed, ex. ./bermuda

<seed>

**Expected Results:** The game will launch with that seed. The seed should print in the console, and

the level should generate the same every time you launch with that seed.

# Test Cases - Enemies:

Note: Some of these cases refer to “levels”. For clarity, Level 1 is rooms 1-5. Level 2 (unlocked after defeating krab boss) is rooms 6-10, and Level 3 (unlocked after defeating sharkman boss) is rooms 11-15. The room you’re in will be printed within the console for debug purposes.

Sharks will track and move to the player when aggravated.

**Actions:** Explore until you encounter a room that has a shark in it. Shoot a projectile at the shark with any method described in the shooting test plan. Leave the room and explore until you find another room that has a shark in it. Position your player directly in front of the shark. Then, run from the shark by hiding behind crates to block its line of sight. Finally, kill the shark by pressing **‘1’** and firing the harpoon projectile until it is dead.

**Expected Results:** When the shark takes damage, it will immediately track onto the player and move to them. When the shark collides with the player, the player flashes red and loses oxygen. When a non-aggressive shark notices you for the first time, a red exclamation point will appear over its head and it will track you and attempt to collide with you. When you hide behind a crate, or move far away, a question mark will appear over its head, and it will resume wandering. When the shark’s health is depleted, it will die.

Sharks will wander when there is no player nearby / not aggravated

**Actions:** Explore until you encounter a room that has a shark in it. Sharks are found in level 1 and level 2

**Expected Results:** Observe that the shark moves in a random direction, and occasionally changes and moves in a different direction.

Fish will wander aimlessly.

**Actions:** Explore until you encounter a room that has a fish in it (most common in level 1)

**Expected Results:** Observe the above result for a fish, but observe that the fish will ignore any interaction and just continue wandering aimlessly, occasionally changing and moving in a new random direction..

Krabs will track and move to the player when aggravated.

**Actions:** Explore until you encounter a room that has a krab in it. Most common in level 1.

**Expected Results:** Observe the above results for a krab, sharing the same aggravated behavior as the shark; however, observe that it moves much slower than a shark, but has more health and deals more damage.

Krabs will wander when there is no player nearby / not aggravated

**Actions:** Explore until you encounter a room that has a krab in it. Most common in level 1.

**Expected Results:** Observe that the krab either does one of the following: moves back and forth randomly in a line, or continuously around in a square. Exact behavior is random, with a 50% chance of happening with each krab enemy.

Urchins should wander around quickly at all times and fire projectiles in the NSEW directions

**Actions:** Explore until you encounter a room that has an urchin in it. Sea Urchins spawn in level 3 (level 3 is after finding and beating the Crab boss and Sharkman)

**Expected Results:** Observe that the urchins don’t detect the player at any radius or directly deal damage for colliding with the player. Every 1.5 seconds, it should shoot out 4 projectiles in the NSEW directions that disappear after 1.5 seconds (if not earlier from a collision with a crate or wall).

Seahorses should periodically fire a bullet at the player

**Actions:** Explore until you encounter a room that has a seahorse in it. (found in level 2 and level 3)

**Expected Results:** Observe that the seahorse, every three seconds, will fire a bullet in the direction of the player if the player is in the seahorse’s line of sight. If the bullet collides with the player, the player should take some damage.

Enemy Projectiles should deal damage to the player and crates, and be stopped by walls.

**Actions:** Explore until you encounter a room that has a seahorse. Get it to shoot a crate by moving such that a crate is between the player and the seahorse, take a hit from the seahorse, and dodge a seahorse attack so that the projectile collides with a wall.

**Expected Results:** In the first case, the crate should take damage (and in the case of the seahorse, be destroyed). In the second case, the player should lose oxygen. In all cases, the projectile should disappear upon collision.

Fishes and Sharks exhibit Boids/Group behavior

**Actions:** Explore Level 1 to find a group of fish, or Level 2 to find a group of sharks

**Expected Results:** Unlike other enemies, notice how they are traveling in a school. They move around almost randomly, but will try to avoid colliding with each other, avoid colliding with walls, but will move towards their center of mass and towards a common direction.

