The Power of Two: Of Numbers and Words

3,7; 5,31; 7,127; 13,8191; 17,131071;..., 132049,216091,...,43112609,...			
two hundred and fifty six, 21, twenty one, 9, nine, 4, four, 4, ...			CML
2,1, 4,3, 6,4, 12,6, ... , 7841433600,1728 ...			universals
0,1,3,1,2,5,2,4,17,3,8,257,4,16,65537			SW-SB-SS
18446744073709551616			cognitive crescendo
$(\pi/\arctan(1.0))^3$			endocranial orchestra
$(1 - \exp^{i*\pi})^6$			multiply ωords by division
$2^{\nu+\omega}$			divide νumbers by multiplication

C.E.Veni Madhavan
15 May 2012

Dedicated
to the memory of my father
C.R.Ekambaram (CREK)
who told me when I was 2^4
that I could and should write
and
to the memory of my father-in-law
V.Panchapagesan,
both of whom showed me
the high points of harmless humour
and
my mother E.Bala
who asks many insightful questions,
to which I try to give whimsical replies.

Contents

Preface

Any power of 1 is 1. A power of two can go to infinity. In general it takes at least two to bounce and shape ideas. Let $\pi, \mu, \omega, \delta, \ \phi_1, \phi_2, \phi_3, \ \tau, \kappa, \sigma, \iota,$ denote my neighbourhoods of father, mother, wife, daughter, friend, family and fraternity, teacher, colleague, student and IISc, respectively. I have benefited immensely by interactions with these neighbourhoods. I denote by $N(cevm)$ the union of these neighbourhoods. Each element of $N(cevm)$ has drawn me into some fascinating area of intellectual inquiry. These forays into various topics have resulted in respectable results and wild-goose chases. They have always been a lot of fun. In this work I have not been able to do justice to all the ideas tossed at me, by all elements of $N(cevm)$. I hope to make up for these, the coverage and linguistic deficiencies in the next version.

A note on language and usage. One gets a queasy, uncertain feeling when one has to choose between certain words - toward versus towards, that versus which. The definite article and hyphenation are also slippery. I have also taken the liberty of cooking up new words or newer morphological endings to existing words. These provide contrived rhyme, rhythm and meter. These words do not complain. Maintaining poetic meter and rhyme with a technical lexicon has been a challenge. In the process, I have inadvertently introduced forms that appear like mixtures of stanza forms of sonnets and limericks with arbitrarily combined iambs, multi-meters and rhyme patterns.

My wife Vidya, a τ-major in a school, and daughter Poornima, an ϵ shaping to be a τ-major in a university, have played a significant role in the development of this book. Our vibrant exchanges of thoughts, on academia, learning and students, have provided me with valuable insights. An immense thanks to $\kappa(cevm)$ in CSA department and IISc for the wonderful atmosphere. A special thanks to, a τ-major, Prof.Y.Narahari, Chairman, CSA for releasing this book.

<div align="right">

cevm

</div>

verse 1

μ-tome

Of νumbers and ωords,
cognitive tags and codes,
we present this micro-tome
in nouveau genre sci-verse form
and touch many interconnected nodes.

verse 2

Power of Two Thought Modules

Thinking, *a la* Kahneman, is based on *two systems* metaphorical
one *Fast*, automatic and the other *Slow*, effortful.
Quick impulses, instinctive or intuitionistic,
and deliberate thoughts intellectual or algorithmic,
co-exist to produce judgments and choices ultimately stable.

verse 3

Power of 2, Rule of 3 and Sign of 4

Numerosity and verbosity are innate.
Many complex systems S we ruminate,
need the power of symbols, words and numbers.
We set below the common framework one remembers
in verses that follow on systems S we instantiate.

We study many systems S in the *SWSBSS* metaphor
invoking the power of 2, rule of 3 and sign of 4.

The stability of a system S,
is a real-valued function
$\sigma_S : W \times B \times K \times T \rightarrow [\mathbf{0}, \mathbf{1}]$,
where W, B, K, T denote the domains,
stonewalls, speedbreakers, softskills and time.
W, B, K are discrete and T is continuous.

We define, $\forall w \in W, \forall b \in B, \forall k \in K$,
$\lim_{t\to\infty} \sigma_S(w, b, k, t) = 1$ or 0,
according as S is *ultimately stable or unstable.*
My *Lemma 1* is that σ_S is generally *well behaved,*
over most of the domain, for most systems,
but for a few systemic singularities.
My *Theorem 1* is that every natural or engineered system S,
is ultimately stable if and only if the function σ_S
is a *sanity preserving transformation.*

War of the Willows by Worthduck and Wiles

On the fields of the antipodes
was the epic battle of the willows
in the third year of the third millennium.

Cricket brooks no curiosity
in USA the Land of Opportunity.
There it is thought to be an insect lowly
while heralded elsewhere as the Game Gentlemanly.

Men in shining helmets
clad in sponsored suits
covered with pads and gloves
faced the wrath
of hurlers maniacal
of a white leather spherical.

Fourteen nations fought furiously
for over forty days continuously.
Political pundits and Met vets
wily punters and sports stats, carnivalous spectators
sporting national pride
and at times little else,
egged on their teams gleefully.

Sly spins, wily wrong'uns, twisting turns,
seamy swings, sharp yorkers and howling bouncers
were answered by
searing strokes, sinuous glances, darting drives
mighty hooks, hefty lofts and punishing pulls.

Alas, what an end inglorious
to the game of the brave warriors.
While the men in blue
from the subcontinent with sheepy Saurav
slithered, slipped and flopped
the men in yellow
from down under with daunting Ponting
stroked, smote and galloped.
And thus in a platter grabbed
the cup of glory
to end the agony
of the War of the Willows
of the year two thousand and three.

Ideation and Innovation at IISc

Ideation and Innovation are the *mantra*
of IISc's perpetual, tireless *knowledge yantra*.
Ebullient thoughts on deep Engineering and Science,
constantly propelled by federal and corporate munificence,
are honed here to perfection by many a global *networking tantra*.

In a world of expanding science brand-width
and shrinking cognitive bandwidth,
SID strives to innovate
by an ecosystem to create,
concrete shapes to ideas of the IISc knowledge labyrinth.

Deep thoughts grind fine in academocracy,
amidst calls of relevance by societal technocracy.
Glitzy northern IISc conglomerates aero, bio, nano
and hard southern clusters info, metallo, and mechano,
tower and tunnel toward innovative corporatocracy.

The semiannual SID Board review
is a tightrope walk over C.V. Raman avenue;
when faced with the *Saraswathi-Lakshmi* dilemma
it is best to follow the path of *Mulamadhyama*,
as both left and right take a far from balanced view.

Last five years have been most enjoyable
handling the business of sciences applicable.
Amidst views non-committal or hopeful,
and perceptions sympathetic or skeptical,
there are midpaths between SW, SB that are SS negotiable.

Which Came First - Numbers or Words?

An eternally challenging question in philology
is to decode and glean the forgotten scripts.
Rises from individuality to universality
and returns from abstract to specifics,
are in the nature of human inquiry
witnessed by many tangible evidences.

It is indeed a technological pity
that the Cro-Magnon folks or Phoenicians
were unable to record voices with fidelity.
The many systems of languages and numbers
show a remarkable, distributed similarity
in cheremes, phonemes, lexemes and morphemes.

Bermuda Triangle - A Cricket Conundrum

In the seventh year of the third millennium
there was a willow war delirium
among sixteen nations of the world
who battled for eight weeks
in four groups of four teams
in the breezy islands of fun and calypso.

The subcontinental trio
of India, Lanka and Bangladesh
were grouped with the up-continental Bermuda.
The great Indian dream
lost its steam
due to the rising minnow from Dhaka
who displayed a courageous saga
of oarsmanship with ball and bat.
Battleship India, then went on a romp
to trounce the Bermuda tramp
in a vengeful leather hunt.
The roller coasting Indian spree
next ended in a crash to the sea
in the encounter with the tigers from Lanka.
The rollicking Bermudan seal
on the Indian coffin nail
was the final pull from the triangle.

An epic riddle of Indian cricket
is why do batsmen croak
when bowlers give a break
and conversely
why do bowlers buckle
when the batsmen crackle ?
As mysterious is this
as the frothy methane warp
of the Berlitzian Atlantic deep
that swallows leviathans
and sinks them to untold depths.
This is the conundrum of cricket
of the Bermuda triangle

Welcome to Combinatorics

How few – none or more ?
How many – one, two, . . . , infinity ?
List all from here to Eternity .

Explore the world of Combinatorics.
Practice the art of Counting.
Answer questions existential, enumerative and generative.

Speak of odd things
of balls, cookies and words
of coins, necklaces, pigeon-holes
of trees, caterpillars and lobsters
of centers, paths and tours
of lattices, polygons and stair-cases.

Speak even of things such as
seatings and unseatings
configurations and non-configurations.

Speak of meta things
of symbols, sequences and series
of numbers, estimates and orders
of matrices of near and distant neighbors
of polynomials characteristic and chromatic.

Speak of lofty principles
of duality, parity and reciprocity
of congruence, equivalence and recurrence
of bijection, inversion and involution
of contradiction, induction and recursion
of summation, differenciation, differentiation and integration.

Dismiss not any question
for it is a thin dividing line
between the trivial and the profound.
Split not hair, about proportionality constants
Absorb all, into tight exponents.
Fear not to rub shoulders with Euler, Polya and Erdös.
Scratch, probe, immerse and explore
and revel in the joy of revealing the gems in E0 234.

