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QURIOSITY

THE MONTHLY NEWSLETTER FROM QUANTINUUM

OCTOBER 2012

ISSUE 3 : VOLUME 6

BOOK REVIEW

QUANT GURU NEIL BOHR

THE QUEUEING THEORY

MAIN STORY:-

DATA ==> INFORMATION CHALLENGE

Quantinuum - The Quants Forum of SIMSR

Its more than NUMBERS

Quriosity

OCTOBER 2012 VOLUME 3: ISSUE 6

From the Mentor's Desk...

Hi All,

Nice to send you all our best wishes for a happy Diwali and a Prosperous New Year.

I understand from the editorial team that some of the features of the last few months, e.g. Book review will become a regular feature from now onwards. While our editorial team will be scouting for new books to review, we do not mind receiving reviews from the readers of good quant books, which we will publish.

We want to make this newsletter a truly joint effort, wherein we collate great content put up by all concerned and interested students and faculties alike.

Thanks for your attention.
Happy Reading

Regards
Prof N.S.Nilakantan
TEAM QUANTINUUM

FROM THE EDITOR'S DESK

Hi All,

It is that time of the year again when we all look forward to packing our bags and taking some time off from the otherwise grueling and busy schedule of a much demanding management course.

Therefore keeping up with mood, QURIOSITY brings to you its latest edition that will invigorate your mind and give you a fresh perspective through its articles on the latest revelations from the world of quants.

The cover story focuses on the challenges of data information transfer gap and furnishes valuable insights on steps that can be followed to bridge the gap.

Quant digest highlights some of the interesting findings using articles such a**s-** "Predicting scientific success", **"**Mathematics of Opinion Formation Revealing How Moderation Trumps Extremism" and "Making Data Work".

The book review covers the much acclaimed and MAN BOOKER PRIZE WINNER 'LIFE OF PI' by Yann Martel.

Further to stimulate the gray matter in your brain; we bring you the wonders of our regular features- quant trivia, quantiz and quant fun.

Happy reading!!

EDITOR

DATA → INFORMATION CHALLENGE

While companies are gathering all manner and volume of data, when it comes to getting insights from that data to the frontlines, where insights really matter, many organizations are losing their way.

"The biggest problem corporations face, whether it's customer service, whether it's sales, whether it's an airline rep, is that they're asked to make critical decisions for the corporation, but the information they're provided is very, very hard to consume and use," said Opera Solutions founder and CEO Arnab Gupta. "Increasingly what we are finding is when you use the power of predictive analytics and the sciences, you can bring information to the front line — average, normal human beings — in a way in which they can apply their creativity by simplifying and moving away from the world of information to the world of directive actions and insights."

But the reality is: a majority of companies don't find a way to disseminate insights to the frontline. What that means is that an important opportunity — the ability to act on insight to influence things like innovation and competitive advantage — is being missed.

According to a survey data conducted by *MIT Sloan Management Review* with SAS, 65% of respondents say their organizations are effective at capturing data, but just 46% of respondents say they are effective at disseminating information and insights. Compounding the issue, only four percent of organizations use all the data they collect. Nearly 30 percent use "not much" of the data they collect.

One CEO of a multinational outsourcing and technology development firm estimates that while his organization captures about 80 percent of its workflow data, it utilizes just 20 percent.

An example of innovation - use of data science

Over the past two years, Match.com, a dating site, has seen more than a 50% increase in revenue, with more than 1.8 million paid subscribers in its core business.
The biggest contributor to Match.com's recent growth spurt, according to President Mandy Ginsberg, is innovation. Several years ago the company began investing in a crack team of data scientists. At the same time, it built out an underlying technology platform that enabled innovation, much of it spurred

by data analytics.

Because a dating site is only as good as its ability to connect people, Match.com has a group of data scientists who are continuously improving a series of more than 15 matching algorithms. Their activities underlie the company's innovative approach to connecting people and support its business advantage in an increasingly competitive market.

Barriers

The ethical issues related to DATA

According to the forthcoming book, Ethics of Big Data (O'Reilly Media, 2012), by former Capgemini principal consultant Kord Davis and doctor of philosophy Doug Patterson, as personal data becomes increasingly public, creators of big data will increasingly face ethical decision points.

