

SANGANANA^{'03} - the Computer Science Quiz

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1 Ramble

A lot of original research has gone into the making of the questions. While the authors do not seek copyright, they believe that if entire rounds or the quiz is re-used (read pilfered) , then the source be acknowledged.

This is *not* a textbook quiz. The aim of the quiz was to involve undergraduates, graduate students and faculty in a single CS - related event.

2 Prelims - ALOHA

2.1 Rules

There are 15 dry questions and 5 visual questions. Questions 5, 10, and 15 are starred and Question 20 is double-starred. In case of a tie, the team with more starred answers goes through.

2.2 Q

1. Which British philosopher lends his name to the logical contradiction reflected by the following imagery?

In a village, there is only one barber. The barber shaves those who do not shave themselves. Then, who shaves the barber?

2. In computer science, if a problem solving method can be applied universally it is a technique. If it can be applied in a few cases, it is called a trick. If it is a one-off solution, then it is called ... what ?
3. What is common to these weird sounding names?
 - Toffli
 - Fredkin
 - Hadamard

- CNOT
4. The world's first natural language conversation system developed by Joseph Weizenbaum was named after the voluble female lead in G.B. Shaw's Pygmalion and My Fair Lady. What was the name of this rudimentary automatic counseling system?
 5. * In 1953, while working on circuit synthesis, this telecommunications engineer at Bell Labs discovered an excellent technique for circuit optimization. This generalization of E. W. Vietch's work is now known by the name of its discoverer. Identify the engineer in question.
 6. Which four letter word derived from the Latin word for "GIANT" comes before Bytes, Pixels and Hertz, and after 'O'?
 7. This Dutch mathematician's contributions to mathematics include analytical number theory and analysis of games. In 1951, he and Paul Erdos proved a graph coloring theorem which states that a graph is k-colorable if every finite subgraph of it is k-colorable. He is best remembered in CS for his state diagrams on shift register sequences. Who is he?
 8. We have all heard about copyright. What is copyleft?
 9. The power of this simple algorithm was recognized after Robert Tarjan and John Hopcroft elegantly solved planarity testing using it. At the ceremony in which they received their Turing Award, the winner of that year's best chess program noted that his program used this technique over 40 million times in a match. Which algorithm?
 10. * What is common to:
 - The Four Color Conjecture [a map of any virtual world can be coloured using only four colors]
 - Kepler's Conjecture [The optimal way to stack oranges is the way the greengrocer does it]
 - Double Bubble Conjecture [Minimal surface area for two identical volumes is the shape of two bubbles joined by a plane]
 11. During WW-II, the US Govt. purchased IBM calculating machines for basic calculations. For complex operations, an algorithm was devised for feeding the output of one machine to another and so on. Richard Feynman suggested that if punched cards of various colors were used out of phase with each other, the throughput could be improved in spite of manual intervention. How do we know this technique?

12. Which mathematical principle is given by the following second order logic formula:

$$(\forall f)(\forall k)\left(\left(f(k) \wedge (\forall n)(f(n) \Rightarrow f(n+1))\right) \Rightarrow (\forall x)(f(x) \vee (x < k))\right)$$

13. Which biologically inspired computational model uses the concepts of niche, elitism, and Roulette wheel?
14. In 2000, the Clay Mathematical Foundation, in the footsteps of David Hilbert, proposed a prize of \$ 1 million for solving seven of the biggest unsolved mathematical problems. These include the holy grail of computing, first posed by Steve Cook in 1971. Which problem ?
15. * Which IIT KGP hall code (2 or 3 letter acronyms as stated in the registration forms) is also the name of a complexity class?
16. The diagram of a pioneering idea and its modern implementation. Identify the idea.

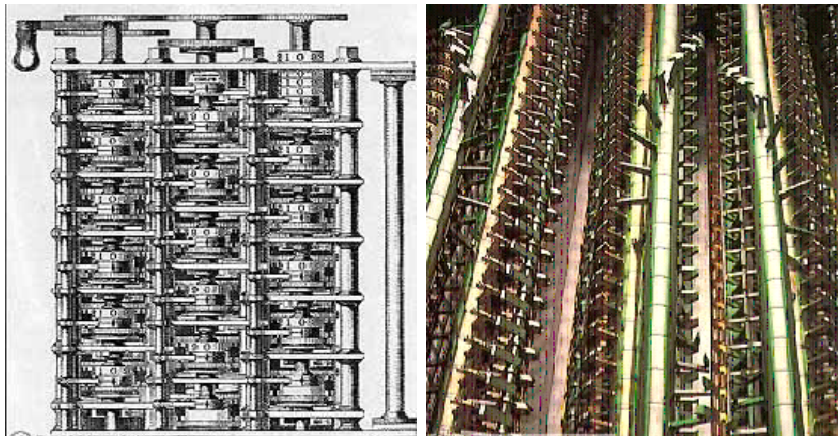


Figure 1: Woodcut by ,18

17. Identify this person, who, in 1854 in the book *An Investigation of the Laws of Thought* discovered what we know as Shannon's Expansion Theorem.
18. The load versus throughput plots of two variants of which protocol look like this?
19. The company was originally called System Development Laboratories, which later changed to Relational Software Inc. Its present name is derived from the famous historical structure in the above figure. Name the company.

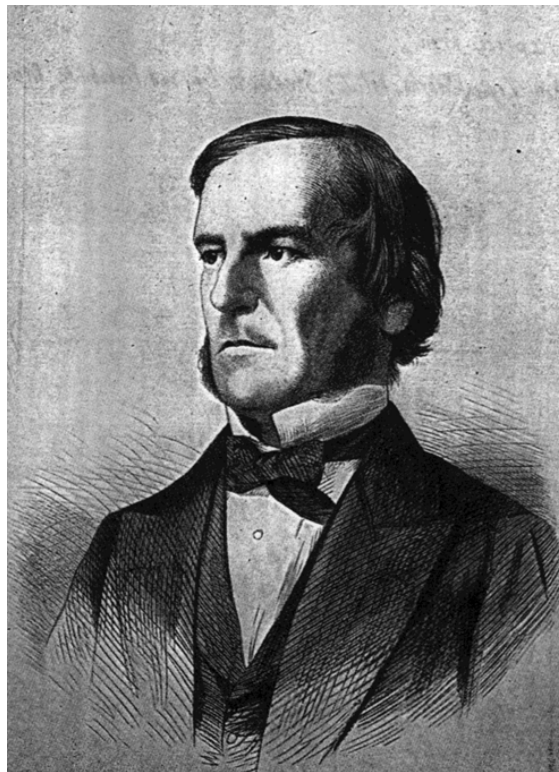


Figure 2: Woodcut by ,18

20. ** This sketch by J. Stolphi, published in the Communications of the ACM in 1987, is an allegorical representation of which concept originally formulated by Robert Tarjan ?