Groups of Sharks will collaborate to surround the player and cut off exist paths

**Actions:** Explore level 2 to find a group of sharks. This behavior will not be present for multiple Sharks found in level 1, even if there are multiple.

**Expected Results:** Unlike other enemies tracking enemies in level 1 (sharks, krabs), notice that if multiple sharks are chasing you, the sharks won’t just move in the direction of the shortest distance to the player like in level 1. Instead, notice that they will fan out, and move in directions that the player may potentially be trying to escape from. Also notice that the sharks still try to avoid each other, and will try to avoid obstacles and walls. This is done by rewarding sharks that are pursuing the player to try to come in at angles that other sharks are not, and punishing sharks for getting too close to obstacles. Also notice that even though other sharks may not have line of sight with the player, since they are rewarded by staying closer to the center of mass of the other sharks, once a shark sees you, the others in the school will gradually move towards the player as well.

Lobsters will momentarily block player projectiles and then charge at the player.

**Actions:** Explore level 3 (door after defeating sharkman) to find lobsters.

**Expected Results:** Lobsters will wander around sub areas on level 3. On a player entering the lobster’s detection radius, they will begin lobster behavior. Lobster behavior begins with a stationary blocking stance (indicated by a shield icon) which will block incoming damage from all player projectiles. Shortly after, the lobster will charge at the player (no shield icon) and will no longer be blocking anymore. The lobster then continues this behavior until it dies or the player exits its detection radius.

Siren (Healer) will wander around and shoot a healing projectile at all of the wounded allies in its sight. **(Milestone 4)**

**Actions:** Explore level 2 or 3 (door after defeating megakrab or sharkman) to find sirens.

**Expected Results:** Sirens will wander around rooms in level 2 or 3. The siren will shoot a healing projectile towards each wounded ally within its line of sight. The healing projectile will get blocked by any wall, crate, or rock. The healing projectile will heal the first wounded enemy in its path. The siren has a short cooldown between each wave of healing projectiles it shoots.

Bloodsuckers (Turtles) will move quickly towards the player and steal health upon collision.

**(Milestone 4)**

**Actions:** Explore level 3 (door after defeating sharkman) to find Bloodsuckers.

**Expected Results:** Notice that the Bloodsucker’s health bar is only 60% full by default. Upon entering the Bloodsucker’s detection radius (Which is nearly the whole room), it should start moving towards the player at a high speed. Upon collision with the Bloodsucker, the Bloodsucker’s health bar should increase (If it isn’t already full).

Tentacles spawned by Cthulhu should stun and damage the player upon collision. **(Milestone 4)**

**Actions:** Enter Cthulhu’s room and wait for it to spawn tentacles. Collide with one of them.

**Expected Results:** Upon collision, the player should take O2 damage, and be stunned very briefly (shorter than the jellyfish).

# Test Cases - Drops:

Colliding with an enemy drop should increment the corresponding inventory counter in the player HUD.

**Actions:** In the tutorial room, shoot at the jellyfish until it dies. Restart by pressing ‘R’ to test repeatedly until it drops a concussive or a net. Then swim over to the drop to pick it up.

**Expected Results:** The drop should disappear from the screen upon collision. If the sprite was a net, the net counter in the player hud at the bottom of the screen should increase by 1. If it was a concussive (blue rings), then the concussive charges should increase by 1. These are capped at 999 for each weapon.

Fish should drop concussive charges at a 25% chance.

**Actions:** Find a fish, and shoot it.

**Expected Results:** 25% of the time, the fish should drop a concussive charge on death, and for the remainder, it should drop nothing.

Jellyfish should drop concussive charges and nets at a 40% chance each.

**Actions:** In the tutorial room, shoot at the jellyfish until it dies. Restart by pressing ‘R’ to test repeatedly.

**Expected Results:** 20% of the time, the jellyfish should drop nothing, while 40% of the time, it should drop a concussive, and 40% of the time it should drop a net.

Urchins, Sharks, and Krabs should occasionally drop Torpedoes.

**Actions:** Find an urchin, shark, or Krab (The urchin only appears after the Sharkman boss room) and kill it. Should a torpedo sprite appear, swim over and collide with it.