Davis and Patterson's four question framework offers an important first step toward a common ground for discussing related issues:

- **Identity:** Is offline existence identical to online existence? "Some think obviously yes, others no, but we want to be explicit and engage the questions in a collaborative fashion."
- **Privacy:** Who should control access to data? Davis points out that three data point can identify 87 percent of Americans: gender, birth date and zip code. "That means in any particular set of data, if I have one of three, I can correlate that data set with another, and I can identify you."
- **Ownership:** Who owns data, can we transfer the rights of it, and what are the obligations of people who generate and use that data? Davis points out that the World Economic Forum describes data as a new economic asset class that can be traded, sold and basically treated as a currency.
- **Reputation:** What is important about reputation, says Davis, is the realization that the number of digital conversations and interactions that take place, and that we can participate in, fragments our ability to manage reputation. "Understanding the implications of that is going to be very important."

Aligning actions to insights around this framework can help guide organizations to make ethical data decisions, says Davis.

Several cultural factors may explain why companies are experiencing this information transfer gap.

Difficulties in sharing data and insights across silos play a role, as do a lack of confidence in the quality of data across silos, which can sabotage delivery of insights to those who can use them best. Plus, few companies have a chain of communication that can effectively transfer insights from the place they are created to frontline staff that can get the most value from them.

How analytics is helpful to overcome these barriers?

Analytics

- gives a moderate competitive advantage
- improves the organization's innovation abilities
- is shifting the organization's power structure

In addition to this, having insights flow to the front-line is more about having a data-aligned *culture* than overcoming some sort of technology barrier — it requires an organizational mindset that can nurture data's metamorphosis from insight to value.

BHAWNA JAIN
PGDM FS 2012-14

QUANTSAPP: QUEUEING THEORY

Customer Satisfaction is a complex yet measurable variable dependant on how he/she is dealt with by the company. This emotion can be quantified and targeted by companies, which would make the ultimate difference of it being recognised as it being world class and customer friendly. This would propel the company's image and rent premium space in customer minds. Just compare Crores of Rupees in advertising to a few papers of mathematics. Which of it is a better option? Presenting to you **The Queueing Theory.**

Queueing theory is the mathematical study of waiting lines, or queues. In queueing theory a model is constructed so that queue lengths and waiting times can be predicted. It started with research by Agner Krarup Erlang when he created models to describe the Copenhagen telephone exchange. The ideas have since seen applications including telecommunications, traffic engineering, computing and the design of factories, shops, offices and hospitals.

In queueing theory, a queueing model is used to approximate a real queueing situation or system, so the queueing behaviour can be analysed mathematically. Queueing models are generally constructed to represent the steady state of a queueing system, that is, the typical, long run or average state of the system. As a consequence, these are stochastic models that represent the probability that a queueing system will be found in a particular configuration or state.

Queueing models allow a number of useful steady state performance measures to be determined, including, the average number in the queue, or the system, the average time spent in the queue, or the system, the statistical distribution of those numbers or times, the probability the queue is full, or empty, and the probability of finding the system in a particular state.

These performance measures are important as issues or problems caused by queueing situations are often related to customer dissatisfaction with service or may be the root cause of economic losses in a business. Analysis of the relevant queueing models allows the cause of queueing issues to be identified and the impact of proposed changes to be assessed.

Business Applications

Businesses hovering around manufacturing (production line), Transport, Restaurants, Supermarkets,

Airports and many more can be termed as single-server queues and are, perhaps, the most commonly encountered queueing situation in real life. Consequently, being able to model and analyse a single server queue's behaviour is a particularly useful thing to do.

A single server that has unlimited queue capacity and infinite calling population, both arrivals and service are Poisson (or random) processes, meaning the statistical distribution of both the inter-arrival times and the service times follow the exponential distribution. Because of the mathematical nature of the exponential distribution, a number of quite simple relationships can be derived for several performance measures based on knowing the arrival rate and service rate.

