



National Institute of Technology, Trichy  
Department of Computer Science and Engineering

# BITS & BYTES

NEWSLETTER



ISSUE 2, AUGUST 2014

<http://www.nitt.edu/home/academics/department/cse>

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Placement Season is in full swing and while everyone is running around trying to land a job. It's time we stop thinking about what we would really want to do with the rest of our lives.

"Do what you love" is an important message, but it's unwise to build a career on the notion that we should all be paid for our passion. The advice captures only part of the story. It tells us how excellent work might be accomplished – by loving it – but it doesn't tell us why the work should be done. What is the point of all the effort? What is being worked toward?

Sure, there are many people doing what they genuinely love. But how many of us love just one thing? It's romantic to imagine that each person is destined for a particular career path, one capable of being discovered with sufficient soul-searching. But most people have multifaceted interests and abilities and could probably be successful and happy in several fields.

Maybe there's another way to encourage new college graduates to think about their careers. Maybe all those commencement speakers would send more young people into the world likelier to be happy in their jobs if the speakers talked about love as a consequence of meaningful work instead of as the motivation for it.

We don't all have to become first responders or social workers. And we can't all find jobs with such obvious benefits to society. When diplomas handed out, though, it might be worthwhile for graduates – and the rest of us – if the popular "do what you love" message were balanced with a more timeless message to find work that, even in some small way, truly matters.

MEGHANA DUVVURI  
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## INTERVIEW WITH FACULTY

# An Apple with

**Dr. R. Leela Velusamy**  
**Associate Professor, CSE**

### **How did your professional journey begin?**

I did my BE in ECE at Nit Trichy (1982-1986). After that i went on to do my ME from Bhargava University. Then i joined NITT again in 1990 as a faculty member.

### **What is your area of expertise and the subjects you teach?**

I teach line mathematical functions , automata and compiler design to the UG students and cryptology, network security to the post graduates. I'm currently working on mathematical foundations of computer science.

### **What was your college experience during your under graduation?**

I was a part of the first girls batch of NITT. There were not many facilities back then and a lot of restrictions were imposed on the girl students. However i didn't face much problem as Trichy is my hometown.

### **Changes observed as to previous years?**

Times were very different back then. There was no autonomy. Students would work very hard and had to do most things on their own. Faculty members would not spoon feed us like it is done today. Life was difficult for students.

### **How is your relationship with the students?**

I'm a very approachable person. I have always been student friendly and am ever ready to help students. I have mentored a lot of students and rescued them from their unhappiness by personally talking to them.

After all this time, i still receive mails and regards from them thanking me. They are very successful now. It makes me happy.

## **Whom you consider as your role model?**

The person who has influenced me the most is Dr. Ramakrishnan Rao, a hard working faculty of the cse department. He is extremely student friendly and his way of tackling difficult situations and speaking in council meetings has inspired me to do the same.

## **What is your favorite topic of studies that you enjoy ?**

I like to read Math related topics and their applications in automata and compilers.

## **What do you like to do in free time (hobbies) ?**

I don't have any hobbies as such. I like to keep everything neat and tidy, so that takes up my time. Apart from that, I listen to speeches of Shri Ravishankar ji and hymns. I hardly watch any movies or television shows.

## **How do you feel about current performance & placements of students ?**

Students are performing very well but the faculty in the department needs to be improved and need to become more student friendly . Our students are attracted to high paying jobs and also possess the capability to achieve them. Seniors should guide their juniors in matters of placements and internships.

## **What was your life defining moment ?**

An earlier student of mine was very depressed here in the campus; complaining about everything around him and would curse his destiny to be here in trichy, so far away from home. I met him and made up his mind in this college. Though he was just a average student, I gave him a recommendation for a University in Florida. Now he is doing PG there . He thanked me a lot via mails and calls.

Similarly few others students who are doing M.Tech. in IIT's and etc thanked me a lot for my guidance. The student's appreciation is my life defining moment.

## **Any message for students?**

Stick to your basic knowledge. Always enjoy whatever work you do. You have to work really hard and to be sincere to achieve your dreams .

# The Department Symposium

VORTEX  
2014

Department of Computer Science and Engineering, National Institute of Technology, Trichy presented **Vortex'14** - the annual all-India technical festival - A stage for the budding engineer in you to prove your skills and grab exciting prizes.

Vortex'14 brought colossal crowds, enterprising events and hefty rewards.



