War of the Weasels: The Creationist Assault on Genetic Algorithms

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Genetic Algorithms

How an Intelligent Design Theorist was Bested by a Genetic Algorithm.

What is a Genetic Algorithm?

A computational method that simulates evolutionary processes to solve problems.

Represent solutions to a Problem in such a way that they can be randomly created, changed or altered

Generate Many Random Solutions (~1000)

Test All Solutions (Calculate Fitness);
Use Better Solutions to Seed New Generations.

Add Mutations, Sex; Repeat over Several Generations.

Let's Try a GA Right Now!

Half of the class, you are "X"s. Each "X"-student will guess and announce a number from 0-100. Try not to repeat an earlier "X".

The Other Half of the class, you are "Y"s. Each "Y"-student will guess and announce a number from 0-100. Try not to repeat an earlier "Y".

Let's Try a GA Right Now!

The Goal: To Find (X,Y) such that

X+Y=A and X-Y=B.

The Catch: You don't know X, Y, A or B!!

The computer knows A & B, but not X & Y.

The "Fitness Test" does the math for you.

Fitness Cell Values are calculated as

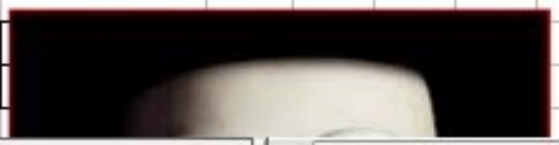
ABS(X+Y-A)+ABS(X-Y-B)

for each pair of (X,Y) guesses.

Let's Try a GA Right Now!

If a Cell Number is small, X and Y are close to the solution.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1		Group 1, X	Group 2, Y	100	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
2	No. 1	50	61	Y1	32	58	98	32	32	40	32	60	32	32
3	No. 2	26	97	Y2	104	104	104	104	104	104	104	104	104	104
4	No. 3	6	47	Y3	10	58	98	32	8	40	4	60	30	22
5	No. 4	39	77	Y4	64	64	98	64	64	64	64	64	64	64
6	No. 5	51	71	Y5	52	58	98	52	52	52	52	60	52	52
7	No. 6	75	32	Y6	26	58	98	32	26	40	26	60	30	26
8	No. 7	56	19	Y7	52	58	98	52	52	52	52	60	52	52
9	No. 8	25	4	Y8	82	82	98	82	82	82	82	82	82	82
10	No. 9	40	39	Y9	12	58	98	32	12	40	12	60	30	22
11	No. 10	44	31	Y10	28	58	98	32	28	40	28	60	30	28
12	No. 11	57	65	Y11	40	58	98	40	40	40	40	60	40	40
13	No. 12	22	56	Y12	22	58	98	32	22	40	22	60	30	22
14	No. 13	1	93	Y13	96	96	98	96	96	96	96	96	96	96
15	No. 14	84	96	Y14	102	102	102	102	102	102	102	102	102	102
16	No. 15	53	85	Y15	80	80	98	80	80	80	80	80	80	80
17														
18		X+Y Goal									min	4		
19		X-Y Goal												
20														



Let's Try a GA Right Now!

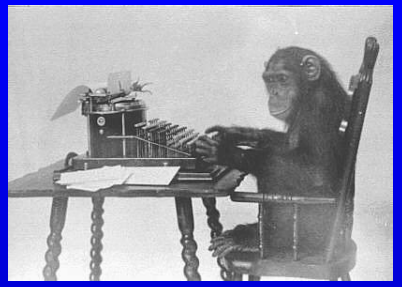
At the end of Round One, the students who chose the best values for X and Y are hereby designated as "Parents" for Round 2.

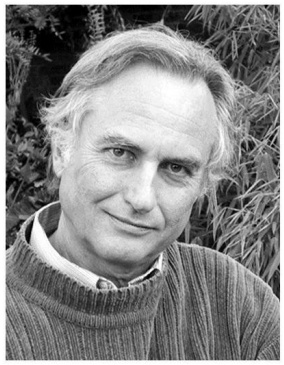
For Round 2, the "Parents" will retain their Round 1 choices. Each non-parent "X" or "Y" team member should guess a New Value, this time, near to their *Parent's* Cell Value.

"The apple doesn't fall far from the tree."

Again, try not to repeat.

Dawkins' Weasel: Blind Watchmaker, 1986





Richard Dawkins's "Weasel" simulation from his 1986 book The Blind Watchmaker involved a Genetic Algorithm and the phrase from Hamlet "METHINKS IT IS LIKE A WEASEL."

Its purpose: to show the difference between *cumulative* selection and *no selection at all*.

In the book, Dawkins warns:

"Life isn't like that. Evolution has no long-term goal. *There is no long-distance target...*"

Creationists Smell Blood - *Weasel* Blood

"Prof. Dawkins' experiment is nothing more sophisticated than this. Like the modified gambling machine, the outcome is rigged. You have a target outcome and cannot fail to reach it through the process used. If you are willing to accept the implicit assumptions of the computer runs, you can 'prove' some really preposterous statements."

Dawkins' weasel revisited

First published:
TJ (now *Journal of Creation*) **12**(3):358–361
December 1998

by Royal Truman

Creationists Smell Blood - *Weasel* Blood

Since 1986, creationists have jumped upon the Weasel example to argue that *ALL* genetic algorithms must have the answers fed into them during execution...

William Dembski: "... stacking the deck by incorporating the very solution that was supposed to be attained from scratch (Dawkins 1986 and Schneider 2000 are among the worst offenders here). …"

Stephen Meyer: "… the illicit expedient of providing the computer with a 'target sequence'..."

UNM “Debate”, 2001

Access Research Network
ARN Library Files

Albuquerque Tribune, February 20, 2001, Tuesday, Pg. A1

UNM Splits Lecture Halls over How Life Came to Be

by Frank Zoretich

Life as we know it: the result of evolution's mindless natural selection, or the result of intentional design by someone or something that might be called . . . God?

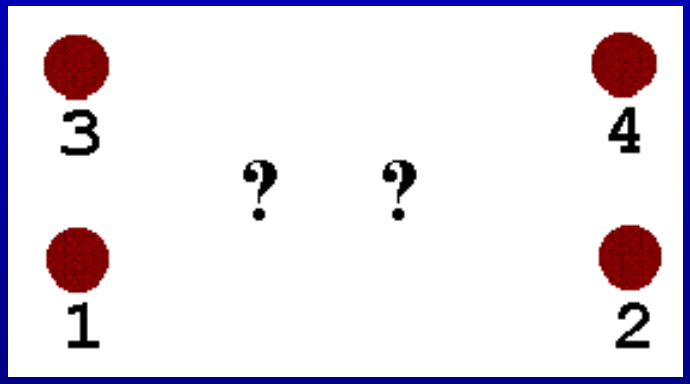
Both sides of the 142-year-old argument triggered by the publication of Charles Darwin's *Origin of Species* in 1859 were presented, separately, in lecture halls at the University of New Mexico on Monday.

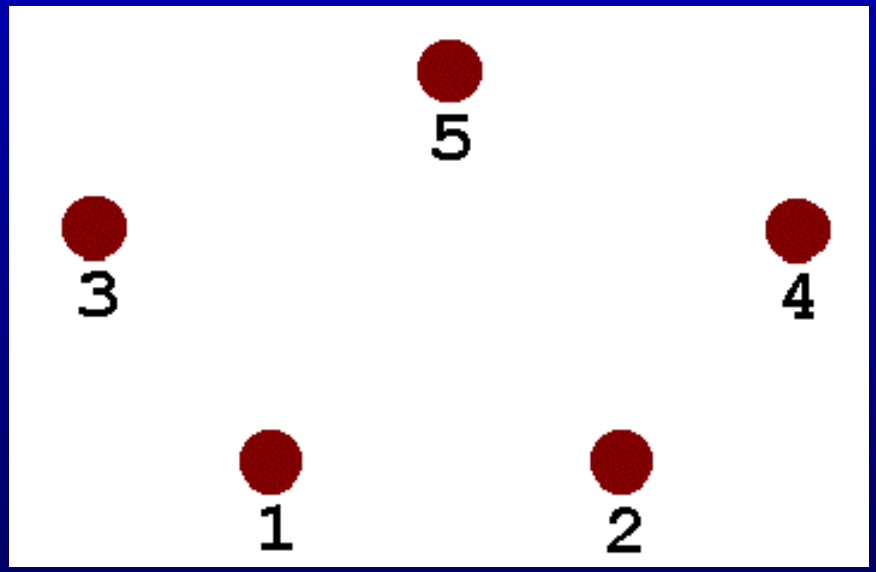
"It's really a debate between the two most powerful forces on the planet: religion and science," said UNM senior and Sandia National Laboratories employee Jason Libersky, who joined a capacity crowd of about 800 people in Woodward Hall to hear Phillip Johnson, an anti-evolution law professor at the University of California at Berkeley, lecture on "The Real Evolution/Creation Debate."

After listening to Johnson, Libersky and about 130 others walked to the Kiva Lecture Hall to hear a rebuttal, "Technical Problems With Intelligent Design Theory," by Dave Thomas, an Albuquerque physicist and mathematician who is president of New Mexicans for Science and Reason.

Steiner's Problem

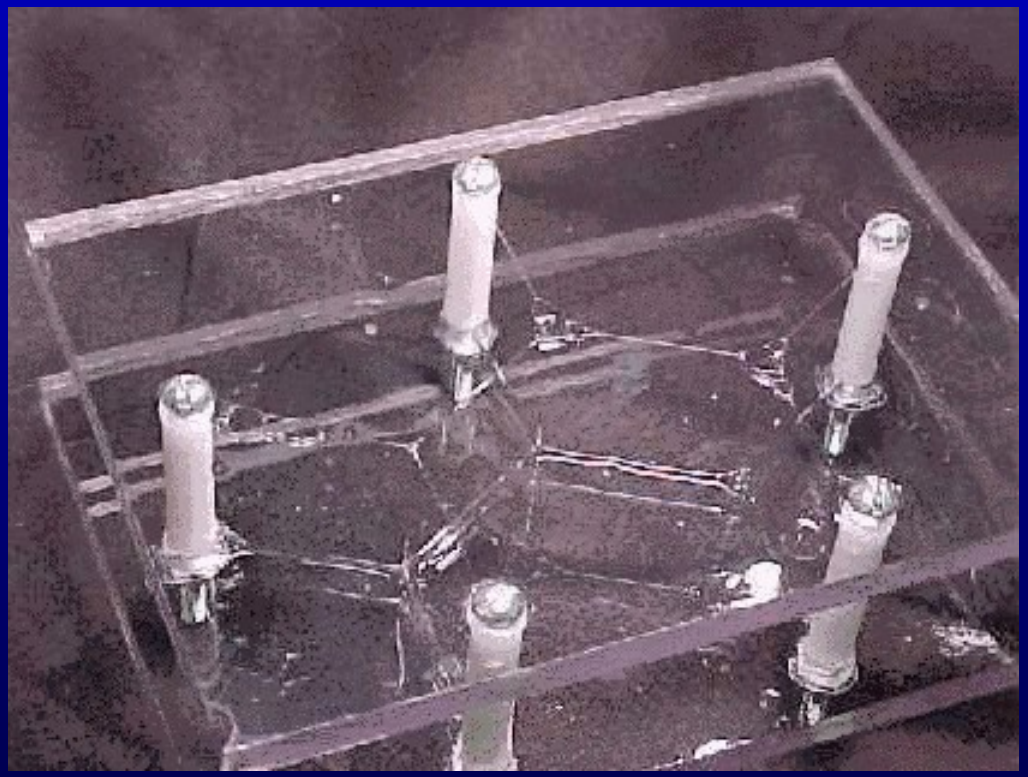
Given N Fixed Points, Find the Shortest Connecting Straight-Line Network (New Internal Points Allowed)





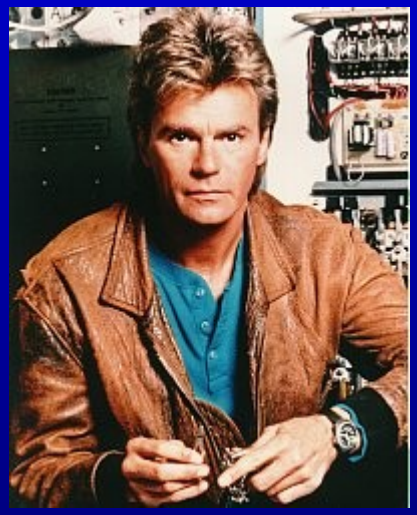
Soap Bubbles and Minimal Surfaces

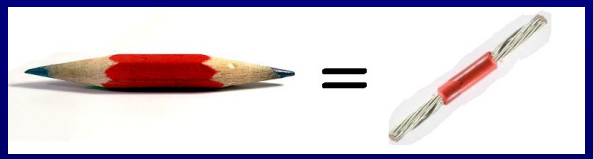
Soap Films Adopt Minimal Shapes Due To Surface Tension, and Can Be Used to Solve Steiner Problems.