2.3 A

1. Bertrand Russell - Russell's Paradox.
2. Hack
3. Quantum Logic Gates / Operators
4. Eliza
5. M. Karnaugh
6. Mega
7. N.G. de Bruijn
8. GNU Public License - the GPL, pun on copyright.

9. The Depth-First Search
10. Proved using brute force computation in the discrete domain. In 1999, the “proof” of Kepler’s Conjecture was given as 100 pages of formal proof and 3 GB of code and results by University of Pennsylvania professor Thomas Hales, then at the University of Michigan, to the journal Annals of Mathematics. The journal sat on it for 4 years, before publishing it with “99%” confidence in 2003. An earlier 1975 failed proof involved geometer Buckminster Fuller.
11. Pipelining
12. Principle of Induction
13. Genetic Algorithms
14. **P = NP ?**
15. **RP** - the Rajendra Prasad Hall of Residence
16. Babbage’s Analytical Engine
17. George Boole
18. Aloha - an easter egg. The other protocol is that of Slotted Aloha.
19. Oracle
20. Self-Adjusting Trees (splay trees will do, AVL trees will not do)

3 Round 1 - HEURISTICS

3.1 Rules

- The questions will be in the form of three clues revealed sequentially pointing towards a single answer.
- After every clue the participants will get 10 seconds to answer. On wrong or no answer the next clue will be revealed.
- Scoring:
 - Correct answer after the first clue: 150
 - Wrong answer after the first clue: -30
 - Correct Answer after the second clue: 100
 - Correct Answer after the third clue: 50
 - No negative marking for second and third clues
- If not answered, the question passes clockwise/anticlockwise to the next team for bonus 50 points, no negative marking. Time: 5 seconds

3.2 Q

1.
 - (a) In the fourth century BC, this Indian developed a formal system for describing his work which is as expressive as the Backus-Naur Form.
 - (b) A parsing technique inspired by his work uses concepts like akamsha, yogyata and sannidhi to model a Constraint Satisfaction Problem in an elegant fashion.
 - (c) Author of Astadhyayi, he is one of the greatest Sanskrit grammarians, whose grammar system is conventionally followed by all the modern Indo-Aryan languages.
2.
 - (a) When an imagery was required for this problem, the author of the paper chose Albania, which was a closed community then, so as not to hurt people's political feelings. Later, when Albania was opened up, he changed the name of the country to a historical one.
 - (b) The author Leslie Lamport received email from John Morgan @ Boeing intimating that Boeing was aware of this kind of agreement problem and was accordingly manufacturing planes by implementing his algorithms from 1986.
 - (c) The problem is about reaching agreement in the presence of faults, and Lamport showed that if $3n+1$ processes are to reach consensus, no more than n of them can be faulty for the processes to correctly reach a consensus.
3.
 - (a) This was created by Dr. Edward Shortliffe in 1974, which later gave birth to offspring like PUFF, CLOT and ONCOCIN.
 - (b) In 1982, this expert took part with human medical experts in ten selected meningitis cases. It scored higher than all the rest due to the power of its backward chaining and certainty factor algebra.
 - (c) It was one of the first Expert Systems named after the English suffix for "a substance derived from a bacterium", and was developed for medical diagnosis of infectious diseases.
4.
 - (a) This term borrowed from the field of Accounting, where it means payment of outstanding loans over a period in installments, was introduced into algorithmics around 1980 by Robert Tarjan and Danny Sleator.
 - (b) In order to design an efficient algorithm for max-flow, Danny Sleator invented self-adjusting dynamic trees. This technique was extensively used in the analysis of dynamic trees.
 - (c) This method of analysis of algorithm concentrates on the average case performance rather than the best or worst case analysis.

5. (a) In 1959, this computer scientist published a paper entitled “Programs with Common Sense” which marked the beginning of application of mathematical rigor to common sense reasoning.
- (b) In reply to his frame based representation and situational calculus, Marvin Minsky in 1974 published “A Framework for Representing knowledge”, in which Minsky argued that AI should not use logic because logic is inherently too conservative.
- (c) He was the brain behind the development of LISP - the lingua franca of AI.
6. (a) The commercial version of this product was first used in Raytheon hearing aids. The first version of it looked like this.
- (b) There was a huge lawsuit between employers of Robert Noyce and the employers of the inventor of this product to decide patent rights.
- (c) Jack Kilby obtained the Nobel Prize for Physics for this pioneering invention in 2000.
7. (a) Arthur C. Clarke named his computer HAL in the story 2001: A Space Odyssey by employing the Caesar cipher on the acronym of this company.
- (b) The seeds of this company were sown when Herman Hollerith, the designer of punched card machines for processing of data in the 1880 US census, founded a company in 1896. In 1924, it merged with several other companies to take its present day shape.
- (c) In the corporate world it is nicknamed “Big Blue”.
8. (a) In a paper published in the 33rd SE Conference on Combinatorics, the authors described the distribution of this particular variable. The mean, median and standard deviation for a special set of observations were found to be 4.69, 5 and 1.27 respectively. Although theoretically the variable can take arbitrarily large values, they found that there were almost no cases where it was larger than 15 and yet finite!
- (b) This variable can take only non-negative integral values and it is 0 in only one particular case.
- (c) This variable is named after a famous mathematician, who in 1949, independently proved the Prime Number Theorem but missed the Fields Medal to Atle Selberg, who got his results published before him.

3.3 A

1. Panini
2. The Byzantine General's Problem
3. MYCIN
4. Amortization
5. John McCarthy
6. Integrated Circuits
7. IBM
8. Erdos Number

4 Round 2 - A*

4.1 Rules

- The aim is to reach any leaf node starting from the root in 90 seconds.
- The children of a node will be revealed only after the parent is answered correctly.
- The teams may choose which child to attempt based on the points and hints given.
- A team may choose to answer any of the remaining children if they answer their chosen question wrongly, but no backtracking is allowed.
- The search may end in three ways:
 - Timeout
 - All paths exhausted
 - Leaf node answered successfully
- Scores: Sum of points of all correctly answered questions (Total of 150 points on all paths). Bonus of +50 for correctly answering a leaf node.

