Black text: original proposal content
Blue text: how Milestone 1 aligns with the proposal
Red text: how Milestone 2 aligns with the proposal
Green text: how Milestone 3 aligns with the proposal
Purple text: how Milestone 4 aligns with the proposal

Technical Elements:

Identify how the game satisfies the core technical requirements: rendering; geometric/sprite/other assets; 2D geometry manipulation (transformation, collisions, etc.); gameplay logic/AI, physics.

- **Rendering**: Render pixel art onto predetermined maps. Render changes to the map (e.g. terrain breaking apart) when these changes are triggered by player actions.
    - Milestone 1:
        - Currently, textured used are temporary normal 2D graphics instead of pixel arts for testing. The art style will be changed into pixel art in the future.
    - Milestone 2:
        - Textures for assets such as the playable character and some buttons are changed to pixel art.
        - Pixel spritesheet has been created.
- **Geometric/sprite/other assets**: Playable characters, enemy characters, weapons (projectiles or melee) are sprites. Character animation (movement, actions), clickable buttons in the menu overlay (abilities, character 1/2/3...) are assets.
    - Milestone 1:
        - Playable characters and enemy characters are sprites.
        - The attack effect is temporarily generated with a red square.
        - Camera can be moved using arrow keys within the map boundary while the overlay UI buttons will stay fixed on the screen,
    - Milestone 2:
        - There is a new main menu page with clickable buttons.
        - Energy bar and health bar for characters have been added.
        - Attack preview arrows have been added
    - Milestone 3:
        - Added sprites for the ability buttons
        - Added sprites in the background for parallax scrolling
    - **Milestone 4:**
        - **Added sprites for the button cooldown**
        - **Added sprites for snowflake particles**

        - **Added sprites for button tooltip and feedback prompts**

- **2D Geometry manipulation:** Player and enemy sprites will be translated to move around the map for each level. Collisions between sprites will be detected. Character and weapon sprites will be animated to show movement and attacks.
    - Milestone 1:
        - Playable characters can move around the map using A and D keys to move left and right respectively.
        - Basic collisions between characters and terrains could be detected. If a player or enemy collides with the terrain, it will not be able to move to the direction of the terrain.
        - When a character is attacked, its sprite will flash red and shake.
    - Milestone 2:
        - Playable characters can climb up and down on a ladder using W and S keys.
        - Left and right movements of playable characters are animated.
    - Milestone 3:
        - Climb up and down movements of playable characters are animated.
- **Gameplay logic:** Need logic to determine outcome of character movements and attacks, allow characters to interact with weapons and potion ingredients, and to determine when the player team has succeeded or failed to complete the level. The order of the attacks will be determined based on the character's stats.
    - Milestone 1:
        - The collision between the attack and sprites will be used to determine if an attack is successful and damage will be taken.
        - The order of the attacks is determined based on the character’s initiative value.
    - Milestone 2:
        - A preview of the angle of the attack will be shown after clicking the ability button.
    - Milestone 3:
        - Some terrains are now breakable by attack abilities
- **Physics:** Player and enemy characters can launch projectiles at one another, which will be affected by gravity and launch angle. Different terrains (e.g. chocolate, gummy) will affect characters' movement abilities on a particular map.
    - Milestone 1:
        - Mouse click could determine the attack angle.

    - Milestone 2:
        - Long-range attack's attack object has a projectile under the influence of gravity.
- **AI**: Need a search algorithm (BFS) and/or a basic decision tree for the enemy behavior. Enemies move to the closest player target in order to get into actionable range. Depending on stats like location and health, the enemy chooses appropriate action.
    - Milestone 1:
        - The enemy has random movement but always attacks to the left.
    - Milestone 2:
        - The enemy will try to move towards the character and attack.
    - Milestone 3:
        - The enemy can climb the ladder to approach the closest playable character.
    - Milestone 4:
        - New healer enemy added
- **Audio:** Sound effects for player and enemy actions (e.g. attacks) or other gameplay events (e.g. beating a level).
    - Milestone 3:
        - Some audio effects are added for in-game events.

Advanced Technical Elements:

List the more advanced and additional technical elements you intend to include in the game prioritized on likelihood of inclusion. Describe the impact on the gameplay in the event of skipping each of the features and propose an alternative.

- Story elements
    - Animation for the storytelling with text dialogue
    - Milestone 3:
        - Story slides are shown at the beginning of the game.
        - Text dialogue about the story is shown in the tutorial level.
- Parallax scrolling background
    - Alternative: static scrolling background
    - Impact would be purely aesthetic if excluded
    - Milestone 3:
        - Simple parallax scrolling effect for the background of tutorial level and level 1.
- Enemy group behavior cooperative planning

    - When multiple enemies are within a certain range, they will work together to "gang up" on a single player character
    - Alternative: enemies will act independently regardless of their proximity to one another
    - Gameplay would be relatively unaffected if this element is excluded; enemy teams may become easier to defeat since it would be possible for individuals to act against the team's best interests
- Complex physical interactions with the environment
    - Breaking/changing terrain during gameplay
    - Alternative: no terrain changes during gameplay
    - Gameplay would be less complex if this element is excluded, but the game would still be playable
    - Milestone 3:
        - Breakable terrains are added to some levels.