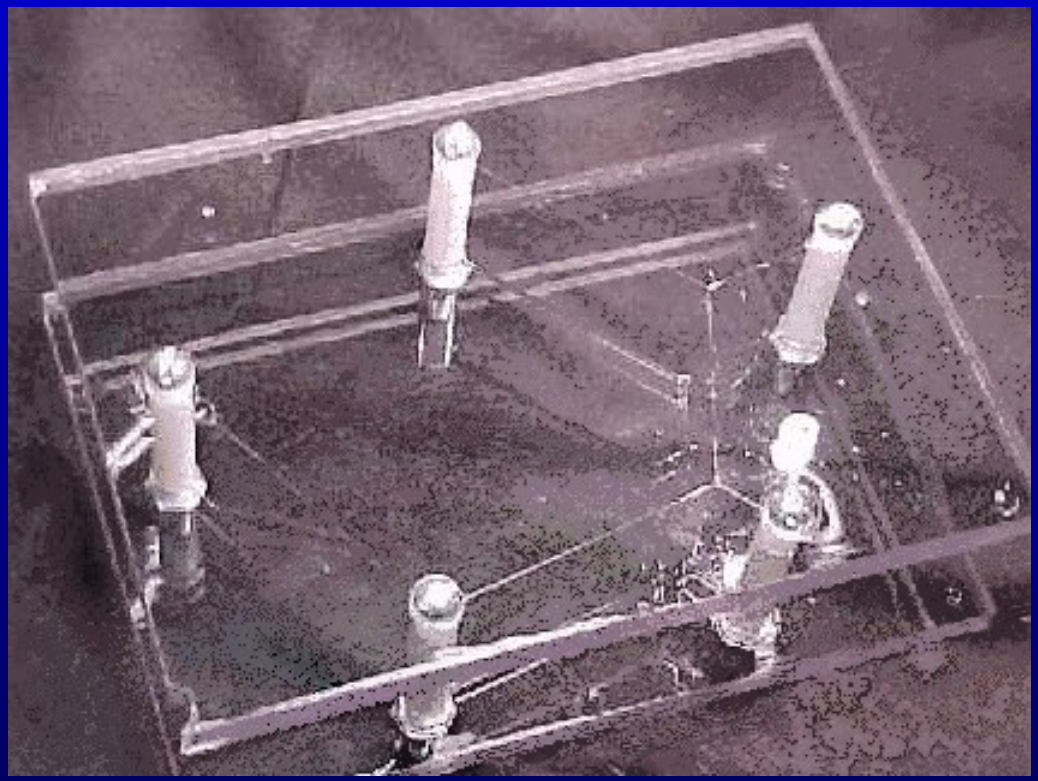


“MacGyver” Solutions

Sometimes Inelegant, But Good Enough to “Get ‘Er Done”







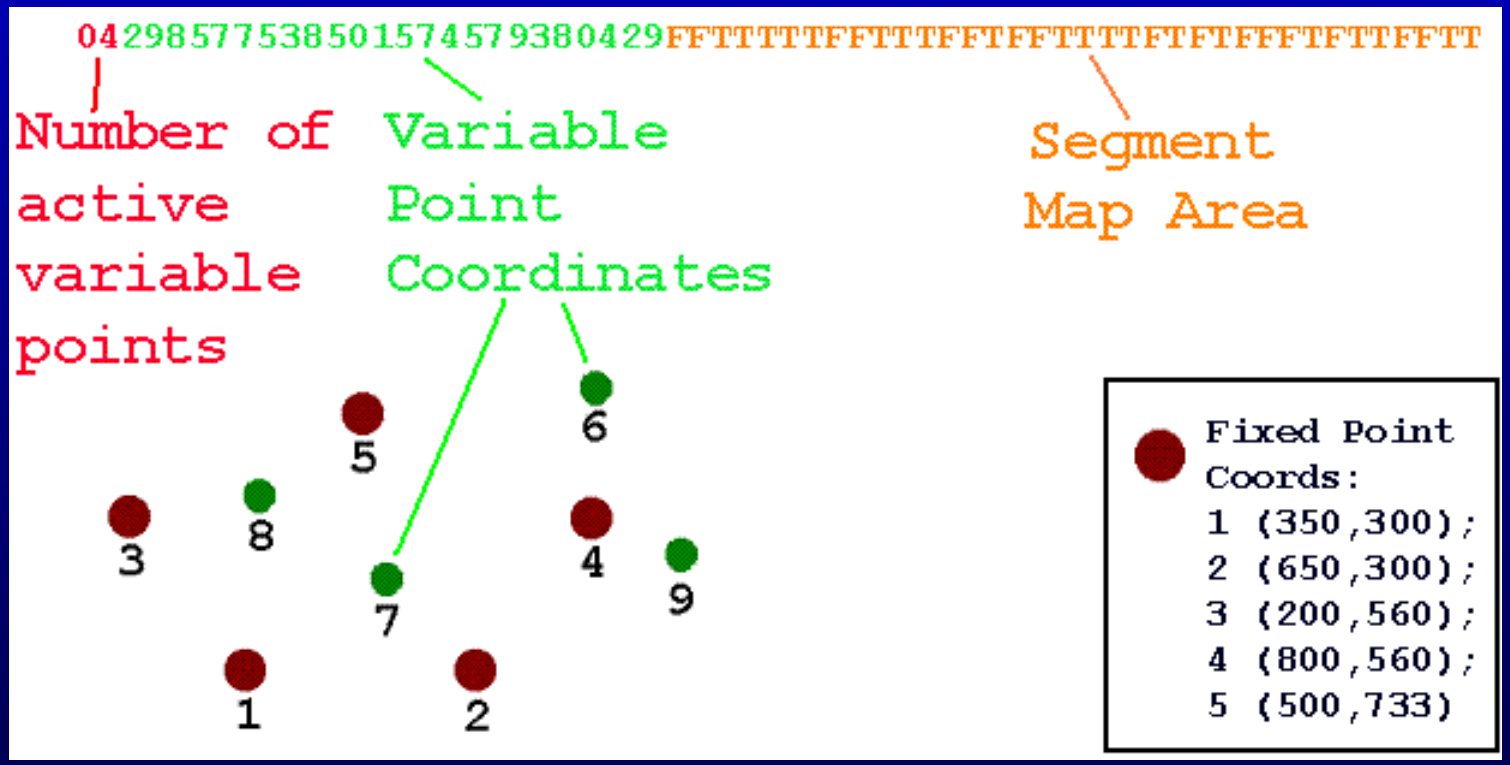
So there may be One Book Answer, yet Multiple Also-Rans

A Genetic Algorithm for Steiner

Use Alphanumeric Strings to act as "DNA".

$0^{8}5^{3}4^{2}8^{1}0^{6}7^{4}2^{4}F_{F}T_{T}T_{F}^{T}T_{F}^{T}F$

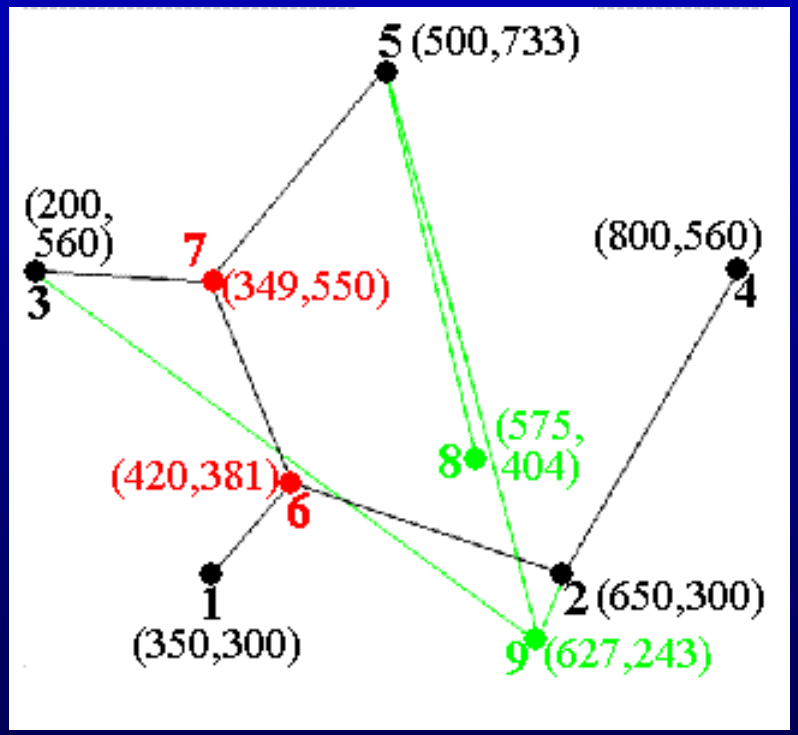
$0^{6}4^{6}7^{3}5^{5}8^{9}2^{3}0^{2}F_{T}T_{T}^{T}F_{T}^{F}F_{F}^{T}T$



“Transcribing” Steiner DNA

DNA of a Typical “Organism”

0242038134955057540462724 3FFFFTFFFFTFTFFTFF FTFTFFFFFFTTTTFFFFF



From Node:	1	2	3
To Node:	FFFFTFFF 6	FTFTFFT 4 6 9	FFFTFT 7 9

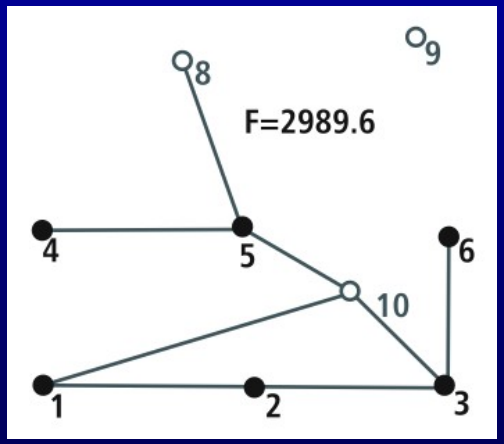
From Node:	4	5	6	7	8
To Node:	FFFFF	FTTT 789	TFF 7	FF	F

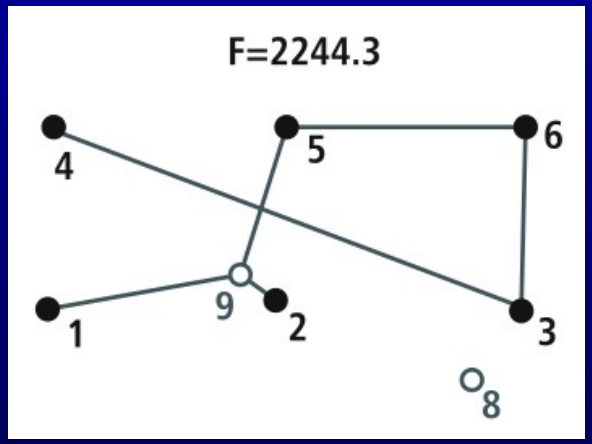
The Fitness Test

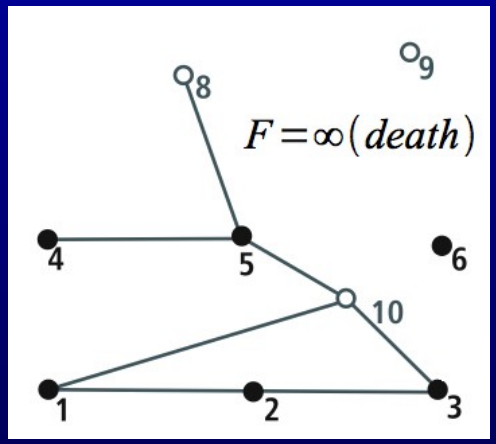
The Fitness Test Does Not Know about the "Target"

Any organisms can have their connectivity and length measured, and be thus compared.