4.2 Q

iuhiui oihjoi iohioio iuhuihi iuhioh io? ihjoisd

4.3 A

5 Round 3 - TAO OF PROGRAMMING

5.1 Dijkstra In Search Of Simplicity and Elegance

- Which term, usually associated with visual signalling, was introduced by Dijkstra into Computer Science because the inspiration behind Dijkstra's idea was a train signalling system?
- In 1965, Dijkstra sat down one evening and prepared a now-famous examination problem for his students at the Eindhoven Technical University. The name suggested by Dijkstra did not stick, and it is known to posterity by the name suggested by Oxford professor C. A. R. Hoare. Identify this famous problem?
- Machine designers Loopstra and Scholten, who had been the engineers of the ARMAC, were building their next machine. Dijkstra solved which design optimization problem for them using the shortest sub-spanning tree algorithm ?
- In 1961, Dijkstra thought of an algorithm using two operations Passeren and Vrijgeven. Later, these operations were implemented on hardware - for the first time on IBM System 360. How are Passeren and Vrijgeven as implemented on IBM 360, better known today?
- You can hardly blame MIT for not taking notice of an obscure computer scientist in a small town in The Netherlands.”

Quoted verbatim from Dijkstra when he pointed out that Multics, an OS developed at MIT suffered from a specific problem (solved long back by Dijkstra) . Dijkstra's warnings went unheeded and Multics suffered from occasional performance glitches. What was the problem?

- In 1970, “ ... on the way home I gave a talk to a company in Brussels. The talk fell completely on its face. It turned out that management didn't like the idea at all. The company profits from maintenance contracts. What was the talk about, being as relevant today as it was then?
- About which field in computer science when Dijkstra was asked where does it fit in, he replied “Not. ... The Europeans tend to maintain a greater distinction between Man and Machine, and have lower expectations of both.?”
- According to Dijkstra, a program with what tended to be about as easy to follow as a legal contract in Marx Brothers film?

- After moving to Texas in the 80s, Dijkstra and his wife used to travel a lot in Volkswagen Camper. What did they affectionately name it, based on the work of a famous British mathematician?

5.2 Knuth The Boundless Interests a Common Thread

- Donald Knuth's first publication was in June 1957 on "The Potrzebie System of Weights and Measures" where he defined the basic units as Potrzebie - the unit of thickness, MAD - the unit of number of things, whatmeworry - the unit of power. Where was this published ?
- Knuth has successfully guided 28 students, and is unwilling to guide more, though he is perfectly happy with the work output of the original 28. Why ?
- In 1958, Knuth wrote a program for the Case basketball team, which according to the coach, helped the team win a league championship. Newsweek published an article about the program - which became famous in its own right. What was the program about?
- In a conversation with Knuth in 1967, Peter Wegner suggested conveying information up and down a parse tree. After first thinking that this was a preposterous idea, Knuth figured out a way to use it and a new technology was born in the field of compilers. What technique?
- According to Knuth, his penchant for depicting haphazard sets of lines by a minimal set of equations later gave birth to which important work pioneered by Knuth.
- In 1974, Knuth wrote a novel about two college dropouts who developed a mathematical system. The name of the novel is identical to the name of the mathematical system, which was actually developed around the same time by Cambridge professor John Conway. What is the name of the book?
- The first version of Knuth's Metafont has a version number of 2. The next two go 2.7 and 2.71. Why such a peculiar version numbering scheme?
- In the 1950s, while compiling a book on compilers, Knuth studied existing parsing techniques, and a new method came to his mind quite naturally as an extension of a bottom up parsing technique. This could parse a greater number of languages compared to existing methods. What was this technique?
- Knuth started using it in 1975, and stopped using it on January 1, 1990. He says that 15 years of this is plenty for one lifetime and he has been a happy man ever since he stopped using it. What is it?

5.3 A

5.3.1 Dijkstra

- Semaphore
- The Dining Philosophers Problem
- Wiring Costs
- Test-and-Set
- Deadlock
- Structured Coding
- Artificial Intelligence
- GOTO statements
- The Touring Machine

5.3.2 Knuth

- The MAD Magazine
- 28 is a perfect number. The next perfect number 496 is too far off.
- Player Ranking and Team Selection
- Attribute Grammar / Syntax Directed Translation
- Metafonts
- Surreal Numbers
- Converging to e
- LR(k)
- email

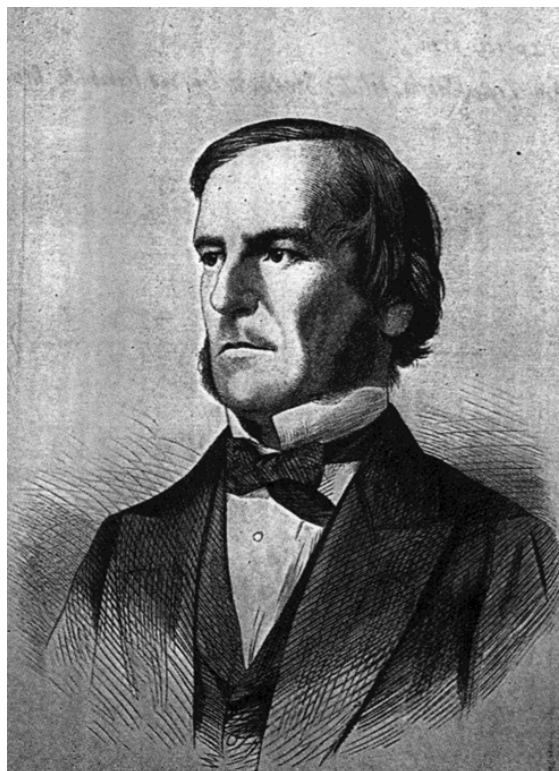


Figure 3: Woodcut by ,18

6 Round 4 - QUICKSORT

6.1 Rules

6.2 QUESTION 0 - demonstration question

6.2.1 Snapshot 1

6.2.2 Snapshot 2

6.2.3 Snapshot 3

6.2.4 Snapshot 4

7 Round 5 - BEST FIT

7.1 Rules

- Teams will choose a topic in ascending order of their scores as at the beginning of the round. Ties will be broken on the basis of the team number.
- Each topic contains two questions each on two related domains.

