Contact: Media Team
E: media@iitalumnicouncil.org
T: +1 650 9008833
M: +91 93155 21237
Twitter: @iitcouncil
www.iitalumnicouncil.org

PRESS RELEASE

IIT Alumni Council Announces the Winner of Global Challenge on Covid19 Pool Testing Strategy

New Delhi, May 7, 2020: One of the challenges in the fight against Covid19 is arising from limited availability of reliable and affordable RTPCR assays and machines. The logical solution to solve this challenge is to evolve options that permit testing of the maximum possible individuals with the minimum possible number of molecular diagnostic tests. One such option is pool testing. Pool Testing involves mixing the samples of multiple individuals and then testing the combined sample in a single test. Another option is to use other tests such as ultrasound and xrays scanned by AI systems to compliment or supplement reliable molecular diagnostic tests.

To address the need for rapid scale up of Covid19 testing in-spite of limitations in RTPCR capacity, the IIT C19 Task Force announced a Global contest among IIT alumni under the Funda Man Global Challenge series. The objective of the Funda Man Global Challenge was to define the minimum number of tests required to accurately diagnose the Covid 19 status of a group of 10,000 individuals . In short , it is to define the Pool testing algorithm and protocol for best results .

"We are very happy at the response of our Fundaman Global Challenge One. We wanted to quickly identify and evaluate options for choosing the best Pool Testing Algorithm by encouraging a large number of IIT alumni across the globe to participate. The Distinguished Jury Chaired by Padam Shri Prof Manindra Agarwal , chose the solution proposed by Parag

Shah , an alumnus of IIT Bombay, as the winner of the contest . The winner strategy can increase test capacity by up to 10x at no additional cost. C19 Taskforce of IIT Alumni Council has forwarded this Pool Testing Strategy as it's recommendation to the Government of India for consideration ", said Ravi Sharma, President, IIT Alumni Council.

The award winning Pool Testing strategy proposed by Parag Shah, alumnus of IIT Bombay

The proven and mass deployed test for Covid-19 is a genetic molecular diagnostic test carried out by RTqPCR machines. Globally, each sample is tested individually. It is however possible to mix upto ten samples into one sample using the indigenous Kodoy Technology Stack which is an open system wherein any standard RTPCR machine modified as per the stack can be programmed to work as a semi-continuous line with any compatible test kit or assay. Most commercial players offer a closed system with batch processing. A combination of pool testing with open systems holds the promise of a 100x increase in capacity of testing at a 85% lower cost for the proposed Megalab in Mumbai.

Parag Shah explained his approach: "My Algorithm is based on the theory of probability - there will be an optimal number of mix (samples) for different percentage of positive cases. The whole process/ algorithm and right optimal mix will depend upon this percentage number , a probable share of positive cases in the set. Though initially one may not have the exact number , one can start with an assumption and change it based on the data that turns up. Also, the process of optimization is to junk multiple negative cases in single test. (e.g. 10 samples together test negative, then in 1 test we are removing 9 samples). This proposed method of testing can save significant number of tests and will allow mass testing. In mass testing, this method can practically use as few as 1500 tests to diagnose 10,000 patients." Parag , who is remembered by his hostel peers for playing chess blindfolded, is the founder of Mechsoft Group Mumbai that builds innovative and algorithmic software products and solution across industries.

The selection of the Jury for the Funda Man Challenge One on Pool Testing Strategy (FMC1) was ratified by the Council of Directors of twenty Indian Institutes of Technology at the IIT Alumni Council with the IIT Kanpur Director as first Chairman of the Director's Council. "The technical quality of responses to the Funda Man Challenge have been excellent . I appreciate IIT Alumni Council for creating the collaboration model of Alumni and Faculty . The collaboration between global alumni and the institutes has ensured the best quality solution of a very complex problem in a short time." said Prof Abhay Karandikar , an IIT alumnus, Director IIT Kanpur.

About IIT Alumni Council

IIT Alumni Council is the largest global body of alumni, students and faculty across all the twenty three Indian Institutes of Technology with over 100+ city chapters in leading cities around the globe. One of the objectives of the IIT Alumni Council is to rally the technological and venture capital prowess of global alumni of all the IITs to launch a frontal attack on social challenges that can be solved through technological interventions. Healthcare is one the challenges being addressed by the Council.

The IIT C19 Task Force was set up in February 2020 by the Global Board of the IIT Alumni Council as a rapid response to the global Covid19 crisis. With over 20,000 active cutting-edge technologists from biotechnology, medical electronics, AI and chemical engineering, the IIT C19 Task Force aspires to lead the fight against C19 by supplementing and complimenting the efforts of the central and state governments. The Council has rallied the considerable resources of the global IIT alumni to catalyse technological and financial interventions in Mumbai city, with a focus on south Mumbai.