Devices:

Explain which input devices you plan on supporting and how they map to in-game controls.

- Keyboard and mouse input
    - Milestone 1:
        - Mouse input for attack angle
- W (climb up), A (move left), S (climb down), D (move right)
    - Milestone 1:
        - A (move left), D (move right)
    - Milestone 2:
        - W (climb up), S (climb down)
- Mouse left click to interact with menu overlay (like clicking on skills or characters)
    - Milestone 1:
        - Mouse input for button
- Use arrow keys to move the camera to see the other parts of the level
    - Milestone 1:
        - Arrow keys can move the camera
- Angle arrow when using a skill that fires a projectile will follow mouse placement. Left click to fire
    - Milestone 2:
        - Mouse placement will influence the angle of the attack in the preview.
        - Left click will start the attack or fire the projectile.

Development Plan:

Provide a list of tasks that your team will work on for each of the weekly deadlines. Account for some testing time and potential delays, as well as describing alternative options (plan B). Include all the major features you plan on implementing (no code).

Week: January 24 - **Milestone 1 Sprint Start**

- First level design
- ECS model (Add a player character and an enemy character)
- Basic 2D rendering and rendering effects
- Basic character movement (WASD)

Week: January 31 - **Skeletal Game (due on February 4, Friday) (for creative part, 2 basic or 1 advanced)**

- Basic physics (e.g. gravity)
- Enemies' movement is initially random
- Overlay for abilities (melee attacks only)
- Simple texture for one playable character and basic terrain texture (textured geometry)
- Key-frame/state interpolation of playable character movement
- Well-defined game space boundaries for the designed first level
- Correct collision processing
- Camera controls

Milestone 1:

- Implemented:
    - A basic ECS model is implemented with components such as player, enemy, terrain, health, motion, camera, background, etc.
    - Have basic 2D rendering with simple textures
    - Have basic character movement with A (left) and D (right)
    - Key-frame and state are interpolated by setting different states for characters
    - Game space boundaries are created using terrains
    - Basic collision detections are implemented
    - Camera controls using arrow keys are implemented
    - Simple randomized enemy movement and a hard-coded attack action
- Missing:
    - A (up) and S (down) controls are missing due to the map design; the map of the first level does not require these movements

Week: February 7 - **Milestone 2 Sprint Start**

- Sprite sheet animation

- Projectile abilities angle preview
- Simple decision tree for enemy abilities
    - One ranged attack, one melee attack
    - End turn if no player characters are in range for attacks
- Help/tutorial features for users

Week: February 14

- New integrated assets
- Basic user tutorial/help
- More level design
- Advanced physics and animation
    - Projectile attacks

Week: February 21 - **Minimal Playable Game (due on February 25, Friday)**

- Reloadability and level selection
- Debugging earlier milestones

Milestone 2:

- Implemented:
    - Spritesheet animation for playable characters
    - Gravity for all entities that are gravity affected (i.e. players, enemies)
    - Proper collision handling in respect to a character free falling while colliding with a wall
    - Angle preview for attacks based on mouse movement
    - Enemy AI:
        - Move to the attack range to attack players
        - Use advanced attack when it is not in cd
        - Keep distance when the health is under 40
    - A help page for users
    - New assets such as the main menu, more buttons, the ladder, health bar, and energy bar
    - Smooth character on and off the ladder logic
    - Long-range projectile attacks
    - Level design for the first level
- Missing:
    - Level selection: only have the first level
- Discrepancies: New tools not mentioned in the proposal have been used
    - The level design is initialized using JSON, and a JSON library called nlohmann-json is used to read .json file
        - https://github.com/nlohmann/json

    - A drawing software called Clip Studio Paint is used to create textures

Week: February 28 - **Milestone 3 Sprint Start**

- Debugging earlier milestones
- Additional levels/terrains
- Handle user input
- Parallax scrolling background

Week: March 7

- Memory management
- Real-time gameplay
- Audio effects

Week: March 14 - **Playable Game (due on March 18, Friday)**

- Debugging earlier milestones
- Consistent game resolution
- Story refinement
    - Introductory animations
    - Ending animations

Milestone 3:

- Implemented:
    - Fixed bugs found
    - 2 additional levels with new effects and 1 tutorial level
    - Breakable terrains
    - Simple parallax scrolling background
    - New audio effects for in-game events and background music are added
    - Introductory story slides
- Missing:
    - Ending animations
- Discrepancies
    - New heal ability added for the playable characters

Week: March 21 - **Milestone 4 Sprint Start**

- Debugging earlier milestones
- Physics-based animations
- Comprehensive tutorial levels
- Enemy group behavior

Week: March 28

- Main menu screens (main menu, level select, character select, character stats screen)
- Optimize user interaction
- Complete tutorial and additional levels
- Evaluate and improve UX

Week: April 4 - **Final Game (due on April 8, Friday)**

- Complete additional advanced features as necessary
- Debugging and minor improvements as necessary

Milestone 4:

- Implemented:
    - Fixed bugs found
    - Explicit save functionality
    - UI for cooldowns
    - Support for different resolution
    - New textures for menus
    - Refined prompts and tooltip
    - Snowflake particles
    - Healer enemy
    - Ending animation
- Missing:
    -
- Discrepancies
    -