# How IBM aims to prove quantum answers no ordinary computer can check

Today’s top story, from reporter Sascha Brodsky:

What happens when a quantum computer solves a problem that no conventional computer can verify? That’s becoming one of the defining questions in quantum computing—and three new demonstrations involving IBM bring the industry closer to answering it. The papers describe calculations that pushed beyond the practical reach of leading classical methods while introducing new ways to test whether the quantum results can be trusted.

“Verification remains one of the biggest challenges in firmly establishing experimental quantum advantage,” Bill Fefferman, an Associate Professor at the University of Chicago, said in a news release.

The three papers, involving researchers from IBM, the University of Chicago, Qedma, Algorithmiq and other organizations, describe calculations that reached regimes where leading classical approaches became impractical or produced inconsistent answers. They also present ways to assess the quantum output in those regimes that can’t be accessed by conventional machines.

Quantum computing is a way to process information using the laws that govern matter at extremely small scales. Ordinary computers use bits recorded as zeros or ones. Quantum devices rely on qubits, which can represent combinations of those states and tackle certain problems differently.

Under IBM’s definition, quantum advantage occurs when a quantum processor performs a task beyond the reach of known classical computing methods—and can still provide a rigorously validated outcome.

The University of Chicago and IBM collaboration used a structured alternative to random circuit sampling, a benchmark involving patterns that become increasingly difficult for conventional computers to simulate.

The authors encoded a 70-qubit logical computation across 97 physical qubits, the hardware components that carry quantum information. The encoding was designed to detect errors that might otherwise disrupt the operation.

IBM and the university said the processor finished in roughly 15 minutes, while leading classical simulations would require impractical resources. The paper establishes a statistical lower bound on fidelity, a measure of how closely the machine produced the intended quantum state.

IBM has reiterated that these are claims of quantum advantage and the next step is for the classical community to respond. The company has placed all three papers on its Quantum Advantage Tracker, where outside groups can test the claims against improved classical algorithms.

“Advances in verification have the potential to unlock practical applications for the next generation of quantum computers,” Soumik Ghosh, a doctoral student at the University of Chicago and co-author, said in the news release published about the demonstration.