Design and Analysis of Algorithms

L01: Overview

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About Myself

- Network/Telecommunication/Applications
  - Industry (25+ years)
- Academy
  - KSIT (1.5+ years)
  - PESIT/PESU (6+ yrs))
  - IITD (research faculty: 4+ years)
- Industry
  - Cloud, Telecom, N/W, Systems and Applications
- Current Research Interests
  - Machine Learning, Cloud technologies
  - Algorithms, Application optimization
  - Experiential Learning - Networking Technology
  - Networks, Security, Data Center networking

Knowledge and Wisdom

- The course is about learning & experiencing
- It is **not** about just knowing (mugging) algorithms
- Knowledge is knowing
  - How to do something
- Wisdom is knowing
  - What, why, how, and when to do it.
- Knowledge can be acquired by learning
- Wisdom is acquired only out of experience
- Objective
  - To set the ball rolling in your mind.
  - Down the line you should start thinking
  - Use your own independent experience to learn

FEAR Misconception

- **F.E.A.R** can be interpreted and handled as

  Forget
  Everything
  And
  Run

  – or

  Face
  Everything
  And
  Rise

- Treat fear of algorithm course as you wish

Why Study Algorithms

- **How do you know** *what you don't know* if region of things to know is limited.
- We use algorithms practically everyday in life
  - – Infant: cry to get milk, roll over to move
  - – Primary school: simple maths
    - Add, multiply two single digit numbers
    - Add multiply multi digit numbers
  - – High School:
    - Arrange your books, notebooks
    - Opening a chapter in text book
  - – College:
    - Finding the shortest route to a destination
    - Finding a friend to help you do your assignment

Your Life & This Course

- Teaching belief
  - Nothing to teach something how to use it
    - Before experiencing it myself
- As a human
  - We are bound to make errors
  - Get used to it
  - Learning requires patience
    - Things have its time and don't force things
- Your assignments are as a group/team
  - Story of 4 people

Story of work

- Story of team of four people
  - ***Everybody***, ***Anybody***, ***Somebody***, ***Nobody***
- An important work was to be done
  - Team was asked to do it
  - **Everybody** thought **somebody** would do it
  - **Anybody** could have done it, but **Nobody** did
- Result
  - **Somebody** got angry as it was **everybody**'s job
  - **Everybody** knew that **anybody** could do it
  - **Nobody** realized that **somebody** wouldn't do it

Story of work

- Summary
  - Job was not done
  - **Everybody** blamed **somebody**
  - **Nobody** did what **anybody** could have done
- Learning:
  - Don’t depend on **somebody**
  - Be **anybody**

Apply Commonsense to Complex Problems

- A story between Car customer and Customer care executive
  - Luxury Division of Car manufacturer received a crazy complaint
- Background
  - Customer goes for ice cream after dinner each day
  - Eats different ice cream depending on the mood
- Customer buys a new Luxury car
  - Goes in the new car to ice cream shop
  - When he buys vanilla ice cream, car won't start
  - For other ice creams he buys, car starts just fine.

Commonsense to Complex Problems...

- Car manufacturer finds it a funny complaint but sends supports engineer
  - With lot of skepticism
  - Engineer goes with the man to ice cream shop
  - Buys vanilla ice cream finds it does not start
  - Next day buys chocolate ice cream, it starts fine
  - Next day buys other ice cream, flavor, car starts fine
  - Next day buys vanilla again, car won't start
- Diagnosis: Vapor Lock in engine
- Summary: **What Really matters is attitude and perception**

Resource Material

- RPR slides and other materials
  - https://github.com/rprustagi/2019_20-Even-18CS43-DAA
  - No short notes for exams!
- Text Books:
  - T1: Design and Analysis of Algorithms - Levitin
  - T2: Computer Algorithms/C++
    - Horowitz, Sahani, Rajsekharan
- Other resource material
  - https://onlinecourses.nptel.ac.in/noc20_cs27
  - Google guru
  - Udacity
  - Coursera etc.

Goals

- Complete your course with flying colors
- Key course to get a decent job
  - (or higher studies abroad)
- Steps to achieve your goals
- Do lot more than statutory (exam, lab) work
  - Don’t mug up, understand, be creative/innovative
  - Ensure implementations work in all conditions.
  - No external parameters should crash it
  - Avoid the excuse “It works for me on my PC”
- Be interactive & responsive
  - With teachers, colleagues, other resources
- Discuss with your colleagues
  - Best way to learn is to teach, and work yourself

Learning

- Study is boring, learning is fun. — Dr RG Rao, IITD
- Work hard to know your limits
  - Regularity pays well
    - Cost of irregularity may be high
  - It takes time for new things to sink in
- Marks are not the end
  - These are just the beginning
  - Doesn’t really matter after a while
- Self gain
  - Acquire surrounding, relevant knowledge
  - Expertise in required tools
    - Know to exploit these
- Challenge the teachers
  - Force them to be provider of recent trends

Learning...