Combinatorica Longa, Vita Brevis. Ergo Cogito.

Welcome to Cryptography - Crypto Verse Made Easy

A self-styled Cryptology Expert using a Variety of Methods
and by means of cryptic asides
demonstrated the power of two and of three
and the nature of computational complexity
in the context of cryptographic operations and security.

It is a thin line between profundity
such as the density of primes w.r.t which an integer is primitive
and of triviality
such as the infinitude of composites.

Now, to which side of the line do the following belong ?
The cardinality of the set of triples of successive primes
one of which is the sum of the other two.
Infinitude of primes in the sequence
$< 1 + \prod_{j \geq 1} p_j >, p_j$ prime.

Do you recognize a cipher when you see one ?
How random is pseudo-random ?
How close to zero is a zero-knowledge proof ?
How strong is a cryptosystem ?
How efficient is a cryptosystem ?

It isn't easy to make a crypto verse
preserving reason, rhyme and meter.
Start with an assorted collection of items
sets, groups, rings and fields
all *literally* synonymous.

Roam the finite field.
Find an element irreducible
or a polynomial minimal.
Pluck a primitive root.
Sprout each element as the power of the root
and plant these powers in an array.
Now you may add exponents to multiply or divide.

How fast can we multiply ?
That is not answered so simply
One uses a variety of tools, honed finely
guaranteeing asymptotic complexity
ranging from quadratic, to sub-quadratic, to super-logarithms poly
all the while hair-splitting about constants of proportionality.

Asking for the exponent
given the power and a primitive element

is *perhaps* one of computational intractability
but, fortunately the saving grace for crypto security.

Give me a *one-way* function
cries the protagonist of strong encryption.
Take a square modulo a composite integer n
or a k-th power residue modulo n
made up as a product of two *nice* primes p, q.
Asking for the square root or the k-th root modulo n
is *perhaps* one of computational intractability
but, fortunately the saving grace for crypto security.

Take the sum of a subset of a set of random weights
cried a protagonist of strong encryption.
"Not safe ", responded a discerning cryptanalyst
for there is a trivial algorithm for super-increasing weights
and a clever probabilistic algorithm due to a lattice basis reductionist.

Pseudo-random bit generators
Stream and block ciphers
all masquerade as one another.
Hashes, digests, MDC's and MAC's galore
in various *avatars* constitute protocols for signature
based on a symmetric or public key cipher.

The prover claims he knows and hence he commits.
The verifier knows not that the prover knows.
So he challenges the prover
to respond to his random queries.
The prover responds based on the challenge and his commitment.
Now the verifier knows whether the prover knows or knows not
without a clue as to *what* the prover knows.

Awake, arise
fill thy cup of knowledge with the joy of
the pleasures of computational cryptography
having savored the taste of E0235.

Cyptologia Longa, Vita Brevis. Ergo Cogito.

SWSBSS 1: Global Economic Meltdown

Let the SWSBSS framework of Verse 3 hold.
Let I, U denote the economic systems
of India and USA, respectively.

The global economic melt-down
triggered by the perennial profligates,
and You Sell Always, fiscal magnates,
has low impact on systems Indian
thanks to our
Stonewalls, Speed-breakers and Soft Skills.

Fannie Mae and Freddie Mac
the Dum and Dee of Capitalist Farce,
the reckless brothers that squeezed laymen
and the mafia that merrily lynched
all sought doles from Uncle Sam and got bailed
but we got spared
thanks to our
Stonewalls, Speed-breakers and Soft Skills.

Hence,
$\sigma_I = 1$, $\sigma_U = 0$.

verse 11

SWSBSS 2: South Asian Sporting Saga

Let the SWSBSS framework of Verse 3 hold.
Let **WC** denote the 50-50 One Day World Cup system.

In the eleventh year of the third millennium
there was a willow war delirium
among fourteen nations of the world
who battled for eight weeks
in two groups of seven teams
in the south Asian sub-continent.

Ball fixes, match fixes, and many scams
silence not millions of fan screams.
Body paints and fancy tattoos
frenzied hoots and lusty boos
rent the air of stadia
and the displays of multi-media.

Scorching drives, lofty pulls
meet shooting yorkers and sharp cutters.
Intrepid feats of batting, bowling and fielding
peppered the script of the unfolding drama.

A turbulent pool B
and a placid pool A,
followed by stormy knock-outs
eliminated the minnows,
some yester year champs
and the entire Caucasian quartet.

We awaited with bated breath
the India Lanka duel
While both wear blues
of different hues,
the crowning glory will be to
Mendis, Malinga and Murali
or Sachin, Sehwag and Kohli
and all their willow warriors raring to go.
India won after a record run chase.

Galli games, local leagues, regional contests;
three-day, five-day drags of the past;
fifty-fifty and twenty-twenty
all formats co-exist:
but the 50-50 one-dayer is the best.

Hence, $\lim_{t \to \infty} \sigma_{WC}(w, b, k, t) = 1.$

Quo vadis dear alumni?

As a dreamy eyed youth
you enter the portals of IISc
to unravel the underpinnings mysterious
f theories mathematical and physical
behind all things electronic and electrical.
Here is the Agora of Science
where you tread softly
lest you tread on someone's thoughts!
This is the place of discerning watchmen,
who quiz you on the cube root of 1728,
or the complex roots of unity.
Here you ponder on lofty matters,
whether fundamental constants change,
or universal change is constant!

Here we coexist,
flora and fauna,
gadgets and gizmos,
and alumni and academics.
The leaves rustle gentle sinusoids,
the bees dance to the tune of impulses,
the birds hum the music of primes,
and the worms wiggle to earthly pressures,
all in sync with
the rhythms of probes and counters,
and of meters and scopes,
and the soulful chats of the scientific polyglots.

From components and devices
to circuits and systems,
from nodes and arcs
through networks and clusters,
were you led up the garden path
of theories and experiments.
Your dreams and nightmares
were full of
pulse trains and waveforms,
automata and languages,
transforms and integrals
algorithms and computations,
and the dreadful poles on the right half planes.

You shed tears of acronyms:
AVL, CFL; SNR, LFSR
PSD, CVSD, LPC;
GSM, CDMA, MIMO and QPSK;
JPEG and KRR; QRL and CEVM;
PSS and MMSE; SVM and MNM;
and so on and on . . .

Many were the sparkling debates
among your ignited minds
at the cozy coffee nook and tea nest
on profundities of the why and what
of DNA vs RNA or analog vs digital
WiFi vs WiMax or solar vs geothermal,
in short on a Theory of Everything!

Carved out you have, technical niches
across boundaries geopolitical,
maintaining enviable growth rates.
The eyes of the world today
widen on India and Bengaluru with dismay
as to how this land of uncertainties
has grasped economic opportunities
with a soaring felicity.

Many pleasant western cabbies
and friendly drivers of taxies
in some recent commissions
have made adulatory expressions,
oh, you guys are from the land of clever techies!

On strong fundamentals rest ye folks of ES-IISc
hence the limits to your growth is infinity.
Return many fold to thy alma mater
on a financial or technological platter.
Quo vadis, dear alumni ?

A Fistful of Rupees and What is in a Name?

A 2 C grant from DST FIST
should quench in part our scientific thirst.
Now is the time for the CSA fraternity,
to ponder and integrate lofty
a balanced agenda of theory and practice non-elitist.

Computer Science and Automation,
a very catchy initial notation,
deserves a call to rechristen,
and the centennial year is the time for reinvention
Applying a spoonerism function
one gets Automata Science and Computation
that sounds good as a course title! A printer's devil may suggest
Computer Science and Automaton
that a grammatical puritan may correct
as Computer Sciences and Automata!

Try my best, am at a loss yet,
to divorce the mesmeric semantics of automation,
from the science of computation,
nor offer connotations other than
processorial or industrial.

To add to the name dilemma
we now have a call to develop a schema
to project one or two areas of thrust,
is contra to the spirit of liberal thought
which to some of us is complete anathema.

But project a focus if we must
then it is only scientifically just
to consider what we do
in our teaching and research ado:
search and organize,
classify and optimize,
articulate and distribute,
compile and compute.

Thus we may arrive at a two term focus phrase:
Department of Computer Search and Annotation,
or concoct a new phrase permuting
Algorithmics, Architectonics and Analytics!
One could include Paradigms and Environments,
to the bag of confusing jargon.
So what is in a name?

SWSBSS 3: Question Paper

Let the SWSBSS framework of Verse 3 hold.
Let **ES** denote the Examination System.
Consider a teacher τ and student ϵ team,
Each is ignorant of what the other knows, we are told!

Every τ offers an intellectual treat
by teasing the grey-cells of an ϵ.
Any ES is a τ - ϵ game never won
without brain, toil, tears and sweat.

Hence, $\sigma_{ES} = 1$.

Musings on Memory, a Synaptic Symphony

A few molecules of glutamate
conspire to congregate
at synaptic vesicles
to manipulate some ion channels
and play a cellular cadence of evoked potentials.
The triggered cascade of impulses neuronal
course through a myriad of fibers axonal,
and reach in milliseconds
many deep folds cortical
achieving a cognitive crescendo.
Is this ceaseless endocranial orchestra
the cognitive anchor to our conscious self ?

