

CHRISTIAN FENNER

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Game mathematician building exact solvers for reel strip design, payout targeting, and regulatory compliance. Published original research on constructive reel strip theory (Zenodo, DOI: 10.5281/zenodo.22139239). Self-directed tools engineer who has built the same solvers for pull-tab games at production scale.

EXPERIENCE

Game Mathematician → Game Design Systems Engineer Mar 2025 – Jun 2026

Arrow International | Las Vegas, NV (Remote)

Custom role and multi-year career plan with team build-out created around individual contributions. Compensation doubled.

- Designed and shipped a complete pull-tab math model: UFL-style game with locking-wild free-game feature and progressive jackpot. Full ticket distributions, prize tables, par sheet, and regulatory documentation.

How? Culmination of every tool below: jackpot solver, probability engine, distribution editor, knapsack balancer: applied end-to-end. Building this game drove the decision to make each tool general-purpose.

- Built real-time progressive jackpot solver. Company went from 2 inaccurate models in 5 years to one on every game, 10 seconds each.

How? Constrained optimization over contribution rates using truncated-geometric survival distributions with moment matching.

- Replaced Monte Carlo with instant exact computation for player-session economics (coin-in, time-on-device, expected cash-out).

How? Absorbing Markov chains and discrete convolution. Boolean event engine answers compound queries simulation cannot.

- Eliminated hours of manual Excel rebalancing; now takes 10 minutes, no math background required.

How? Custom brush editor for painting ticket distributions freehand. Atomic suck/split moves preserve EV and hit-rate exactly. Volatility knob via max-entropy Boltzmann fitting.

- 10-15% productivity lift across ~100 employees.

How? End-to-end CI/CD automation integrating version control, cloud storage, and computer-vision detection to auto-generate documentation.

Actuarial Analyst Jan 2024 – Feb 2025

AFLAC | Remote

- Causal inference models (R, Python) for policy evaluation. 50x speedup over prior simulation via SDEs.
- Built direct-to-consumer data pipeline (SQL, Snowflake, Streamlit) for experience studies.

PUBLISHED RESEARCH

- "Existence and Construction of Reel Strips from Mathematical Specifications": Preprint, Zenodo (2026). DOI: 10.5281/zenodo.22139239. First constructive theory for targeting RTP, hit rate, and volatility simultaneously. Current SOTA (Kamanas et al., 2021) searches count vectors for RTP alone via metaheuristic optimization and lists independent hit-rate and volatility control as open future work. This paper solves that open problem by construction.

INDEPENDENT GAME MODELS

- Jackpot Climb: Treasure Temple: Original 3x5 ways-to-win slot designed independently. 95.8% RTP across four components: base game with compounding stacked-wild multipliers (Temple Shake), a hold-and-spin vertical climb feature with lava destruction and cliff-hanger survival mechanics (Jackpot Climb), locking-wild free spins with conditional reelsets modeled as an absorbing Markov chain (Amazing Absorbers), and a progressive jackpot. Full reel strips, payable, par sheet, sensitivity analysis, and analytical verification. Playable demo at gamemathemagics.com.

PORTFOLIO: GAMEDMATHMAGICS.COM

(Read the paper, see my custom career plan, interact with my apps, and play and see my math models, all LIVE here)

- Maestro: Full game-math design platform: node-graph authoring, knapsack-balanced tickets, live simulator, self-describing export.
- Loom: Reel strip construction tool: builds strips from target specifications using the co-location matrix framework.
- Foresight: Player-experience query engine: exact compound event probabilities with full session economics.
- Runway: Optimal play advisor: bet sizing, denomination mixing, and stop-loss strategy for any distribution.

TECHNICAL SKILLS

Languages: Python, C#, C++, JavaScript, TypeScript, SQL, R

Methods: Custom Hierarchical Knapsack Solvers, Custom Compositional Convolutions via Kernel Decomposition, Constrained Optimization, Absorbing Markov Chains, Discrete Convolution, L-BFGS, Reverse-Mode AD, Branch-and-Bound, MILP, Monte Carlo, Causal Inference

Tools: Excel (PyWin32COM automation), Visual Studio, Snowflake, Power BI, Git, Node.js, React

EDUCATION

B.S. Mathematics | University of Oklahoma | 4.0 GPA 2023

All undergraduate math completed in 2 years + 27 graduate credit hours. Tutored every subject at the math center: including courses taken concurrently, from calculus through stochastic processes.

Actuarial Exams: P, FM, FAM, SRM, MAS-1. All passed within one year

Fun fact: Beat 10/10 escape rooms in a single day with one friend. Perfect record.