C R Rao Advanced Institute of Mathematics, Statistics & Computer Science (AIMSCS)

University of Hyderabad Campus, Gachibowli
Prof. C R Rao Road, Hyderabad, India 500 046
Website: http://crraoaimscs.org

Seminar on

Modeling movement of birds through graph theory principles

By

Arni S.R. Srinivasa Rao,

Georgia Regents University

Abstract:

In this talk, three theorems on Hamiltonian Path problems that were developed to understand the distances travelled by birds on a grid graph will be discussed. Understanding animal movements and modelling the routes they travel can be essential in studies of pathogen transmission dynamics. Pathogen biology is also of crucial importance, defining the manner in which infectious agents are transmitted. In this article we investigate animal movement with relevance to pathogen transmission by physical rather than airborne contact, using the domestic chicken and its protozoan parasite Eimeria as an example. We have obtained a configuration for the maximum possible distance that a chicken can walk through straight and non-overlapping paths (defined in this work) on square grid graphs. We have obtained preliminary results for such walks, which can be practically adopted and tested as a foundation to improve understanding of non-airborne pathogen transmission. Linking individual non-overlapping walks within a grid-delineated area can be used to support modeling of the frequently repetitive, overlapping walks characteristic of the domestic chicken, providing a framework to model faecal deposition and subsequent parasite dissemination by faecal/host contact. We also pose an open problem on multiple walks on finite grid graphs. These results grew from biological insights and have potential applications. This is a joint work with Fiona Tomley and Damer Blake.

Keywords: Spread of bird diseases, Eimeria, Maximum walks, longest paths, NP-Complete. MSC: 92A17, 68Q17

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Ramanujan Building, C R Rao AIMSCS

Brief Bio of Dr. Arni S.R. Srinivasa Rao

EXPERIENCE:Dr. Rao is an Associate Professor at Georgia Regents University since2012. Prior to this he taught and performed research at several premier institutions, including the Indian Statistical Institute (ISI), University of Oxford, the Indian Institute of Science and University of Guelph. His research areas are: Mathematical Biology, Models in health insurance, Roter-Router Models, Complex dynamics and SLE. He received the Heiwa-Nakajima Award (Japan) and DST Fast Track Young Scientists Fellowship in Mathematical Sciences (New Delhi). Dr. Rao has been a Principal Investigator, Co-investigator or Joint-Investigator on numerousinternational and nationally funded grants. He has published numerous scientific articles as the single author, lead author and co-authorin prestigious journals (including ***The Lancet***, ***Notices of the American Mathematical Society***,etc) andleading biomathematics journals such as the ***Journal of Theoretical Biology, Journal of Mathematical Biology***, etc.

RECENT RESEARCH IMPACT:Dr. Rao jointly with renowned entomologist Dr. Jim Carey (Professor in UC Davis/ UC Berkeley) proved a **Fundamental Theorem** in stationary population models. A report on this was selected as a '***success story***' and was appeared in the 'Research Highlights' of theMathematical Biosciences Institute, Ohio, which is an NSF Funded Institute.

GOVERNMENT POLICY:Dr. Rao was a consultant for the World Bank and other international agencies and has contributed for national policies in epidemics such as AIDS, Avian Influenza, Swine Flu, etc. He is frequently consulted for building math models for assisting various program implementationsby private as well as governments. He delivered talks as an 'Invited Speaker', 'Plenary Speaker', Keynote Speaker' at various National, International events. Dr.Rao is in the **International Advisory Committee, ICSCI2014,** and **Organizing Committee** of **SMB2015**, Atlanta, USA. He sat in several committees in the academia and in the government.

TEACHING:Dr. Rao has teaching experience in the following subjects: Mathematical Biology (at Graduate level), Metric Topology and Complex Analysis (at Graduate level),Differential Equations (at Undergraduate level), Stochastic Process (at Graduate level), Mathematical Epidemiology (at Graduate level), Real analysis (at Graduate level), Topic in elementary number theory (at Undergraduate Graduate level), Actuarial Science (and related subjects at Graduate level).