Technical Whitepaper: The Melancholy Engine

Author: Nicholas Panek **Date:** December 2, 2025 **Subject:** Algorithmic Authorship of Procedural Minimalist Piano Compositions

1. Abstract

"The Melancholy Engine" is a proprietary generative software system developed by Nicholas Panek. Unlike stochastic "random note" generators, this engine utilizes a **Constraint-Based Harmonic Model** to emulate the emotional cadence of contemporary classical piano. The software functions as a "Virtual Pianist," executing specific performance directions defined by the author, including harmonic minor constraints, rubato timing variances, and velocity layering.

2. Creative Methodology

The music generated by this system is an instance of **Parametric Composition**. The author (Panek) defines the emotional "boundary conditions," and the software explores the permutation space within those boundaries.

The copyright claim is founded on:

1. **The Harmonic Logic:** The specific restriction to Minor and Dorian modes to evoke specific emotional responses (Sadness, Longing, Resolve).
2. **The Performance Algorithm:** The logic governing the "Left Hand" (Accompaniment) versus "Right Hand" (Melody) interaction.

3. The Algorithm (Mathematical Proof)

The engine constructs music based on two distinct, interacting logic streams.

A. The Harmonic Constraint (The "Sadness" Scale)

The software is restricted to the Natural Minor scale (M) relative to a root (R), often modifying the 7th degree for harmonic tension:

$$M=\{R+i \mid i \in \{0,2,3,5,7,8,10\}\}$$

B. The Accompaniment Function (Left Hand)

The left hand does not play randomly. It follows an **Arpeggiation Logic** (Lt) defined by the **Flow Constant** (F). It creates a "bed" of sound by rolling through the root, third, and fifth of the current chord.

$$Lvel \approx Uniform(40,65)(\text{"Soft/Background"})$$

C. The Melody Function (Right Hand)

The right hand generates melody based on a **Sorrow Probability** (S).

- If S is high, the algorithm favors long, sustained notes (Whole/Half notes) on chord tones.
- If S is low, it introduces "Passing Tones" (notes between the chord tones) to create movement.
- **Velocity Logic:** The right hand always plays 20-30% louder than the left hand to simulate a pianist "singing" the melody.

D. The Rubato Simulation (Human Timing)

To prevent robotic output, the Time Delta (Δt) is not fixed. It "drifts" based on a sine wave function to simulate a human player slowing down at the end of a phrase:

$$\Delta t_{final} = \Delta t_{base} + (\sin(t) \times DriftFactor)$$

4. Uniqueness and Verification

Every composition is stamped with its generation parameters in the filename:

- **Format:** `Piano_[Key]_[BPM]_[Flow]_[Sorrow].mid`
- **Example:** `Piano_Am_65BPM_Flow80_Sorrow9.mid`

5. Conclusion

By defining the specific scales, the interaction between the two hands, and the velocity curves that simulate human emotion, Nicholas Panek retains sole authorship of the logic and the resulting audio recordings generated by "The Melancholy Engine."