**Expected Results:** Upon death, based on the enemy (25% for Sharks, 50% for Krabs, and 75% for Urchins), a Torpedo Sprite should appear in the enemy’s place with a specific chance. If the sprite appears, colliding with it should cause the sprite to disappear and cause the Torpedo counter in the inventory HUD to increment.

Seahorses should occasionally drop Pistol Shrimp.

**Actions:** Find a Seahorse and kill it. Should a shrimp sprite appear, swim over and collide with it.

**Expected Results:** Upon death, a Shrimp Sprite should appear in the enemy’s place with a 30% chance. If the sprite appears, colliding with it should cause the sprite to disappear and cause the shrimp counter in the inventory HUD to increment.

Bloodsuckers should drop Pistol Shrimp and O2 Canisters. **(Milestone 4)**

**Actions:** Find a Bloodsucker (In level 3) and kill it.

**Expected Results:** Upon death, a Shrimp Sprite should appear in the enemy’s place with a 20% chance. If the sprite appears, colliding with it should cause the sprite to disappear and cause the shrimp counter in the inventory HUD to increment. Otherwise, an O2 canister should spawn, and colliding with it should restore some of the player’s O2.

Sirens should drop an O2 Canister at a 75% chance. **(Milestone 4)**

**Actions:** Find a Siren (In level 3) and kill it.

**Expected Results:** 75% of the time, the siren should drop a O2 canister on death, and colliding with it should restore some of the player’s O2. For the remainder, it should drop nothing.

Sharkman miniboss drops a geyser on death

**Actions:** Kill Sharkman in its miniboss room by making it run into all six metal crates.

**Expected Results:** Sharkman disappears and a functional geyser is dropped.

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# Test Cases - Bosses:

You can encounter the Mega Krab miniboss room.

**Actions:** Explore the map until you encounter a room where there is a giant red krab. You can use the console prints to help you; each time you enter a room it will say “Player entered room: x,” the miniboss room is at room 5.

**Expected Results:** When you enter the room, a cutscene will play. Observe the giant enemy krab. Observe that this room will always have 2 connections: one going into it and one going out of it, since this boss guards the next difficulty area.

Mega Krab miniboss will wander and repeat a few basic behaviors.

**Actions:** As in the previous room test, explore until you find the Mega Krab miniboss room. Mega Krab miniboss room is found between level 1 and 2. (First boss after game start)

**Expected Results:** Observe that the miniboss cycles randomly between a few random behaviors. After a time interval. It is probabilistic, where the Krab will have ~50% chance of attempting to melee, ~30% chance of trying to shoot fish, and ~20% chance of wandering. When you enter the room, it should either wander aimlessly or attempt to attack you. The exact behavior it is attempting is printed in the console: “Crab boss is wandering!”, “Crab boss is trying to melee!”, and “Crab boss is trying to shoot player!”.

Mega Krab miniboss will wander

**Actions:** As in the previous room test, explore until you find the miniboss room. Console says “Crab boss is wandering!

**Expected Results:** Mega Krab miniboss will walk around the room aimlessly, bounding off of walls, and damaging the player if they come in contact with them

Mega Krab miniboss will melee player

**Actions:** As in the previous room test, explore until you find the miniboss room. Console says “Crab boss is trying to melee!”

**Expected Results:** If the player is far away, Mega Krab miniboss will walk around the room aimlessly, bounding off of walls. If the player is close, a red exclamation mark will appear and they will chase the player, damaging the player if they come in contact with them. If the player runs far away or hides behind a crate, a yellow question mark will appear, and the krab will resume wandering.

Mega Krab miniboss will shoot fish at player

**Actions:** As in the previous room test, explore until you find the miniboss room. Console says “Crab boss is trying to shoot player!”

**Expected Results:** If the player is far away, Mega Krab miniboss will walk around the room aimlessly, bouncing off of walls. If the player is close enough, a red exclamation mark will appear and they will chase the player, and will launch a fish every couple seconds. The fish will damage the player if they come in contact with them. Upon collision with a player/wall, fish will resume default wandering behavior until killed. Krab damages the player if they come in contact with them, but will attempt to move away from the player if they get too close. If the player runs far away or hides behind a crate, a yellow question mark will appear, and the krab will resume wandering.