On the other side we have the Telecom Industry, Traffic Management, BPO's and more can be termed as Multi-server queue which are identical but have multiple inter dependant server situations. When modelling these situations care is needed to ensure that it is a multiple servers queue, not a network of single server queues, because results may differ depending on how the queuing model behaves.
Poisson & Exponential Distributions that have been taught and are easily forgotten is a useful queueing model represents a real-life system with sufficient accuracy and is analytically tractable. A queueing model based on the Poisson process and its companion exponential probability distribution often meets these two requirements. A Poisson process models random events (such as a customer arrival, a request for action from a web server, or the completion of the actions requested of a web server) as emanating from a memory less process. That is, the length of the time interval from the current time to the occurrence of the next event does not depend upon the time of occurrence of the last event. In the Poisson probability distribution, the observer records the number of events that occur in a time interval of fixed length. In the (negative) exponential probability distribution, the observer records the length of the time interval between consecutive events. In both, the underlying physical process is memory less.

Models based on the Poisson process often respond to inputs from the environment in a manner that mimics the response of the system being modelled to those same inputs. The fact that such models often give "worst-case" scenario evaluations appeals to system designers who prefer to include a safety factor in their designs. Also, the form of the solution of models based on the Poisson process often provides insight into the form of the solution to a queueing problem whose detailed behaviour is poorly mimicked. As a result, queueing models are frequently modelled as Poisson processes through the use of the exponential distribution.

VARUN S.
PGDM-IB 2012-14

CHINESE ROOTS OF LINEAR ALGEBRA

A recurring theme in the history of mathematics is the cultural setting of the work. Believe it or not, social context is controversial. On one side, context must be important because mathematics rests on human experience, on the other hand, society cannot matter because mathematics is pure thought. The latter view is reinforced by what specialists learn of the past through their work: a "heritage" of famous ideas attributed to the past but couched in the latest terminology, which makes the ideas appear to be immutable. The Chinese Roots of Linear Algebra by Roger Hart will stimulate some lively discussion because many books about the heritage of mathematics barely mention China.

Several types of calculations were performed in ancient China that continued to be practiced in eastern Asia through the 19th century. Some ancient calculations resemble those of the present day, including the "Gaussian elimination" of American precalculus algebra textbooks.

Of sources for mathematics that survive from ancient China, the most comprehensive is the Nine Chapters of the Mathematical Art, which was compiled anonymously about two millennia ago. Roger Hart's focus is Chapter Eight of the Nine. These are the problems interpretable in modern algebra as simultaneous linear equations.

The linear calculations described in Chapter Eight were as follows,
A system of n linear equations with the same quantity of unknown's xj,

$$\sum_{j=1}^{n} a_{i,j} = b_i \qquad \text{for } i=1,2,3,\ldots\ldots\ldots\ldots\ldots n.$$

was represented by placing the numbers for each equation in a vertical column of the counting table. Rotating columns by ð/2 to give rows makes the modern table, for n = 3,

$$A^{(1)} = \left|\begin{array}{ccc|c} a_{1,1} & a_{1,2} & a_{1,3} & b_1 \\ a_{2,1} & a_{2,2} & a_{2,3} & b_2 \\ a_{3,1} & a_{3,2} & a_{3,3} & b_3 \end{array}\right|$$

The ancient calculation amounts to multiplying the tableau on the left by the matrix,

$$\begin{vmatrix} 1 & 0 & 0 \\ -a_{2,1} & -a_{1,1} & 0 \\ -a_{3,1} & 0 & a_{1,1} \end{vmatrix}$$

which creates a second tableau $A^{(2)}$ of integer entries with 0 in the first column below the diagonal. I will use the uniform notation $\alpha_{i,j,}{}^{k}$ for the entries of the kth tableau. Upon n - 1 such steps, the counting-board cum tableau is in the form algebraists call "row echelon" and numerical analysts call "upper triangular",

$$A^{(1)} = \begin{vmatrix} \alpha_{1,1} & \alpha_{1,2} & \alpha_{1,3} & \alpha_{1,4} \\ 0 & \alpha_{2,2} & \alpha_{2,3} & \alpha_{2,4} \\ 0 & 0 & \alpha_{3,3} & \alpha_{3,4} \end{vmatrix}$$

Converting back to symbolic algebra, this form of the tableau corresponds to recurrence formulae from which the unknowns can be evaluated in reverse order,

$$\sum_{j=1}^{n} \alpha_{i,}{}^{n}{}_{j} x_j = \alpha_{i,}{}^{n}{}_{n+1} \qquad \text{for i=n,.....,1}$$

It is remarkable that Gaussian elimination appears in modern precalculus textbooks with the same visual style of ancient China.