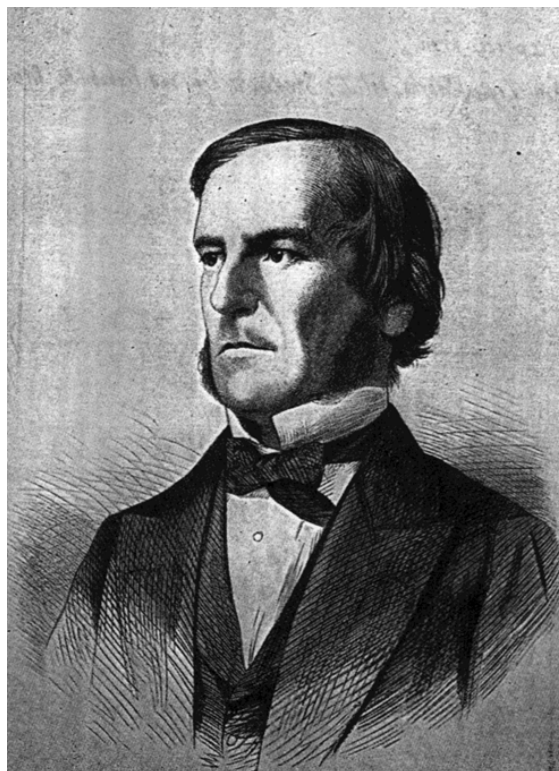


Figure 4: Woodcut by ,18

- Questions may pass to the next team clock/anticlock-wise.
- Scoring: Direct: +30, Bonus: +50 No negative marking

7.2 Books and NLP

1. This mathematician once commented, "It is not breaking the code that matters, its where you go from there. That's the real problem." A very successful biography by the name Breaking the Code has come out, which has been made into a very successful West End play of the same name. Who is the mathematician concerned?
2. In May 1997, Barnes and Noble - the world's largest book chain, reported that sales of Fritz Leber's book The 64 Square Madhouse had dramatically picked up, even though the book had not sold well in decades. Why?
3. This was the only book on Computer Science that was nominated among the twelve best scientific monographs of the century by the American Scientist, rubbing shoulders with books by Feynman on QED, and Einstein on relativity. Which book?

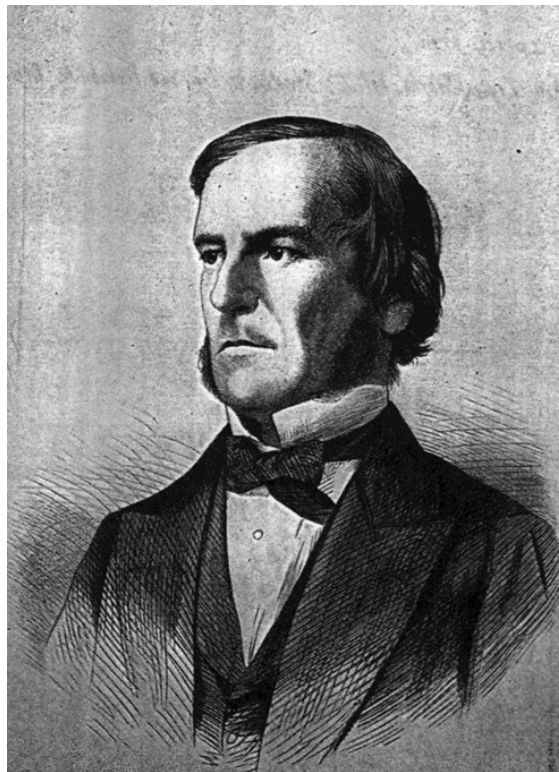


Figure 5: Woodcut by ,18

4. In 1957, which commonly used English language construct did Noam Chomsky use to show that English grammar cannot be modelled using Finite state machines (FSMs)?
5. In 1991, a paper titled “Was the Earl of Oxford the True Shakespeare?” talks about remarkable similarity of texts written by the Earl of Oxford and Shakespeare when subjected to computer analysis. What was the metric of similarity that they used, which is traditionally used in text classification and data mining systems ?
6. Donald E. Knuth published a paper on an English alphabet in which he explored the mathematical shape of that letter through the ages and explained his several day effort to find the equation that yields the most pleasing outline. Which letter?

7.3 Computational Complexity

1. In the late 1950s, Russia’s operations research community had informally characterized certain optimization problems as requiring perenor. Later, Steve Cook formally defined this class of problems as NP

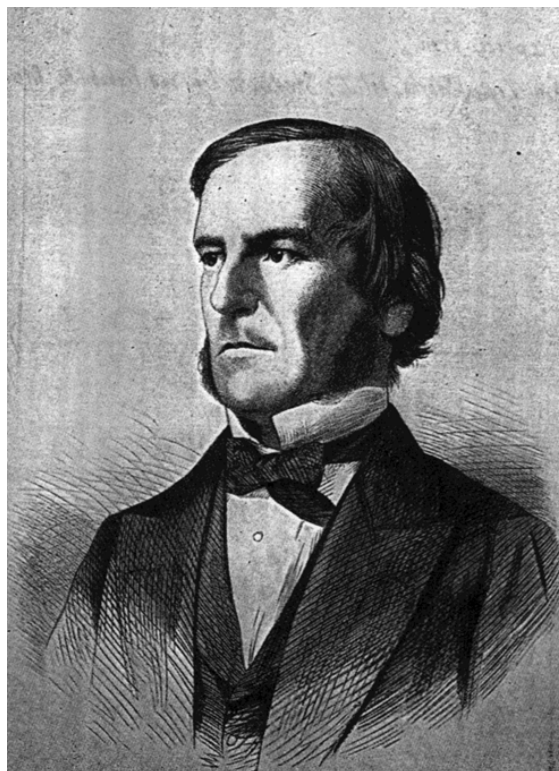


Figure 6: Woodcut by ,18

Hard. What does *perebor* mean in Russian?

2. In 1993, Leonard Adleman discovered a way to solve this intractable problem using strands of DNA and established biological laboratory techniques. However, this approach could not be realized because for an input size of 1000, it requires more molecules than are present in the known universe. Which problem?
3. Isolated in the USSR and unaware of the developments in the West, Leonid Levin *Leonid Levin* published a paper in 1973 titled "Universal Sequential Search Problems" in a Soviet journal. Which major breakthrough in Computer Science would have been credited to him had he published the work two years ago?
4. The following limerick is based on Princeton University professor Sanjeev Arora's work on PCP (probabilistically checkable proofs). Fill in the blank.

