HR001119S0052
ONISQ
Frequently Asked Questions (FAQs)
as of 4/10/19

35Q: Do we need to comply with NIST 800-171?

35A: Please see Section VI.B.10 of the BAA titled "*Disclosure of Information and Compliance with Safeguarding Covered Defense Information Controls."*

34Q: Which sections of the FAR are applicable to the proposers and ultimately participants in the program?

34A: Per Part II Section I of the BAA "This Broad Agency Announcement (BAA) constitutes a public notice of a competitive funding opportunity as described in Federal Acquisition Regulation (FAR) 6.102(d)(2) and 35.016 as well as 2 CFR § 200.203. Any resultant negotiations and/or awards will follow all laws and regulations applicable to the specific award instrument(s) available under this BAA, e.g., FAR 15.4 for procurement contracts."

33Q: I work for a company that has quantum hardware and we want to make it available for ONISQ performers to try out their ideas. How can we participate in the program?

33A: DARPA does not plan to enter an agreement with any company to make hardware available to ONISQ performers. Companies that are interested in providing access to their equipment for potential performers should participate in teaming arrangements with proposers directly and be included as part of their teams (even if they wish to participate as unfunded collaborators).

32Q: Can foreign institutions participate in the program, either as the prime or as a subcontractor?

32A: Yes.

31Q: For a TA1, is there a preference for an academic partner or a company to be the prime proposers?

31A: There is no preference on the type of institution that can propose as a prime.

30Q: Is there an agreed upon benchmarking figure of merit (FOM)?

30A: There is no preset benchmarking FOM, as it depends on the problem of choice. It is expected that the proposers describe in detail the rationale behind the chosen benchmarking FOM.

29Q: Can a team propose two different hardware platforms in TA1?

29A: Yes.

28Q: Is it possible to parallelize (perhaps even in time) either one or multiple smaller processors in order to reach the metric of $N \cdot p > 10{,}000$?

28A: No, that metric applies to a single processor. Notice, in addition, there are also quantum advantage demonstration goals that will need to be achieved and it is anticipated that single processors with $N \cdot p > 10{,}000$ will be needed.

27Q: Are approaches to error-corrected NISQ devices in scope? What about error mitigation techniques.

27A: The advancement of fully fault-tolerant quantum computation is outside the scope of this BAA. Error mitigation techniques may be needed as part of TA1 in order to reach program goals.

26Q: Can a PI or subcontractor be in multiple proposals for the same TA?

26A: Yes. If more than one such proposal is selected for funding the government will make appropriate changes to the Statements of Work to ensure that the same work is not funded multiple times.

25Q: Is the parameter p the same as circuit depth d?

25A: No. While p and d are proportional to each other their relationship will depend on the choice of specific hardware and algorithm. For some implementations, d might be significantly larger than p.

24Q: Is the desire to understand extension to larger problem sizes for a given problem instance restricted to hardware demos (i.e. is classical simulation of QAOA in scope of the program)?

24A: Extension to larger problem sizes is relevant to both TA1 and TA2. Classical simulation of QAOA is not relevant on its own but it may be needed as part of an effort to meet program objectives.

23Q: What is the performance metric (e.g. probability of success) to determine whether a particular value of $N \cdot p$ has been achieved?

23A: This depends on the implementation and hardware platform. The burden is on the proposer to explain how this will be proved or determined.

22Q: Will improvement of current algorithms like QAOA or theoretical study of the feasibility of current algorithms be considered in TA2?

22A: DARPA is interested in innovative and revolutionary approaches instead of incremental improvements over the state of the art. TA2 has 3 subareas with the aim of addressing these program goals: (a) Identify families of instances in combinatorial optimization where hybrid quantum/classical approaches can outperform classical methods; (b) Develop novel

methods that will enable addressing large combinatorial optimization problems for DoD applications and can be efficiently implemented in NISQ devices; (c) Develop new quantum optimization algorithms for NISQ devices.

21Q: Is there a minimum value for the number of qubits N and parameter p required to meet the figure of merit metric $N \cdot p$ >10,000?

21A: No. Notice, however, there are also quantum advantage demonstration goals that will need to be achieved.

20Q: Can a proposer use cloud-based quantum computers instead of building hardware for TA1?

20A: Every proposal will be judged by the likelihood that the approach can meet the milestones and goals of the program; ONISQ is agnostic with respect to the hardware that is proposed.

19Q: How do you plan to run ONISQ if multiple teams receive awards? Will there be venues for cross-pollination of ideas, approaches and results between teams?

19A: PI review meetings will be held approximately every six month to foster collation between teams and foster collaboration.

18Q: Is it possible to propose investigating more than one related combinatorial optimization problems as part of the same proposal?

18A: Yes.

17Q: What (if any) interaction is expected or desired between TA1 and TA2 teams?