The poster for Vortex 2014, an annual technical symposium of the Department of CSE, NIT Trichy, held from 18-20 April. The event is organized by the Computer Science Association (CSA). The poster features a central logo of a blue and black vortex. Surrounding the logo are several event categories listed in green hexagons: Reverse Coding (Engineer programs from executables), Debugging (Resolve the bugs), Ethical Hacking Workshop, Online Programming Contest (ACM ICPC style), Clueless (Online treasure hunt), Hack the Shell (Win internship at Optmyzr), Vortex Main Quiz (Tech Quiz), Paper Presentation (Present your ideas), and Google Cloud Workshop (By GDG, NITT). A cash prize worth 80 K is to be won. The registration website is www.vortex.org.in. Contact information for Shraavan Kumar (8939922199), Mohana Sudharsan (9962040320), and Mathur Sathya (9600257658) is provided at the bottom.

## EVENTS

- **CLUELESS:-**

Welcome to Clueless, the online treasure hunt of Vortex 2014. It is a furious race to finish the maze. A million directions at each point, you will be spoilt for choice. Quizzing, puzzle solving, crosswords, ciphers, random codes, crazy goggling, put all this in a blender and what you get is clueless. You will not only have to think outside the box but will have to find the box in the first place. If you think coding and mathematics is your expertise then be prepared to be clueless with clues. Clueless is an online event and we invite participation from all over the world.

- **DEBUGGING:-**

The eyes of an eagle, attention to detail and an obsession for precision- if you have these traits, Debugging is the event for you. The inexplicable field of bugs is feared by every programmer. Segmentation faults and a gazillion lines of error are enough to crack the calm of experienced coders. But all you need is a towering level of patience and honed skill. Think you are up to it? Debugging is the event to find out. Look at the intricacies of the given buggy code and sieve the faults out.

# VORTEX 2014

- **HACK THE SHELL:-**

*The stage is set.*

*The maze is virtual.*

*You have the most dangerous weapon*

*– “The TERMINAL.”*

An event for the adventurous and the curious.

Explore the surroundings, hack into the network, break the clues and voila you are there.

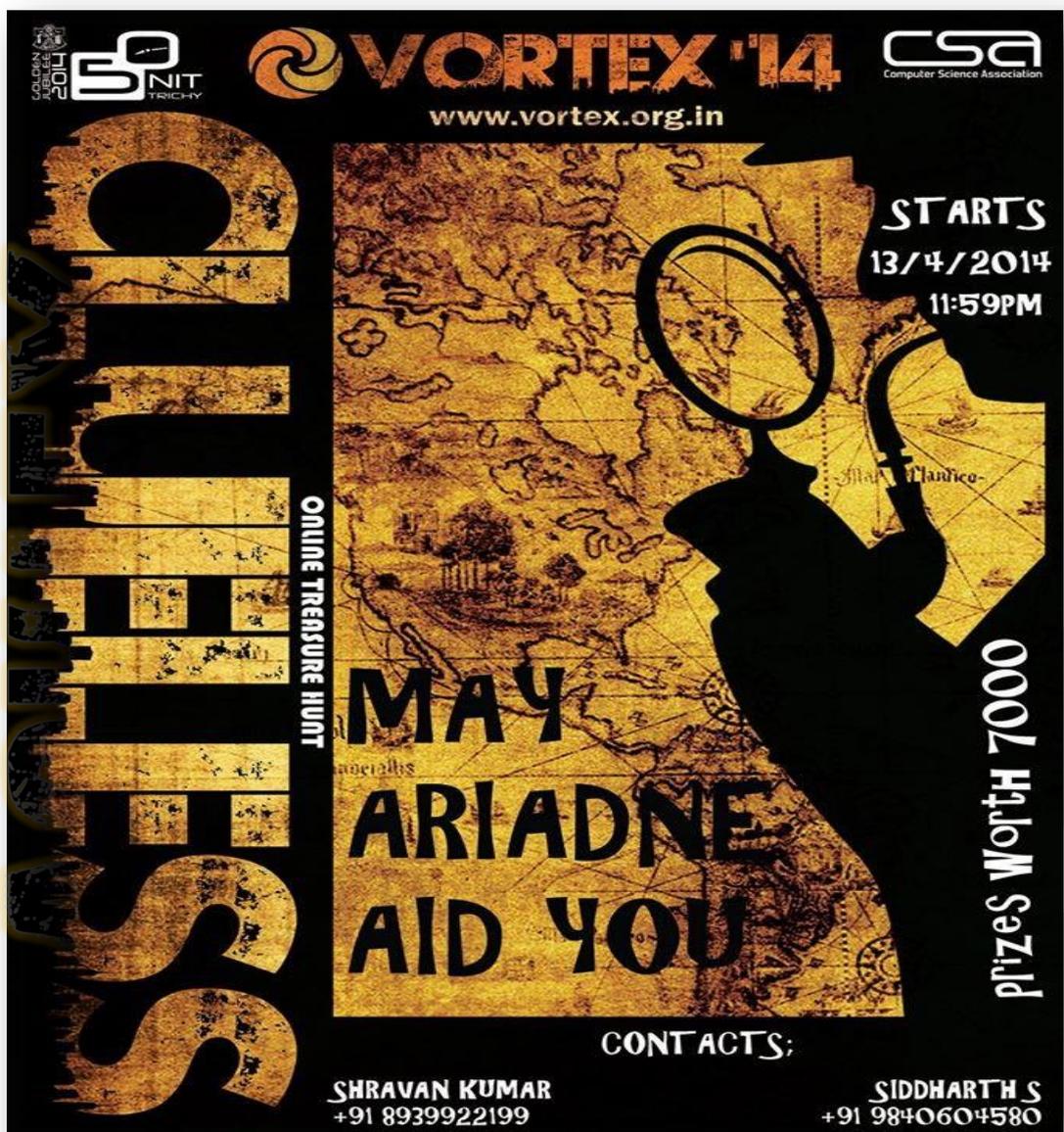
A challenge for you to prove your Linux skill!