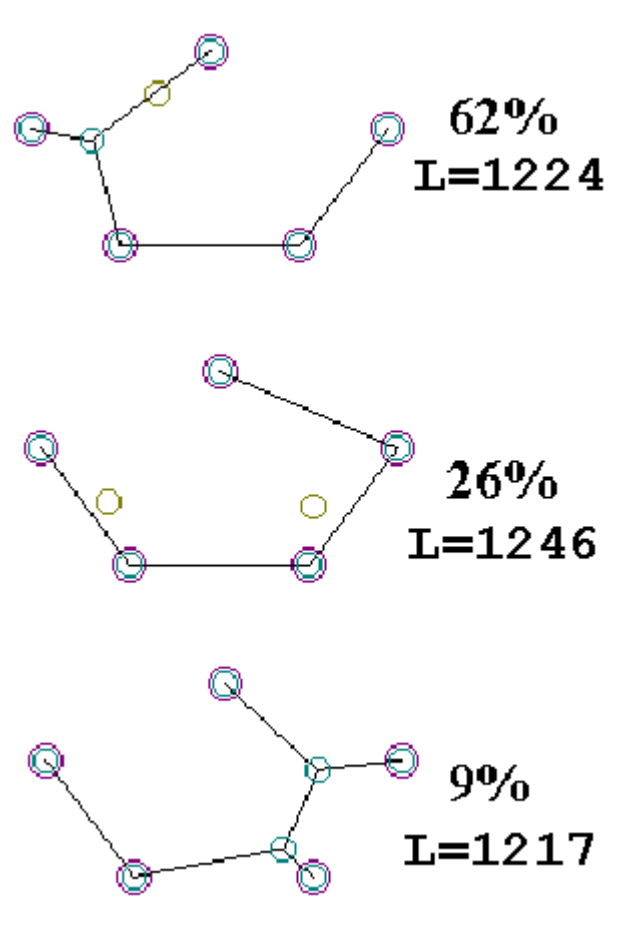
"For many are called, but few are chosen." Matthew 22:14

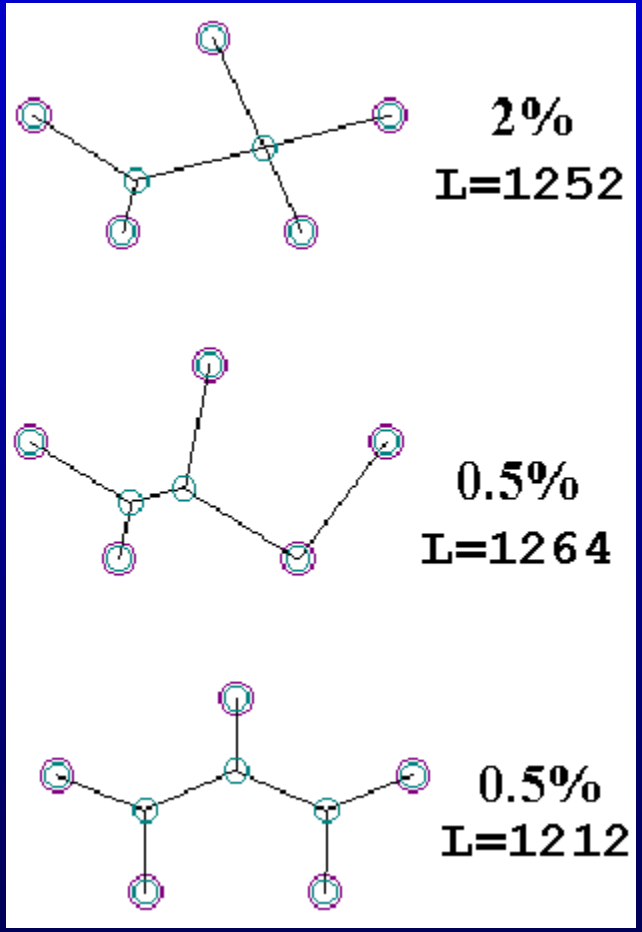






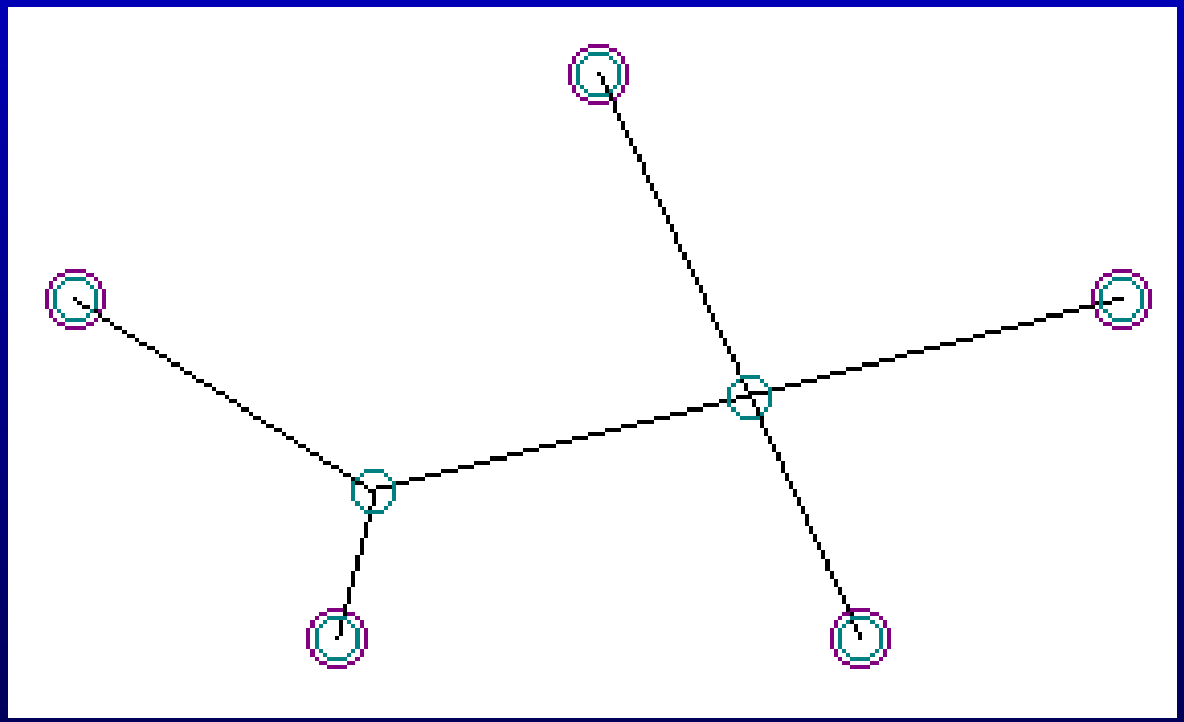
Results After Hundreds of Runs of Many Generations Each





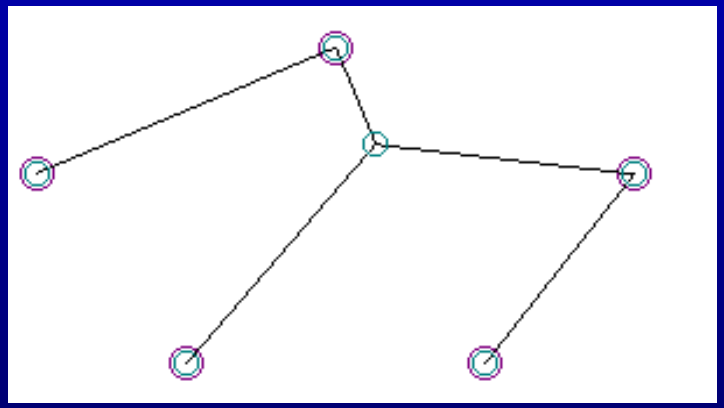
Genetically Stable/Soap Unstable

The "Face Plant" has a Four-Segment Junction That Becomes a Bowtie with Soap Bubbles.

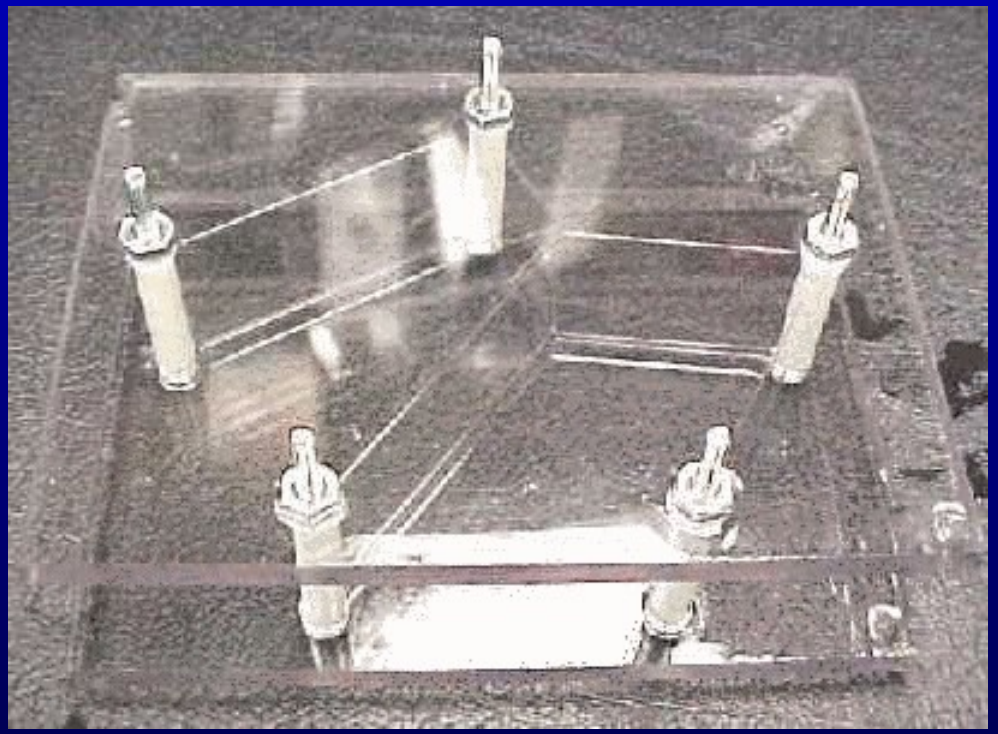


Genetically Unstable/Soap Stable

The "Doggie" Is Quickly Out-Competed by Shorter Organisms, and Goes Extinct, Even if Engineered In.



1403



Target? Target? We Don't Need No Stinkin' Target!

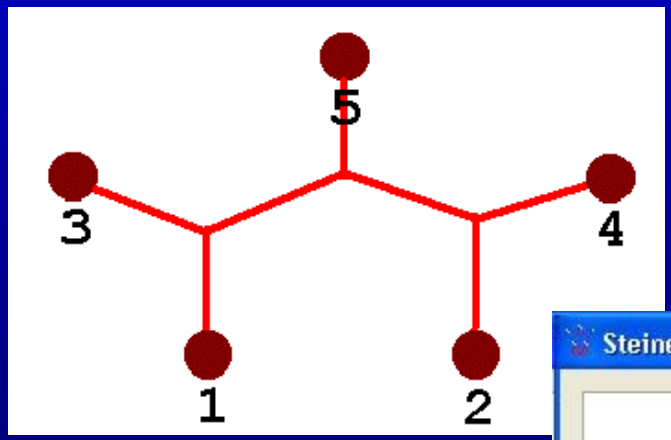
July 2006: The War of the Weasels Begins.

UNCOMMON DESCENT

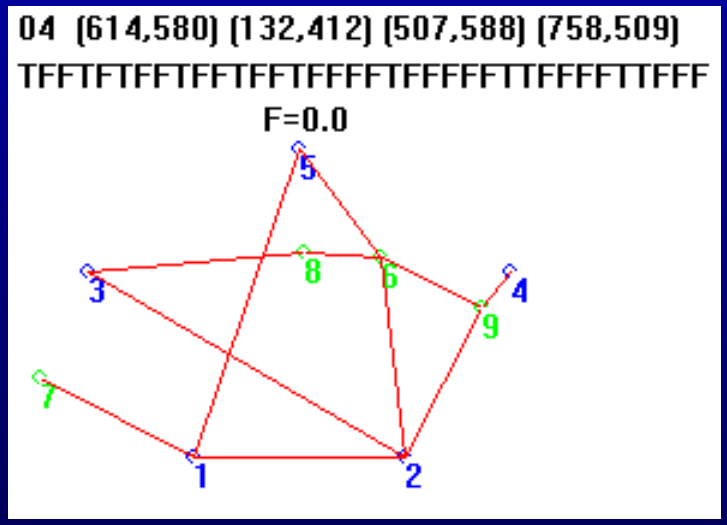
THE INTELLIGENT DESIGN WEBLOG OF BILL DEMBSKI & FRIENDS

No Target Is Needed

While MacGyvers are most common, the Book Solution appears every few hundred simulations (200 gen's each).



A Real "Target" (Specified DNA)



STEINER

***LIVE*!**

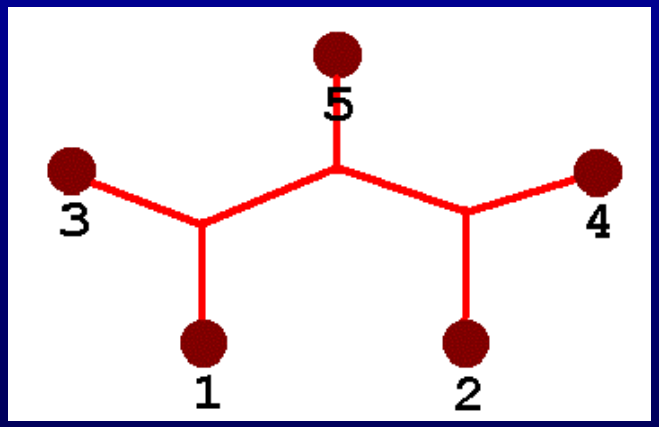
Irreducible Complexity

"A single system composed of several well-matched, interacting parts that contribute to the basic function, wherein the removal of any one of the parts causes the system to effectively cease functioning,"

In Michael Behe's book Darwin's Black Box, Behe goes on to claim that IC structures are impossible in gradual evolution (improvement by slight, successive modifications to precursor systems), "*because any precursor to an irreducibly complex system that is missing a part is by definition nonfunctional*."

