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## Separating quantum and classical computing: rigorous proof and practical application

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## Stellingen

Behorende bij het proefschrift

“Separating quantum and classical computing: rigorous proof and practical application”

1. FBQP  $\neq$  FBPP. [Chapter 2]
2. Any circuit cutting scheme (cut-local or otherwise) will never be able to efficiently decrease the minimum width of an adversarially selected circuit by a constant amount. [Chapter 5]
3. Many cases modelled as computation with advice are in fact instances of bounded advice. [Chapter 3]
4. Practical use of quantum machine learning will require hybrid schemes to effectively use limited quantum resources. [Chapter 4, Chapter 6]
5. Pretending every PhD thesis can be understood by readers not already intimately familiar with the topic presented is exactly the kind of doublethink George Orwell was afraid of in ‘1984’. [Chapter 1]
6. Bounds on circuit cutting can ultimately be improved to match the strength of quantum space hierarchy theorems.
7. Numerical evidence and scaling arguments in the moments of the permanent are sufficient evidence to believe the Permanent Anti-Concentration Conjecture.
8. The most useful quantum algorithms will be discovered by empirical use, not found via theoretical analysis.
9. It is common for scientists to overprescribe meaning to variance. For practical application, the probability of a given event or set of events is the relevant quantity. The variance is merely a tool to calculate this probability, and is, by itself, meaningless.
10. Without a societal realignment to meet the threats posed by superintelligent AI, with high probability, we have less than 20 years left to live.

Simon Callum Marshall  
Leiden, 27 May 2025