

# MATHEMATICS OF YACHT (YET ANOTHER COVID HEALTH TESTING) PROTOCOL FOR EPIDEMIC MANAGEMENT

BY INAVAMSI ENAGANTI<sup>†</sup> AND SHIRSHENDU CHATTERJEE<sup>‡,\*</sup> AND BUD MISHRA<sup>†,§</sup>

*Healthbadge, Inc.*<sup>†</sup> and *City University of New York*<sup>‡</sup> and *New York University*<sup>§</sup>

YACHT provides an evolving tool<sup>\*</sup> for imposing structure on the flow of Covid infection information obtained from community testing, collective policy and individual compliance. YACHT could not assume soundness, invariance, symmetry and completeness of the available information and relied on signaling game theory to design solutions that could evolve with the variable narratives, theories, individual utilities and pathogen variants. Thus, YACHT suggests a novel and a very flexible pool-testing[[?pooling](#)] and badging protocol in the context of controlling contagious epidemics and tackling the far-reaching associated challenges, including understanding and evaluating individual and collective risks of returning prior infected individuals to normal society and other economic and social arrangements and interventions to protect against disease. YACHT uses both control theoretic and game theoretic mathematical models that may be centralized (an optimizing policy maker mandates behavior based on estimated models) or decentralized (a strategizing individual selects their behavior based on available asymmetric information). YACHT protocol demonstrates how society can continue to carry out plausible economic activities in addition to controlling the prevalence of a contagious disease by keeping the number of infected people below a desired limit without compromising an individuals' privacy despite the presence of deception and selfishness among people, and limitations of available resources. Different types of badges would come with different restrictions. Badges would be reissued periodically by third-party testing centers via suitably frequent pool testing of samples of the participants. The size of the pools, frequency of tests, and allowable activities for people with a given type of badge would depend on the available resources, the prevalence of the disease, and the efficacy of the equipment used in the tests.

INAVAMSI ENAGANTI  
HEALTHBADGE, INC.  
E-MAIL: [inav@healthbadge.org](mailto:inav@healthbadge.org)

SHIRSHENDU CHATTERJEE  
DEPARTMENT OF MATHEMATICS  
CITY UNIVERSITY OF NEW YORK, CITY COLLEGE  
160 CONVENT AVE, NAC 4/114B  
NEW YORK, NY 10031 , USA  
E-MAIL: [shirshendu@ccny.cuny.edu](mailto:shirshendu@ccny.cuny.edu)  
URL: <http://shirshendu.ccny.cuny.edu/>

BUD MISHRA  
COURANT INSTITUTE OF MATHEMATICAL SCIENCES  
NEW YORK UNIVERSITY  
251 MERCER ST., WWH 405  
NEW YORK, NY 10012 , USA  
E-MAIL: [mishra@nyu.edu](mailto:mishra@nyu.edu)  
URL: <http://cs.nyu.edu/cs/faculty/mishra/index.html>

---

<sup>\*</sup>The research of S. C. is supported in part by the NSF grant DMS 1812148.

*Keywords and phrases:* Epidemics, Badging, Pool-testing, Group-testing, ODE model, Policies

<sup>\*</sup>“Yet Another...” reflects this evolving structure of the solution.