Irreducible Complexity?

Redundant Complexity



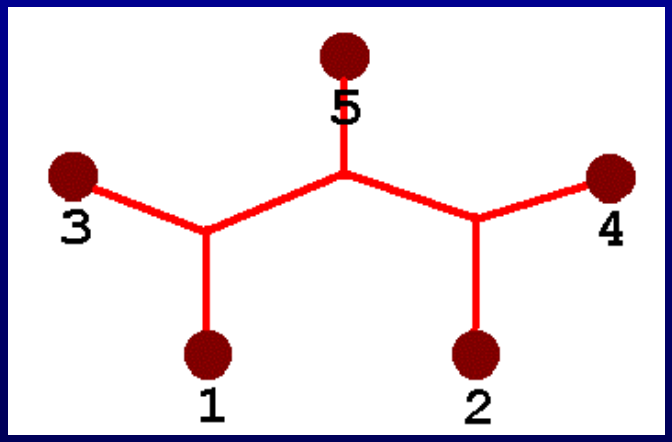
121

2874

1368

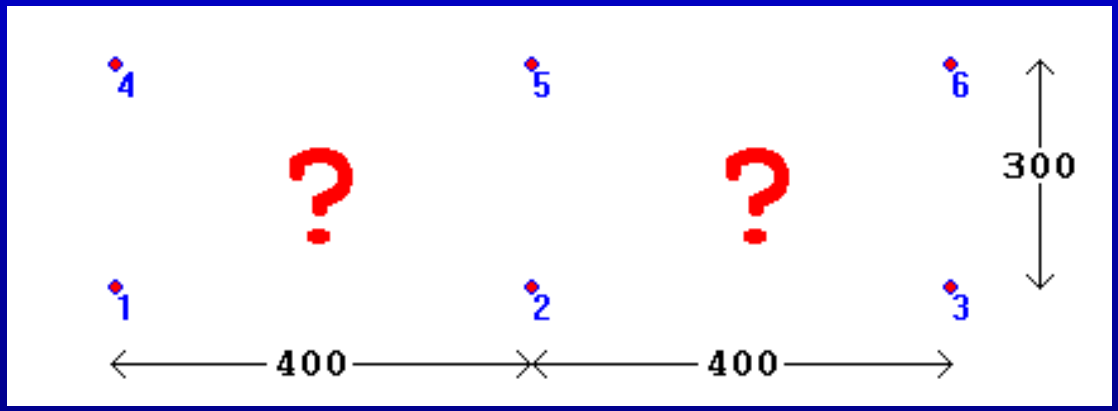
Complex Specified Information

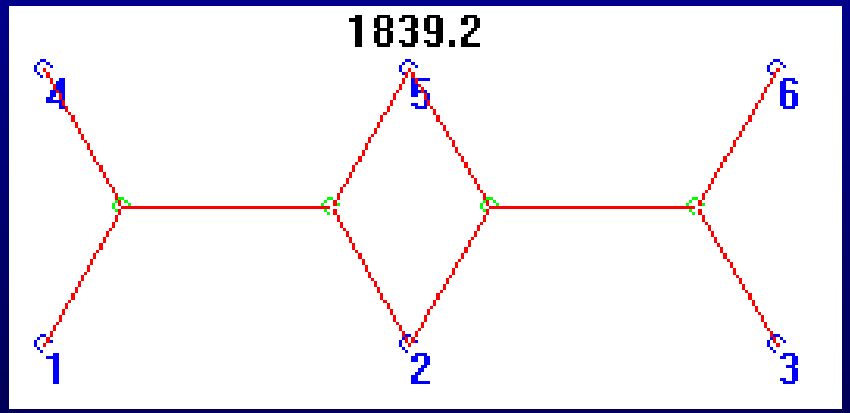
The Steiner solutions themselves are CSI, by virtue of their being Complex (in the sense that the correct answer is rare enough to be improbable) and by virtue of their being Specified Information (as the formal Solution to a given math problem).



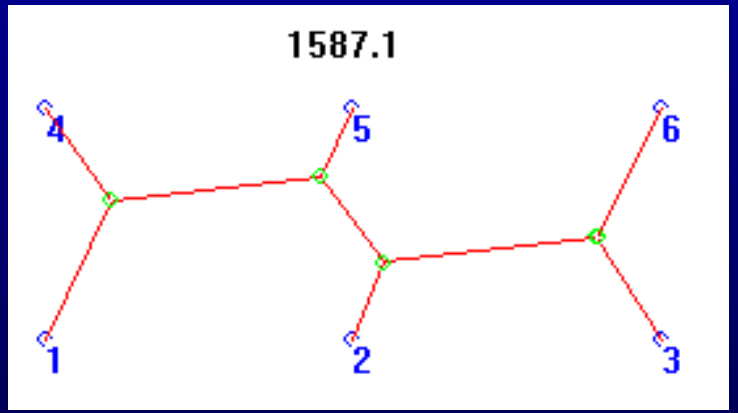
The Design Challenge

What is the Steiner Solution for This 6-Point Grid?



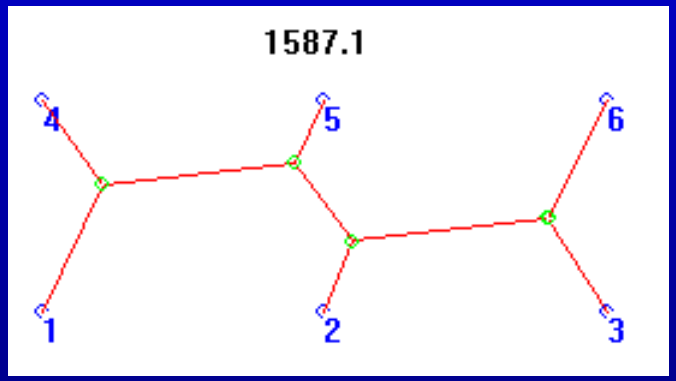


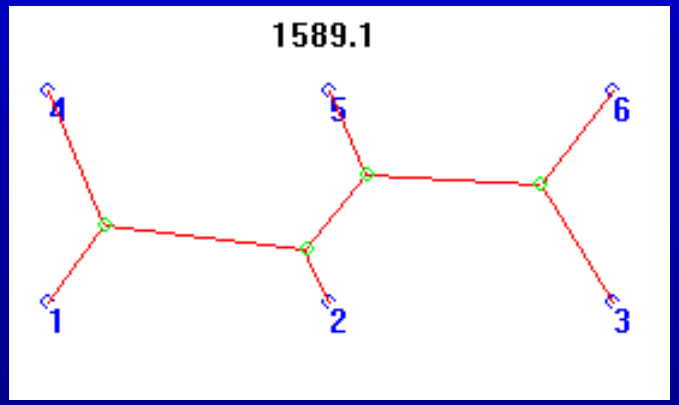
Answer: 1587.1

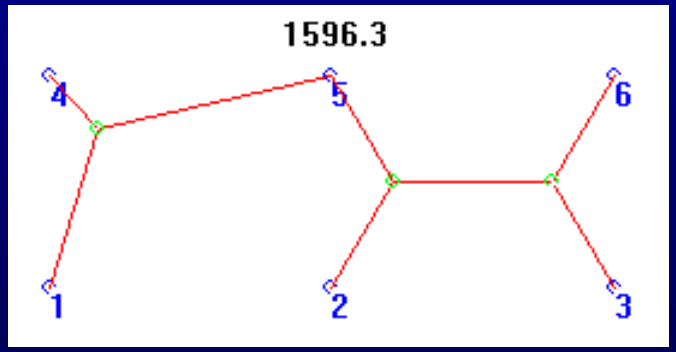


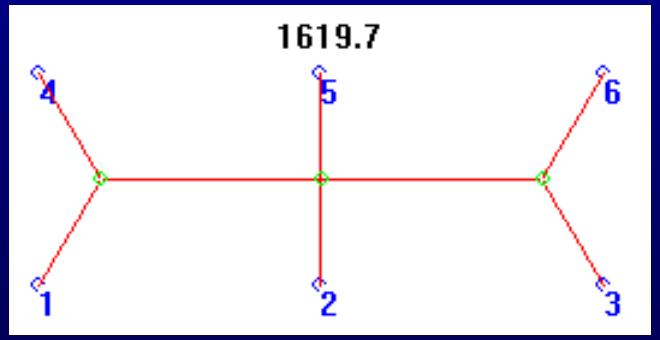
Public Answers were Submitted

Some of the Shapes Found and/or Independently Submitted









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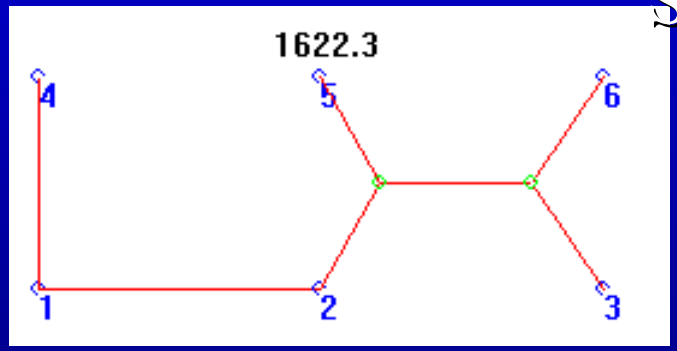
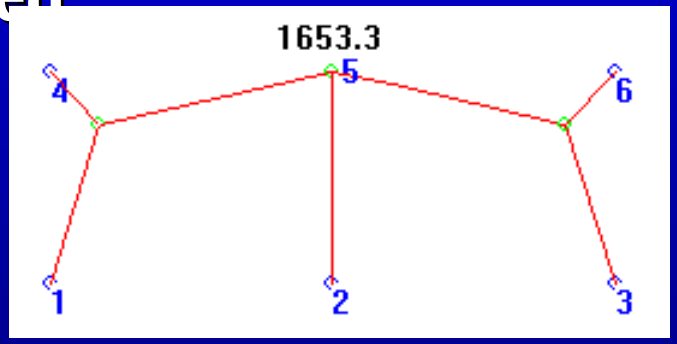
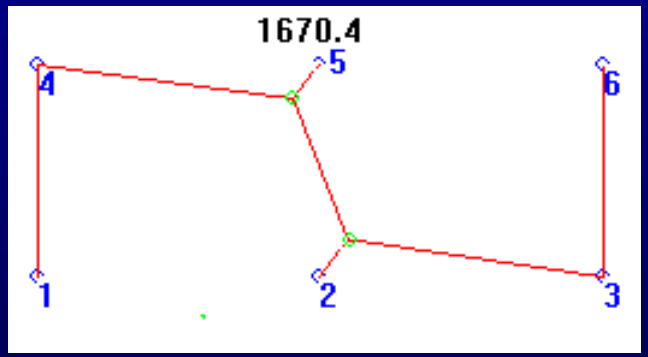
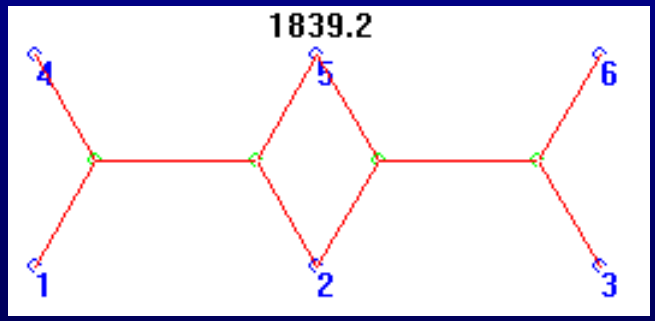