One clever young theorist said, "Gee!
I'll define a new type called PCP."

So he did some contemplation,
Spent many days on calculation,
And finally said, “Damn, it’s no simpler than _____ !”

5. In 1979, Pippenger characterized a complexity class based on circuit problems. Steve Cook named this class after Pippenger. Pippenger tried to repay the compliment by naming another complexity class as Steve’s Class but it never caught on. What is the complexity class named after Pippenger?
6. “Hello, Michael. This is Vaughn. I’m getting the output from these experiments . . . $2400 - 593$ is prime. $300! \times 338 + 821$ and $300! \times 338 + 823$ are twin primes.”

Identify Michael, who had devised the algorithm for finding the prime numbers. What was so special about his algorithm ?

7.4 Shape, Form and Interaction

1. This was the first GUI (Graphical User Interface) developed long before the term was coined. It introduced HCI as a new field in CS. The image shows its developer running it on TX-2 console in MIT in 1963. Identify the man and his creation.
2. In 1787, W.A. Mozart penned the rather unusual composition *Musikalisches Würfelspiel*. This composition uses a technique which most of today’s advanced automated music composers use. Which technique ?
3. Which computer standard was decided by the memory it took for completely storing Beethoven’s Ninth Symphony ?
4. This French engineer for the firm of Renault designed a single parametric equation for generating a curve whose shape could be moulded by a set of ”control points”. To this day, all automobiles designed by Renault are modelled by this technique and the curves are named in honor of this engineer. What is the name of this curve?
5. When McDonald’s decided to analyze which neighborhoods in New York should be served by which outlet, it used some technical diagrams originally studied by Johann Dirichlet and sometimes called Dirichlet tessellations, but formally named after the turn of the century Russian mathematician who systematically analyzed them. What are the diagrams called?
6. In the late 1970s, A. Lempel and J. Ziv of Israel and T. Welch of Unisys developed an image compression algorithm, which was also independently developed by V. Miller and M. Wegman of IBM. After a

major patent war, won by Unisys, it targeted software vendors making tools for the GIF format that uses the algorithm resulting in a new image format PNG. What was the algorithm ?

7.5 Formal Languages

1. Programming languages habitually undermine ASCII values 9, 10 and 32. Therefore, a dedicated group of programmers decided to write a programming language which uses only permutations of these three characters as its constructs. What is the name of the programming language?
2. In May 1958, an international committee convened in Zurich to standardize and internationalize FORTRAN. They ended up sketching out the blueprint for ALGOL. Which novel feature of ALGOL, which FORTRAN lacked as it had only global naming of variables, made it win over the programming community?
3. This programming language, originally designed by Seymour Papert in the 1960s for the purpose of computer pedagogy, is extensively used today for drawing fractals with its turtle graphics. Which language?
4. Which fundamental concept about finite state automata was introduced by Rabin and Scott in 1959 in a paper titled "Finite Automata and Their Decision Problems" ?
5. In 1936 Alan Turing, in a paper titled "On computable numbers with an application to the Entscheidungsproblem, introduced the concept of Universal Turing Machine. What is Entscheidungsproblem and who posed it?
6. In the 1930s the Polish mathematician M. Presburger showed that his arithmetic system was Turing-decidable. Later Rabin and Fischer were able to show that although decidable, Presburger arithmetic could be impractically hard despite the fact that it used only one arithmetic operation. Which operation?

7.6 Ancient India and ...

1. Negative taken from cipher becomes positive, and affirmative becomes negative; negative, less cipher, is negative; positive is positive ...

Quoted from a translation of Brahmagupta's Brahmasiddhanta. What is cipher in this verse ?

2. Around the 1st century BC, Pingala authored the Chhandashastra - the treatise on metrics, where he developed a mathematical formalism, which was reinvented by Leibniz in the 17th century, formalized in the 19th century. Which formalism?
3. It was named *kha* by its discoverer. Later Indians christened it with myriads of names like *aakaasha*, *jaladharapatha*, *div*, etc. Which name among the myriads has been retained through the ages and is the name by which we presently refer to it?
4. The process of removing existential quantifiers from a first-order logic formula is named after a famous Norwegian mathematician of the 20th century who also did pioneering work in metalogic, non-standard models of arithmetic and theory of recursive functions. Identify the process named after this mathematician.
5. An Iranian computer scientist introduced a term in 1965 which appeared in the titles of 566 papers in the 70s, which rose to 2361 in the 80s and more than 23753 in the 90s. Identify the scientist and the term.
6. Tweety is a Bird. All birds can fly. Therefore, Tweety can fly. Suppose now I tell you that Tweety is a penguin and so it cannot fly. Hence there is a contradiction.

To circumvent this inherent problem with deductive logic, John McCarthy proposed a rule called circumscription. Formally, what notion did McCarthy introduce with the concept of circumscription?

7.7 Operating Systems and Unix

1. Two races of people depicted in Jonathan Swift's Gulliver's Travels went to war over how to eat an egg. This led to nomenclature of which terms in CS?
2. Which term, inspired by Maxwell's imaginary agent, who helped sort molecules at different speeds and worked incessantly, was introduced into UNIX in particular and operating systems in general?
3. What is common to UNIX, icecreams and quarks ?
4. In the 1960s, L. A. Belady at IBM suggested a clairvoyant solution for an OS problem. A slight variant of this impractical solution was later designed, the theoretical analysis of which was made possible by Tarjan and Sleator's concept of competitiveness. They showed that the new algorithm was as competitive as its clairvoyant counterpart. What was the modified algorithm ?

5. When Leslie Lamport was growing up, there was only one store in his locality that used tickets to decide who would get served next. Later, Lamport used this idea to design a mutual exclusion algorithm that did not require any hardware support. What did the local store sell ?
6. It is said that in petitions of dissent, the signatories would sign the petition in a circular fashion with signatures radiating outward from the centre, so that no person could be held as the leader - as could be the case with a linear list. What term supposedly came into English language because of this practice and was later incorporated into OS scheduling strategies ?

