GDD

🎮 EARLY ACCESS GAME DESIGN DOCUMENT (GDD)

Algorithmia: The Path of Logic — Early Access Build

(Prologue + Array Plains + Twin Rivers)

📌 0. Overview

Algorithmia is a puzzle-adventure RPG that teaches *data structures and algorithms (DSA)* through exploration, visual puzzles, and intuitive interactions.

Instead of memorizing formulas or grinding LeetCode, players learn DSA concepts by *living them* inside a story-driven world.

Early Access includes:

- **3 regions:** Prologue, Array Plains, Twin Rivers
- **10+ core puzzles**
- **A full Concept Bridge system**
- **Two multi-phase boss puzzle battles**
- **A simplified Logic Forge system**
- **Codex entries for every concept learned**
- **2–4 hours of gameplay**

The purpose of Early Access is to deliver a polished vertical slice that captures the game's identity:

✨ *DSA learning through fun, intuitive gameplay.*

📌 1. Core Gameplay Pillars

1. Exploration

- Top-down 2D pixel world
- Walk around villages and natural areas
- Talk to NPCs
- Step into puzzle zones or interact with puzzle objects

2. Intuitive DSA Puzzles

- Each region contains **3–5 puzzles**
- Each puzzle is a visual/metaphorical representation of an algorithmic pattern
- Difficulty escalates gradually

3. Concept Bridge (Core Feature)

After each puzzle:

- NPC explains what the player *actually did*
- Introduces the DSA pattern informally
- Shows commented pseudocode
- Provides a mini interactive practice exercise
- Updates the Codex

4. Boss Puzzle Battles

- No combat
- Multi-step, high-intensity puzzles
- Each boss represents a FAANG-style algorithm pattern
- Completing all region puzzles unlocks boss

5. Logic Forge

- A small “coding dojo”

- Lets the player practice algorithm steps in simplified form
- Early Access version uses drag-and-drop, choose-the-step, pointer-movement puzzles

6. Codex

- In-game encyclopedia
- Stores all patterns, explanations, and worked examples
- Unlocks entries as you complete puzzles

📌 2. Controls

- **Move:** WASD / Arrow Keys
- **Interact:** E
- **Menu:** ESC
- **Codex:** C
- **Inventory:** I
- **Fast-forward dialogue:** Space

📌 3. World Structure (Early Access Scope)

Regions Included

1. **Prologue – Chamber of Flow**
2. **Array Plains – Arrays, Sorting, Hashing, Two Sum**
3. **Twin Rivers – Two Pointers, Sliding Window**

Region Flow

Prologue → Array Plains → Twin Rivers → End of EA

Each region:

- 3–5 core puzzles
- 1 boss
- 1–2 Logic Forge challenges
- 1 Codex set

📌 4. Region 0 — Prologue (Chamber of Flow)

Purpose

- Teach exploration basics
- Introduce puzzle activation
- Establish tone + world rules
- Introduce Professor Node
- Show how Concept Bridge works in a simple form

Environment

- Floating geometric platforms
- Ambient glow
- Minimal obstacles
- Soft music

🧩 Prologue Puzzles

Puzzle P0-1 — "Follow the Path"

Goal: Introduce pattern following

Mechanics:

- A sequence of tiles lights up
- Player walks on tiles in the same order

Learning:

- Pattern matching
- Sequence recognition

Puzzle P0-2 — “Fractured Sentinel”

Goal: Teach environmental manipulation

Mechanics:

- 3–4 glowing fragments are scattered
- Push them into correct slots
- Unlock passage

Learning:

- Spatial reasoning
- Cause-and-effect

🛡️ Prologue Boss — Fractured Sentinel

Type: Simple puzzle room boss

Phases

1. Repeat longer pattern sequence
2. Assemble larger multi-part tile formation
3. Follow fading footprints to final pedestal

Result:

- Sentinel bows and dissolves
- Unlocks Array Plains

📌 5. Region 1 — Array Plains

Theme

Order, indexing, grouping.