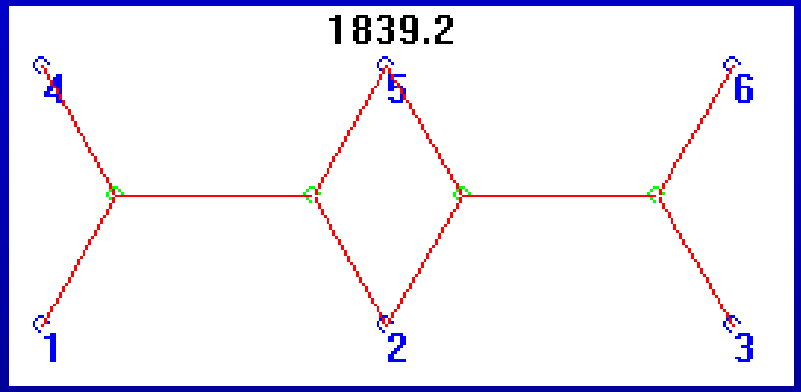


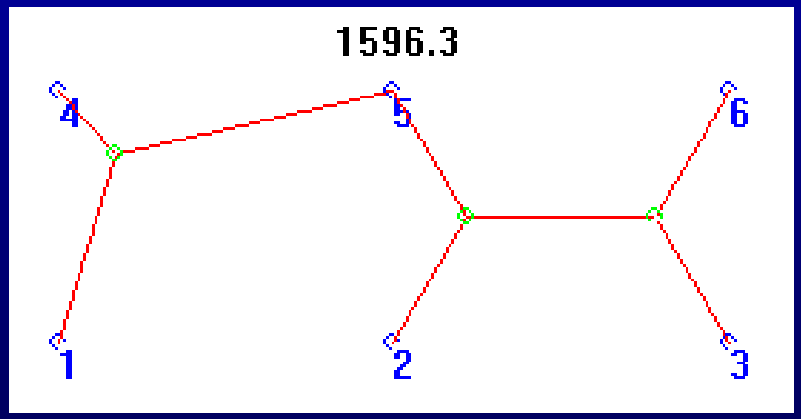


Salvador Cordova – First Attempt

Comment #119718 Posted by Salvador T. Cordova on August 15, 2006 8:59 AM
"To find a solution, one could try the software at: http://www.diku.dk/geosteiner/"
Salvador

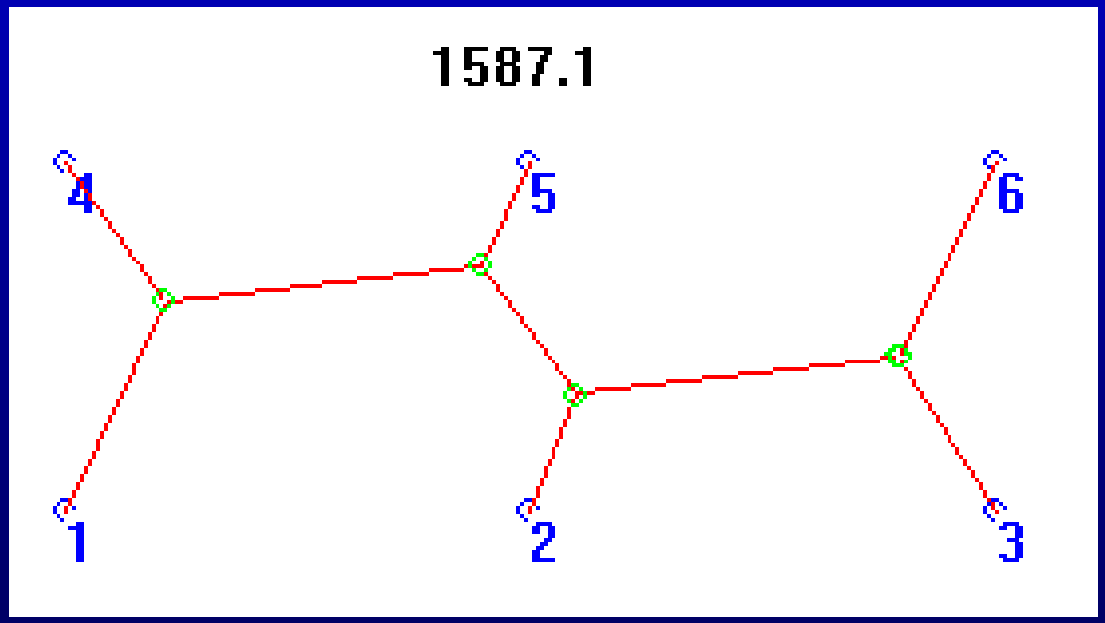
Cordova's 2nd & 3rd Attempts





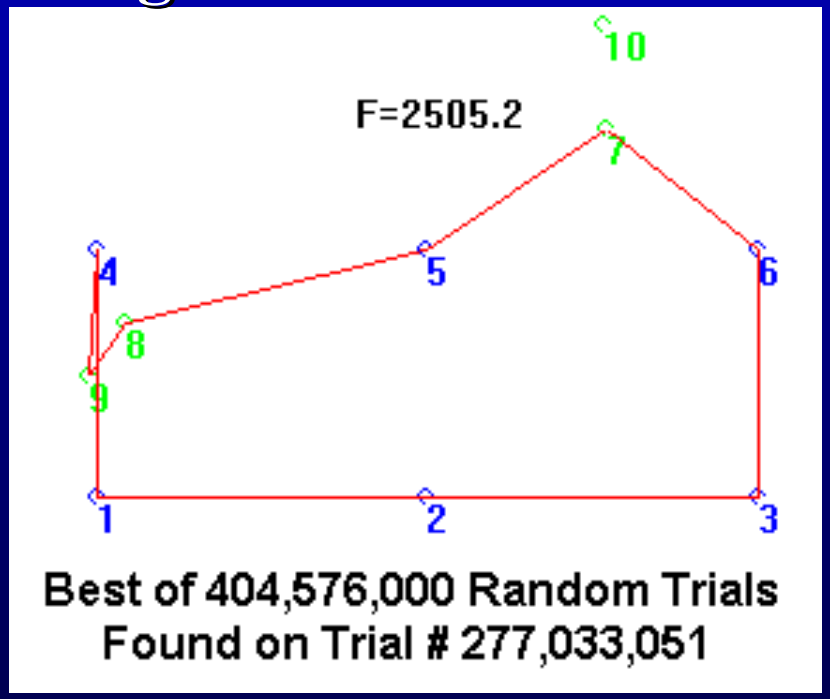
Leslie Orgel's Second Law

"Evolution is smarter than you are."

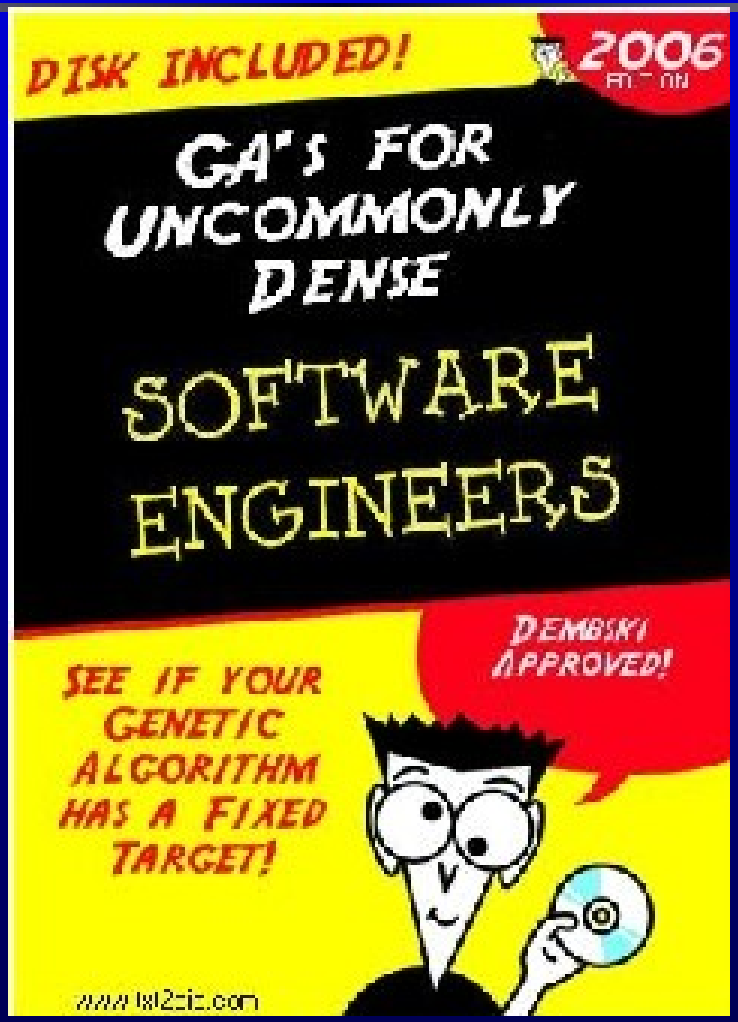


Cordova's Response

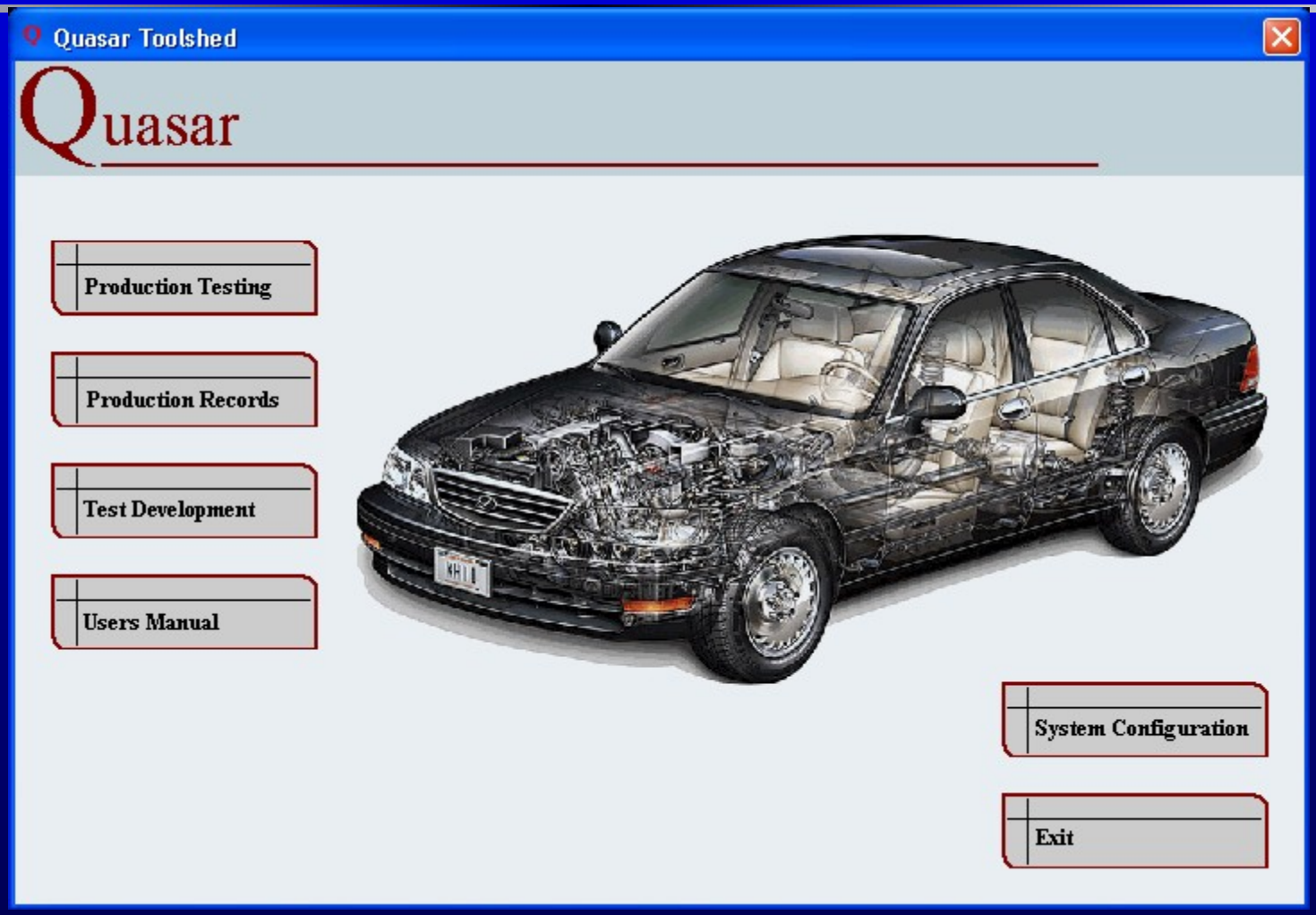
Cordova said there was no shame in being beaten by the computer, because Computers are designed to do lots of math very, very fast, and are thus superior to humans in that regard.



