Jacob B. Collins

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EDUCATION

M.S. Computer Science | Expected Graduation: December 2026　　　　**California State University, Chico**
B.S. Computer Science | Cum Laude **|** December 2025 **| GPA: 3.74**
Data Science Certificate | December 2025
HPC & Quantum Computing Club | President
CSCI Research Enthusiasts Club | President

SKILLS

Programming: C/C++, Python, R, MPI, OpenMP, Pthreads, CUDA-Q, Qiskit, UDS, Winsock

Tools & Libraries: OpenCV, NetworkX, PyTorch, Slurm, Docker, Singularity, SDL, Git CLI, CMake, GCE

PUBLICATIONS

Mission Planning Simulation and Design Software Scaling
for Shared and Distributed Memory Computing
- Modified NASA's GMAT to run distributed Monte-Carlo simulations.
- Used OpenMP to parallelize 6-DOF Runge-Kutte integration.
- Automated testing with Bash scripts.
- *2,387% Speedup* on a 62-node system *(96.2% parallel).*

IEEE Aerospace Conference 2026 10.0304
Tools: *MPI, OpenMP, CMake, Bash, C++*

Quantum Semiprime Factorization: Leveraging Grover's Algorithm for
Efficient Prime Decomposition
- Wrote a generalized quantum circuit construction & testing program.
- Utilized Grover's Algorithm to find prime factors.
- New method that uses asymptotically less qubits than alternatives.
- Ran tests as Slurm jobs on SDSC Expanse with custom singularity container.

CS-CSU 2025 Research Conference
Tools: *Slurm, Singularity, CUDA-Q, C++*

PROJECTS

Distributed Sieve of Eratosthenes
- Implemented a large prime number sieve ($p^2 < 2^{128}$) from scratch in C.
- MPI for distributed memory scaling, OpenMP for shared memory scaling.
- Sieve is a bit-indexed array to maximize memory efficiency.
- Ran tests via Slurm on SDSC Expanse using 16 nodes x 128 threads/node.
- *12,655% speedup (99.3% parallel)* observed finding all primes $< 10^{10}$

Tools: *Slurm, MPI, OpenMP, C*

Low-Latency Cross-NAT Multiplayer Game
- Fully functional cross-platform game engine and server from scratch in C++.
- Matchmaking server hosted on Google Cloud Enterprise (GCE) VM.
- Client-side network functions written for both UNIX sockets and Winsock.
- Implemented UDP Hole Punch for clients to achieve cross-NAT P2P.

Source - GitHub
Tools: *UDS, Winsock, CMake, GCE, SDL, C++*

Iterative Network Simulation
- Simulated an iterative adaptation of the prisoner's dilemma.
- Ran testing to view behavior provided varying network structures.
- Automated generation of animations to visualize the scenario over time.

Source - GitHub
Tools: P*ython, NetworkX*

Road Network Processing & Analysis
- Designed a road network extraction & processing pipeline for OSM data.
- Prioritized memory efficiency by parsing file streams with low overhead.

Writeup on Pages | Source - GitHub
Tools: *Python, NetworkX, R, Bash*

EMPLOYMENT

i-SAIL Lab Assistant
- Organized budget, purchase orders, diagrams, etc. for WIP computer lab.
- Designed 3D models of lab space & equipment to verify lab plans.
- In-person liaison for students in summer research program.

California State University, Chico
Dr. Sam Siewert
June 2025 – August 2025

Lead Student Research Assistant
- Coordinated student research efforts involving quantum computing.
- Taught how to design & simulate quantum circuits with CUDA-Q in C++.

Chico State Enterprises
Dr. Jaime Raigoza, Dr. Sam Siewert
June 2024 – December 2024