We shall
explore these cerebral labyrinths
with allegories and metaphors,
paradigms and models,
and simulate and experiment
in many formal dialects
mathematical and statistical,
linguistic and neurobiological.

Do spike trains
ignite the sparks of thought ?
Do fleeting thoughts
gel into amorphous concepts ?
Do ephemeral concepts
weave the web of knowledge ?
There lies the mystery of mind-scape,
unravel which we shall
by traversals top-down and bottom-up.

We draw the parallels between
cogits, cogiton and cogitron with
bio-amines, neuron and cortex.
We ponder about qualia and meme
and the essence of many a dream.

We build models using
equations differential and components principal,
architectures neural and algorithms computational.
Are memories made of
multi-sensory perceptual fusions,
captured as invariant representations,
of nested sequences

of spatio-temporal patterns ?

We speak
of bugs and slugs and chicks and bonobos
of mice and men and phantoms and daemons.
We choreograph the trilogy
of brain, memory and mind,
the hardware, software and know-ware.

Is homeotrophy
the answer to creativity ?
Does a grammar of thought co-exist
with a grammar of randomness ?
And thus shall we reason about,
the ensemble of neuro-transmitters
that excite, inhibit and modulate
and concoct
a heady brew,
the alchemy of thought.

Is thought(ness)^k, $k = 0, \ldots, \infty$
the transcendence between
thoughtlessness and thoughtfulness ?

Welcome to NLU and Mind Your Language

English, Sanskrit or Indic
Latin, Greek or Slavic
all are based on grammars universal
and built on principles combinatorial.

From chereme to phoneme
to lexeme and morpheme,
we slice and splice
and search and parse.
We play with words and
automate the rules.
We pull strings of nuances
to build delicate cadences
of meanings and metaphors
that shape the world of thoughts.

From Panini to Chomsky
and Allen and Jurafsky
with Bryson and Baker
and Crystal and Pinker,
we will course through
the stimulating avenue
of the language of thought
on the language craft.

My new *Cognitive Markup Language*
denoted **CML**, analogous to XML,
with many tags linguistic and cognitive
will capture human mentalese creative.
My program *filectomy* for dissection
with extant tools NLTK and Python
will constitute a dream project
that we will work to effect
a perceptron for a natural language
or a cogitron for the language of the mind.

A picture is worth a thousand words
but, a word is equal to a thousand thoughts.
Probability and statistics,
syntax and semantics,
information and entropy,
sense and disfluency,
are cogs in the fascinating vehicle
of the natural language of the mind.

SWSBSS 4: Anatomy of Terror

Let the SWSBSS framework of Verse 3 hold.
Let $\mathbf{T}$ denote the terrorism system.

Who can win ?
in this paradigm of lose-lose
of the mindless game of carnage.
A few able bodied people
of enormous mis-guided zeal,
nurtured in cocoons of hate
by zombie zealots
are the contemporary societal blots.

Years of indoctrination,
sermons of toxic thoughts,
and hopes of martyrdom and bliss
alter the cortical wirings forever.

How to detox and rewire,
these warped minds ?
Restoration of sanity
amidst unthinking bestiality
calls for
a programme of cognitive re-training.

Hardskills of counter-terrorism
entail acts of valour and heroism.
They save many an innocent victim,
and reduce inevitable collateral harm.
They plough through unknown to disarm
and leash the beasts of the terror farm.

We also need to deploy soft-skills,
of love and empathy,
of learning and sympathy,
to cure the society of these evils.
Soft-skills of all people
are needed to prevail,
over every mental stone-wall
and to bring sanity on rail
over the obdurate elements
and societal speed-breakers.

Hence, $\sigma_T = 0$.

SWSBSS 5: Under-graduate Programme

Let the SWSBSS framework of Verse 3 hold.
Let **UG** denote the under-graduate programme.

The IISc UG Programme debate
culminating in the 17 Sept Senate,
generated a fair amount of heat and light
with many a view spelled forthright.
A palpable acceptance of the idea in the air
clouded by despondency and despair,
fears of the unknown and of failure,
concerns narrow and beliefs bounded,
sensitivity, optimism and hope confounded
by issues logistic and algorithmic,
all lightened by good natured banter
on cricket, youth and gray hair.

Universality of education and science
and the great Indian demographic bulge trend,
surely an inflation with a healthy dividend,
imply millions of dreamy eyed youngsters
are set to knock at the lofty portals of IISc
to learn the underpinnings mysterious
of theories physical and mathematical,
of concepts biological and chemical,
of principles electrical and mechanical,
and their interplay on matters
of earth, energy, environment, other emerging enterprises.

Here we ponder on heady matters,
whether fundamental constants change,
or universal change is constant!
with unfettered scientific bravado
on issues nano, bio, info and cogno
at the intersection of ideas
and confluence of NBIC technologies.
Little do we need, but a lot to share
with a few sparkling kids
these intellectual adventures.

Grind we will, exceedingly fine,
as our IISc mills grind slowly,
thanks to our
Stonewalls, Speed-breakers and Soft Skills.
Hence, $\sigma_{UG} = 1$.

SWSBSS 6: Purported Proof that P ≠ NP, is ∉ NP

Let the SWSBSS framework of Verse 3 hold.
Let **PneqNP** denote a proof that $P \neq NP$.

Proofs are not what they used to be
lamented the oldest member.
Even if it is not one from *The Book*,
ought not there be a sequence of lemmae
$A \rightarrow B \rightarrow C \rightarrow A$
as in Falting's proof of Mordell conjecture
or, Perelman's proof of Poincare conjecture
or, Wiles' proof of Fermat's Last theorem.

But, then $P = NP$ is a meta-meta question
bordering on Godel's incompleteness notion.
Many gadgets and widgets
in a proof-maze do play a role.
One needs a clear route to the goal.

Vinay Deolalikar brews
A heady mix of ideas
from logics, ensembles, statistics,
random graphs and statistical physics.

What follows is a roller-coaster ride
on the proof road-map
over many stonewalls, speed-breakers,
and slippery terrains
to be negotiated with many soft skills.

Encode k-SAT formulae as structures,
apply first order logic formulae, and
do poly time class captures
as least fixed point computations
for constraint satisfiability questions.
Take a random leap into the space of
conditional distributions of solutions
of random k-SAT ensembles.

Next invent, a difficult to mnemonize,
element-neighbourhood-stage product (ENSP)
model for these distributions on graphs
and work out factorizations of the distributions.
Look closely at the irreducible factors, and
with deftness, bound them in poly-log bundles.

Finally invoke some heady statistical physics notions
that warrant the largeness of long range interactions
to provide the sought after contradictions
to the purported behaviour of poly-time expectations.

Thus any adroit algorithmic effort to obtain
in poly-time a k-SAT solution will be in vain!

The initial elation may be at fault
as many a skeptic with a sobering note,
with lightning speed on the internet,
have cast many a serious doubt;
but all agree to toast
the collective bashing of intellect
to determine if $P = NP$ or not!.
Hence, $\sigma_{PneqNP} = 1$.

SWSBSS 7: Peer Recognition

Let the SWSBSS framework of Verse 3 hold.
Let **PR** denote the *Peer Recognition* system.

The paper, "A Network Analysis Approach
to Understand the Human Way-finding Problem",
authored by four of us was selected
as the Best Paper in the Perception/Action category
of the Computational Modeling Prizes
in the Annual Conference COGSCI 2011
of the Cognitive Science Society,
held in Boston, USA, in July 2011.

We analyse, and model path structures,
traversed by participants,
in networks of Word Morph instances,
between source and destination words.
My hypothesis is, every thought is a subgraph
in a complex cognitive graph.

In a world of facts
there is a place for values.
In a world of h-indices and impact factors
there is a place for considered matters.
Theories, experiments, models, and simulations
mark many scientists' tribulations.
Undaunted they explore a deep mystery
and expound in a research paper the story.
An occasional peer group eclat
inspires a loftier intellectual assault.

Hence, $\sigma_{PR} = 1$.

A Proposal to Unravel Thought - Act I

A set of glutamate-rich academics
debated intensely for thirteen weeks
in many dialects mentalese
and metaphors diverse
on a proposal to the sympathetic neurons of DST cliques.

The behavioralists, geneticists and medicalists of Bangalore South
together with the cellular, neuro biologists of Bangalore North
converged to the salubrious Bangalore Middle
to unravel the mysteries of the brain-mind riddle
with computationalists, naturalists and socialists(!) in-houth.

Questions of cognitive networks generativity
of immense inter-disciplinary complexity
including hippocampal expressions
and amygdalaic suppressions
led to the multi-million dollar dream proposal of ingenuity.

The vagaries of administrative sanctions
shall not dampen the academic convictions,
and the scientific groundwork
generated by the cognoscenti network
may be built upon by support from host institutions.

Further Acts to follow

The BPO Imbroglio

In the beginning, it was body shopping
from LOU, the Land of Uncertainties
to LOO, the Land of Opportunities.
The IT czars
TCS and Infy,
WIPRO and Sify,
shipped able bodies
to work under cyber daddies
on offshore platforms
and collect many a greenback,
while native hackers sweated
on archaic domains and platforms discarded.

Then came the
explosive bandwidth
and some roadwidth
along with goodies of
implosive taxes and duties,
and glass and aluminium facades
of call centers and cyber factories.