The Chinese Roots of Linear Algebra chronicles the linear problems of ancient China in the Nine Chapters and supplies new insights about their solution. What remains to investigate is whether Chapter Eight of the Nine influenced modern linear algebra. Are the Nine Chapters a "root", or are they a separate development, and either way, are they not part of our mathematical heritage?

AASHUMI MEHTA
MMS 2012-14

QUANTS NEWS DIGEST

"Predicting scientific success" by Daniel E. Acuna

In 2005, University of California San Diego physics professor Jorge Hirsch invented an index, generally known as the h-index, for quantifying a scientist's publication productivity. Noting that the h-index and similar indices only capture "past accomplishments, not future achievements," the authors of this article describe their work developing a formula to predict a scientist's future h-index, based on the information available in a typical CV. They began with a large initial sampling of neuroscientists, Drosophila researchers, and evolutionary scientists. The application of several restrictions to this group reduced the sampling to "3,085 neuroscientists, 57 Drosophila researchers and 151 evolutionary scientists for whom we constructed a history of publication, citation and funding. These features included the number of articles written, the current h-index, the number of years since publishing the first article, the number of distinct journals published in, and the number of articles in prestigious neuroscience journals. The resulting formulas, for neuroscientists in particular, yielded "respectable" predictions, and showed that while the importance of the current h-index in predicting future h-indices decreased over time.

Note: -For more details, please refer http://www.nature.com/nature/journal/v489/n7415/full/489201a.html

Mathematics of Opinion Formation Reveals How Moderation Trumps Extremism

In an era when the importance of extremist viewpoints is increasing, Steve Strogatz created a model of zealots and moderates to study how the population of each group changes over time. Strogatz's initial model was based on encounters between a "listener" and a "speaker," chosen at random from a group of moderates or two different viewpoint camps, with the condition that a speaker from one viewpoint camp would bring a moderate listener over to his own side or turn an opposing viewpoint listener into a moderate, while a moderate speaker would have no effect. The model demonstrated that if one group of zealots constitutes a sufficiently small percentage of the overall population, then the reigning viewpoint will prevail; when the percentage of zealots reaches a certain threshold, however, almost the entire population is converted to the zealot viewpoint. In an effort to increase the size of the moderate camp, Strogatz and his collaborators tried a variety of scenarios and found that only allowing moderates to evangelize was successful.

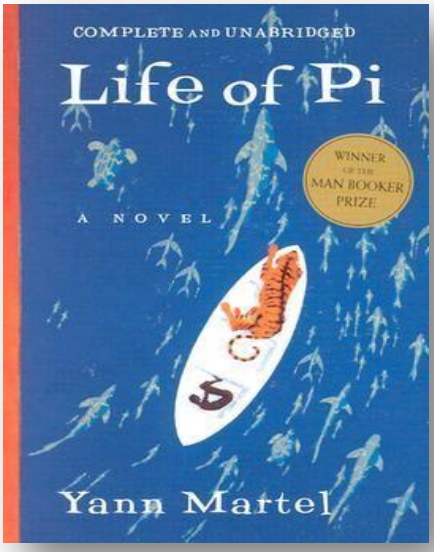
Note: - For more details, please refer http://www.technologyreview.com/view/429294/mathematics-of-opinion-formation-reveals-how/

MANISH MURTHY
PGDM 2012-14

BOOK REVIEW: THE LIFE OF PI

Pi Patel is the son of a zookeeper in Pondicherry, India. He was given the full name of Piscine Molitor after a Parisian swimming pool frequented by a family friend. But when kids at school took to calling him Pissing, he shortened it to Pi, that familiar figure for the ratio of a circle's circumference divided by its diameter. At one point he says: "And so in that Greek letter that looks like a shack with a corrugated roof, in that elusive, irrational number with which scientists try to understand the universe, I found refuge."