Inspired by sorted farmland and organized crop fields.

Atmosphere

- Rows of crops, each labeled
- Barns filled with baskets and crates
- Villagers frustrated by “out-of-order” items

Concepts Taught

- Arrays
- Sorting
- Hashing
- Two Sum Pattern

🧩 Array Plains Puzzles (Core)

Puzzle AP1 – “Fix the Farmland”

Concept: Sorting + Indexing

Mechanics:

- Tiles 0–7 scrambled
- Push them into correct order
- Rails lock when correct

Concept Bridge:

- Sorting
- Index value relationship

- Pseudocode for simple sort

Puzzle AP2 – "Find the Lost Tool"

Concept: Direct access (O(1))

Mechanics:

- Villager describes lost tool
- Baskets labeled with indices
- Player chooses exact basket

Concept Bridge:

- Index vs search
- Why O(1) is powerful

Puzzle AP3 – "Organize the Harvest"

Concept: Hashing

Mechanics:

- Items fall with symbols (🌾, 🍓, 🥔)
- Group into matching baskets
- Some items designed to collide

Concept Bridge:

- Hash buckets
- Collision concept
- Simple hash illustration

Puzzle AP4 – "The Pairing Grounds"

Concept: Two Sum pattern

Mechanics:

- Step on 2 tiles that add to target

- Timer increases tension
- Wrong pairs reset

Concept Bridge:

- Two Sum explanation
- Pseudocode + annotated walk-through
- Mini-forge: choose partner logic

📌 6. Region 1 Boss — The Shuffler

Pattern Inspiration:

- Sorting
- Hashing
- Two Sum
- FAANG equivalent: **Group Anagrams / Two Sum / 3Sum**

Boss Type: Hybrid Puzzle Boss

Phase Breakdown

Phase 1 — Sort the Rows

Rearrange shifting crop rows under time pressure.

Phase 2 — Hash the Baskets

Correctly group symbols into matching “buckets.”

Phase 3 — Two Sum Arena

Step on pairs of tiles that sum to the target.

Phase 4 — Fix the Broken Sequence

Three lanes scramble independently — fix all at once.

📌 7. Region 2 — Twin Rivers

Theme

Mirrored riverbanks, warm vs cold waters, floating bridges.

Concepts Taught

- Two Pointers
- Pointer Movement
- Sliding Window

Atmosphere

- Gentle flowing sound
- Reflective surfaces
- NPCs refer to “moving together” or “tracking windows”

🧩 Twin Rivers Puzzles (Core)

Puzzle TR1 – “Mirror Walk”

Concept: Two pointers

Mechanics:

- Control two characters simultaneously
- Must stay symmetric

Concept Bridge:

- What two pointers are
- Why they start opposite ends

Puzzle TR2 – “Meeting Point”

Concept: Convergence

Mechanics:

- Move inward to reach glowing target
- If wrong move made → reset

Concept Bridge:

- Pointer convergence logic
- When to move which pointer

Puzzle TR3 – "Sliding Window Catch"

Concept: Sliding window

Mechanics:

- Adjustable glowing frame
- Must capture moving fish pattern

Concept Bridge:

- Expanding vs shrinking window
- Maintaining a valid window

Puzzle TR4 – "Breaking the Currents"

Concept: Pointer logic under shifting conditions

Mechanics:

- Current pushes left pointer down, right pointer up
- Maintain symmetry

Concept Bridge:

- Pointer decisions under constraints

📌 8. Region 2 Boss — Mirror Serpent

Pattern Inspiration:

- Two Pointers

- Sliding Window
- FAANG equivalents: “Container With Most Water”, “Longest Substring Without Repeating Characters”

Boss Type: Traversal + Pattern Boss

Phase Breakdown

Phase 1 — Symmetry Trial

Move two characters in mirrored paths.

Phase 2 — Convergence Challenge

Reach the exact meeting point discovering correct logic.