This is your chance to work side-by-side with the smartest minds from across the country.

- **ONLINE PROGRAMMING CONTEST:-**

There are no flamboyant explanations for online programming contest. You are the master of your own destiny. You are supposed to optimize your code, make it error free to tackle the time constraint and corner case. Buckle up for one of the most brain draining contest of Vortex '14. The best brains in the world competing against you, coding against time to compile their most efficient programs. For those looking for a worldwide exposure of your coding skills, Vortex online programming contest '14 sets the stage for you.

# VORTEX



The poster features a dark background with a golden, textured map of the world. A silhouette of a person wearing a magnifying glass is positioned on the right side, looking at the map. The text is arranged in a structured layout with various fonts and colors.

**50th** NIT TRICHY  
**VORTEX '14**  
www.vortex.org.in  
CSA  
Computer Science Association

**STARTS**  
13/4/2014  
11:59PM

**ONLINE TREASURE HUNT**

**MAY ARIADNE AID YOU**

**Prizes Worth 7000**

**CONTACTS:**  
SHRAVAN KUMAR  
+91 8939922199  
SIDDHARTH S  
+91 9840604580

- **REVERSE CODING:-**

Coding is unraveling a mystery line by line. With umpteen possibilities leading to a set single outcome, it will take all the skill in you to find out how exactly you landed up there. And this is Reverse Coding. An event designed to test if you have built your love for coding on strong foundations. Wrack your brain cells to decipher the output and work your way back to the beginning. Figure out the program, code it and mystery solved. Elementary!

- **TRIATHLON:-**

Do you feel the urge to showcase your multitude of talents in varying fields of computer science but lack the arena for a show-down. Triathlon gives you the opportunity to compete and portray your versatility in aptitude, data structures, algorithms and more.

- **VORTEX MAIN QUIZ:-**

A haven for those with the technical chutzpah to display your geekiness. At vortex main quiz, smart is indeed the new sexy. Here, we pit your tech know-how against some of the best minds across India. A Battle Royale, slay your opponents and emerge the winner, in this quintessential clash of brain over brawn. We await the crowning of the next tech wizards.

## **WORKSHOPS**

- **Ethical Hacking:-**

Workshop on Ethical Hacking is not about the illegal things it's all about how to secure your system. This workshop aims to give Technocrats a basic knowledge of hacking and how to protect your system against hazardous effects.

This workshop was beneficial for students in following ways:

Firstly, the workshop gives a student an insight of the Ethical Hacking i.e. compromise of email hacking DOS attacks SQL Injection etc. if you have the interest to be the part of one them this surely is the place to be at to get the firsthand experience of working on high end projects Hands-on session along with Theory sessions step by step. We also provide our own Ethical Hacking Toolkit , which consists of all the Tools and Techniques covered in the Workshop.