The IIT C19 Task Force is Chaired by eminent biotechnologist and IIT Kanpur alumnus, Dr K Vijay Raghavan, Principal Scientific Officer of the Government of India. It is financially supported by global foundations and Tier 1 domestic social funds including the PanIIT Fund. The PanIIT Fund, which commenced operations in April 2020 is India's largest SEBI regulated

domestic social philanthropic fund that brings together global IIT Alumni, IIT faculty/students and industry to speed develop technological solutions for urgent social challenges. The C19 Task Force is currently addressing technological challenges in testing and treatment of Covid19 patients and is providing real time technological support to entities around the world that are engaged in the battle against c19 in these to areas.

For more information on IIT Alumni Council , please visit www.iitalumnicouncil.org

ANNEXURE 1
Jury Comments

1. *The jury found the entry submitted by Parag Shah – IIT Bombay, BTech (Mechanical), 1987 – as the best among all entries.*

2. *He starts with the assumption that the fraction of positive tests are not known and argues how to figure it out through tests. He proposes a nearly optimal algorithm for testing, and also provides some analysis.*

3. *Some members of the jury did their own analysis of different algorithms for doing testing. In particular, algorithms based on binary search and group testing were analyzed. The conclusions are summarized below. In drawing these, following assumptions were made:*

   - *A test always gives correct answer.*
   - *Fraction of infected samples is very small. As per current testings, it is less than 0.045 and this is further reducing as testing is getting ramped up. When considered for general population, this number is highly likely to be far less, say, less than 0.0001 (this amounts to 1.3 lakhs people infected today).*
   - *Any strategy that requires mixing of samples, should be as simple as possible. Otherwise chances of human errors go up.*

4. *The algorithm divides a given group of samples in two equal size subgroups, tests for each subgroup by mixing, discards if a subgroup is negative, and recursively repeats for positive subgroups. The exact amount of tests required were calculated and were shown to be roughly 2k log B/k where B is the number of samples in a group and k is the number of positive samples.*

5. *The algorithm tests a given group by mixing. If negative, all samples are negative. If positive, test each sample separately. It is instructive to analyze this algorithm for its performance.*

Let p be the actual fraction of infected population (as per assumption above, $p < 0.0001$), and B the number of samples in a group (B = 10 as per the problem statement). The probability that a group has no positive samples is $(1 − p)B ≈ 1 − pB$ (for the stated values of p and B). Hence, the expected number of tests is $1 + pB · B = 1 + pB2 ≈ 1$ (for stated values of p and B).1

6. *It is clear from the above analysis that the Group Testing algorithm is simplest, and essentially optimal for the likely value of "p" in our country. Hence is recommended to be used.*

7. *The above analysis is correct modulo the assumptions listed at the beginning of the section. Of these, the first one requires elaboration. The standard test for Covid-19 is by RTPCR machines. There are many manufacturers of these machines, which have widely varying costs. Some of these machines are known to provide extremely accurate results. On the other hand, some other makes, and some other testing mechanisms, are known to go wrong occasionally. The jury is still deliberating how to handle results with error.*

ANNEXURE 2
About the Jury

The Jury consisted of eminent faculty members and IIT Alumni from around the world. Here is a brief about them:

	Jury Member	*Career Highlights*
1.	*PadmaSri Manindra Agrawal,* *IIT Kanpur* *Chairperson of the Jury*	*He is a professor at the Department of Computer Science and Engineering and the Deputy Director at the Indian Institute of Technology, Kanpur. He was the recipient of the first Infosys Prize for Mathematics and the Shanti Swarup Bhatnagar Award in Mathematical Sciences in 2003. He has been honored with Padma Shri in 2013.*
2.	*Professor M Vidyasagar, FRS,* *IIT Hyderabad*	*Currently a Distinguished Professor in Electrical Engineering at IIT Hyderabad, he is a leading control theorist and a Fellow of Royal Society. Previously he was the Cecil & Ida Green (II) Chair of Systems Biology Science at the University of Texas at Dallas. He has also headed the Advanced Technology Center at TCS and been the Director of Centre for Artificial Intelligence and Robotics (CAIR), a DRDO defence lab in Bangalore.*
3.	*Dr Sitabhra Sinha,* *IMSc Chennai*	*He is Professor of Theoretical Physics at institute of Mathematical Sciences (IMSc), Chennai and an adjunct faculty member of National Institute of Advanced Studies, Bangalore. He is a PhD from Indian Statistical Institute, Calcutta. His areas of research fall broadly under complex systems, nonlinear dynamics and theoretical & computational biophysics.*
4.	*Dr Rohinton Dehmubed,* *Silicon Valley IIT Alumni Rep*	*He has a BTech from IIT Bombay with a PhD from Columbia University in EE /high speed communications. He is an active researcher with interests in high speed transducers and healthcare pilfer-proof packaging with provenance tracing for high value therapeutics. He is based in Silicon Valley.*
5.	*Dr Kapil Talwar,* *Asia Pacific IIT Alumni Rep*	*He has a BTech from IIT Bombay with a PhD in Chemical Engineering from Washington University. He is an active researcher with interests in green chemistry, cyber security and healthcare.*
6.	*Shri P Balaji,* *India Alumni Rep*	*An Alumni of IITR and IIMA, he heads the Vodafone Foundation & Regulatory Affairs for Vodafone India. He has been CEO of companies like Nokia and Sony Ericsson before joining Vodafone.*