Proposal Review 8 : 2152988

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Agency Name:	National Science Foundation
Agency Tracking Number:	**2152988**
Organization:	
NSF Program:	CDS&E-MSS
PI/PD:	Hickernell, Fred
Application Title:	Collaborative Research: Quasi-Monte Carlo for Efficient Simulation
Rating:	Fair

Review

Summary

In the context of the five review elements, please
evaluate the strengths and weaknesses of the proposal with respect to intellectual merit.

Strengths:
Monte Carlo methods are becoming increasingly popular to solve science and engineering problems, and it is clear that approaches that increase their convergence rates would advance such problems. The proposed work will expand an existing software library to improve its performance. It will also develop relevant theory around convergence rates, and explore techniques to recover it based on the findings. New methods for sampling big data will also be explored.

Weaknesses:
It is unclear whether this proposal is appropriate for the CDS&E-MSS program, as the priority of the work seems to be implementation of existing methods into existing software.

This proposal would benefit from more clear organization. The introductory paragraphs require subsequent sections to be read in order to understand much of the content presented there. Although the proposal clearly explains the purpose and advantages of LD points and QMC methods, a substantial amount of background knowledge is assumed (e.g. how are LD points generated? What limitations to applications do the smoothness requirements on f pose?). This proposal would benefit from higher level discussions to introduce and motivate the challenges that the proposed work will address, perhaps in place of the excerpts of python code. The proposal would also benefit from fewer abbreviations and jargon to improve readability and understanding. The proposal would be made stronger if the plans for development were more specific, e.g. what approaches will be taken to develop a theoretical description of the performance of LD sequence generators described in 3.1.1.

In the context of the five review elements, please
evaluate the strengths and weaknesses of the proposal with respect to broader impacts.

Strengths:
This proposal will grow an open source python software library, increasing access for practitioners, and accelerating adoption in new application areas. It will also provide a test bed for theoreticians and algorithm developers. I appreciate the acknowledgement and emphasis on the importance for students to learn appropriate use of mathematical tools. The PI has demonstrated their commitment to increasing accessibility, as the existing code is open source and a tutorial on the software was given in 2020,

Weaknesses:
Although the PIs have experience advising PhD students who are women, the proposal would be made stronger if specific plans of recruiting and supporting students from this and other underrepresented groups were outlined.

Please evaluate the strengths and
weaknesses of the proposal with respect to any additional solicitation-specific review criteria, if applicable

Summary Statement

This proposal addresses quasi monte carlo methods, which uses LD, or low discrepancy, sampling, however the proposed work is implementation of existing methods into existing software. The challenges that the proposed work will address were not well motivated, and details for the software (algorithmic) development were sometimes lacking.

This proposal ranks in the bottom third of those proposals that I reviewed for this panel.