- **Google Cloud:-**

The Google App Engine is a platform as a service that lets you build and run applications on Google's infrastructure. Apps become easier to build, maintain and scale, as you have to simply upload your applications and it is ready to go. Find out how to develop apps for the App Engine and deploy them in Python at a 4 hours workshop, extensively spanning across these topics. The workshop will cover concepts related to servers load balancing, databases and much more.

- **Python:-**

Python is one language that allows concise and direct translation from notepad scribbling's to code. Learn about the coolest programming language, Python. A 3-hour intensive hands-on workshop that dives deep into the python internals, advanced techniques and best practices This detailed workshop covers all from basic syntax to solving problems to developing applications.

Nittfest this year had a very appealing theme of 'Vikings'. The CSE clan soared in the battlefield as the defending runner ups. Everybody expected a king like performance Thor and Odin, full of Loki-like mischief. But in the end, the performance was like a bunch of 'trolls' (pun intended). CSE clan in the end managed to get a mere 69 points in total and finished 9<sup>th</sup> in the points tally, possibly the worst performance in its history. In spite of that, this year's Nittfest was perhaps the best one in terms of senior-junior interaction and eternal bonding. The team work from all years, devoid of sleep, toiled day and night with the just one thought in their minds... "GO COMPSCI ! " .

In keeping with our NITTFEST traditions, a greater part of the points came from the English Lits events. CSE was in the second place overall in this Lits arena. The main events in which our students secured positions were: debate, spell bee, crossword, dumb c, jam, what's the good word, general quiz and lone wolf quiz. This was a field where CSE could play to its strengths and managed to place in a majority of these events. Apart from English, in the area of Tamil Lits, a commendable amount of efforts was put in to break prior streaks. A team placed in Puriyadha Pudhir while performances in other events were also appreciable. The department's performance in Hindi Lits was the best in its history with a total of 18 points. Nittfest'14 kicked off with the popular event of Qawwali wherein the CSE clan were not good enough to be in top 3 positions but still managed to grab audience's attention with their soulful singing. The CSE clan attained 3<sup>rd</sup> position in Street Play with the thought provoking theme of 'ignorance'. The department attained 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> positions in Chakravayuh, Cricket Quiz and Dumb C respectively.

The choreo-group experienced "hard work leads to success" when all the day and night practices, arguments, sweat, laughter, hard work, excitement brought them the 3<sup>rd</sup> place! The all-nighters pulled by the CSE gamers added 8 points with their victory in CS and Blur! Our artists added color and creativity in whatever they took part be it face painting, graffiti, Dominoes etc.. A few mistakes led to our D Qing in events like Movie Making, Movie Spoof etc.. but now when we look back, it's the enjoyment and time spent together which matters the most!

Nitfest'14 may not have turned out victorious for the CSE department, but it shall forever be remembered by the other junior batch mates who had a lot of fun and surprised the seniors in various fields whether it was dancing or English Lits, acting or Qawwali! A few pre-final year students squeezed time out of their hectic schedules and proved the loyalty towards our department. Last but not least, the final years who slogged day in and day out to make Nittfest'14 one to remember! And even though things may not have turned in our favor, the CSE clans won't lose heart!

# GO COMPSCI

Computer forensics is a specialized field, which deals with the employment of set predefined procedures to thoroughly examine a computer system using software and tools to extract and preserve evidence of criminal activity. Or moreover, Computer forensics is the practice of collecting, analyzing and reporting on digital information in a way that is legally admissible.

It can be used in the detection and prevention of crime; in any dispute where evidence is stored digitally or where crimes are committed by gaining logical access to computer systems and networks. Therefore, evidence in such cyber crimes, if any is usually in electronic form. Such evidence is capable of being tampered in an undetectable manner thus losing its credibility in the court of law.

Thus, Computer forensics follows a similar process as other forensic disciplines, and faces similar issues.

Computers may constitute a 'Scene of a crime'. For example with hacking or denial of service attacks or they may hold evidence in the form of emails, internet history, documents or other files relevant to crimes such as murder, kidnap, fraud and drug trafficking.

It is not just the content of emails, documents and other files which may be of interest to investigators but also the 'metadata' associated with those files. A computer forensic examination may reveal when a document first appeared on a computer, when it was last edited, when it was last saved or printed and which user carried out these actions. This vital information collected and extracted by Computer forensic experts will constitute as crucial evidence.

In order to understand the stages of Computer forensics, let us examine the following case study.