7.8 Life, Society and Everything

1. If English prefers the highest, Dutch prefers the lowest and Vickrey prefers the second highest, then these are formal protocols for which everyday social activity?
2. “How to Fold Graciously”, a talk delivered in 1969, introduced the notion that a normal protein may have as many as

$$10^{300}$$

possible shapes. Even assuming that a protein can sense as many as 1014 configurations per second, it should still take 10278 years for the protein to find its correct shape. However, in nature it requires a few minutes for this purpose. How do we better know this paradox?

3. Anfisen’s dogma assumes that one can predict the native protein tertiary structure from first principles based on which parameter of dynamical systems?
4. The book ”The Algorithmic Beauty of Plants”, by Lindenmayer and Prusinkiewicz is based on a particular class of rewrite rule systems in formal language theory. The system described in this book has proved remarkably versatile for drawing various regular figures, especially fractals. Which class of rewrite rule system are we talking about?
5. In 1979, R. A. DeMillo et al published a paper “Social processes and Proofs, Theorems and Programs”, where they showed that reliability of mathematical proofs comes through a social process of repeated reviewing. The absence of such a process in the programming community led the trio to suggest something that later gave birth to a new field in CS. Which field?
6. The fact that pheromones accumulate best on the fastest travelled path by ants has given rise to biologically inspired algorithms for what ?

7.9 Cryptography and Jargon

1. Peter Shor, an engineer at Bell Labs, devised an algorithm for factoring a number in

$$O((\log n)^3)$$

time and

$$O(\log n)$$

space. Shor's algorithm was demonstrated by IBM in 2001 which factored 15 into 5 and 3. Such an algorithm should make prime factorization based cryptographic techniques like RSA obsolete. Why hasn't that happened ?

2. The Dining Cryptographers Protocol is:

3 cryptographers sit down to dinner. Every pair tosses a coin secretly from the 3rd . Everyone notes if the two tosses he observed are different and lies about what he noted if he wants to pay for dinner, else he tells the truth. An odd number of differences indicates a cryptographer is paying.

This protocol will be implemented in the next version of P2P file-sharing software like Kaazaa. Why?

3. This term originated from the Greek words for *roof* and *writing*, and the idea is extensively used in Cryptography in applications like digital watermarking. What?
4. How is Jan Lukasiewicz, a Polish scientist who worked on logic, logical calculus, and most notably recursive stacks, remembered for posterity?
5. While this now means "the simplest or most symmetrical form to which all notations of the same class can be reduced without loss of generality" , originally this term in Latin meant a rule or a standard, and came to be associated with church rules and standards. What word ?
6. We often hear a lot of talk about 4GLs. What exactly are 4GLs ?

7.10 The Web and other Distributed Systems

1. What is common to the search for Merseinne Prime numbers, the Human Genome Project, and the search for intelligence outside Earth?
2. In the 1970s, it was found that users of the ARPANET on Multics machines could not perform one important function normally on their machines because of the Multics "line kill" command. What function and why?

3. Kevin MacKenzie's creation "tongue in cheek" were reinvented in 1981-1982 by Scott Fahlman on the CMU Bulletin Board. He noticed that humorous notices posted on the bulletin board often led to arguments because people would miss the point. So he suggested the use of something which led to the evolution of an internet craze. What?
4. In Greek Mythology, it is the 3-headed dog which guards the gates of Hades and stops the living from entering the world of the dead. The 12th and final task of Hercules was to kidnap this creature. Which protocol takes its name from this mythical beast?
5. Connect the two diagrams shown.
6. Which game has given rise to the name of an unbounded effect associated with distributed rollback?

7.11 Architecture

1. The following division result was posted by Tim Coe of Vitesse Semiconductor in January 1995. In MATLAB, his example was

$$x = 4195835 \quad y = 3145727 \quad z = x - (x/y)*y$$

z turned out to be 256 instead of zero. What was revealed as a result of this?

2. Since Pentium was the next product in line after the 80386 and 80486 it should have been called the 80586. So why not 80586?
3. Howard Aiken proposed a machine called the Automatic Sequence Controlled Calculator in 1937 which was renamed in 1939. This computer gave rise to a pioneering concept in computer architecture. What?
4. Rheinhold Weicker wrote a set of programs in 1984 that are now used to compare the relative performances of microprocessors. What are they collectively known as ?
5. One of the measures of the speed of a microprocessor originated from the speed of VAX 11/780 since it was the first machine to cross this threshold. Which measure?
6. Connect all the pictures to bus arbitration with a single word.

7.12 Graph Theory

1. In 1999, in a paper in Nature, T. Fink and Y. Mao of the Cavendish Laboratory, Cambridge analyzed persistent random walks on a triangular lattice to offer sartorial advice. By doing so, they found 85 ways

of performing this particular task, but rejected all but ten on the basis of aesthetic constraints of symmetry and balance. Previously, there were only 4 standard ways of performing this task. Which aspect of men's fashion did they formally investigate ?

2. This graph has an entire book dedicated to it and appears on the covers of the Journal of Graph Theory and Discrete Mathematics. Shown are the 3 rather uncommon embeddings of this graph. Identify the graph.
3. IF a group of men and women may date only if they have previously been introduced, THEN a complete set of dates is possible if and only if every subset of men has collectively been introduced to at least as many women, and vice versa.

This theorem was proved by P. Hall in a paper titled "On representatives of subsets". It enables us to prove that in a playing card deck, it is possible to draw one card from each of 13 arbitrary piles of 4 cards each such that we can end up with one card of every rank. How do we better know this famous theorem?

4. In 1967, Milgram conducted a social experiment in order to study the concept of 6 degrees of separation". He sent letters to randomly addressed people in US. They could forward the letter to people they knew. The letter had to reach a randomly chosen final receiver in Boston. What graph theoretic property of social networks - large random graphs with dense clusters - was Milgram studying?
5. Many pen and paper parlour games are based on graph theoretic ideas - like the Box game. A particular game - Nim - asks two adversaries to alternately colour the edges of a graph using pencils of three different colours. The first player to complete a monochromatic triangle loses. What kind of graph should be chosen so that the game does not end in a draw ?
6. "Graphic Programming Using Odd or Even Points", a paper in Chinese by M. K. Kwan in 1962, proposed an intractable problem that was solved by Johnson and Edmonds. What problem?

7.13 Smaller and Smaller

1. With respect to miniaturization, what is the ergonomic threshold?
2. In a talk to the American Physical Society titled "There's Plenty of Room at the Bottom", Richard Feynman provided the vision for the development of a new field when he conjectured that big machines could make small machines, which could make even smaller machines, and so on. This talk was the genesis of what field?

