GIAN course on

When Good Algorithms Yield Bad Software

(20 – 24 November, 2017)

Overview

Disciplined software development typically starts with one or more suitable algorithms that are then translated into code. These algorithms may be standard ones, taken from the literature, or they may be custom algorithms developed during the software design process. There exists a well-developed body of theory related to the question what constitutes a good algorithm. Apart from the obvious requirement of correctness, the most important quality of an algorithm is its efficiency. Computational complexity provides the tools for determining the efficiency of an algorithm; often, it is relatively easy to capture the efficiency of an algorithm in this way. However, for the software developer the ultimate goal is efficient software, not efficient algorithms. Here is where things can get complicated – it is often not well understood how to go from a good algorithm to good software. It is this transition that the course addresses.

Computational complexity is based on basic assumptions which help designers in analysing algorithms. Unfortunately, many of these assumptions are violated by modern computing environments. As a result, it is quite possible to start with a good algorithm and end up with bad software, either altogether incorrect or of unacceptable performance.

This course carefully examines the fundamental assumptions of algorithm analysis and explains, with concrete examples, how these assumptions may fail to hold for software. It explores the consequences and implication of these differences and proposes techniques that avoid the resulting pitfalls. The overarching objective is achieving the desired goal of producing software as efficient and effective as possible. Consequently, the course's emphasis is on practical aspects of the software development process, especially on the transition from good algorithms to efficient software

Objectives

- Exposing the student to the fundamental assumptions made when designing and using algorithms
- Contrasting these assumptions with the reality of today's computational platforms, emphasizing the crucial differences with the assumptions underlying algorithm developments and analysis
- Reviewing the implications for software development of this discrepancy between the two worlds (algorithm development and software development)
- Explaining the implications of the assumptions in the algorithm world that cause problems for the software world
- Discussing methods of mitigating the resulting negative implications for the software arising in this process

Schedule	Duration : November 20 – 24, 2017 (20 hours) Place/Venue : Tezpur University, Tezpur, Assam, India **Number of participants for the course will be limited to 50.**
You Should Attend If…	• You are a student at any level (BTech/MCA/MSc/MTech/PhD) or a Faculty from reputed academic institutions and technical institutions. • You are an executive, engineer, researcher from private, service, and government organizations including R&D laboratories who has had experience with large-scale industrial programming since it is only when doing this work that one becomes aware of the pitfalls that are addressed in this course

Fees	The participation fees for taking the course is as follows:
	 Participants from abroad : US $500
	 Industry/ Research Organizations:INR 10000/-
	 Academic Institutions:
	   ➢ Faculty/staffs: INR 4000/-
	   ➢ Research scholars: INR 2500/-
	   ➢ PG Students: 1000/-
	
	 The above fee includes all instructional materials, computer use for tutorials and assignments, laboratory equipment usage charges, 24 h internet facility. The participants will be provided with accommodation on payment basis in the University Guest House (current official rate is Rs.500/- per day for single occupancy; Rs.400/- per day for double occupancy and Rs.300/- per day in the dormitory of the guest house) and outstation research scholars/PG students will be accommodated in the University hostels (current official rate is Rs. 150/- per day with bed roll).

Modules	**Tentative outline:** **Part I:** *The Algorithm World: Regularity, Predictability, and Asymptotics* • A taxonomy of algorithmic complexity,including time and space, worst case, average, and best case,bit andword,on-line andoff-line, and I/O complexities of an algorithm • Fundamental assumptions underlying algorithmic complexity **Part II:** *The Software Side: Disappointments and How to Avoid Them* • Sources of disappointments, including incorrect software, performance discrepancies, unpredictability, and infeasibility and impossibility • Implications of non-uniform memory for software, including the influence of Virtual Memory Management • Implications of compiler/system issues for software, including recursion and space complexity, garbage collection, and memory mappings • Implications of the finiteness of the representation of numbers • Infeasibility and undecidability: implications for software development

The Faculty

Ernst L. Leiss is Professor of Computer Science at the University of Houston. He earned degrees in computer science (M. Math., University of Waterloo, Canada, 1974), engineering (Dipl.-Ing., TU Vienna, Austria, 1975), and mathematics (Dr. techn., TU Vienna, Austria, 1976). He taught at Waterloo, the University of Chile in Santiago, and the University of Kentucky before joining the faculty at the University of Houston in 1979. His research interests include formal language theory, high-performance computing, and security. He has supervised and conducted research resulting in 17 doctoral dissertations, over 100 master theses, six books, and about 170 peer-reviewed publications in conferences and journals.