### **CASE STUDY:**

#### Facts of the case:

- An Individual who was working for a biomaterials firm gained employment in a competing firm. This Individual had used several dozen diskettes for storage at his old firm, and used same diskettes for storage at new firm. Previous employer alleged and claimed that the individual took designs from old firm to new firm on diskettes.  
Computer Forensics experts were engaged to demonstrate employee's innocence.

### **STAGES OF AN EXAMINATION:-**

#### • **READINESS**

In commercial usage, computer forensics can include educating clients about system preparedness. For example, forensic examinations will provide stronger evidence if a server or a computer's built-in auditing and logging systems are all switched on.

#### • **EVALUATION**

The evaluation stage includes the receiving of clear instructions, risk analysis and allocation of roles and resources. Risk analysis for law enforcement may include an assessment on the likelihood of physical threat on entering a suspect's property and how best to deal with it. Commercial organizations also need to be aware of health and safety issues, and of possible risks both financial and to their reputation on accepting a particular project.

- **COLLECTION**

If acquisition is to be carried out on-site rather than in a computer forensic laboratory, then this stage would include identifying, securing and documenting the scene. Interviews or meetings with personnel who may hold information relevant to the examination would usually be carried out at this stage.

The collection stage also involves labeling and bagging of evidential items from the site. These must be sealed in numbered tamper-evident bags. Consideration should be given to securely and safely transporting the material to the examiner's laboratory.

- **ANALYSIS**

Analysis depends on the specifics of each job. The examiner usually provides feedback to the client during analysis, and from this dialogue, the analysis may take a different path or be narrowed to specific areas. Analysis must be accurate, thorough, impartial, recorded, and should be completed within the time-scales available and resources allocated.

- **PRESENTATION**

This stage usually involves the examiner producing a structured report on their findings, addressing the points in the initial instructions along with any subsequent instructions. It would also cover any other information which the examiner deems relevant to the investigation.

### **TYPES of COMPUTER FORENSICS:-**

- **Disk Forensics**: The process of acquiring and analyzing the data stored on physical storage media. Disk forensics includes both the recovery of hidden and deleted data and also file identification - the process of identifying who created a file or message.
- **Network Forensics**: The process of examining network traffic, including transaction logs and real-time monitoring, using sniffers and tracing.
- **Internet Forensics**: The process of piecing together where and when a user has been on the internet or internal company network. This is used to determine whether inappropriate Internet content access and downloading was accidental or not. It is also used to determine if sensitive information was emailed inappropriately using a personal email account.
- **Email Forensics**: The study of source and content of electronic mail as evidence. It includes the process of identifying the actual sender, recipient, date, time and location from where the email originated. Email has become a significant issue for individuals and organizations. Harassment, discrimination or unauthorized activity violating company policy can be identified via email forensics.
- **Proactive Forensic Investigation**: Often, the computer forensic investigation is the early "quick peek" discovery, and analysis of computer evidence is performed before a situation escalates. Often, Human Resource specialists or internal legal counsel initiate it when a situation has the potential to become more involved.



A  
Few  
Moments  
With  
HARI

When you look at this guy may be your mind knocks for something that have I seen him somewhere?

Mr. **HARISHANKARAN K** is the alumni of NITT, pass out of 2008 batch. Apart from this he is the Co-founder & CTO at **interviewstreet.com**. Earlier he worked with IBM as a Software Engineer(2008-2009) & also he did his intern at Novell as a Software Developer. Also he was selected for Google Summer of Code under Mozilla Organization in 2007.

**What does NITT mean to you?**

This is really a hard question, I think it's not enough space to share my experience of NITT. Well I will keep it short & I can say it was a nice and an incredible learning experience with some of the most intelligent minds from all over the India. This is the place where I learnt most of the things I know. NITT taught me about each and every culture across the country. I had a lot of fun in NITT with my colleagues. It was an amazing experience in NITT within those 4 years.

## How were your experiences in the CSE department?

It was really a very good experience with CSE department. I was given the responsibility to setup Linux Lab for the first time & I did it successfully. I learnt so much things about how to manage infrastructure. Actually, that helped me a lot to open a completely new organization.

## How have you started with Interview Street? Tell us about your success story.

By the way it's a saying that there is always a long story behind success. I can only tell you that we started as a platform to conduct mock interviews. We started this with zero users & now we reached to thousands of users per day. It pivoted to help companies to hire faster & better.

## What challenges have you faced to achieve this goal?

I would like to tell you that making a product is an easier task instead of getting the product fit with the market strategy, it is the biggest challenge and I have faced the same. We have lost nearly 1.5 years making almost no money in trying to build the product.