3. The director of Fairchild Semiconductor's R D Laboratories, wrote an article for the 35th anniversary issue of Electronics magazine. The law stated in this article, in order to be true, requires an infinite demand from an economic viewpoint. Which law?
4. Which 2 words connect the above 2 pictures?
5. Although ECL is the fastest logic family available in the market, which is theoretically the fastest logic family?
6. What does 74 stand for in the chips – 74616, 74386 and 7400?

7.14 A

7.14.1 Books and NLP

1. Alan Turing
2. IBM's Deep Blue beat Kasparov. A computer beat the world champion in the book as well.
3. The Art of Computer Programming (TAOCP), by Donald E. Knuth
4. If ...Then ...Else, which incidentally happens to be part of most programming language vocabularies as well - and can cause problems for the compiler if not disambiguated properly.
5. Word frequency and word ranks
6. S

7.14.2 Computational Complexity

1. Brute Force
2. The Travelling Salesman Problem
3. NP-Completeness. As it was Steve Cook beat him to it.
4. NP. NP-complete or NP-Hard gets no marks. The traditional limerick rhyme scheme is aabba !
5. NC. Nick's Class.
6. Rabin and his randomized primality testing scheme.

7.14.3 Shape, Form and Interaction

1. Ivar Sutherland and the Sketchpad. The birth of HCI.
2. Randomization. Literally, the Musical Dice Game. Several small compositions are pieced together in a sequence based on dice throws, in the face of certain global constraints.
3. The time on a CD. 74 minutes. Exactly why is a mystery but many urban legends follow - fodder for other quiz questions.
4. Bezier curve. The curves were used by Pierre Bezier of Renault and was based on Paul de Casteljau's algorithm.
5. Voronoi Diagram. After Russian mathematician Georgy Voronoi.
6. The LZW algorithm. The answer is in the question itself.

7.14.4 Formal Languages

1. Whitespace - just imagine !
2. Recursion.
3. LOGO. A take-off from LISP with significant list processing power.
4. Non-determinism.
5. Entscheidungsproblem poses the decidability of arithmetic. it was first proposed by David Hilbert among the 13 most important mathematical problems facing 20th century at the International Congress of Mathematicians at Paris in 1900.
6. Addition. The basic axioms for Presburger Arithmetic is a subset of those of Peano Arithmetic.

7.14.5 Ancient India and ...

1. Zero
2. The Binary Number System
3. shunya. Another question on zero.
4. Skolemization. The Norwegian mathematician in question is Thoralf Skolem.
5. Fuzzy. The Iranian scientist in question is Lotfi Zadeh of University of California, Berkeley.
6. Non-monotonic logic. Consistent hypotheses may not always remain so.

7.14.6 OS and UNIX

1. Little Endian and Big Endian. Depending on whether the least significant or the most significant byte is stored first.
2. Daemon.
3. They all come in flavours.
4. The LRU or Least Recently Used. The clairvoyant algorithm was OPT.
5. Cakes and bread. It was a bakery. The algorithm was the Bakery Algorithm.
6. Round Robin. The etymology is doubtful, to say the least.

7.14.7 Life, Society and Everything

1. Auctions. English auctions are the traditional "going, going, gone ..." variety. Dutch auctions perform countdown. In Vickrey auctions, the second highest bidder wins but pays the price quoted by the highest bidder.
2. Levinthal's Paradox.
3. The Hamiltonian.
4. L-Systems, named after Lindermeier.
5. Formal Verification.
6. Routing.

7.14.8 Cryptography and Jargon

1. Shor's algorithm requires quantum computers. Though theoretically feasible, quantum computers are yet to be practically implemented.
2. Provably anonymous information transfer.
3. Steganography.
4. The Polish notation - a method of writing operators and operands is named after Jan Lukasiewicz.
5. Canonical. From canon. Arabic *qanoon* also means rule. Greek *kanon* signified a kind of reed whose leaves were used as a standard of length.
6. High-level, non-procedural, formal languages - SQL, tex, lex

7.14.9 The Internet and other Distributed Systems

1. All of them use screensavers to tap idle CPU cycles into massively distributed systems running over the Internet with centralized control.
2. email. The line kill command was @.
3. Smiley or Emoticon. A few cases are :) :)) :D :(:((
4. Kerberos - from Cerberus or Kerberos - the dog guarding Hades.
5. Causality.
Einstein's "cone of causality" which demonstrates which points in space time can causally affect a certain point in space-time and which points in space-time can be causally affected by a certain point in space-time.
Lamport's process diagrams from which, using Lamport's clock, one may ascertain which event can possibly causally affect which events.
6. Domino Effect. The game is, of course, Dominoes.

7.14.10 Architecture

1. The Pentium Bug.
2. Numbers cannot be patented in the US. Intel tried to patent 80486 but could not.
3. The Harvard Architecture.
4. The Drystone Benchmark.
5. MIPS or Millions of Instructions Per Second.
6. Daisy Chaining - as connected to the Daisy stitch, Daisy Duck and the Daisy flower.

7.14.11 Graph Theory

1. Ways to knot a tie.
2. Petersen's Graph.
3. Hall's Marriage Theorem.
4. Diameter. The results (that the diameter is 6 for the human society) are dubious, and are being validated presently. The concept of "Six Degrees of Separation" has been glorified in plays and film.

5. Graphs with Ramsey Number 3.
6. The Chinese Postman problem.

7.14.12 Smaller and Smaller

1. The ergonomic threshold is the threshold of miniaturization below which a device becomes too difficult for a person to operate for a person since it becomes too small. Cellphones are nearly there.
2. Nanotechnology.
3. Moore's Law. The person in question is Gordon Moore, co-founder of Intel. According to some sources, the law has changed over the years to fit the data, which explains its accuracy.
4. Totem Pole - real Red Indian totem poles and the TTL Totem Pole configuration.
5. GaAs - the Gallium Arsenide family.
6. 74 stands for TTL.