- Clarify your doubt
- Don't **ASSUME**
- If you do assume, following happens

ASS

U

ME

- **Stop not, allowed to go,** `or`

  Stop, not allowed to go

Be Alert

- Following words have same letters.
- Arrangement of letters makes all the difference
  - **LISTEN**
    - **SILENT**

- **TEACHER**
  - **CHEATER**

Evaluation Methodology

- Exams: External: 60 marks, Internal: 40 marks
- Internal: 10 (Assignments), 30 (Theory)
  - To qualify for VTU Exam: need to score >=16
- Assignments (4+): primarily programming assignments
  - In a team of size 2 or 3 (make your team this week)
  - Any team member can be asked to explain
  - Submissions online (Github repository)
    - Program should run on a Linux system
    - Plagiarism gets 0 marks
- Theory exams: (3+, 4th if needed)
  - First 2 will be open book.
    - Questions will be solving the problem
    - Rote memorization will not wok
  - 3rd (if 4th) can be on open book or regular pattern

TEAM Formation

- T.E.A.M
- The
  - Ever
    - Arguing
      - Member

- Together
  - Everyone
    - Achieves
      - Miracles

- F.E.A.R
- Forget
  - Everything
    - And
      - Run

- Face
  - Everything
    - And
      - Rise

Assignments' Alternative

- Alternative to assignments
  - Implement a mini-project
  - Need to show the progress on fortnightly basis
  - Mini projects topics can be suggested by you
    - Need to get explicit approval
- Few examples
  - Solutions for `NxN` grid points with minimal number of straight lines
  - Cards for binary search game for a given `N`
  - Enhance turtle sorting animations with more soring algos and making it interactive for each step
  - Animation of Hanoi's tower for K towers
  - Animation of Union-Find, N-queens,… etc.

Course

- Approach
  - – Interactive and inquisitive
  - – Ask lots of questions
  - – Extra material, information
  - – Be inquisitive
  - – All questions, comments are intelligent
  - – When in doubt, open your mouth
  - – Don’t hijack the session

Classroom Management

- Recommended teaching contact hours: 50
  - Recommended hours: 3 theory, 2 tutorial
  - Practical available weeks: 13
  - Will take most tutorial hours
- Absence may be costly (or beneficial?)
  - May miss out on understanding the concepts
- Would like to have **outstanding** students
  - Not (Out)-Standing students
    - Class doors will be closed (after 5 mins)
  - Late comers disturb the class hygiene
    - (Adhere to Swachh Bharat)
  - Can move out of class any time
- Learn to have class discipline (no cross talks)
  - Will be given time to discuss during exercises

Classroom Management

- Cost of each class hour:
  - 60*75K/(36+**50**+40+40+40+40+36+36+12)≈₹14K
  - Know the cost of class bunk, asking for class off etc.
- Instructor access
  - My office in Dept
    - During tea break
    - Lunch break?
    - Non-class hours
  - After college hours (till 5:00/5:30pm - extensible)
    - Mostly dept office (or CSE Research center)
  - Communication: on email only
    - Unlikely on social media
    - Whatsapp, Facebook, Twitter, Linkedin etc.

Course Plan

- Excel sheet to provide details (github)
- May deviate quite a few times.
- At times will cover more material than needed
  - Expect 20+% more than syllabus
- Concept consoliation
  - Will try to suggest exercises beyond labs.
  - Need to know your interest.
  - Will be done after class hours
- Challenges
  - Verbal Accent - Incomprehensible, fast
  - Ask to repeat, slow down
  - Maintain silence to be audible

Prerequisites

- Prerequisites for this course
  - Review and overhaul of *Data Structure* course
    - This course heavily depends upon it.
    - Spend time to understand all the concepts.
    - Do your lab programs without digging into memory repository.
  - Use of net resources to develop understanding
    - google, geekforgeeks, stackoverflow
    - Nptel, coursera, eDx
  - Willingness to work hard
    - Try out extra exercises

Summary

- Resource material
- Course plan
- Marks and evaluation
- Activities preparedness