## What is the role of NITT professors in shaping your future?

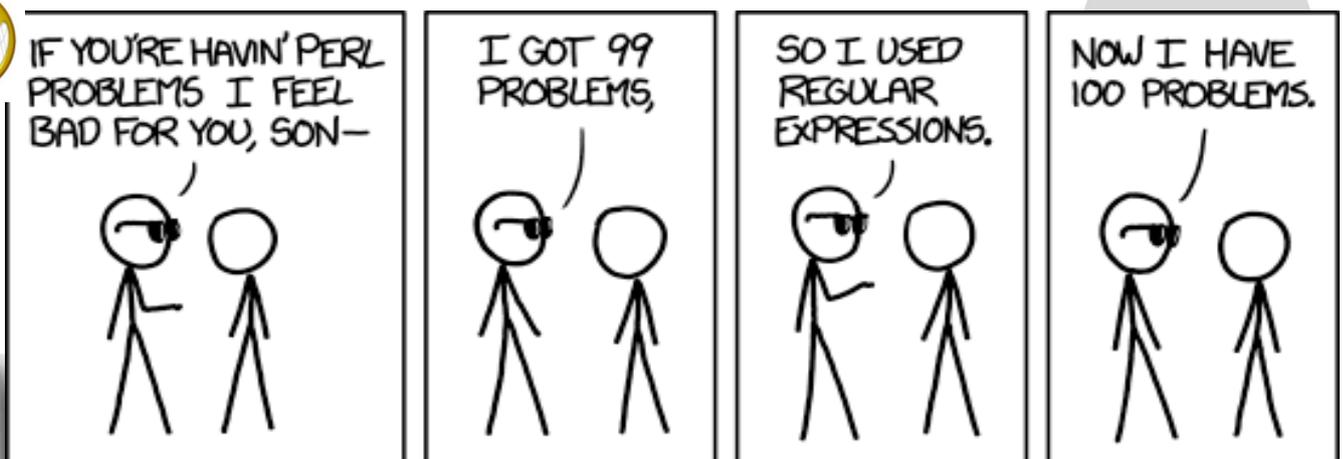
I think the professors of the department understand the need of all over development of the student along with the technical knowledge. Some of the professors are the best like Leela Ma'am, Baktha Sir, HT Ma'am, Gururaj Sir are all amazing & still they help me in case I need.

## Can you tell us about the opportunities for NITT students in Interview Street?

See there are a lot opportunities for an NITT student, but still if you are asking An NITT student can apply to Interview street.

## Since you are a role model for many students, so any advice for them?

I would like to share my idea that make something that people really want.



# Gizmo Talk

TRENDING  
TECHNOS

Remember the helmet that Tony Stark uses in the Iron Man? The one with a holographic interface letting you anchor various menus to certain surfaces, sticking a virtual screen on a desk, attaching a note to a wallet or even playing a virtual game in the physical world? This helmet has now become a reality. Thanks to Meta, a digital startup founded by Israeli-born former Columbia University student Meron Gribetz. **META SPACE GLASSES** are the most innovative augmented reality headset that supports cool stuff like 3D visualizations, facial recognition, virtual gaming, laser tagging, voxel editor and more.



While Google Glass seems like a virtual post-it note in front of your face, Space Glasses boast to be an entire PC replacement able to abstract all of the major computer and tablet functions and add more cool features like “one device, multiple screens” on top of this. This wearable computer is developed on Unity 3D platform and is joined with gesture tracking software allowing you to interact with virtual objects. It means you can have apps spread around your home that you can use as real-world anchors and spatial navigators for your real-life gadgets and services. Navigating apps this way can free your brain up for other interesting things. Compared to capabilities of Space Glasses, Google Glass seems like a Bluetooth headset popping out notifications about your environment. Space Glasses, in their turn, enable the Holy Grail of Augmented Reality (AR) – the surface tracking based on the most advanced computer vision research and allowing tracking the white paper or blank walls that has always been the most difficult computer vision problem to solve.

When it comes to extended and advanced play in MMOs, Razer’s Naga has the reputation of being the obvious choice of gaming peripheral. The signature design with its 12-button number pad attached to the side first launched in 2009 and is now synonymous with online play. The Naga series has retained its position as the top-selling **MMO MOUSE** in the world as a result. For newcomers though it will take some time getting used to and the three most glaring features on the physical design side for Naga newcomers are the trademark 12-button thumb grid, the wider berth compared to standard gaming mice .