Thus grew the reverse tides
of terabytes of chores to
the backoffice girls and boys
and a quadrillion keystrokes
belted out in the byelanes of LOU
at ghostly hours
in gleaming towers
by youthful zombies
exported output at the speed of thought
to the head honchos of LOO.
SanJose to Chennai
NewYork to NOIDA,
Boston to Bangalore,
Oregon to Gurgaon
beat the drums of software destiny.

These giant waves of outsourcing
were immense job loss causing
said Kerry the Heinz King
triggering a debate in LOO
to settle which
the wise men of Washington
set up a Senate sub-committee on anti-FPO

chaired by an expat Indian Angelo
and hired a Bangalore startup
to provide the background research prop-up !

The BPO Imbroglio might
turn a full cycle.
Facing a mounting inflow
of Caucasian minds and bodies
into the swelling job market
in Cyberabad, Cybalore and Cybennai,
the smart Indian techie alecs
may yet look overseas
to the CHEAPER labour pools
to outsource
the imported chores
back to
LOO the Land Once of Opportunities !

verse 23

Genome

Neither 23 nor $2^{23} - 1$ is a *prime Mersenne*.
The power of twenty three is in the Book of the Gene.
Ridley relates at least one gene in each chromosome
to code a human attribute in the language of genome.
Oh, what a fabulous world we live in?

SWSBSS 8: Indostat Myths

Let the SWSBSS framework of Verse 3 hold.
3et **IS** denote the *Indostat* system.

World-wide Indophily is a trend today,
though indo-stats tend to zero divided by infinity.
many socio-economic indicators per capita
ignore fiscal effects disparita.
On terms of Big Mac or Masala Dona or Tall Latte
used for corrections of purchasing power parity, PPP
India is 4 times better
at $ 4 trillion GDP.
Income per capita is a dismal $ 3600.
This GDP (and GMP) considered over a square kilometer,
at $ 2 million scores over Uncle Sam's at $ 1.4 M.

We develop new weighted measures
of aggreagated multiples of indicators,
with model correction coefficients
representing stonewall strengths
speedbreaker rate limits
and softskill scores.
We show that under new normalized *cevmstat* scheme,
$\sigma_{IM} = 1$.

verse 25

Obsessive Graph Colouring

Obsessed with coloring semi-random graphs,
on seeing a collection of random giraffes,
this poly time algorithmician
like many a talented theoretician
estimated as one, the minimum colours to cover nature's gaffes.

Graph Hamiltonicity is notorious
for tripping the adventurous.
Erdösian results abound
on this combinatorial concept profound.
This never-say-die graph theorist
invented simplified conditions
for presence of Kuratowski homeomorphs
in graphs that are chordal and planar
and carved out an elegant linear time detection algorithm.

verse 26

Fine Structure of NP

The fine structure of complexity classes in NP
appeared to him as way too sloppy.
Using models of circuits and pebble games
with fancy hyphenated names
he set out to make the complexity theorists more happy.

verse 27

1728

Sixth power of two times third power of three
was intimate to the man who knew infinity
and listed by him as the $d(n)$ of a highly composite number.
It is a discriminant function constant in the denominator,
One more is the Carmichael number three.

verse 28

Database Cycles and Dependencies

This intrepid database theorist
referred to as a hypergraph cyclist,
classified cycles as $\alpha-, \beta-$, and $\gamma-$,
cleverly knitted them lemma by lemma
into a dependency theory that charmed every purist.

Not content with the edifice of forms normal
he invented a framework lattice theoretical
to explain why, given $AC \Rightarrow BC$,
you may write $A \Rightarrow B$ by canceling C
thereby producing many results *non-trivial*.

verse 29

Convexity, Linearity and Simplicity

Does polygonal convexity
imply algorithmic linearity?
asked this man computational geometry possessed.
Indeed so, for many CG problems, he showed
with cute diagrams and elegant theorems of great ingenuity.

verse 30

Pisciculture of Computational Geometry

Many bright math-struck youngsters from Howrah
generate ideas over hilsa fish and cups of cha?
They revel in computations on problems geometric,
and convoluted questions often eccentric,
such as least number of watchmen to guard serrated galleria.

verse 31

Naming a Language

Make nibbles bit by bit,
and string words byte by byte.
Neurons think *cogit* by cogit,
and build percepts *membit* by membit
I need a good meta language label
to reason about a multi-layer model
for fields aural, visual and verbal
and perhaps for taste, touch and smell.

I have an apt name, CML, for such a language
with markup tags to represent a cognitive message.

verse 32

Delicate Estimation

Most crypto group operators commute
though some of their designers have travel hate.
This well-travelled, polymath young man
specialized in combinatorial estimation
for smoothness density and code distance formulae delicate.

verse 33

Hunting for Polynomials and Sieves

A low-degree polynomial with small real roots,
and monotonically *size-skewed* coefficients,
emitting small norms for a large number of inputs,
and a high density of small norm *smooth integers*
all influence NFS clock ticks.
In this demanding pursuit
a few *semi-smooth* residues, we collect.
The trick is to develop a tight analytic estimate
and to obtain deeper performance insight.
Percent point savings in clock cycles vindicated our attempt.

verse 34

Algebra, Bitstreams and Ciphers

Universal cryptanalysis of encrypted bit streams
is possible by solving nonlinear Boolean systems.
Challenges are in linearizing and setting up
and coping up with the large system blowup.
This brave scientific analyst pulled off many such non-*triviums*.

verse 35

Power of 2-Lemma

$N =$ two raised to six plus epsilon
with epsilon between zero and one,
years or $\simeq 2^{30+\epsilon}$ seconds I have
for generating thoughts creative
on matters of universal human concerN.

When stuck in a hierarchical $k$lemma
on decision making on terra firma,
there is 2^{-k} chance
that a random jump by each of k, once,
will give the right answer in the k-level schema.

verse 36

Network Navigation

Source-destination navigation
on a network of concepts association
by a human participant
is unambiguously different
from a greedy exploration
or a random scan.
The absolute degree differences,
between successive path vertices
tell apart the three schema.

verse 37

Flora and Fauna of νumbers and ωords

My post-PhD, scientific years thirty-seven
have been full of *regular* intellectual fun.
37 is the first irregular prime of Kummer,
the Fermatian exponent leading to one as class number.
Oh, what fiendish ways numbers behave,
and curious connections with words they have?
Strings over the small alphabets of size 10 and 26
yield the exquisite lores of numbers and words.

verse 38

Derandomization and Graph Gimmickry

Obsessed with space bounded derandomizations
he connected graphs, hash and pseudo-random functions.
Enroute he encountered the complexity of graph editing,
and invented a scheme for graph prefix-free coding,
and crafted $\chi(G)$, $\omega(G)$ and Kraft inequality connections

verse 39

Stopwords Matter or Stopword Matters

Authorship attribution in stylometry
depends on stopword frequency.
SVM classifier of LDA topic vectors,
on literature of different genres,
supports this surprising theory
that innocuous stopwords matter crucially.

Choice of the right number of LDA topics
depends on factorization of the document-word matrix.
Topic splitting has a unimodal relation
to entropy regularization.
Minimizing factor matrix distances
yields the right number of topics!

Group Orders

Group orders g, with large prime factors
are dream objects of crypto system designers.
A poly time algorithm of Schoof for $g = \#E(\mathbf{F}_q)$
computes the Hasse-Weil trace modulo many primes p.
The core computations are checking congruences
in the ring $\mathbf{F}_q[x]/f_p(x)$ of polynomials.

We bring to bear our specialist craft
to implement high-speed arithmetic
using a combo of classical, Karatsuba and FFT
with many choices parametric
along with special moduli CRT
and achieve performance sub-quadratic.

Art of Multiplication

Our FFT-CRT multiplication works in $O(n(\log(n)^2))$ time,
not as good as the asymptotically fast $O(n(\log(n))^*)$.
In actual practice
we handle with ease
millions of bits long
polynomials and integers arising in
Mersenne primes, Bernoulli numbers and irregular primes.

Numbers take shape over different radices,
pebbles, fingers, digits and various bases.
The *multi-bases* of recent lore
provide fast *modexp* functions galore,
when tweaked with appropriate indices.

The beginning and the end form a central human question,
addressed and expressed in many forms of narration.
Many-to-one *pluribus unum*, and one-to-many,
words, like cells, divide, join and multiply;
but *numbers* are divided efficiently via multiplication!

verse 42

Years Around IISc

My Years around IISc have been forty-two
the number given by Deep Thought as answer to
life, the universe and everything.
These cerebral years have meant Everything.

Hunting for the power of an algo-logarithm
is like the quest for a mystical Boojum.
Tweaking the lines of a sci-verse canto,
feels like a sailor mate who forgot his boxes 42.