Phase 3 — Sliding Window Trap

Adjust window to capture serpent’s weak spot.

Phase 4 — Combined Final

Perform all mechanics under timed pressure.

📌 9. Concept Bridge System (Detailed)

This is the MOST important educational mechanic.

Each puzzle ends with:

🟧 1. Story Recap

NPC tells the player what they did:

> “You didn’t check every pair.
>
> You looked at one tile, then asked what tile completes it.”

🟦 2. Pattern Reveal

Example:

> “This is called the Two Sum pattern.
>
> It’s used whenever you need to find two values that add to a target
>
> without checking every possible pair.”

🟨 3. Pseudocode with Human Explanation

```
for each number x in the list:
    figure out y = target - x
    if y is in memory:
        return (x, y)
    else:
        store x in memory
```

Explained:

- “Look at each number one at a time.”
- “Ask what partner you need.”
- “Check if you've seen that partner before.”
- “If yes, you're done.”

🟩 4. Micro-Practice (Logic Forge Lite)

Examples:

- Reorder algorithm steps
- Choose pointer movement
- Match value with partner
- Identify earliest valid window

🟫 5. Codex Update

Unlocks full entry with:

- Concept name
- Plain-English explanation
- Pattern definition
- Pseudocode
- 1–2 text-only real problem descriptions
- Tips for recognition

📌 10. Logic Forge (EA Version)

Location

A small glowing building in each region.

Early Access Version Includes

- “Assemble the algorithm steps” puzzles
- “Choose pointer move” interactive snippets
- “Match the pattern” quizzes
- No real code execution yet

Rewards

- Codex unlocks
- Advancement
- Story dialogue

📌 11. Codex (DSA Pokédex)

Stores

- Patterns
- Explanations

- Pseudocode
- Real-world analogies
- Example problems (described, not solved)

EA Entries

- Arrays
- Sorting
- Hash Maps
- Two Sum
- Two Pointers
- Sliding Window

📌 12. Inventory

Very lightweight:

- Key Fragments
- Special region artifacts
- Logic Forge passes

No consumables yet.

📌 13. UI/UX

Panels

- Dialogue box
- Inventory
- Codex
- Quest Log (main quests only)

- Settings

HUD

- Clean, minimal
- Interaction prompts only

UX Principles

- Simple
- Readable
- Friendly
- No clutter
- Fast dialogue with Space

📌 14. Art Direction

Style

- 2D pixel art
- Bright, clean, Pokémon/Minish Cap-inspired
- Smooth animations
- Subtle glow around algorithmic elements

Regions

- Prologue → abstract, glowing
- Array Plains → agricultural, organized
- Twin Rivers → mirrored blue/orange palette

📌 15. Audio Direction

Music

- Calm, reflective
- Region-themed melodies

SFX

- Soft footsteps
- Puzzle triggers
- Item pickups
- Glitch effects for boss

📌 16. Technical Design

Engine

Godot 4.2 (2D)

Core Singletons

- `GameState` — save progress
- `CodexManager` — pattern entries
- `LogicForgeManager` — Forge challenges
- `Analytics` — local event logging

Scenes

- Regions (maps)
- Puzzle rooms
- Logic Forge
- Boss arenas
- Concept Bridge screens

Save Data

- Completed puzzles
- Codex unlocks
- Key fragments
- Region progress

📌 17. Early Access Roadmap

Phase 1 — Prologue

- Build map
- 2 puzzles
- Boss
- Base UI
- Concept Bridge framework

Phase 2 — Array Plains

- Map + NPCs
- 3–5 puzzles
- Boss
- Logic Forge AP
- Codex AP
- Concept Bridges

Phase 3 — Twin Rivers

- Map + mechanics
- 3–5 puzzles
- Boss
- Logic Forge TR

- Codex TR
- Concept Bridges

Phase 4 — Polish & Launch

- Save/load
- Music
- SFX
- QA
- Trailer
- Steam setup
- Release