Leiss has lectured in 32 different countries, in three different languages. He has been an ACM Distinguished Lecturer from 1991 until 2014 (he was the first ACM Distinguished Lecturer to visit India) and the chair of the Houston chapter of the IEEE Computer Society since 1981.

Registration: Interested participants should register first with the GIAN website (http://www.gian.iitkgp.ac.in) for a one-time registration fees of INR 500 which will enable them to enrol for any number of courses being offered. Subsequent registration for this course will have to be done with Tezpur University by the **SHORTLISTED CANDIDATES AFTER GETTING CONFIRMATION E-MAILS FROM THE COURSE COORDINATOR.** They need to pay the requisite fees and fill up the Registration Form attached with this brochure. Duly filled in registration form can be sent to the coordinator both by online and offline modes.

Travel Information: The university campus is about 15 km east of Tezpur town which is located on the northern bank of mighty river Brahmaputra. Tezpur is the district headquarters of Sonitpur District of Assam, and is also known as cultural capital of Assam. It is well connected with Guwahati/Dispur, the capital city of Assam, which is about 200 km from Tezpur. Guwahati, the gate way to the Northeast India is well connected through major airlines and good trains with the rest of the country. Tezpur is connected with Kolkata by Air India flights thrice a week on Tuesday, Thursday and Saturday. Private buses and ASTC buses ply frequently from Guwahati ISBT to Tezpur. Tezpur (Dekargaon) is also connected by rail through the Dekargaon-Rangapara-Kamakhya route. However, preferred mode to reach Tezpur from Guwahati is by road.

Course Coordinators

- Prof. Bhogeswar Borah
- Dr. Arindam Karmakar

Department of CSE
Tezpur University, Napaam-784028,
Tezpur, Assam, INDIA

Phone:

(+91)-3712-275355, 9435490984 (M)
(+91)-3712-275320, 9435506206 (M)

E-mail:

bgb@tezu.ernet.in
arindam@tezu.ernet.in

REGISTRATION CUM ACCOMMODATION REQUEST FORM

(To be submitted by the <u>SHORTLISTED CANDIDATES ONLY</u> AFTER GETTING CONFIRMATION E-MAILS FROM THE COURSE COORDINATOR. This form should reach electronically by September 30, 2017 and hard copy by October 10, 2017)

INTERNATIONAL WORKSHOP (GIAN) ON

When Good Algorithms Yield Bad Software

November 20 - November 24, 2017

Department of Computer Science and Engineering, Tezpur University

Tezpur, Assam

Name (BLOCK LETTERS): …………………………………………….......... M/F:……….. Designation/

Professional   Title: ….……………………………………………………..

Affiliation/Organization:……………………………………………………………………… Address:

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Tel.: ………………………………….. . Mobile: ………………………………………....

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*GIAN Registration ID: ....

Accommodation Required (Yes/No): …………...……………………………………... Single The

Registration fee of Rupees …………………………………………………has been paid via Demand Draft

No.…………………………………………..in favour of the Registrar, Tezpur University/through SBI

online/offline banking bearing Transaction No. ………………................... to SBI Tezpur Main Branch

(RTGS/IFSC code: SBIN0000195, Bank MICR Code: 784002002) A/C No. 30448821505 of Tezpur University.

Demand Draft/Fee Receipt has been enclosed herewith.

Date: Signature

*To be generated through registration on the GIAN website http://www.gian.iitkgp.ac.in