For the Naga 2014, the thumb grid has been augmented significantly with mechanical switches, meaning more defined, cleaner thumb clicks. It also features more pronounced, redesigned individual buttons, allowing for easier recognition and more precise button presses for players. Much like the Razer Black Widow keyboards, once you go Razer mechanical, it’s hard to go back, and the improvement is a welcome one. Another highlight addition to the Naga design is the tilt-click scroll wheel where players can not only click the wheel as a third ‘main’ button, and scroll up and down. The latest iteration of the wired Razer Naga is now available worldwide.

A **ternary search algorithm** is a technique in computer science for finding the minimum or maximum of an increasing or decreasing function. A ternary search determines either that the minimum or maximum cannot be in the first third of the domain or that it cannot be in the last third of the domain, then repeats on the remaining two-thirds. A ternary search is an example of a divide and conquer algorithm.

## ALGORITHM

Let a unimodal function  $f(x)$  on some interval  $[l; r]$ . Take any two points  $m1$  and  $m2$  in this segment:  $l < m1 < m2 < r$ . Then there are three possibilities:

1. if  $f(m1) < f(m2)$ , then the required maximum can not be located on the left side -  $[l; m1]$ . It means that the maximum further makes sense to look only in the interval  $(m1;r]$
2. if  $f(m1) > f(m2)$ , that the situation is similar to the previous, up to symmetry. Now, the required maximum can not be in the right side -  $[m2; r]$ , so go to the segment  $[l; m2]$
3. if  $f(m1) = f(m2)$ , then the search should be conducted in  $[m1; m2]$ , but this case can be attributed to any of the previous two (in order to simplify the code). Sooner or later the length of the segment will be a little less than a predetermined constant, and the process can be stopped.

choice points  $m1$  and  $m2$ :

$$m1 = l + (r-l)/3$$

$$m2 = r - (r-l)/3$$

## Run Time Complexity

$$T(n) = T(2/3 * n) + 1$$

$$= \Theta(\log n)$$

CODE IT 28  
DAYS  
LATER  
FONT



**DISTINGUISHED ALUMNI & FACULTY WITH HONORABLE PRESIDENT DR PRANAB MUKHERJEE**



**CSE 2014 BATCH**

The Association for Computing Machinery (ACM) is a US based international learned society for computing. It was founded in 1947 and is the world's largest scientific and educational computing society. It is a not-for-profit professional membership group. Its headquarter is in New York City.