Oh! What a tangled web we have to unweave
for a thought we wish, to conceive.
A complex network we traverse
by mental processes diverse.

verse 43

The Irony of Theory and Practice

Primes is in **P**
thus spake Agarwal, Kayal and Saxena.
Primes came into **RP** *via* Fermat, Miller, Rabin
and Solovay and Strassen.
Primes came into **NP** *a la* Pratt.
Did all this mean *practically efficient*
deterministic poly time proof as a *primality test?*

verse 44

Erdös Letter

Chordal graphs are *perfect* and *triangulated*.
The subclass of k-trees are recursively constructed.
This tenacious student did not let up
until he found a new characterization, algorithm setup,
and a letter from Erdös that got our spirits elevated.

verse 45

An ϵ gets Erdös number One

The exponential sums over characters
of Jacobi and Gauss, can be used as detectors
in *almost* deterministic, *near* poly time algorithm
for telling if an integer is prime.
This tenacious student implemented this in 1987
on a mainframe machine long forgotten.

verse 46

Missing Erdös Number One

Graph independence number $\alpha(G)$ is teasingly notorious
for trapping the unwary into many garden paths perilous.
I thought I almost settled a conjecture
on the 2/3 bound on $\alpha(G)/|V(G)|$,
for *triangle-free G*.
Erdös told me it was not to be.
So I do a proof rejig
for *planar, triangle-free G*.
Erdös got disinterested by the constructive machinery
and felt there ought to be a better combinatorial jugglery.

verse 47

Truth behind Steganography

Compression, encryption and steganography,
place opposing constraints on security and efficiency.
Resampling operations on images with modified bits,
yield graded color distribution through statistical fits.
Thus he gets a scheme to estimate the embedded quantity!

verse 48

Power of Image Distortion

Petabytes of words and images circulate,
and we compress, garble, hide and corrupt
by many ways statistically clever.
A bit plane encoder and a combined encryptor,
we show, is fast and yet defies the cryptanalyst.

verse 49

Tale of Many Sieves

A *y-smooth* integer is only divisible by primes $< y$.
Collecting a large set S of these is the current way
to factor efficiently a large integer, one believes,
by *quadratic*, *number field* or *lattice* sieves.

Tiny, little, giant prime
How I wonder where you gleam ?
buried in a rare, smooth integer
like a beacon to factor a large number.

Public key cryptanalysts are most excited
if these heuristics can be tweaked,
to demonstrate increase in size of S
within computational bounds.

The simple *linear sieve* arrangement,
we show, admits a *cubic sieve* enhancement,
for *discrete logarithm* modulo *certain* primes p
and estimates of $| \{(x, y, z) : x^3 \equiv y^2 z \bmod p\} |$.

verse 50

Large Sparse Systems

After much parallel, distributed sieving work mod p,
we have to solve $Bt = 0$ for a large, sparse $0/1 B$.
Near quadratic time iterative algorithm
due to Lanczos or Wiedeman, for the problem
needed to be massaged to quickly get the solutions t.

verse 51

Chordality, Hamiltonicity and Visibility

By new notions, *base sets*, *reduced clique hypergraphs*,
he lit up the combinatorial structure of *chordal graphs.*
A new class, *2-separator chordal* graphs that are *Hamiltonian*,
he invented to expand a class of *visibility graphs* of a polygon,
and to conjure efficient algorithms for *isomorphism* of such graphs!

verse 52

Planarity, Decomposability and Embeddability

First he identifies a certain set of subgraphs forbidden,
exploiting decomposability and ordering property
for a new characterization and linear time recognition
algorithm for the class of Hamiltonian planar-3-tree.

Then he expertly extends this characterization
for testing in linear time planar, chordal Hamiltonicity.
Ordering the vertices by a certain scheme of exploration,
give the minimum value of stack, queue numbers of a 2-tree.

verse 53

Gaze Patterns, Scan Paths and Perception

Let $S = \{<x_0, y_0>, f^\alpha, b^\beta, d^\gamma, s^\delta, <x_1, y_1>\}^n$,
with +ive integer exponents be the foveation sequence.
Buried in it is a lot of perceptual sense
that our cognitive apparatus picks with ease.

In the scanpath sequence S, we have information
on, begin, end $\mathbf{x}, \mathbf{y}$ coordinates, duration of $\mathbf{f}$ixation,
intervening $\mathbf{b}$link duration and pupil width $\mathbf{d}$ilation
and the quick occulomotor $\mathbf{s}$accade transition.

It is the data modeling-analysis dream
to elicit principles of the cognitive theme
that, from S, generates, represents and retrieves,
and relates internal word-views and external world-views.

I Raise a Question

Who is a barbarian?
the misguided malapropist on Potomac,
or the dreaded despot of Mesopotamia?

History will tell they say, But who?
The arm-chair intellectuals,
in effect the marginals?
The economic Mughals,
the twenty-first century ghouls?

The cradle of civilization was Ur
inspiring the code of Hammurabi of Nebhuchadnezzar.
On the banks of Tigris, Euphrates shone
the magnificent splendour of Babylon.
From the mausoleums of Baghdad and Solimaniyah
to the chants of the caliphates of ancient Persia
were born the wonder of the Arabian nights
of Sindbad, Alibaba and a thousand dreams.
Weaved they with minds, the magic carpets
and the evocative words of Firdausian poets.

The priceless treasures of arts of millennia
ravaged by vandals of war evoked dementia,
may eventually resurface in the boudoirs
of some insensitive corporate buccaneers.
The cruises, patriots and stingers,
belching awesome visible fires
shall never match the embers of creativity
stoked by the centuries of human civility.

Prompted by the troubling question
on the current belligerent situation,
and forever believing in ultimate human nobility
I attempt to give a satisfying answer to the query.
Who is a barbarian?

Power of POINT

Awake, arise and muster your POINT
along with sigint, comint, elint
and mathint, compint and opint.
For, all these int
without Plain Old Intelligence (POINT)
is too little for cracking a crypt,
and that is the point.

Tread with care
in Blechley Park and Fort Mead,
Menworth Hill and masjid House.
For, these abound with
crypto geeks and code crackers.
Not a day passed
sans my lectures on board
on knotty technical rebuses
to goad, cajole and evoke
your hidden POINT.

As the glimmering stars in the inky sky
so are the ephemeral bits of the private key.
A point on a line of slope erratic
or a point on a curve structure elliptic
or a point in a feature space dynamic
all will succumb to an analytic POINT.

Don the mask, wear the cloak
attempt all ciphers freak.
Rid your ego from the word go
and share your ware - soft or brain.
Never lose focus of POINT
never shall you faint
nor forget efforts joint,
to muster a cumulative power of POINT.

verse 56

Analytics of ABC

Let $r(n)$ denote the product of distinct prime factors of n,
$a, b, c > 0$ be integers with $(a, b, c) = 1, a + b = c, n = abc$.
Then, $\forall \epsilon > 0, \exists$ *only finitely many a, b, c* $\ni r(n)^{1+\epsilon} < c$.
There lies another quirky Diophantine analysis question.

Let a, b be prime integers of nearly same size with $a * b = n$.
Many multiplication algorithms to compute n are *easy*;
but the number field sieve for factoring n is slow, you see.
There lies the dichotomy of direct versus inverse computation.

Factoring a non-negative matrix C,
as a product of non-negative matrices A, B
with $\|C - AB\|_F^2$ global minimum balance,
in polynomial time, is unlikely to be!
A single heuristic of best performance,
for all practical cases is not to be.

verse 57

Heuristics, Linguistics, Mathematics and Algorithmics

A single cell thinks locally, but precisely,
A collection of connected cells ideate globally.
The analyses of hidden heuristics and algorithmics,
invoke powerful rules of statistics and mathematics.

Oh! What a tangled web we have to unweave
for, a thought, we wish to conceive.
A complex network we traverse
by mental processes diverse.

A language of thought generally
and embodied principles linguistics
create the neural codes that achieve
a word-view of the world-view by a clever parse.

verse 58

Multiple Attribute Tree

Searching a binary tree on one key
is a computer science freshman play.
Efficient partial match on secondary attributes
needed multi-dimensional or multiple attribute trees.
k-d tree and our MAT were the first data structures in the fray.

Cognitive Limit

A few billion seconds and a billion neurons firing
is a lifetime of effortful thinking.
A million-fold down-conversion encoding rate,
yields a 2^{42} size intermediate *engrams* set.

At a few million engrams and a penny per thought
life is all about a few billion size thoughtset.
That Life, the Universe and Everything,
has a *cognitive limit* of 2^{30} is amazing!

Après nous le **data** *déluge*
proclaim, the fictional *Deep Thought* machine huge
and the real machines *Blue Gene* and *Watson*,
since we handle more bytes beyond the cognitive limit.

The power of human discourse networked
amplifies the thought-world a billion-fold.
We face a new paradigm in the scientific terrain,
to balance the cognitive limit with the tireless machine.

verse 60

Power of β

Despite acts of libricide amidst universal bibliophily,
βooks reflect the indomitable psyche of humanity.
From Hypnerotomachia Poliphili and incunabula
to McLuhan massage and ϵ-βook mania
thoughts have gained true liberty.

verse 61

Power of Epsilon

For every young one termed $\epsilon > 0$,
there exists the dad called $\Delta > 0$.
In the dad bounded home neigbourhood
any continuous function is epsilon bounded.
However, when the epsilon leaves the home nest
discontinuities arise for any function at many a point.
This ϵ veered to man-machine decision support systems
while the Δ swung toward machine-man interactions.

verse 62

Power of Δ

A rational dad, Δ, has immense tolerance
for his ϵ's carefree and youthful exuberance.
Mine approved of attempts at pidgin French
but not Lenin, Hitlerian or any other moustache,
as a foreign tongue scores over labial fungus on elegance.

verse 63

Power of the Alphabet

Strings over 0 to 9, A to Z, Greek and LaTeX
is my universe of numbers and words metaphoric.
Let $\pi, \mu, \omega, \delta,\ \phi_1, \phi_2, \phi_3,\ \tau, \kappa, \sigma, \iota$,
denote my neighbourhoods of
father, mother, wife and daughter,
friend, family and fraternity,
teacher, colleague, student and IISc, respectively.
π, μ, ω, δ are singleton sets.
The other sets are of large cardinality.
An immense thanks to all the elements of
$\pi, \mu, \omega, \delta,\ \phi_1, \phi_2, \phi_3,\ \tau, \kappa, \sigma, \iota$,
for sharing my thoughts prophetic
on strings over 0 to 9, A to Z, Greek and LaTeX.

verse 64

Power of Iterated Ω

Let $\pi, \mu, \omega, \delta,\ \phi_1, \phi_2, \phi_3,\ \tau, \kappa, \sigma, \iota$,
denote neighbourhoods as before.