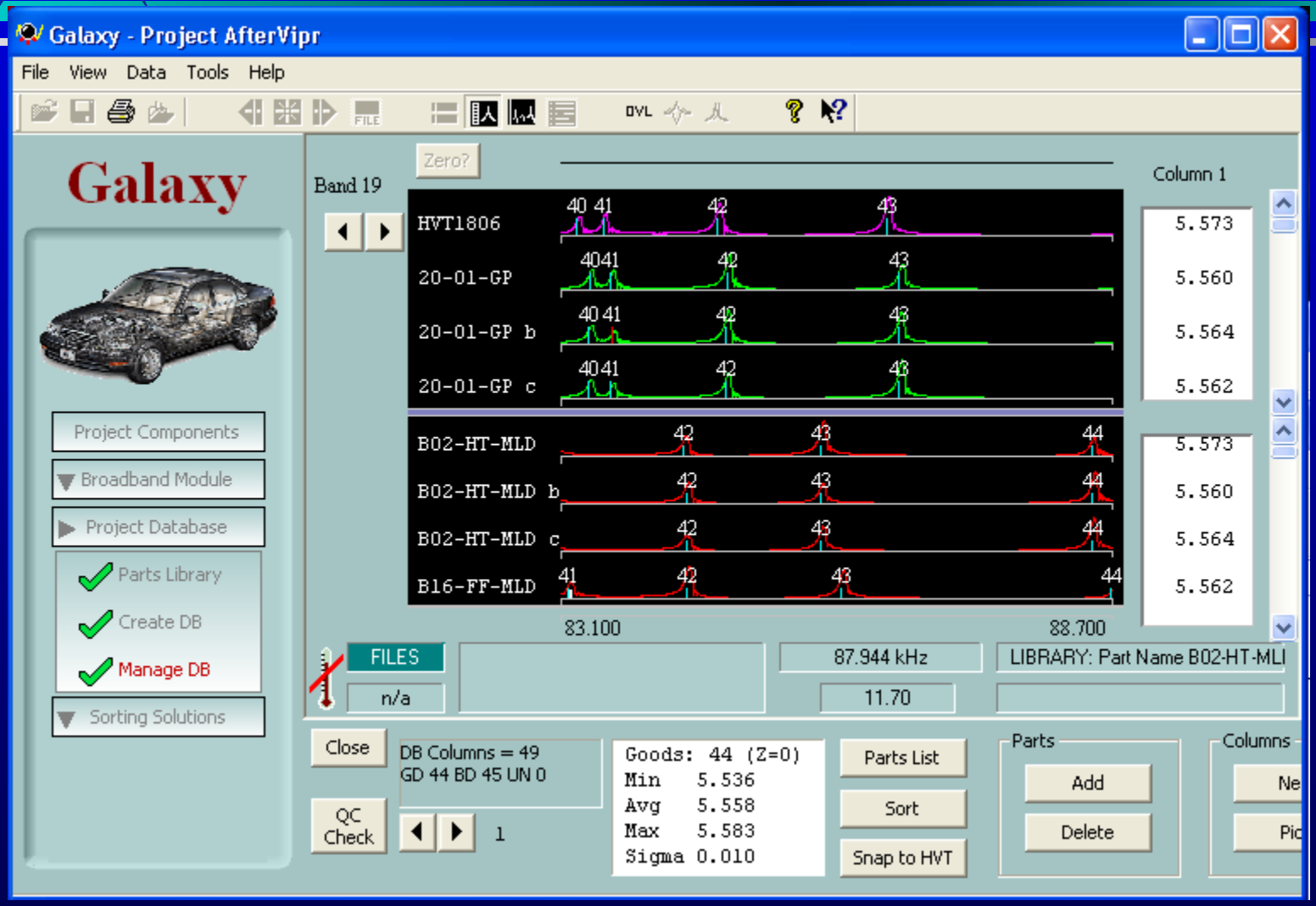
GA's for Dummies – the Booklet



Genetic Algorithms in Industry



Genetic Algorithms in Industry

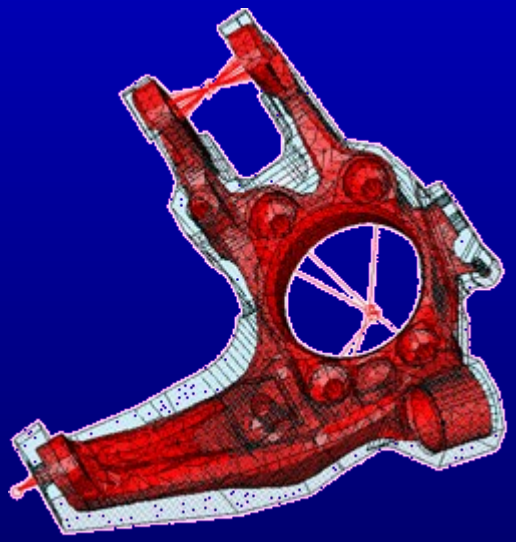


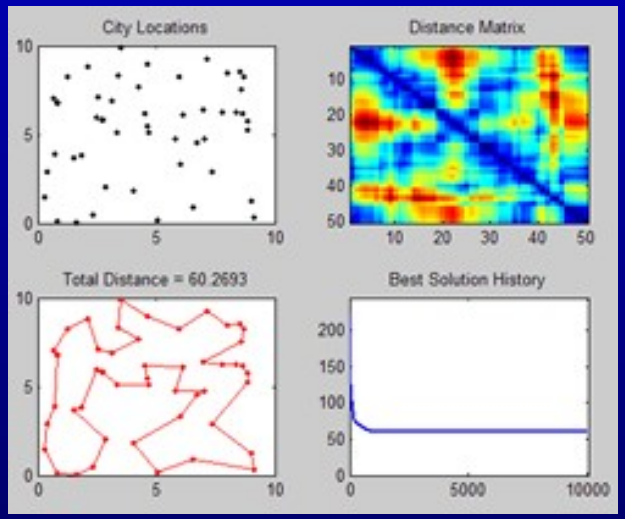
Even at 1500 groups evaluated by PC per second, 75 peaks in groups of 10 would require 17 years!

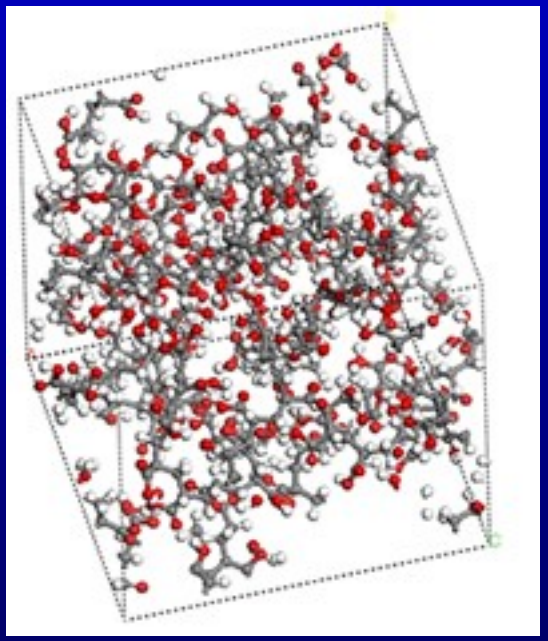
Genetic Algorithms in Industry

15 Real-World Uses of Genetic Algorithms

http://brainz.org/15-real-world-applications-genetic-algorithms/





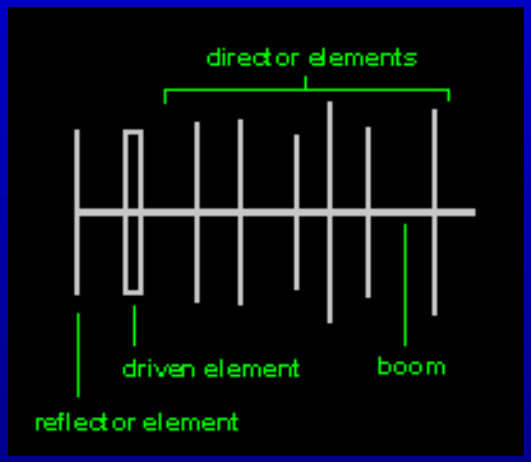


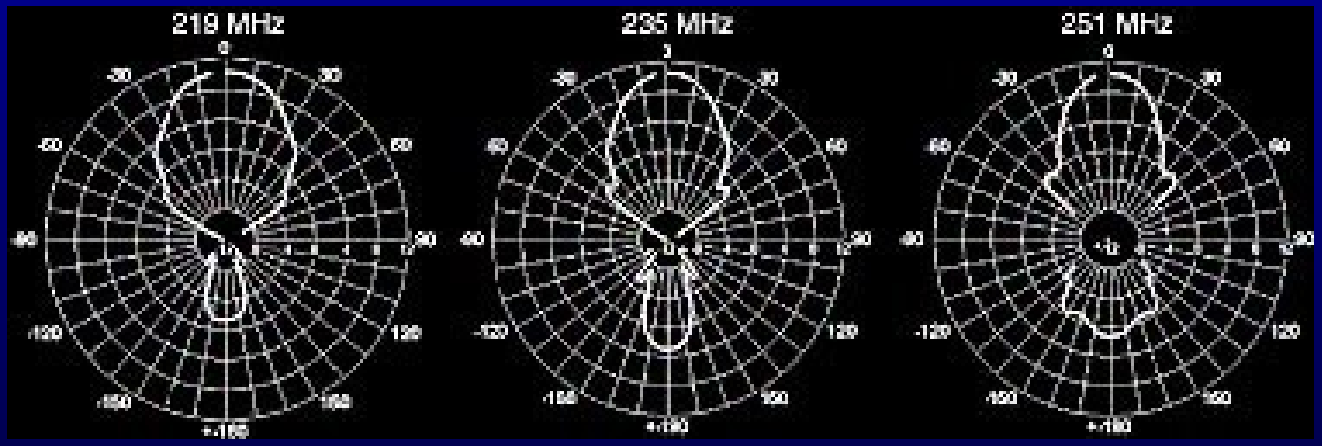
Genetic Algorithms in Industry

Antenna Design at NASA

NASA, Continued

http://ti.arc.nasa.gov/projects/esg/research/antenna.htm





Genetic Algorithms in Academia

http://discovermagazine.com/2005/feb/cover

Avida : Testing Darwin by Carl Zimmer

Digital organisms that breed thousands of times faster than common bacteria are beginning to shed light on some of the biggest unanswered questions of evolution

More Developments

Baylor University professor Robert Marks, and his "Evolutionary Informatics Lab"

More Developments

Evolution News & Views

September 5, 2007

News Analysis of Media Coverage of the Debate Over Evolution

« *The Privileged Planet*: Such a Dangerous Idea Its Author Had To Be Stifled | Main | Nine Gorilla Teeth and a Confession of Evolutionist Ignorance »

Academic Freedom Expelled from Baylor University

According to CSC senior fellow and leading ID theorist William Dembski, what follows is:

> "[A] big story, perhaps the biggest story yet of academic suppression relating to ID. Robert Marks is a world-class expert in the field of evolutionary computing, and yet the Baylor administration, without any consideration of the actual content of Marks's work at the Evolutionary Informatics Lab, decided to shut it down simply because there were anonymous complaints linking the lab to intelligent design."

Read on if you care at all about academic freedom and protecting the right of scientists to freedom of scientific inquiry.

What a difference a year or two makes. Or not. The ugly specter of academic suppression seems incapable of being dispelled at Baylor University. It first ghosted across the campus a number of years ago when leading ID theorist William Dembksi undertook

R. Marks on “Weasel”

“ID The Future” podcast, July 20, 2007

“We've looked at a number of elementary sort of evolutionary programs. I think a classical one for example, is out of Dawkins' book, where he talks about 'Methinks it is like a Weasel' and is able to quote-unquote 'evolve that' in I think 43 steps or something like that. Well it turns out that the process that he used actually infused a lot of information - a lot of beforehand knowledge of what he was searching for….”

First Rebuttal: Ewert, Dembski, Marks, April 2012

OPEN ACCESS

BIO-complexity

Research Article

Climbing the Steiner Tree—Sources of Active Information in a Genetic Algorithm for Solving the Euclidean Steiner Tree Problem

Winston Ewert,[1*] William Dembski,[2] Robert J. Marks II[1]

[1] Department of Electrical and Computer Engineering, Baylor University, Waco, Texas, USA; [2] Discovery Institute, Seattle, Washington, USA

Abstract

Genetic algorithms are widely cited as demonstrating the power of natural selection to produce biological complexity. In particular, the success of such search algorithms is said to show that intelligent design has no scientific value. Despite their merits, genetic algorithms establish nothing of the sort. Such algorithms succeed not through any intrinsic property of the search algorithm, but rather through incorporating sources of information derived from the programmer's prior knowledge. A genetic algorithm used to defend the efficacy of natural selection is Thomas's Steiner tree algorithm.

EDM 2012

The Darwinist claim is that no such assistance is required. Rather, natural selection is innately capable of solving any biological problem that it faces. Analogously, a genetic algorithm ought to be able to succeed given nothing more than the description of the problem faced. It should not be necessary for an intelligent agent to tune or direct the evolutionary process. Any process so tuned is a teleological process, not a naturalistic one. The argument from genetic algorithms depends on maintaining the ateleological status [13].