Although occasionally uncomfortable at school, Pi is incredibly happy at home surrounded by a veritable wonderland. He learns that the zoo animals live by habit and, once their basic needs are met, are content to repeat the same rhythms and rituals every day. Change the routine in the slightest way, however, and the animal will express confusion, anger, or retreat into a safe place. He grows up knowing not to anthropomorphize — assign human characteristics — to the animals. In one very scary scene, Pi's father demonstrates than animals are beasts who are driven by their hungers and passions. He also teaches the boy about how a circus animal trainer is able to control large animals by assuming the position of the alpha male, demonstrating dominance and an ability to provide for their needs.



Throughout his journey, Pi practices religious rituals — "solitary Masses without priests or consecrated Communion hosts, darshans without murtis, and pujas with turtle meat for prasad, acts of devotion for Allah not knowing where Mecca was and getting my Arabic wrong." But these provide a stay against despair and loneliness and his grief for his lost family. The worst enemy is fear.

He observes: "It is life's only true opponent. Only fear can defeat life. It is a clever, treacherous adversary, how well I know. It has no decency, respects no law or convention, shows no mercy. It goes for your weakest spot, which it finds with unerring ease. It begins in your mind, always. One moment you are feeling calm, self-possessed, happy. Then, fear, disguised in the garb of mild-mannered doubt, slips into your mind like a spy."

One of the things that makes Life of Pi such an extraordinary read is that it covers so many fascinating subjects with aplomb. Martel provides overviews of animal behavior, survival at sea, the limits of reason, and a boy's coming of age. The novel is a work of spiritual adventurism, a expression of mystical awareness, and a salute to the ample powers of imagination and the versatility of storytelling. During his long stay aboard the lifeboat with the tiger, Pi notes: "My greatest wish — other than salvation — was to have a book. A long book with a never-ending story. One I could read again and again, with new eyes and a fresh understanding each time. Alas, there was no scripture in the lifeboat."

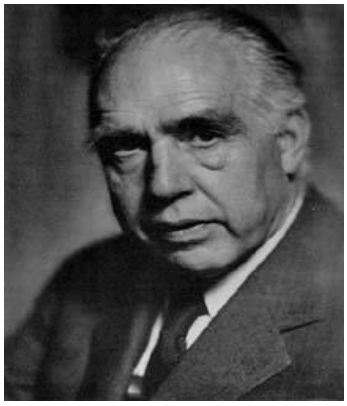
"In mathematics, Pi is an irrational number which means it's a number that goes on forever. Yet it's constant in science, so we use this irrational number to get to the rational understanding. It's that contradiction that that is assuming. Religion is like that — an irrational number, it doesn't make sense on its own, but it helps make sense of the world."

This ambitious novel is stuffed with ideas, interesting people, and exciting situations. Each reader could spend quite a bit of time pondering the spiritual implications of the deep relationship that develops between Pi and Richard Parker over the course of their confinement together. At first, the teenage is scared out of his wits that the animal will eat him. Then he tries to keep the tiger happy with food, fresh water, and regular routines. The final level of their interaction is a surprise that will only startle those who haven't had the delight of close mystical relationships with animals.

Life of Pi is a multileveled exploration of the beautiful mysteries that light up our lives and have no rhyme nor reason of their own. Yet without them, we would be nothing more than wonder-deprived creatures.

ADITI PALIWAL
PGDM-IMC 2012-14

QUANT GURU of the MONTH



October 7, 1885 - November 18, 1962

Niels Henrik David Bohr was a Danish physicist who made foundational contributions to understanding of atomic structure and quantum mechanics, and was awarded the Nobel Prize in Physics in 1922.He proposed a successful quantum model of the atom in 1913. He was the first to apply the quantum concept, which restricts the energy of a system to certain discrete values, to the problem of atomic and molecular structure.