A set-valued function on these eleven sets, Ω,
by a process of repeated iteration
can be extended over the entire universe Υ,
thus admitting a world-wide ramification.
Consider $\Omega^k(\pi, \mu, \omega, \delta, \phi_1, \phi_2, \phi_3, \tau, \kappa, \sigma, \iota) = \Upsilon$.
would k be bounded above by forty-two?

Endnote is Not an End

In this endnote, I collect some data on indexes, structures, statistics and digital signatures. Each of these 4 sub-sections gives, a sample of the complete data. The data presented here is a small, indicative, subset of the total data. I have generated these using programs I have developed as a part of my ongoing research in the area of computational psycholinguistics, natural language processing and cryptography. Indeed, the names of my C-programs, *wordectomy.c, phrasectomy.c, sentectomy.c, filectomy.c, versectomy.c*, reflect the various ways in which I *dissect* strings of numbers and words. My *synthesis* programs complement this suite. These tools are part of my ambitious programme of modeling and understanding how humans and machines *understand.*

Indexes: Sample Entries

The triplet [v:s:l], denoting [verse number : stanza number : line number (ignoring blank lines between stanza)], is the *index entry* for a word. Lexicographic compilations, such as books of quotations, provide the keyword-in-context string along with an index and a sequence of such list entries. The *complete list* generated using my programs runs to a few thousand annotations. I give below a sample, showing formats and conventions, of randomly chosen items from the complete list.

```
academics [21: 1: 1] A set of glutamate-rich a.
acts [60: 1: 1] Despite a. of libricide amidst universal bibliophily
algorithm [ 9:10: 5], [19:10: 1], [29: 1: 2], [25: 2: 9], [44: 1: 4]
coffee [12: 5: 3] at the cozy c. nook and tea nest
cogiton [15: 4: 2] cogits, c. and cogitron  with
cognitive
 [ 1: 1: 2] cognitive tags and codes,
 [ 5: 2: 2] and shrinking cognitive bandwidth,
 [15: 1:10] achieving a cognitive crescendo.
 [15: 1:12] the cognitive anchor to our conscious self?
 [20: 3: 6] in a complex cognitive graph.
 [21: 3: 1] Questions of cognitive networks generativity
 [53: 1: 4] that our cognitive apparatus picks with ease.
 [53: 3: 2] to elicit principles of the cognitive theme
constants
 [ 8: 7: 4] Split not hair, about proportionality constants
 [ 9: 7: 6] all the while hair-splitting about constants of proportionality.
 [12: 1:13] whether fundamental constants change,
cryptanalysis
 [34: 1: 1], [49: 2: 5], [ 9: 1: 2], [ 9: 5: 1]
graph
 [25: 2: 1], [38: 1: 2], [38: 1: 3], [51: 1: 3]
universal
 [16: 1: 3] all are based on grammars universal
 [35: 1: 5] on matters of universal human concerN.
 [34: 1: 1] Universal cryptanalysis of encrypted bit streams
```

[18: 3: 1] Universality of education and science
[64: 2: 3] can be extended over the entire universe Υ,
word
[16: 5: 2] but, a word is equal to a thousand thoughts.
[55: 5: 3] Rid your ego from the word go
[20: 3: 3] in networks of Word Morph instances,
[3: 1: 3] need the power of symbols, words and numbers.
[8: 3: 2] of balls, cookies and words
[31: 1: 2] and string words byte by byte.
[54: 3:10] and the evocative words of Firdausian poets.
[63: 1: 2] is my universe of numbers and words metaphoric.
zero
[9: 4: 3] How close to zero is a zero-knowledge proof?
[24: 2: 2] though indo-stats tend to zero divided by infinity.
[35: 1: 2] with epsilon between zero and one,

Structures

Format: Verse; L, W, C, S : numlines, numwords, numchars, numstanzas;

V	L	W	C	S	numlinesineachstanza													
1	5	22	149	1	5													
2	5	41	293	1	5													
3	22	192	1066	6	5	2	6	3	3	3								
4	39	202	1173	6	3	4	6	8	5	13								
5	25	177	1164	5	5	5	5	5	5									
6	12	74	484	2	6	6												
7	36	192	1057	3	6	17	13											
8	35	198	1268	8	3	3	6	3	5	6	8	1						
9	72	521	2999	14	5	4	5	5	5	7	6	4	8	5	6	7	4	1
10	19	103	603	4	3	6	8	2										
11	40	221	1270	8	2	6	6	4	6	9	5	2						
12	72	388	2263	8	14	12	13	8	7	8	5	5						
13	41	242	1398	6	5	11	5	5	8	7								
14	9	69	386	3	4	4	1											
15	61	276	1782	8	12	8	9	5	8	6	10	3						
16	40	199	1155	5	4	10	8	10	8									
17	37	176	1052	7	2	8	4	6	6	10	1							
18	40	232	1445	6	2	12	11	10	4	1								
19	53	327	1955	12	2	8	5	4	5	6	3	6	4	2	7	1		
20	27	164	1003	5	2	8	6	10	1									
21	21	117	859	4	5	6	5	5										
22	57	255	1513	5	12	7	15	10	13									
23	5	48	245	1	5													

24	21	133	794	5	2	4	7	6	2
25	14	75	528	2	5	9			
26	5	36	203	1	5				
27	5	45	245	1	5				
28	10	69	436	2	5	5			
29	5	29	201	1	5				
30	5	37	243	1	5				
31	10	68	366	3	4	4	2		
32	5	30	220	1	5				
33	10	74	458	2	5	5			
34	5	38	254	1	5				
35	10	64	373	2	5	5			
36	9	36	247	1	9				
37	8	61	369	1	8				
38	5	36	271	1	5				
39	12	62	435	2	6	6			
40	12	81	507	2	6	6			
41	17	111	741	3	7	5	5		
42	12	84	466	3	4	4	4		
43	8	52	289	1	8				
44	5	40	265	1	5				
45	6	44	263	1	6				
46	10	69	433	1	10				
47	5	35	260	1	5				
48	5	35	209	1	5				
49	16	128	722	4	4	4	4	4	
50	5	45	248	1	5				
51	5	55	344	1	5				
52	8	63	431	2	4	4			
53	13	95	648	3	5	4	4		
54	31	185	1163	5	3	5	10	8	5
55	31	174	912	5	7	5	5	6	8
56	15	143	782	4	5	4	4	2	
57	12	77	479	3	4	4	4		
58	5	38	234	1	5				
59	16	125	779	4	4	4	4	4	
60	5	30	239	1	5				
61	10	81	470	1	10				
62	5	39	249	1	5				
63	17	104	612	1	17				
64	8	68	454	3	2	4	2		

Statistics

```
Table : prob-distribution: numstanzaswithklines

k     1     2     3     4     5     6     7     8     9     10
f     7    15    11    36    58    27     9    18     4     10
p 0.033 0.072 0.053 0.172 0.278 0.129 0.043 0.086 0.019 0.048
P 0.033 0.105 0.158 0.330 0.608 0.737 0.780 0.866 0.885 0.933


f=numstanzas with k lines; p=prob; P=cum. prob.
(Note: max. num (58) of stanzas are all of limerick form)


VERSE STATS:
verses= 64 lines= 1194 words= 7330 chars=44424 stanzas=  209
chars/word= 6.06 words/line= 6.14 lines/stanza= 5.71 stanzas/vers= 3.27
TABLE below gives a comparison of the distribution of 8 principal
part-of-speech tags in 3 different text.
```

	Conj	Det	Prep	Adj	Noun	Pron	Adv	Verb
This Book :	0.038	0.080	0.085	0.064	0.061	0.012	0.016	0.068
Wodehouse :	0.039	0.121	0.103	0.073	0.160	0.104	0.049	0.122
Tolstoy :	0.059	0.166	0.130	0.099	0.235	0.083	0.062	0.138

Signatures: Copyrightleftcenter

Bookends hold books upright. Book endnotes are notends. Numbers and words are the fuels of thoughtware. Man invented these to communicate freely. Then he invented devious schemes to protect these to claim priority. Later he invented methods to outwit these schemes. Authors of great literature have not bothered about copyright issues, on any aspect of form, structure or content. Wodehouse and O'Henry may have borrowed, from Lewis Carroll, the phrases *Pigs have Wings*, *Cabbages and Kings*, respectively. Groucho Marx initiated a satirical spat on the word *Casablanca*. I have taken liberties with classical and Shakespearean sonnet forms, limerick forms of Lear, and quatrains, rhymes and meters.

If we drop a chalk in our family gathering, it will land with high probability on a *teacher*. My wife Vidya, daughter Poornima, sisters Uma, Girija and nieces Aarti, Preeti and Sindhuja have provided me many amusing anecdotes on $\tau - \sigma$ (*teacher - student*) interactions. A standard pre-occupation of teachers is to invent ways to cope with copying by students.