Mega Krab miniboss drops a geyser on death

**Actions:** Kill the Mega Krab in its miniboss room.

**Expected Results:** The Mega Krab disappears and a functional geyser is dropped.

You can encounter the Sharkman miniboss room.

**Actions:** Explore the map until you encounter a room where the only enemy is a shark with legs. You can use the console prints to help you; each time you enter a room it will say “Player entered room: x,” the miniboss room is at room 10.

**Expected Results:** Observe the giant enemy shark with legs. Observe that this room will always have 2 connections: one going into it and one going out of it, since this boss guards the next difficulty area.

Sharkman miniboss runs in randomly chosen straight lines

**Actions:** Explore level 2 until you find the Sharkman miniboss room.

**Expected Results:** After the cutscene plays, Sharkman will start near the center of the room and move in a straight line in a random direction. Upon hitting a wall or crate, it will change to a random direction away from the wall or crate it just collided with.

Sharkman miniboss periodically tries to target the player after a collision, turns red if it targets the player

**Actions:** Explore level 2 until you find the Sharkman miniboss room, and stay alive in the room

for a while.

**Expected Results:** If the player is close enough and not blocked by crates, Sharkman will turn red and run towards the player after a collision. If the player is not close enough or is blocked by crates, Sharkman will choose a random direction after a collision as described above.

Sharkman miniboss immediately tries to target the player after being hit

**Actions:** In the Sharkman miniboss room, hit Sharkman with any weapon projectile.

**Expected Results:** If the player is not blocked by crates, Sharkman will turn red and immediately run towards the player. If the player is blocked by crates, Sharkman’s behavior won’t change.

Sharkman miniboss breaks crates when red and afterwards stops targeting the player and speeds up

**Actions:** In the Sharkman miniboss room, move the player such that they’re between a crate and

the Sharkman, then wait for Sharkman to turn red (or shoot him) and let it charge towards the

player. When Sharkman charges, move out of the way such that Sharkman hits the crate.

**Expected Results:** On collision, the crate should break and drop an oxygen canister, and Sharkman should lose one sixth of its health. After colliding, Sharkman should change to a random direction, move faster, and no longer be red or target the player.

Sharkman miniboss drops a geyser on death

**Actions:** Kill Sharkman in its miniboss room by making him run into every crate.

**Expected Results:** Sharkman disappears and a functional geyser is dropped.

You can encounter Cthulhu final boss room **(Milestone 4)**

**Actions:** Explore the map until you encounter a room where the only enemy is a stationary monster in the middle of the room surrounded by rocks. You can use the console prints to help you; each time you enter a room it will say “Player entered room: x,” the final boss room is at room 15.

**Expected Results:** The enemy does not move from the middle of the room. Observe that this room will always have 1 connection: the one you entered from, since this is the final room.

Cthulhu will spawn tentacles that try to attack the player **(Milestone 4)**

**Actions:** Enter Cthulhu’s room and stay alive.

**Expected Results:** Tentacles should be spawned in waves periodically (While the boss's other mechanics aren’t playing) in random positions A max of 8 should be present at any time.

Cthulhu will shoot fireballs at the player in waves periodically. **(Milestone 4)**

**Actions:** Enter Cthulhu’s room and stay alive.

**Expected Results:** The boss should shoot pink fireballs in waves (While the boss's other mechanics aren’t playing) which ignore obstacles (not walls). Upon colliding with the fireballs, the player should take O2 damage. The fireballs should disappear upon collision with the player or a wall.

Cthulhu will shoot O2 canisters at the player in waves periodically. **(Milestone 4)**

**Actions:** Enter Cthulhu’s room and stay alive.

**Expected Results:** The boss should shoot O2 canisters in waves (While the boss's other mechanics aren’t playing) which explode upon collision with the player, or a wall or obstacle. If the explosion makes contact with the player, the player should take O2 damage. If the canister goes 2.5s (or 1.425s in phase 2) without colliding with anything (aside from the tentacles), the O2 canister should go inert (not move or explode) and become a drop available for pickup by the player.

Depleting Cthulhu’s health bar for the first time should trigger Phase 2 (Angry Form). **(Milestone 4)**

**Actions:** Deplete Cthulhu’s health bar for the first time.

**Expected Results:** A screaming sound effect should play, and the boss’s texture should change. The boss’s health bar should increase in increments until the health bar is full, during which Cthulhu is immune to damage.