Has EDM never heard of...

Extinction?

Second Rebuttal: Ewert 2014

OPEN ACCESS

BIO-complexity

Critical Focus

Digital Irreducible Complexity: A Survey of Irreducible Complexity in Computer Simulations

Winston Ewert*

Biologic Institute, Redmond, Washington, USA

Steiner trees

Dave Thomas presented his model as a genetic algorithm that evolves solutions to the Steiner tree problem [16], a problem that can be viewed as how to connect a number of cities by a road network using as little road as possible. In his model Thomas penalizes excess roads and disconnected cities; the fitness function assesses a small penalty for each length of road and a large penalty for leaving any city disconnected.

Thomas claims that his model can evolve an irreducibly complex system:

> And finally, two pillars of ID theory, "irreducible complexity" and "complex specified information" were shown not to be beyond the capabilities of evolution. [16]

He makes this claim because removal of any roads in Figure 2 disconnects the network, and makes it impossible to travel

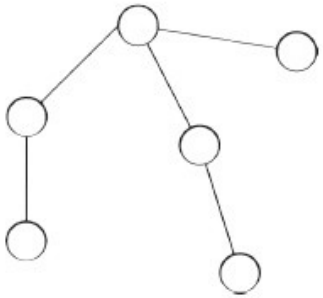


Figure 2: A depiction of a Steiner tree. The circles represent cities, and the lines, roads between the cities. doi:10.5048/BIO-C.2014.1.f2

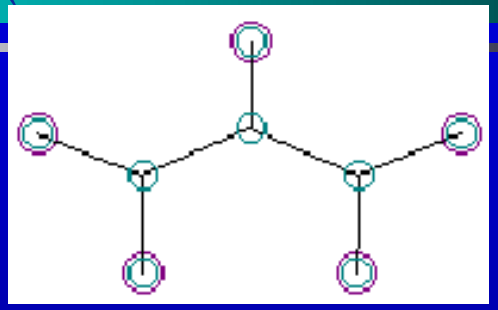
between some of the cities. According to Thomas, the roads are therefore the parts of an irreducibly complex system. It should be noted, however, that obtaining a connected road network is actually trivial—a connected network can be achieved by random chance alone. A depiction of such a network can be seen in Figure 2. The difficulty in the Steiner tree problem is in trying to minimize the amount of road used [21], not in getting a connected network. Therefore we can say that there are no intermediate evolutionary stages in obtaining such a network.

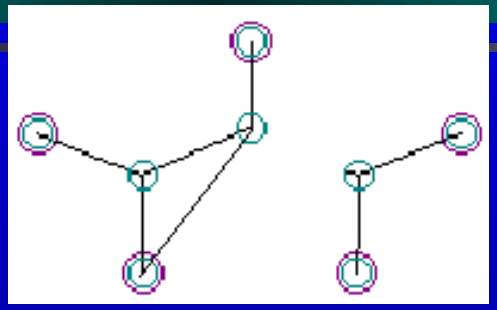
Irreducible Complexity: a "Barrier" to Evolution?

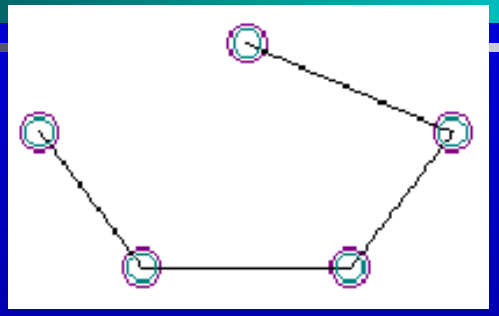
IC occurs when removal of *any part* of a complex system *breaks* that system.

"Since natural selection can only choose systems that are already working, then if a biological system cannot be produced gradually it would have to arise as an integrated unit, in one fell swoop, for natural selection to have anything to act on." - Michael Behe's book Darwin's Black Box

Ewert says Steiner Solutions are *not* "Irreducibly Complex"







Ewert simply discards the requirement that the network be minimal length, and substitutes a far easier problem, Minimum Spanning Trees (MSTs). Since random chance selections can happen upon MSTs fairly easily, Ewert says the solutions are thus trivial, and thus not really 'irreducibly complex' as per Behe's concept.

Ewert 2014

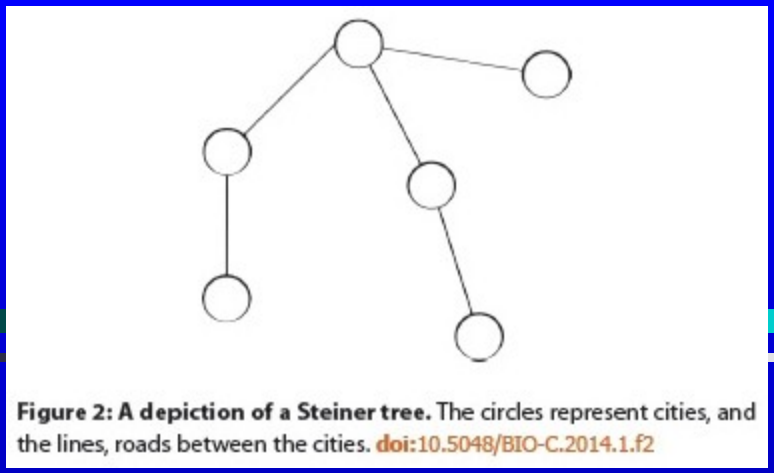


Figure 2: A depiction of a Steiner tree. The circles represent cities, and the lines, roads between the cities. doi:10.5048/BIO-C.2014.1.f2

Ewert: "According to Thomas, the roads are therefore the parts of an irreducibly complex system. It should be noted, however, that obtaining a connected road network is actually trivial–a connected network can be achieved by random chance alone. A depiction of such a network can be seen in Figure 2. *The difficulty in the Steiner tree problem is in trying to minimize the amount of road used [EDM 2012], not in getting a connected network.* Therefore we can say that there are no intermediate evolutionary stages in obtaining such a network."

Ewert 2014

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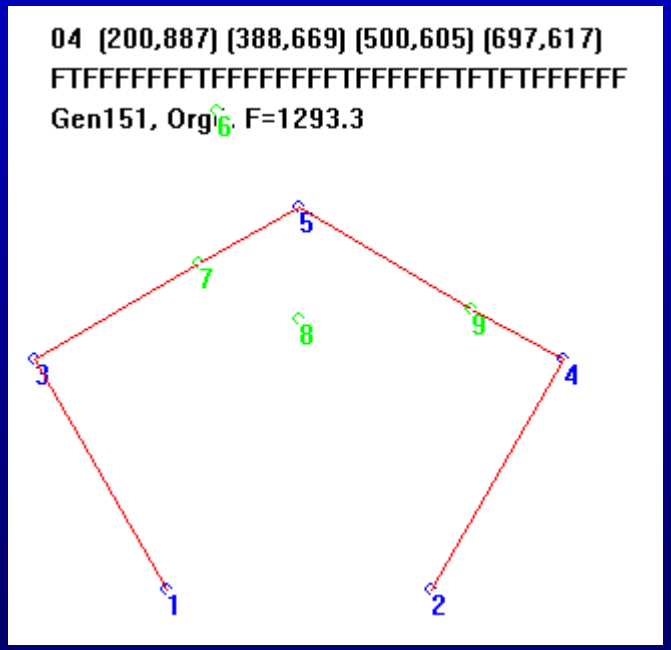
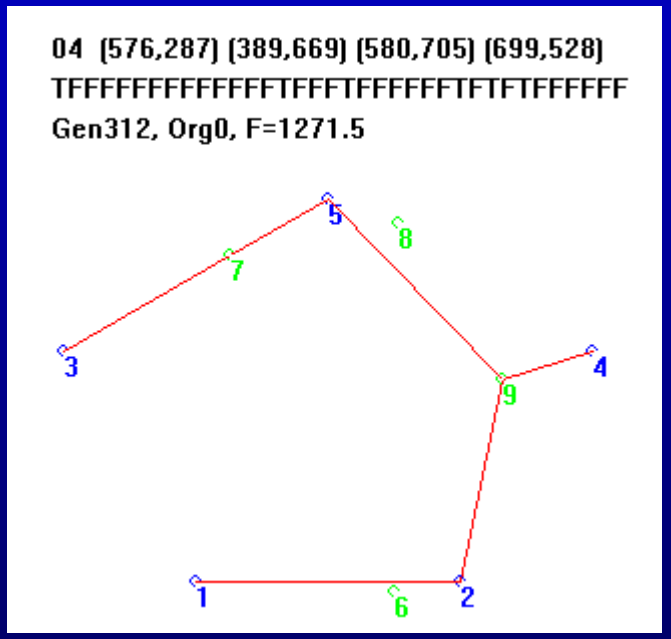


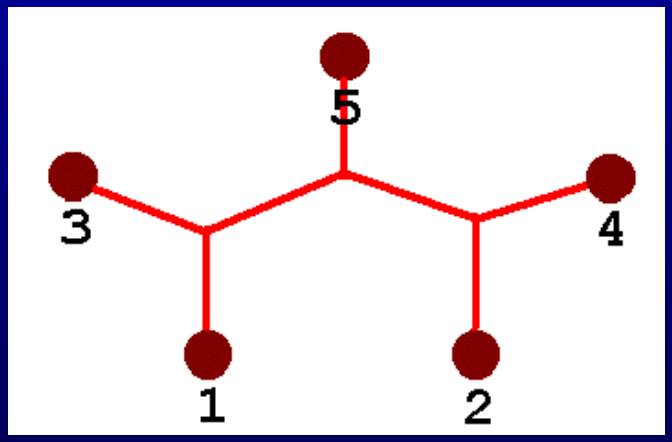
WRONG!



Equivocating Steiners with MSTs is a classic *STRAWMAN FALLACY*!

Complex Specified Information: another "Barrier" to Evolution?

The Steiner solutions themselves are CSI, by virtue of their being Complex (in the sense that the correct answer is rare enough to be improbable) and by virtue of their being Specified Information (as the formal Solution to a given math problem).



Consider this: Dawkin's example of "METHINKS IT IS LIKE A WEASEL" Has *ZERO* Complex Specified Information!!

Because Dawkins' algorithm converges every time, the probability is high (1.0), so the "complexity" is low(0.0). Dembki, "No Free Lunch: Why Specified Complexity Cannot Be Purchased Without Intelligence" (2002)

vary inversely—the greater the complexity, the smaller the probability.[15] It follows that Dawkins's evolutionary algorithm, by vastly increasing the probability of getting the target sequence, vastly decreases the complexity inherent in that sequence. As the sole possibility that Dawkins's evolutionary algorithm can attain, the target sequence in fact has minimal complexity (i.e., the probability is 1 and the complexity, as measured by the usual information measure, is 0).[16] Evolutionary algorithms are therefore incapable of generating true complexity. And since they cannot generate true complexity, they cannot generate true specified complexity either.

p. 183

Ewert 2016: Specified Complexity

Ewert: " ….specified complexity requires the calculation of probability according to the mechanism hypothesized to be in operation. Complex Specified Information is merely defined as at least 500 bits of specified complexity. Under Thomas's simulation, the optimal solution evolves 0.5 percent of the time. This is fewer than 8 bits of specified complexity. Consequently, the Steiner tree is not an example of Complex Specified Information. Thomas appears to be saying that it would have a large amount of specified complexity under a uniform random hypothesis, which would be true. However, that is irrelevant.."

Guessing the 5-point Steiner Solution by *Chance*: p = $1/10^{26}$

Steiner DNA

043494745005626504 75FFFFTFFFFFFFTFFTFFFFFTFTFTFT

2345678

1+:FFFFTFF

2+: FFFFFT

3+: FFTFF

4+: FFFT

5+: FTF

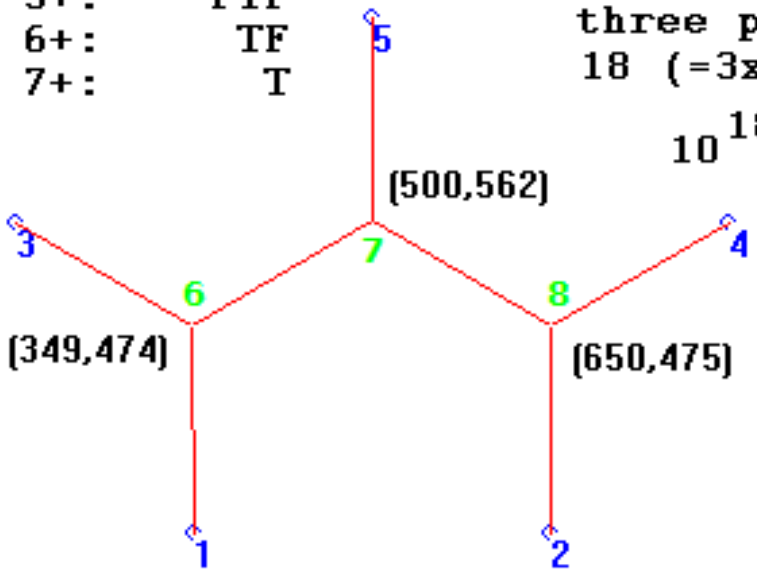
6+: TF

7+: T

8*7/2 = 28 LINKS

2^{28} POSSIBILITIES

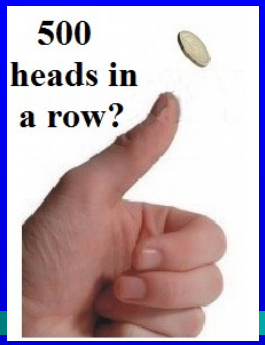
Number of ways to fill three points, requiring 18 (=3x2x3) digits, is 10^{18}, or ~2^{59}



(Uniform) probability to choose this solution randomly is $2^{28+59} = 2^{87}$, or 87 bits.