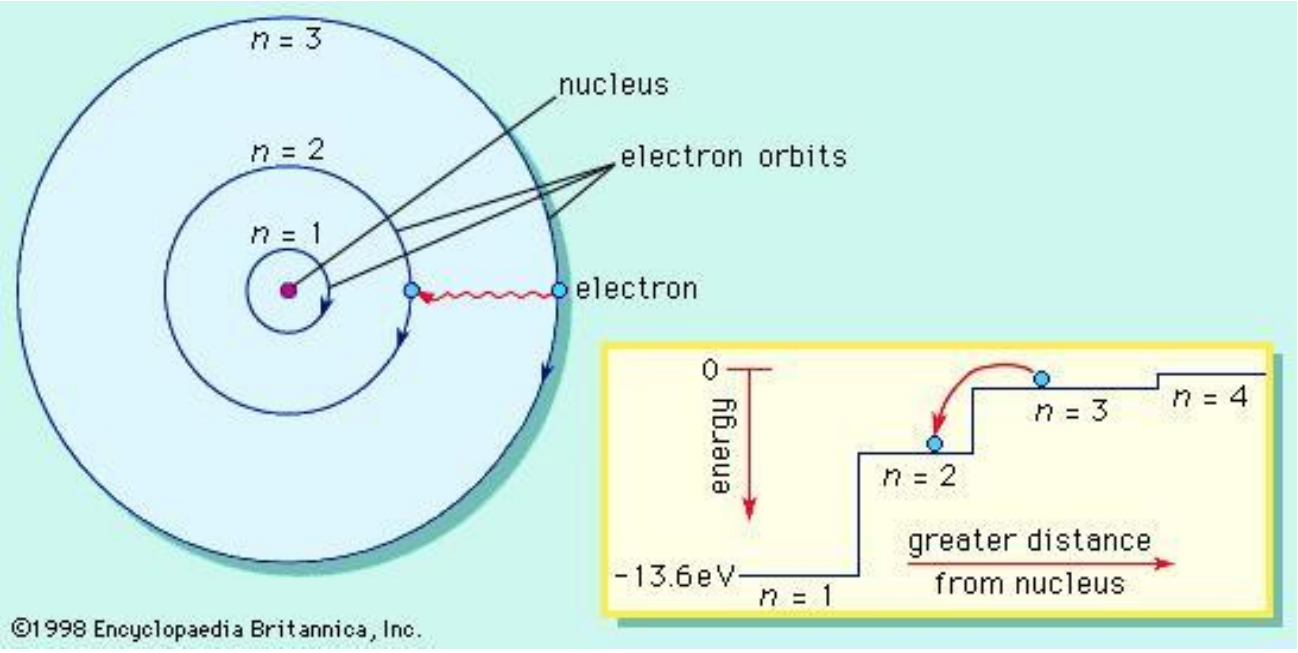
He was the first to apply the quantum concept, which restricts the energy of a system to certain discrete values, to the problem of atomic and molecular structure. Bohr obtained his doctorate in 1911 with a dissertation on the electron theory of metals.

Bohr atomic model:- The Bohr Model is a planetary model in which the negatively-charged electrons orbit a small, positively-charged nucleus similar to the planets orbiting the Sun. The gravitational force of the solar system is mathematically akin to the Coulomb (electrical) force between the positively-charged nucleus and the negatively-charged electrons.

- Electrons orbit the nucleus in orbits that have a set size and energy.
- The energy of the orbit is related to its size. The lowest energy is found in the smallest orbit.
- Radiation is absorbed or emitted when an electron moves from one orbit to another.

Major contribution:-

- The Bohr model of the atom, the theory that electrons travel in discrete orbits around the atom's nucleus.
- The shell model of the atom, where the chemical properties of an element are determined by the electrons in the outermost orbit.
- The correspondence principle, the basic tool of Old quantum theory.
- The liquid drop model of the atomic nucleus.
- Identified the isotope of uranium that was responsible for slow-neutron fission – 235U
- Much work on the Copenhagen interpretation of quantum mechanics.
- The principle of complementarity: Those items could be separately analyzed as having several contradictory properties.