The modern digital world is also overly concerned about protection. In the world of *digiterati*, my copyright protection scheme may be useful. I leave out phrases like *a fistful of* that I have borrowed and turned around. To be jest, I give below a sample output of my scheme.

```
my AESplainkey m = "the power of two" :
 t h e   p o w e r   o f   t w o
2008053216152205183215063220215
my AESplainkey m signed with my RSA private key d, modulus n,
and public key e, gives the signature s as s=m^d mod (n).
For purposes of verification of the encrypted signatures that
follow, the public information is given below.
s=
19566946497958580649001057646276192713175449485822918101 5158
53164352217790290541766246765539121197806440263985884111 9087
34270986668141168229963035813976412164632267966182119499 8947
42763398837019933267438415265671284410624930709049301764 8490
06758955626906165594343039034969738611581830257135549865 73304879210
e=
20146651330355917051078065881191094512075096326950780503 3522
68788085902026620834374123082361099054696409246140909060 2247
98612147505496768308674659950533681547031377551582179341 5782
30005348606074861745998772235148234723120864302890712010 0684
14841172352944126442744447423241680196677217095502560474 510561060353
n=
40541388617276612428020891797061564534676392989132998455 6053
99410354094121244633641414143110215594650479231673188111 6543
68617685452917011664632866452590787841851879751327335442 4605
81607575811517223027307742280930717969472963219377984952 9012
78531730508244994828402874679411507748781870714726052427 909343657039

sample input strings:
 [ 1: 1: 2] cognitive tags and codes,
 [ 5: 2: 2] and shrinking cognitive bandwidth,
 [15: 1:10] achieving a cognitive crescendo.
 [15: 1:12] the cognitive anchor to our conscious self?
sample input strings encrypted with my AES-key
FA894822C41C219677833E6306FAD666
F6552ABBB07F1E29739D8508C58E384A
D899B62471B80B7F5C6BF50EA20EDA20
A90A0B1745F5DBA307854C3BA6DC4AFD
C1A5060EB284169A798D3E04D2087A51
52848608BE41FBCE24AC22D8824EE0B5
46EDFBD97330EFF423E6F00F5923763F
and 8 more such lines.
```

> Numbers and words are objects of beauty,
> and as Keats said, are for ever, a joy.

Notes

A note on Notes. I give an explanation of the ideas behind the verses. Then I give a list of sequence numbers of related reference material. For compactness, I do not list the author names in this list. The full details are in the *References*. Each note can expand to a tale. I have adopted brevity of prose. I leave the rest to the readers' ingenuity.

1. Number-play, wordplay and swordplay are similar. In their best form, all make a point with skill, panache and finesse. *Touché* captures their effect. Numbers and words are central aspects of human nature. This little book attempts to showcase their interplay. [**R**: 7, 19, 30, 69, 81, 82, 103].

2. In his fascinating new book, Daniel Kahneman presents an integrated view of two main cognitive processes. It is possible to conduct measurements using the eye-tracker, EEG and fMRI to verify many hypotheses on human behaviour regulated by these two systems. [**R**: 56, 85, 117].

3. Power of two, rule of three and sign of four are recurring metaphorical themes in human inquiries and endeavours. Much of my verse-casting of our thoughts and actions runs on these lines. To reason about them I invented a framework called *stone-walls, speed-breakers and soft-skills*, abbreviated SWSBSS. The unbounded, rational optimist in me believes in ultimate stability of systems. The verses in this tome in the series SWSBSS all use a common base hypotheses set. I collect them in this verse to be recalled. [**R**: 20, 48, 50, 81].

4. Cricket evokes a war-like passion in India. Even statistically non-savvy sports fans are aware of a Duckworth-Lewis formula. This verse is based on the World Cup 2003. [**R**: 59, 126].

5. IISc is a unique place. It pulsates with ideas. The ethos of IISc is ideal for high quality basic and applied research. A window of IISc, Society for Innovation and Development (SID), manages applied research. The SID Board meetings at IISc give one lessons in a balanced approach between academic and applied aspects of science and engineering. *University Innovation* is a contemporary field of study. [**R**: 42, 53, 59, 67, 70, 109, 122].

6. Numbers and words are entwined. Which came first is a nice, moot question. [**R**: 15, 25, 32, 50].

7. The performance of the Indian Cricket Teams is a matter of national concern. This verse on a watery grave inspired by the debacle of World Cup 2007, is a sequel to the Verse 4. [**R**: 96, 126].

8. Combinatorics is everywhere. It is a nice blend of mathematical rigour and unusual problems. This verse is based on the syllabus of my course *Computational Combinatorics - E0 234*. [**R**: 7, 29, 43, 45, 60, 68, 121].

9. From antiquity to modern times, number theory and cryptography have revealed surprising connections. This verse is based on the syllabus of my course *Cryptography - E0 235*. [**R**: 1, 3, 9, 45, 62, 86, 102].

10. Local financial crises and their reverberations across a networked world are themes of economics discourse. Such a theme is an eminent candidate that can be studied under the SWSBSS framework. [**R**: 52, 75, 77, 87, 92, 97, 107].

11. Imponderable India redeems itself. This verse is based on the rise of the fallen cricketing elephant in the World Cup 2011. [**R**: 116, 126].

12. This was read in the evening session of the IISc Centenary Conference, as a part of the Alumni Meeting during IISc Centenary Conferences. [**R**: 3, 43, 51, 109].

13. Academic departments need to work hard to get funding. They have to work harder to figure out their *thrust areas.* [**R**: 70, 109].

14. How difficult it is to make a question paper? Making a question papers has always been a challenge. Eliciting and evaluating acquired knowledge may be tried through exercises and questions. I have also occasionally tried certain whimsical, non-standard modes such as crossword puzzles on numbers and words. [**R**: 3, 43, 68, 121].

15. The COMIC spirit infected me some years ago and now it has taken serious turns. This verse is based on the syllabus of my course *Cognition and Machine Intelligence - E1 335* [**R**: 17, 25, 26, 30, 38, 46, 54, 57, 64, 65, 80, 82, 90, 122].

16. The language bug infected me many years ago and now it is turning virulent. This verse is based on the syllabus of my course *Natural Language Understanding - E1 246.* [**R**: 8, 15, 18, 25, 28, 49, 55, 108].

17. The nine-eleven and twenty-six-eleven carnages prompted this outburst, similar to my reactions in Verse 53. [**R**: 56, 57, 82, 90].

18. IISc is making a transition. The introduction of a new under-graduate programme was heartily debated at IISc in true academic spirit. [**R**: 109].

19. Among the many hard mathematical nuts to crack, seven were identified as *Millennium Problems* by the Clay Institute. The $P = NP$ question is one of this elite set. Mild tremors were set in motion by the announcement of a proof. The purported proof is different from some claims to fame by amateur hacks on Goldbach or twin prime conjectures. [**R**: 39, 60, 121].

20. In the pursuit of science the chase for truth is as enjoyable as obtaining the answer. Peer recognition is *also* an important aspect of productivity. The wordmorph game which we reinvented was first invented by Lewis Carroll. He called it the Doublet game and gave an example: *head, heal, teal, tell, tall, tail.* It is of combinatorial interest to study situations such as: *power, tower, toer, toe, too, two.* Such string edit problems have many real-world applications. [**R**: 112, 113].

21. In the pursuit of science the chase for grant is not as enjoyable as obtaining it. In India the scientific community certainly holds in high esteem, the *eventual* generous supports from the government. [**R**: 44, 77, 109].

22. During the last decade India has gained the sobriquet, "back office of the world". This has positive and negative overtones. This verse made some years ago reflects the ongoing theme. [**R**: 59, 77, 97, 107].

23. The exact values of Mersenne primes and closely related *perfect numbers* are mere number theoretic curiosities. But, number theory abounds with other deep and related results and applications. Similarly, the *number* 23 of chapters of the human genome book is not special. The *contents* of the chapters are amazing. [**R**: 45, 57, 72, 73, 74, 81, 95].

24. India is a statistical paradox of numbers - the laws of large and small numbers hold simultaneously. For every example, we have a counter-example. No finite quantity here, must be divided by the size of the population (tending to infinity) to avoid null effects. [**R**: 33, 44, 92, 97, 109, 116].

25. Coloring graphs, random or otherwise, with few colours, is a canonical *hard* prob-

lem. It has many trivial and profound applications. Theoreticians and practitioners quickly diverge and identify niche areas. There are many existential, enumerative and constructive questions in combinatorics. Determining bounds, designing algorithms and estimating computational complexities are fascinating tasks. A particular mindset is to be cultivated to handle these lovely problems. [**R**: 110, 111].

26. Computational Complexity Theory explores the deep connections between algorithms, languages, machines and computation. The central question whether $P = NP$, (considered in Verse 19), and other auxiliary questions fuel an academic industry of mathematicians and computer scientists. [**R**: 39, 124].

27. I conjecture that Srinivasa Ramanujan had already been friendly with the *taxi-cab* number 1729 associated with him. His notes and papers, prior to his trip to Cambridge, display the integer 1728 in at least three contexts. [**R**: 3, 27, 35, 45, 58, 91].

28. Database theory, algorithms and applications have strong interactions with data and information structures, data mining, data warehousing, information retrieval, language and other content analysis, machine learning, to name a few. Modeling relational databse dependencies through hypergraph cycles produced novel insights. Another natural model for relational database dependencies is through discrete lattice theoretic formalism. [**R**: 63, 64].