In Phase 2, Cthulhu’s projectiles should move faster, and tentacles should spawn at a greater rate. **(Milestone 4)**

**Actions:** Enter Phase 2 in the Cthulhu boss fight.

**Expected Results:** O2 canisters and fireballs that the boss shoots should move faster, and tentacles should spawn at a greater rate, when the shockwave or frenzy projectiles aren’t happening.

In Phase 2, Cthulhu should periodically send out two shockwaves. **(Milestone 4)**

**Actions:** Enter Phase 2 in the Cthulhu boss fight.

**Expected Results:** While other mechanics aren’t playing, the boss should occasionally send out two shockwaves, which will deal damage to the player upon contact unless the player is behind an object (the obstacles/rocks). The shockwave should disappear if the player takes damage from it, and should persist if the player doesn’t until it expands off screen..

In Phase 2, Cthulhu should periodically send out waves of frenzy projectiles. **(Milestone 4)**

**Actions:** Enter Phase 2 in the Cthulhu boss fight.

**Expected Results:** While other mechanics aren’t playing, the boss should occasionally send out frenzy projectiles (green circles), which ignore obstacles (not the walls) and deal O2 damage to the player upon collision with them, as well as heal Cthulhu. They should disappear upon collision with the player or a wall.

# Test Cases - Sound Effects:

Sound effects play based on player status, player actions, enemy actions, enemy status, and collision feedback.