17A: DARPA is hoping there will be interaction during the course of the program, as it may prove beneficial to teams working on both TAs. It is not required and need not be addressed in a proposal.

16Q: Are combinatorial models of chemical phenomena (e.g. hydrophilic/hydrophobic protein folding) considered chemistry for ONISQ purposes?

16A: See 15A.

15Q: Will quantum reinforcement learning or other machine learning problems be considered an optimization problem for this program?

15A: See 14A. The onus is on the proposers to show that the problem of choice maps onto a combinatorial optimization problem.

14Q: Frustrated spin systems can be mapped onto classical combinatorial optimization problems. This is relevant to strongly-correlated magnetic materials. The gate-model QAOA approach can be used. Does this fit the ONISQ program?

14A: The program is focused on combinatorial optimization problems, the choice of problem is up to the proposers. National security relevance needs to be justified (potential contribution and relevance to the DARPA mission is one of the proposal evaluation criteria).

13Q: Could you clarify whether national laboratories like NIST and Sandia are eligible as subcontractors? Is permission of PM possible or required?

13A: This depends on whether the government entities are eligible to compete. If they are not eligible to compete they may be funded separately as Government Furnished Service, but they can be included in proposals as subcontractors without PM permission. The burden is on the government entity to show whether they are eligible or not to compete. Please refer to Section III.A.1.b of the ONISQ BAA.

12Q: Is there a down-select between Phase 1 and Phase 2?

12A: Each project will be evaluated at the end of Phase 1 with respect to the milestones and goals and the decision about Phase 2 will be made based on performance in Phase 1.

11Q: Does TA2 require demonstration on NISQ hardware or is the work purely theoretical? Would implementation in existing hardware make a TA2 proposal more competitive?

11A: TA2 work is purely theoretical. Implementation in existing hardware is beyond the scope of TA2.

10Q: Is there a floor or ceiling amount for each performing team?

10A: No. Cost should be commensurate with the amount of work needed to meet the program objectives.

9Q: The BAA states that the approximate anticipated sum-total of awards made is $33M. Is there a contemplated total budget by TA?

9A: No. Funds will be allocated by TA depending on the quality of the proposals received.

8Q: Could you define what counts as "hybrid algorithms"? Is the classical part of the algorithm strictly restricted to outer-loop optimization (e.g. optimizing the parameters of the QAOA) or are we allowed to combine quantum and classical solvers in order to show a separation of performance with respect to purely classical solvers?

8A: A hybrid algorithm uses a combination of classical and quantum processors. A combination of quantum and classical solvers that can outperform purely classical state-of-the-art solvers may be of interest.

7Q: Is it essential that the optimization problem be discrete? For example, wouldn't a continuous classical optimization problem, when placed on a quantum computer, be naturally "quantized". Isn't then the discreteness of the problem irrelevant?

7A: The program is focused on combinatorial (discrete) optimization problems. It is up to proposers to explain the relevance of their proposed problem to the ONISQ program.

6Q: Can there be any theoretical work as part of a TA1 proposal or should all theory be proposed as a TA2 proposal?

6A: As stated in the BAA, Section I.E, theoretical support on algorithm implementation optimization and benchmarking is expected to be integral and critical to the success of a TA1 effort and should be proposed therein.

5Q: Do I understand correctly that only classical optimization problems are in scope, while intrinsically quantum optimization problems (such as e.g. finding ground state energies of quantum Hamiltonians) are out of scope?

5A: Yes, ONISQ is restricted to real-world classical combinatorial optimization problems. Intrinsically quantum problems are outside the scope of the program.

4Q: Is NISQ hardware going to be made available to performers for this effort?

4A: No. DARPA will not be providing access to any hardware as part of the program. Teams proposing work on implementing optimization algorithms in hardware (such as those proposing to TA1) must have access to a hardware platform (either as the prime, a subcontractor or an unfunded collaborator).

3Q: My question concerns the proposed metric of $N \cdot p > 10{,}000$. In particular, while QAOA specific optimization algorithms have an alternating structure, not all variational ansatzes do. If one uses an optimization algorithm whose ansatz does not have an alternating structure, then how will this be treated under the program's figure or merit.

3A: While the ONISQ metric of $N \cdot p > 10{,}000$ applies to algorithms with an alternating structure, proposers may choose a different variational ansatz. The onus is on the proposers to clearly relate the chosen hybrid algorithm to the focus and goals of the program, and to interpret the metric as it applies to their approach in a reasonable way.

2Q: I would like to use an annealing processor to speed up processing for a task of national security importance. Is that within the scope of the program?

2A: No. See 1A.

1Q: ONISQ is concerned with QAOA methods and implementations (i.e., for so-called gate-based quantum machines). Are QAAs or adiabatic quantum computing systems of interest also?

1A: ONISQ is focused on hybrid variational approaches for combinatorial optimization problems. As stated in the BAA, page 4, quantum annealing approaches are explicitly excluded from the ONISQ program.