8 X

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Index

- 2001: A Space Odyssey, 7
- 7400, 23
- 74386, 23
- 74616, 23
- 80386, 21
- 80486, 21
- Johann Peter Gustav Lejeune Dirichlet, 16
- Abraham Lempel, 16
- akamsha, 6
- Alan M. Turing, 17, 23
- Albania, 6
- Albert Einstein, 26
- ALGOL, 17
- American Physical Society, 22
- American Scientist, 13
- An Investigation of the Laws of Thought, 3
- Annals of Mathematics, 5
- Aristid Lindenmayer, 19
- Arpanet, 20
- Arthur C. Clarke, 7
- ASCII, 17
- Astadhyayi, 6
- Atle Selberg, 7
- auction
 - Dutch, 25
 - English, 25
 - Vickrey, 25
- Automatic Sequence Controlled Calculator, 21
- Backus-Naur Form, 6
- backward chaining, 6
- Barnes and Noble, 13
- Bell Labs, 2, 20
- Bezier curve, 24
- Boeing, 6
- Box ame, 22
- Brahmagupta, 17
- Brahmasiddhanta, 17
- Breaking the Code, 13
- Buckminster Fuller, 5
- Cambridge University, 21
- Carnegie Mellon University, 21
- Cavendish Laboratory, 21
- certainty factor algebra, 6
- Chhandashastra, 18
- Chinese Postman problem, 27
- Christian B. Anfinsen, 19
- circumscription, 18
- Clay Mathematical Foundation, 3
- CLOT, 6
- Communications of the ACM, 4
- Constraint Satisfaction Problem, 6
- daemon, 25
- Dana S. Scott, 17
- Danny Sleator, 6, 18
- David Hilbert, 3, 24
- Deep Blue, 23
- Dining Cryptographers' Protocol, 20
- Dirichlet tessellation, 16
- Discrete Mathematics, 22
- Domino Effect, 26
- Donald E. Knuth, 14, 23
- Drystone Benchmark, 26
- E. W. Vietch, 2
- ECL, 23
- Edward Shortliffe, 6
- Electronics, 23
- Ellis J. Johnson, 22
- email, 26
- Entscheidungsproblem, 17
- Fairchild Semiconductors, 23
- Fields Medal, 7
- FORTTRAN, 17

frame based representation, 7
 Fritz Leber, 13
 Fuzzy Logic, 24

 GaAs, 27
 Garry Kasparov, 23
 georgy Voronoi, 24
 GIF format, 17
 Gordon Moore, 27
 Gottlieb Leibniz, 18
 Gulliver's Travels, 18

 Hades, 21
 HAL, 7
 Hamiltonian, 25
 Harvard architecture, 26
 Hercules, 21
 Herman Hollerith, 7
 Howard Aiken, 21
 Human Genome Project, 20

 IBM, 2, 16, 18, 20, 23
 Intel, 27
 International Congress of Mathematicians, 24
 Ivar Sutherland, 24

 J. Stolphi, 4
 Jack Edmonds, 22
 Jack Kilby, 7
 Jacob Ziv, 16
 James Clerk Maxwell, 18
 January Lukaszewicz, 20
 John Hopcroft, 2
 John McCarthy, 18
 Jonathan Swift, 18
 Joseph Weizenbaum, 2
 Journal of Graph Theory, 22

 Kaazaa, 20
 Kerberos, 26
 Kevin MacKenzie, 21

 L Systems, 25
 Lamport's clock, 26

 Laszlo A. Belady, 18
 Leonard Adleman, 15
 Leslie Lamport, 6, 19, 26
 Levinthal's Paradox, 25
 LISP, 7
 Lotfi Zadeh, 24
 Ludwig van Beethoven, 16
 Ninth Symphony, 16
 LZW algorithm, 24

 Mark N. Wegman, 16
 Marriage Theorem, 26
 Marvin Minsky, 7
 Massachusetts Institute of Technology, 16
 MATLAB, 21
 McDonald's, 16
 Mei-Ko Kwan, 22
 Merseenne Primes, 20
 Michael O. Rabin, 17, 23
 MIPS, 26
 Mojzesz Presburger, 17
 Moore's Law, 27
 Multics, 20
 Musical Dice Game, 24
 Musikalisches Würfelspiel, 16
 My Fair Lady, 2

 Nanotechnology, 27
 Natural Language Understanding, 27
 Nature, 21
 NC, 23
 New York, 16
 Nick Pippenger, 16
 Nim, 22
 Noam Chomsky, 14
 Nobel Prize, 7
 not, 5
 NP, 23
 NP Complete, 23

 ONCOCIN, 6

 Paul de Casteljau, 24

Paul Erdos, 2
 Peano Arithmetic, 24
 Peer-to-Peer File Sharing, 20
 Pentium, 21
 Pentium Bug, 26
 Peter Shor, 20
 Petersen's Graph, 26
 Philip Hall, 22
 Pierre Bezier, 24
 Pingala, 18
 PNG format, 17
 Polish notation, 25
 Prime Number Theorem, 7
 Princeton University, 15
 Przemyslaw Prusinkiewicz, 19
 PUFF, 6
 Pygmalion, 2

 Ramsey number, 27
 Relational Software Inc., 3
 Renault, 16
 Reinhold Weicker, 21
 Richard A. DeMillo, 19
 Richard Feynman, 2
 Richard P. Feynman, 22
 Robert Noyce, 7
 Robert Tarjan, 2, 4, 6, 18
 Roulette wheel, 3
 RSA, 20

 Sanjeev Arora, 15
 sannidhi, 6
 Scott Fahlman, 21
 SETI, 20
 Seymour Papert, 17
 Shannon's Expansion Theorem, 3
 situational calculus, 7
 Sketchpad, 24
 Skolemization, 24
 Stanley Milgram, 22
 Steve Cook, 3, 14, 16, 23
 Steven Milgram, 22
 System Development Laboratories,

Terry Welch, 16
 The 64 Square Madhouse, 13
 The Art of Computer Programming,
 23
 The Travelling Salesman Problem,
 23
 Thomas Fink, 21
 Thomas Hales, 5
 Thoralf Skolem, 24
 Tim Coe, 21
 totem pole, 27
 Totem Pole configuration, 27
 TTL, 27
 Turing Award, 2
 Turing decidability, 17
 Turing Machine
 Universal, 17
 turtle graphics, 17
 TX-2, 16

 Unisys, 16, 17
 Universal Turing Machine, 17
 University of California, Berkeley,
 24
 University of Michigan, 5
 University of Pennsylvania, 5

 VAX 11/780, 21
 Victor S. Miller, 16

 West End, 13
 Wolfgang Amadeus Mozart, 16

 yogyata, 6
 Yong Mao, 21

 Zurich, 17