29. Computational Geometry, a topic invented by computer scientists draws upon coordinate geometry, algorithms and data structures, graph theory, combinatorics, algebraic geometry and numerical analysis. It covers a rich collection of theoretical and practical questions. [**R**: 78].

30. I had great excursions into computational geometry for a few years. During this exciting time I had many close calls with convoluted polygonal algorithms and bright, argumentative students. [**R**: 78].

31. Computer language processing systems use a system of definite tags as meta-level descriptors. Human cognitive mechanisms work with multiple tags. It is our endeavour to design a specification meta-language using a variety of *cognitive tags*. This is a part of an ongoing study. In a sense language and cognition go tongue-in-brain. [**R**: 8, 55, 56].

32. The quest for y-smooth integers, is central to integer factoring algorithms. We have developed certain analytical results in this area. [**R**: 3, 16, 40, 62].

33. There is an important set-up step in integer factoring, pertaining to the construction of a *suitable* number field, for the efficacy of the sieving step. We have developed a few new heuristics for this step. [**R**: 3, 22, 40, 45, 62, 66].

34. Cryptanalysis of stream and block ciphers is of theoretical and practical interest. This work is based on the new field of algebraic cryptanalysis. [**R**: 3, 62, 88, 106].

35. Human cognitive resources are bounded. It is possible, in principle, to estimate our cognitive capabilities based on a quantification of the resources and the demands placed on them. (see Notes 59). [**R**: 5, 47, 57, 100].

36. Navigation on networks is a generic modeling scheme for a variety of problems from different domains. We study networks arising from *concept association*, *wordmorph games* and *eyegaze scanpaths*. [**R**: 12, 112, 113].

37. Primes come in two flavours - regular and irregular - according to Kummer. He showed that Fermat's Last Theorem is true for exponents p that are *regular*, i.e. for p

that do not divide the class number of the p-th cyclotomic field. A closed form formula for the class number was discovered by Dirichlet. This involves Bernoulli numbers. The infinitude of irregular primes is not known. We extended the list of irregular primes, beyond a million, by testing the Bernoulli number criterion. This involved the power of our large-scale integer computation algorithms. [**R**: 9, 35, 45].

38. Randomized algorithms provide provably efficient and practically useful methods for hard combinatorial problems. Intricate constructions can then be devised to remove the randomization steps. This area is a rich play-ground for theoreticians and discerning practitioners. [**R**: 76].

39. Words in sentences are handled in two non-standard sets - stop words and content words. In our works on natural language processing and related applications to summarization, stylometry and translation, we found that stop words do matter in certain types of statistical formulations. [**R**: 11, 12, 13, 89].

40. Nonsingular cubic curves known as elliptic curves and closely related elliptic functions, elliptic integrals are nice objects in the confluence of algebra, analysis, arithmetic and geometry. They have many applications in cryptography. A remarkable polynomial time algorithm for computing the order of the group of points on an elliptic curve over a finite field was discovered by R.Schoof. This set the tone for powerful developments in the field. We tackled the intriguing computational aspects of this algorithm. [**R**: 9, 10, 27, 61, 120].

41. We invented efficient algorithms for handling large-scale integer computations arising in testing Mersenne primes, identifying irregular primes and computing orders of elliptic curve groups. Numbers are represented in many common radices such as 2, 8, 16, 10. The radix (base) in which 42 stands for 64 is 15.5. Such rational or fractional and even irrational radices find applications in number and polynomial representations suitable for discrete Fourier transform based high-speed multiplication algorithms. These modules are used in very-large-scale-integer computations arising in Mersenne numbers, irregular primes. Algorithms for fast integer and polynomial computations rely on the primitives of addition and multiplication. Perhaps these were the first algorithms invented by man. Division algorithms use reciprocal, multiplication and Newton iterations. [**R**: 3, 27, 60, 68, 73, 86, 98, 120].

42. In Life, the Universe and Everything, Arthur Dent wants to know the question for which he has the answer 42. We are told of a spaceship landing on Lord's Cricket Field. The sailor is a member of the motley crew of the Hunting of the Snark. In Alice in Wonderland, we hear the King read out to Alice an absurd Rule 42. Douglas Adams and Lewis Carroll tossed around many innocuously profound (or profoundly innocuous) concepts. People have wondered why the number 42 pops up so many times in the writings of both. [**R**: 5, 22, 34, 123].

43. The deterministic polynomial time algorithm for testing primality by the Indian trio settled an open question. Ironically the *practical* world is still content with a more efficient probabilistic algorithm. [**R**: 3, 6, 43, 86].

44. Paul Erdös was a prolific mathematician of the twentieth century. An academic proximity with Erdös measured by a co-authorship distance with him, was a much sought-after goal of many researchers. He would respond to any technical query, from anyone, from any part of the world, in writing. A technical letter from him to this

student became a trophy. [**R**: 24].

45. It was quite challenging to tackle the computational issues of a deterministic super-polynomial time primality testing algorithm based on sophisticated algebraic number theory. This intrepid scholar who worked with me on this problem, later got a much looked up to *Erdös* number 1 during his Ph.D study abroad. [**R**: 3, 86].

46. I interacted with Paul Erdös, during my visit in 1987 to the Mathematical Institute of the Hungarian Academy of Sciences, on the problem of bounding the independence number of triangle-free graphs. Erdös considered my proof for a sub-problem in the form of an approximation algorithm and provided insight into the conjectural implications. [**R**: 119, 121].

47. Steganography is an ancient art and a part of the modern science of cryptology. There are many ways of embedding a form of digital content into another form of digital content. Both offenders and defenders of digital storage and transmission engage in these studies. We have generated a few interesting ideas. [**R**: 114, 115].

48. The acts of encoding, compression and encryption can be combined to design practical systems, maintaining security and efficency. [**R**: 114, 127, 128].

49. Eratosthenes sieve is a scheme for collecting prime integers. Two modern ideas for factoring large integers are based on (i) group orders and (ii) quadratic congruence criteria. The second class of algorithms hunt for a large collection of smooth integers. The two main forms of this class are the quadratic sieve and the number field sieve (NFS). The main step of these consist of two major sieves - the rational sieve and the algebraic sieve. These are further handled by other mechanisms called line sieve, cubic sieve, lattice sieve and what we call adaptive sieve. Many adroit steps are required to implement these sieves in large-scale, parallel, distributed computing environments. We have implemented many sieves in the course of our integer factoring programme. There is a cryptic verse due to Pollard called " A Tale of Three Sieves", of 3 stanzas each of 4 lines. [**R**: 1, 2, 3, 14, 83, 125].

50. Solving large sparse system of linear equations modulo 2, is a major task in a variety of cryptanalysis techniques such as integer factoring, algebraic attacks on symmetric key ciphers. We have carried out large-scale implementation exercises in cluster computing platforms in the context of integer factoring by NFS. [**R**: 62, 79, 106].

51. Notions of chordality, Hamiltonicity and visibility are interconnected. They can be carefully orchestrated in the design and anlaysis of graph and geometric algorithms. [**R**: 68, 104, 105].

52. Notions of planarity, decomposability and embeddability are interconnected. They can be exploited in the design and anlaysis of graph algorithms. [**R**: 68, 93, 94].

53. Our recent psychophysics experiments using an eye-tracker instrument on with *text, image* stimuli provide us valuable information and insight into some aspects of human perception and cognition. Much work on modeling, analysis and inferencing remains to be done. [**R**: 56, 101].

54. The Iraq War turned on my verse gene in 2003. It got expressed by a request from my brother-in-law J.Raja who, in a state of terminal illness, asked me to write something about this war. [**R**: 32, 90].

55. Cryptanalysis is of concern to information protectors. Certain type of people

practice this science in certain ways. Intelligence is in great demand here. [**R**: 3, 62].

56. The letters A, B, C denote many metaphors. Scientists often adopt whimsical mnemonics. I pick three such situations from mathematics and computer science. [**R**: 11, 12, 45, 106].

57. The signs of these four schemata are everywhere. Human cognition develops strategies drawing upon tools from all the four processes. Conversely, to reason about human cognition we invoke principles from all the four. [**R**: 34, 56, 57, 65, 69, 81, 100].

58. Efficient partial match query on secondary keys is a key requirement of database search systems. We introduced novel multi-dimensional tree data structures and search algorithms for these tree traversals. [**R**: 41, 118].

59. Human cognitive resources are being stretched with the advent of global information explosion. Modeling and understanding the factors will lead us to ways of coping. (see Notes 36). [**R**: 5, 47, 48, 81, 100].

60. Human beings owe a lot to books. This verse is a tribute to the wonderful inanimate objects. [**R**: 17, 21, 31, 71, 99].

61. Erdös coined the word ϵ for a child. I call an offspring a *principal* ϵ and a student a *quasi* ϵ. My principal ϵ and some of my quasi ϵ have taken to academic careers. $\epsilon - \tau$ transitions are not smooth - they entail many examinations, papers, theses and teaching. The world of academia is where the full spirit of liberte, egalite and fraternite is always felt. [**R**: 84].

62. My father wrote me some fascinating letters during my student days. Some of this whimsical stuff has been indelibly imprinted on me. [**R**: 36].

63. A thanksgiving ode to the people around me with whom I have shared my numeric and alphabetic outbursts. [**R**: 4, 23, 37, 81].

64. People around me have people around them and so on. Human message propagation today, through the many modern media, works wonders!

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