Werner Heisenberg worked as an assistant to Bohr and university lecturer in Copenhagen from 1926 to 1927. It was in Copenhagen, in 1927, that Heisenberg developed his uncertainty principle, while working on the mathematical foundations of quantum mechanics. In April 1940, early in World War II, Germany invaded and occupied Denmark. Following the war Bohr returned to Copenhagen. He continued to advocate the peaceful use of nuclear energy. He died in Copenhagen in 1962 of heart failure.

SATYADEV KALRA
PGDM-FINANCE 2011-13

QUANTIZ of the MONTH

Q 1) If log102 = 0.3010, then find how many digits are contained in the number 256?

Q 2) A clock loses 1% time during the first week and then gains 2% time during the next one week. If the clock was set right at 12 noon on a Sunday, what will be the time that the clock will show exactly 14 days from the time it was set right?

Q 3) Given that on 27th February 2003 is Thursday. What was the day on 27th February 1603?

Q 4) In a 100m race, Sam beats John by 4 seconds. On the contrary, if Sam allowed John to start 16m ahead of Sam, then Sam and John reach the finishing point at the same time. How long does Sam take to run the 100m race?

Keeping the Grey matter Alive!

Q 5) Name two letters when pronounce one after the other pronounces a number instead?

Please send us the answers at simsr.quantinuum@gmail.com. Answers and Name of the winner (first all correct /most correct entry) will be published in the next issue.

We didn't receive any correct entry to last issue's Quiz!!
The correct entry for the August's issue was sent by Sameer Rastogi, PGDM-IB 2012-14.
Congratulations!

Solutions to last issue's Quiz of the month

Q 1) Weigh it in sets of 3.

Q 2) All 12 months.

Q 3) 1 Hour.

Q 4) 116 years.

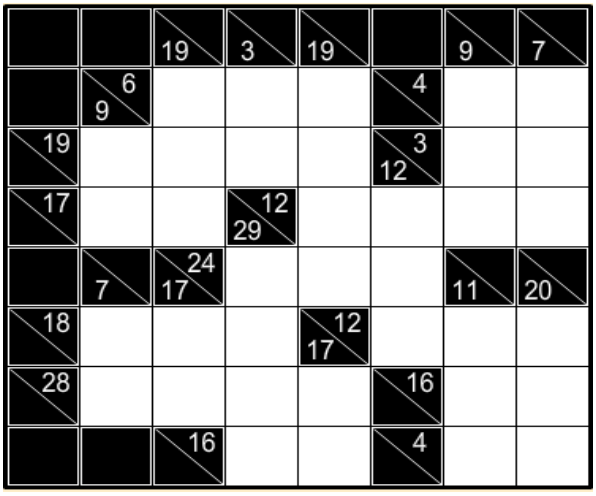
Q 5) A Coffin.

QUANTIZ TEAM

QUANT FUN

KUKORU of the Month

Each puzzle consists of a blank grid with sum-clues in various places. The object is to fill all empty squares using numbers 1 to 9 so the sum of each horizontal block equals the clue on its left, and the sum of each vertical block equals the clue on its top. In addition, no number may be used in the same block more than once.



Please send us the answers at simsr.quantinuum@gmail.com.
Answer and name of the winner will be published in the next issue.

Solution to last month's Sudoku of the month

1	6	5	4	7	3	2	8	9
9	8	3	6	2	1	5	7	4
7	2	4	8	5	9	6	1	3
4	9	6	2	8	7	3	5	1
8	5	7	3	1	6	4	9	2
3	1	2	5	9	4	8	6	7
5	7	8	1	3	2	9	4	6
2	4	8	7	6	8	1	3	5
6	3	1	9	4	5	7	2	8

The correct answer to Sudoku was given by Gaurav Bhargava, PGDM-Finance 2009-11 batch. Congratulations!

QUANT TRIVIA

"Arithmetic is where numbers fly like pigeons in and out of your head. ~Carl Sandburg."

QuantConnect

Quantinuum, the Quant's forum of KJ Somaiya Institute of Management Studies and Research is formed with two objectives. Firstly to remove the common myth from the students mind that mathematics is difficult. Secondly to give students an exposure on how to make decisions in real life business problems using quantitative techniques. This helps to bridge the gap between theory and the practical application.

For any further queries and feedback, please contact the following address
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