**Actions:** Player shoots but projectile hasn’t been reloaded.

**Expected Sound Effect:** Empty gun sound effect plays

**Actions:** Player shoots a harpoon

**Expected Sound Effect:** Oxygen blast sound effect plays.

**Actions:** Player shoots a net.

**Expected Sound Effect:** Net shoot sound effect plays.

**Actions:** Player shoots a concussive.

**Expected Sound Effect:** Concussive shoot sound effect plays.

**Actions:** Player shoots a torpedo.

**Expected Sound Effect:** Torpedo shoot sound effect plays.

**Actions:** Torpedo collides with wall or enemy.

**Expected Sound Effect:** Explosion sound effect plays.

**Actions:** Player shoots a shrimp.

**Expected Sound Effect:** Shrimp sound effect plays.

**Actions:** Enemy dies to a player projectile.

**Expected Sound Effect:** Enemy death sound plays.

**Actions:** Player enters a door.

**Expected Sound Effect:** Door sound effect plays.

**Actions:** Projectile collides with crates.

**Expected Sound Effect:** Crate hit sound effect plays.

**Actions:** Projectile destroys a crate.

**Expected Sound Effect:** Crate death sound effect plays.

**Actions:** Projectile collides with metal crate.

**Expected Sound Effect:** Metal crate hit sound effect plays.

**Actions:** Projectile destroys metal crate.

**Expected Sound Effect:** Metal crate death sound effect plays.

**Actions:** Lobster starts blocking stance.

**Expected Sound Effect:** Lobster block sound effect plays.

**Actions:** Lobster blocks a player projectile.

**Expected Sound Effect:** Lobster block projectile sound effect plays.

**Actions:** Urchin shoots projectiles.

**Expected Sound Effect:** Urchin shoot sound effect plays.

**Actions:** Seahorse shoots projectiles.

**Expected Sound Effect:** Seahorse shoot sound effect plays.

**Actions**: Player collides with a Turtle (Bloodsucker) **(Milestone 4)**

**Expected Sound Effect**. Violent sucking sound plays.

**Actions:** Pressure plate gets activated by something with enough mass (Player, crate, rock) **(Milestone 4)**

**Expected Sound Effect:** Unlock sound plays

**Actions:** Pressure plate gets deactivated by removing something with mass (Player, crate, rock) **(Milestone 4)**

**Expected Sound Effect:** Lock sound plays

**Actions:** Krab Boss cutscene begins **(Milestone 4)**

**Expected Sound Effect:** Dramatic sound effect plays

**Actions:** Cthulhu Enters Phase 2 after its health bar is depleted for the first time **(Milestone 4)**

**Expected Sound Effect:** Screaming sound effect plays

**Actions:** Player dies and fades to death screen **(Milestone 4)**

**Expected Sound Effect:** Mysterious death sound effect plays

**Actions:** Player defeats Cthulhu final boss **(Milestone 4)**

**Expected Sound Effect:** End game sound effect plays

**Actions:** New dialogue appears **(Milestone 4)**

**Expected Sound Effect:** Notification sound effect plays

**Actions:** Player saves the game **(Milestone 4)**

**Expected Sound Effect:** Save sound effect plays

**Actions:** Player picks up projectile or gas canister **(Milestone 4)**

**Expected Sound Effect:** Pick up sound effect plays

**Actions:** Player projectile hits enemy **(Milestone 4)**

**Expected Sound Effect:** Hitmarker sound effect plays

**Actions:** Sharkman rages **(Milestone 4)**

**Expected Sound Effect:** Sharkman rage sound effect plays

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# Test Cases - Music:

Music plays based on certain events like entering boss rooms, cutscenes, and new levels.

**Actions:** Start the game.

**Expected Music:** Level 1 music will be looped until the Krab boss encounter.

**Actions:** Enter the Krab boss room from Level 1. **(Milestone 4)**

**Expected Music:** Krab boss music will be looped until krab boss dies.

**Actions:** Krab boss dies **(Milestone 4)**

**Expected Music:** Level 1 music will be looped until the player enters level 2 door inside the Krab boss room.

**Actions:** Enter level 2 from Krab boss room **(Milestone 4)**

**Expected Music:** Level 2 music will be looped until the sharkman boss encounter or player returns to Level 1.

**Actions:** Backtrack and enter the Krab boss room (Level 1) from Level 2 **(Milestone 4)**

**Expected Music:** Level 1 music will be looped until the player enters Level 2 again.

**Actions:** Enter the sharkman boss room **(Milestone 4)**

**Expected Music:** Sharkman boss music will be looped until sharkman dies.

**Actions:** Sharkman boss dies **(Milestone 4)**

**Expected Music:** Level 2 music will be looped until the player enters Level 3 door inside sharkman boss room or returns to Level 1.

**Actions:** Enter Level 3 from Sharkman boss room **(Milestone 4)**

**Expected Music:** Level 3 music will be looped until the player encounters the final boss Cthulhu or player returns to Level 2.

**Actions:** Re-enter Sharkman boss room (Level 2) from Level 3 **(Milestone 4)**

**Expected Music:** Level 2 music will be looped until the player enters Level 3 or Level 1

**Actions:** Enter Cthulhu boss room **(Milestone 4)**

**Expected Music:** Final boss music will be looped until Cthulhu begins phase 2.

**Actions:** Cthulhu boss begins phase 2 **(Milestone 4)**

**Expected Music:** Final boss phase 2 music will be looped until Cthulhu dies.

# Test Cases - Dialogue (Communications in HUD):

Dialogue and hints show up in the communications HUD based on room or actions. NEW: the Communications HUD will flash and make a notification sound when a new story element or hint has been printed.

**Actions:** Start in / enter the tutorial room.

**Expected Dialogue:** The information in these carvings might be useful. Hopefully HQ gets these transmissions eventually, there's no signal here.

**Actions:** Entering a normal room filled with enemies (not tutorial or boss room).

**Expected Dialogue:** No signs of the crew or our submarine here.

**Actions:** Use **‘2’**, **‘3’**, **‘4’**, or **‘5’** to try to switch to a weapon without ammo.

**Expected Dialogue:** Interesting... Groundbreaking even… HQ, I can use weapons I have available on-hand, but not imaginary ones..."

**Actions:** Left-click rapidly trying to fire multiple of the same projectile simultaneously.

**Expected Dialogue:** It takes time to reload a gun underwater, around the time my last shot hits. On the other hand, if I have different guns already reloaded...

**Actions:** Collecting a net consumable.

**Expected Dialogue:** These nets should stun an enemy for a while.

**Actions:** Collecting a concussive consumable.

**Expected Dialogue:** These concussives should push back several enemies for a moment.

**Actions:** Collecting a torpedo consumable.

**Expected Dialogue:** These torpedoes should do damage in an area on impact.

**Actions:** Collecting a pistol shrimp consumable.

**Expected Dialogue:** There is a lot of power packed in this pistol shrimp. Using it should eviscerate almost anything in front of me.