Uniform probability, 2^{87} ways (87 bits, P = 1 in 10^{26}); but 1/200 GA success means <8 Bits; *if the GA worked every time, ID's CSI would be 0 bits!*

Catch-22



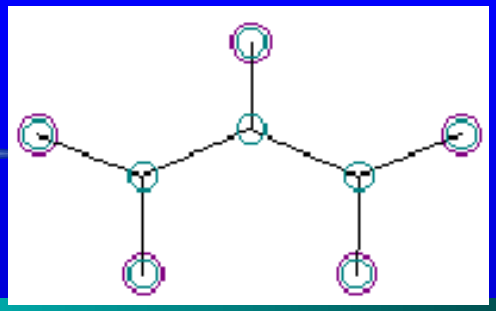
Under Dembski's definition of CSI ...
If the Genetic Algorithm under consideration *always* gets the answer to the posed problem, it has ZERO CSI.

If the Genetic Algorithm gets the answer, say, once in 200 trials, it has Less than 8 Bits of CSI ($2^8 = 256$).

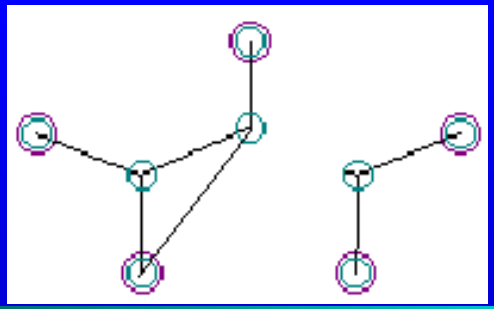
Only if the Genetic Algorithm gets the solution *rarely*, say once in 10^{150} trials, does it finally achieve the honor of possessing "500 Bits of CSI."

This is as rare as tossing a fair coin 500 times, and getting heads *every time*.

The Game is RIGGED: Evolution can *never* create CSI!



Summary

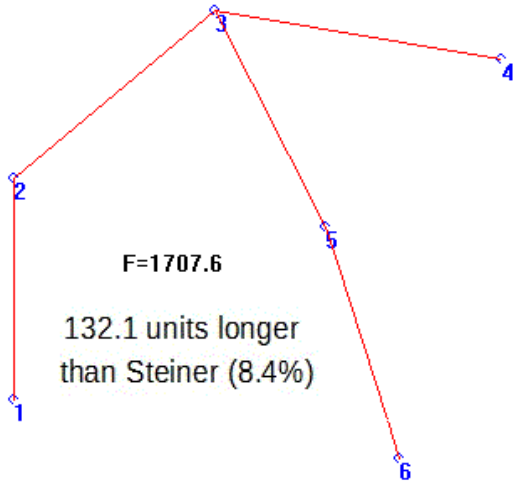


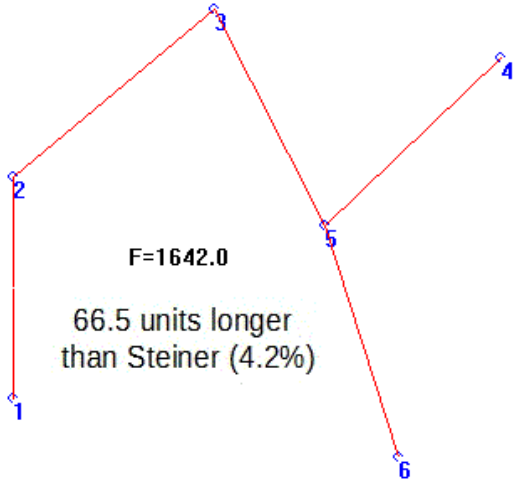
The Steiner GA solutions *are* "irreducibly complex", in the sense that they *are* complex, interconnected structures which would/could be rendered non-functional if even one element was removed or re-routed.

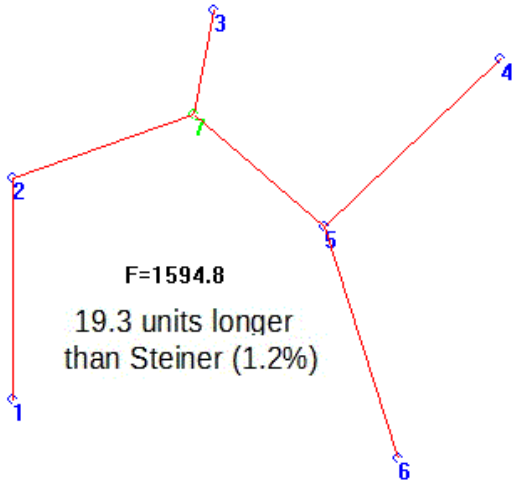
The Steiner GA solutions *are* "complex specified information", in the sense that they are complex, *specific* structures which are the only valid solutions of a class of math problems.

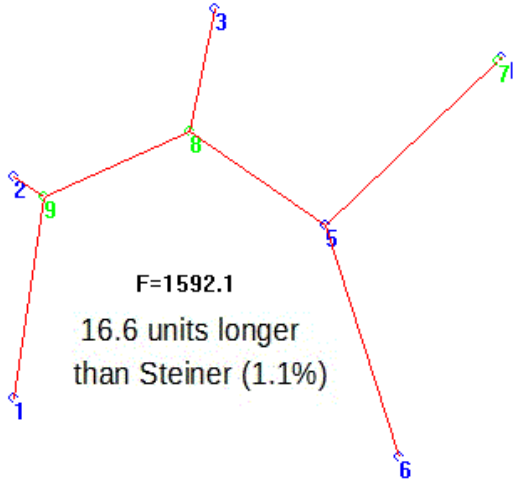
The Genetic Algorithm always gets answers, some better than others. Once in a while, it stumbles upon the ideal, best solution – and *no target is required*.

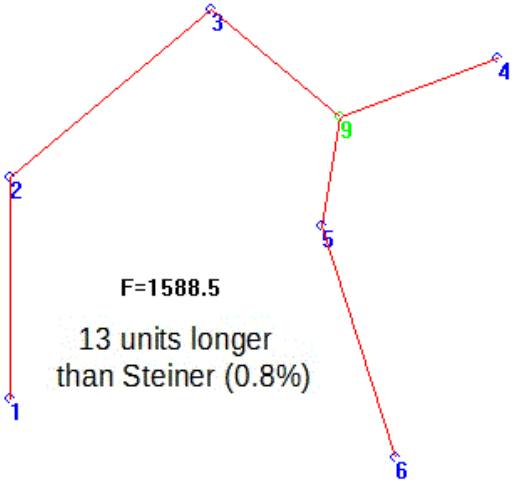
The Kicker

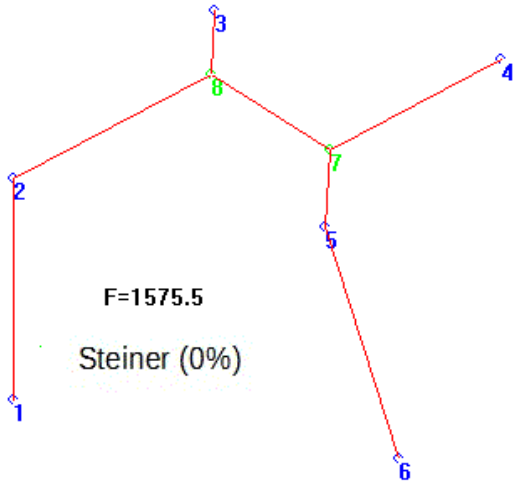

F=1707.6
132.1 units longer
than Steiner (8.4%)


F=1642.0
66.5 units longer
than Steiner (4.2%)

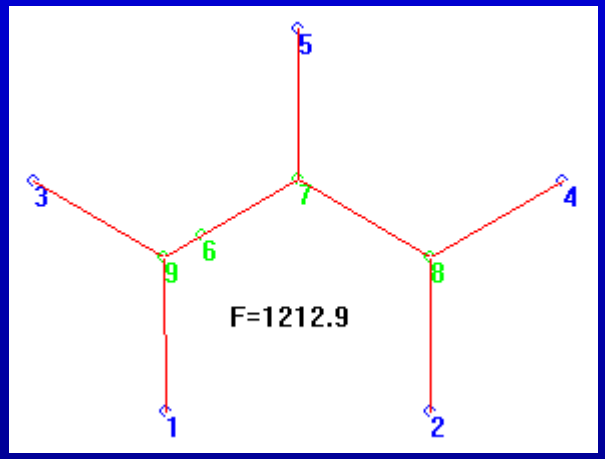

F=1594.8
19.3 units longer
than Steiner (1.2%)


F=1592.1
16.6 units longer
than Steiner (1.1%)

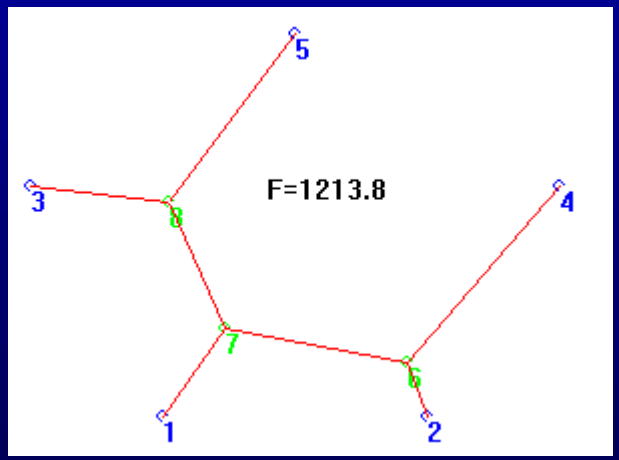

F=1588.5
13 units longer
than Steiner (0.8%)

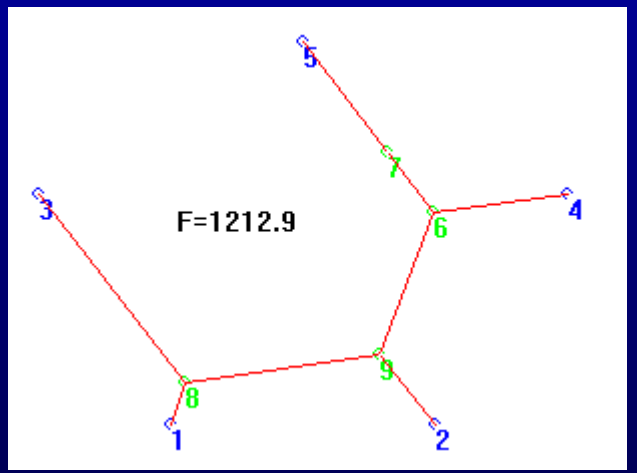

F=1575.5
Steiner (0%)

Hamlet – not just about Weasels



"There are more things in heaven and earth, Horatio, Than are dreamt of in your philosophy." - Hamlet





Conclusion

"Distant Targets" are not needed for Genetic Algorithms.

Genetic Algorithms can solve difficult, non-trivial Problems.

ID Creationists need to Move Past "Weasel"

ID Creationists Don't Always Tell the Truth

"Irreducible Complexity" and "Complex Specified Information" can Emerge in Unguided Evolutionary Simulations, and in Biology Too.

Evolution is Smarter than You Are

Final Comments

Intelligent Design Creationists need to move past simply attacking evolution, as if that somehow proves Creationism or ID.

The "Burden of Poof" is on them.

"The War of the Weasels: How an Intelligent Design Theorist was Bested in a Public Math Competition by a Genetic Algorithm!" Skeptical Inquirer Vol. 34.3, May/June 2010. http://www.csicop.org/si/
http://www.physics.smu.edu/pseudo/ID/War_of_the_Weasels.pdf (complete)

Dawkins' Weasel: The Blind Watchmaker, 1986

From a televised Presentation on the Blind Watchmaker

Link