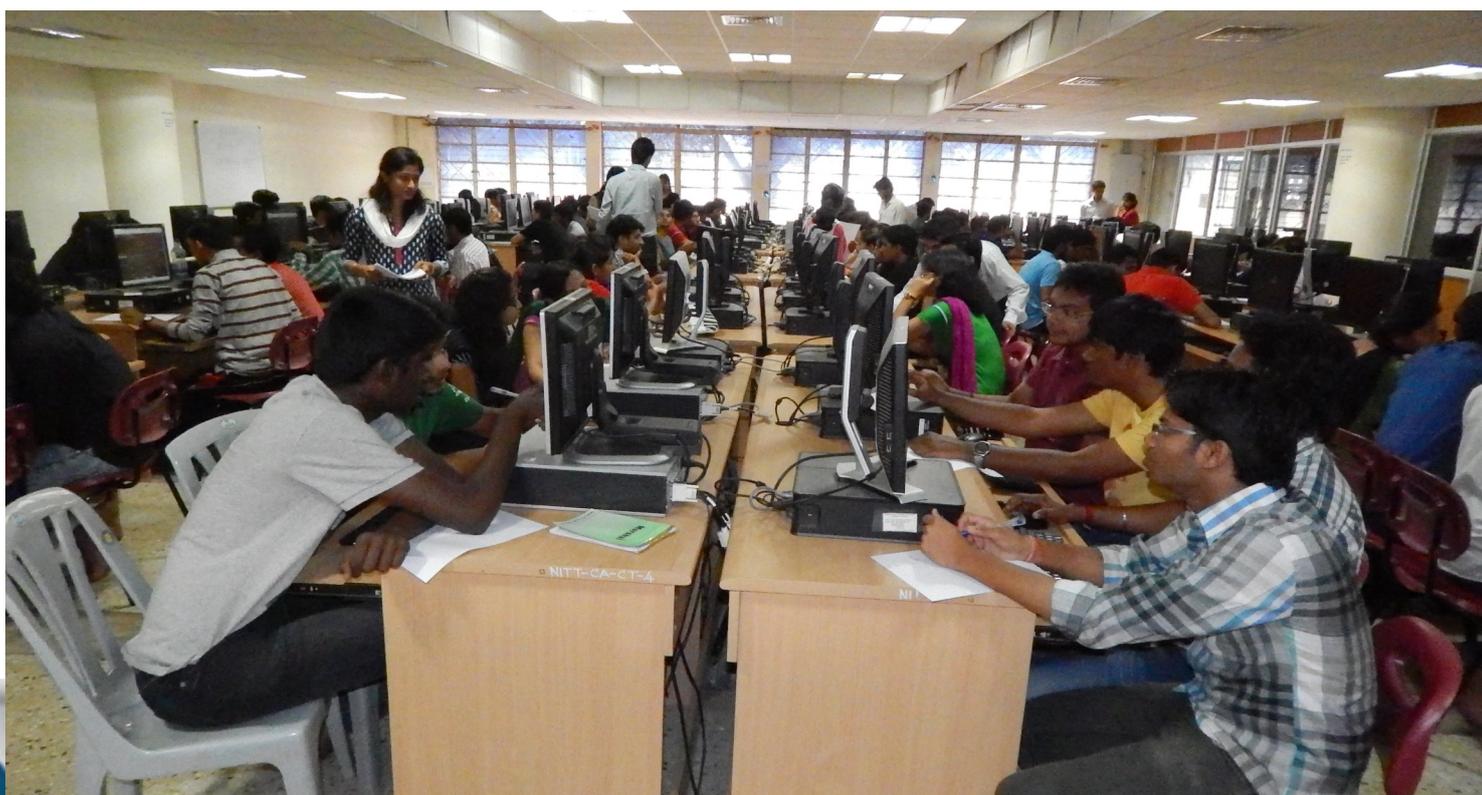
**STUDENT CHAPTER:-** ACM is organized into over 170 local chapters and 35 Special Interest Groups (SIGs) through which it conducts most of its activities. As of 2014, there exist ACM Student Chapters in 41 different countries.

**NIT TRICHY STUDENT CHAPTER:-** The ACM Student Chapter of NIT Trichy was the first Student Chapter of ACM in India. This chapter is run by the MCA students of Department of Computer Applications of NIT Trichy. The Staff Advisor of the chapter is Dr. S Nickolas, Head of the Department of Computer Applications.

The Chapter organizes various Coding Competitions, Classes, Workshops and Seminars. The Chapter is also involved in various Real Time Projects (EMC Automation Project) and publishes Newsletters as well. In addition to this, the ACM Student Chapter of NIT Trichy conducts two annual Technical Symposiums - INFOTREK and ACUMEN.

INFOTREK is an inter-departmental technical symposium in which the students of all the departments of NIT Trichy can participate and ACUMEN is an intra-departmental technical symposium meant for the students of Department of Computer Applications only. In both these symposiums, various types of events are conducted which include Coding Competitions, Quiz Competitions, Surprise Games, Online Events and a final Flagship Event.

Recently, ACM club has applied for the CODECHEF Campus Chapter which has been activated by CODECHEF. The future plans regarding CODECHEF Campus Chapter are to conduct various classes and workshops on Online Coding as well as other aspects of Programming so that the students can get a know-how of Online Compilers and Online Coding. Several Coding Competitions will also be organized by CODECHEF Campus Chapter.



# Decrypt The Bits

## CROSS WORD

									1		12	
2		8		9								
						10						
				3				11				
4	7											
				5								
				6								

### ACROSS:-

1. Global Positioning System (3)
2. A pictorial representation of the logic flow in a system (4-5)
3. A recognized and definable cross over points between two systems (9)
4. Acronym for a network that connects computer systems that are close together within a single building (3)
5. Computer that has been designated to share resources and data (6)
6. A function that takes a variable size text input and returns an irreversible fixed size string called the message digest (4)

### DOWN:-

2. A system designed to prevent unauthorized access to or from a private network (8)
7. A group that defines US Standards for the information processing industry (4)
8. An acronym for recognition of printed or written text characters by a computer (3)
9. A mechanism of catching information on the web browser (7)
10. Protective software designed to defend your computer against malicious software (9)
11. A system based function that directs a call to an application to transfer the data (6)
12. A small electronic device about the size of a credit cards that electronic memory and possibly an embedded integrated circuit (5-4)



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