**Actions:** Try to collect over 999 of a specific player projectile (not the harpoon) (likely not producible during gameplay).

**Expected Dialogue:** I don't need that many... I can't carry that many… I don't even know how I acquired that many…

**Actions:** Enter the room with the Mega Krab Boss.

**Expected Dialogue:** That is not the shadow from before, but those are pieces of our submarine. Better not get backed into a corner, this crab is !@#$%&\* HUGE.

**Actions:** Enter the room with the Sharkman Boss.

**Expected Dialogue:** That shark is !@#$%&\* FAST, and those limbs belong to some of the crew… I wonder how hard it'll be for it to stop if it's charging straight at me…

**Actions:** Enter the room with the Cthulhu Boss. **(Milestone 4)**

**Expected Dialogue:** That's the !@#$%&\* thing that attacked us in the first place... It's time to avenge my crew.

**Actions:** Wait for Cthulhu to start shooting oxygen canisters. **(Milestone 4)**

**Expected Dialogue:** That thing is throwing oxygen canisters... If they don't hit anything, I could use them once they stop moving.

**Actions:** Wait for Cthulhu to create a blue, expanding shockwave. **(Milestone 4)**

**Expected Dialogue:** That shockwave is bone shattering... If I don't hide behind something, I'm going to suffer the brunt of it.

**Actions:** Try moving into a red / blue / yellow door without the same-coloured key.

**Expected Dialogue:** This door isn't open. It appears I need to find a matching key.

**Actions:** Try moving into a door that is locked with a pressure plate. **(Milestone 4)**

**Expected Dialogue:** It won't budge. Maybe the pressure plate I saw earlier will open the door.

**Actions:** Try moving into a door during a boss fight (Mega Krab or Sharkman).

**Expected Dialogue:** I can't leave now! I need to take this thing out once and for all.

**Actions:** Try leaving the tutorial without killing the jellyfish.

**Expected Dialogue:** This door isn't open. Maybe I can squeeze through the bars, but first let me kill this jellyfish.

**Actions:** Enter a pressure plate room and see the door lock behind you. **(Milestone 4)**

**Expected Dialogue:** The door locked behind me! If I use the pressure plate in both rooms it should stay open forever...

# Test Cases - Cutscene Overlays:

Unique cutscenes/overlays show up at key points in the game

**Actions:** Start game (via “./bermuda”)

**Expected Overlay:** Game should show title screen with game name, team number and members, and “press space to start” message

**Actions:** Start game then press space

**Expected Overlay:** Title screen should transition to intro cutscene showing the player’s submarine being taken by a dark entity into a hole, and the player follows to rescue the submarine, and the screen should transition to tutorial room after 5 seconds

**Actions:** Continuously shoot or take damage from enemies until player runs out of oxygen

**Expected Overlay:** Screen fades to black then shows red text saying “YOU DIED” with additional text below and a prompt to restart by pressing “r”

**Actions:** Enter krab boss or sharkman boss room

**Expected Overlay:** Screen should show cutscenes of showing the respective miniboss and its name, and the screen should transition to miniboss room after 5 seconds

**Actions:** Reach the final room

**Expected Overlay:** Screen should show blue text saying “THE END” with additional text below and a prompt to restart by pressing “r”

Miniboss cutscenes no longer show after respective miniboss is killed

**Actions:** Reach and kill Mega Krab or Sharkman then exit and re-enter the miniboss room

**Expected Results:** No cutscene plays, as if the player entered a standard room

# Test Cases - Robustness

**Actions:** Run the game for a significant amount of time. Additionally, walking back and forth between rooms and restarting (**‘r’**) will promote the creation and destruction of entities.

**Checking method:** VS tools and/or Valgrind as per Piazza @223

# Creative Components

These are the creative components we want graded for this milestone.

**Game Balance:** Adjusted enemy damage, drop rates, room configurations

**Reloadability**: Saving and loading to save files

**Enemy group behaviour; Cooperative planning**:

* Siren (Healer) Enemy, which can heal an ally when they get wounded