Noesis

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Editorial

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Titan Test: Enclosed is the final version of my Titan Test. Since a senior editor at Omni nixed Omni's publication of the test, I have reverted to a version of the test that is quite similar to the format of the Mega Test, as you will notice, e.g., no multiple choices. This will make it possible to combine the best problems from this test with the best problems of the Mega Test at some future date, if that should ever seem desirable. I have put the scoring fee at $25.00 because that is how much I've been charging for scoring the Mega Test for the past year and because this test is comparable in length and difficulty to the Mega Test.

Chris Cole: There is a passing mention of member Chris Cole near the bottom of page 231 of a book titled Who Got Einstein's Office?, by Ed Regis, published recently by Addison Wesley. When I mentioned this fact to Chris by phone, he said he'd already read the book, and he seemed a little underwhelmed by it all, saying "Well, it's better than a poke in the eye." Incidentally, Chris's wife gave birth to their first child in mid-November, but I neglected to ask the name and gender.

John Sununu: Since my debts now total some $10,000, my income has dwindled to barely $250 per month, and Omni turned down my new test, I have been casting about for employment and decided to ask New Hampshire Governor John H. Sununu, who has been designated to serve as White House Chief of Staff in the Bush Administration, if there might be some job for me under him, perhaps as a research assistant of some kind in view of my background as a librarian, my recent Ph.D. in philosophy, and my still more recent receipt of the Rockefeller Prize for my philosophical essay on truth. Sununu had scored very high on my Mega Test in 1985: 44 out of 48, as reported in the January 1986 issue of Omni, p. 112. To my pleasant surprise, Governor Sununu sent me an encouraging response, which I reproduce on the following page.

Editing "Noesis": I intend to continue editing this journal at least through issue 36. If any member would like to serve as editor for issues 37 through 48 (April 1989-March 1990), let me know. You should be willing and able to put out an issue every month even if you have received no material from members during some of those months. You can use newspaper clippings or your own essays, puzzles, etc., to fill up an issue for which you have received insufficient material from other members. The important criteria are (1) monthly regularity, and (2) including material that will be of some interest or relevance to the members. I will continue as editor so long as no suitable replacement has come forward.

OFFICE OF THE PRESIDENT-ELECT
WASHINGTON, D.C. 20270

November 28, 1988

Mr. Ronald K. Hoeflin
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Dear Ron:

Thank you very much for your letter. As you know my schedule the past few years has been rather hectic and I have not been able to stay in touch.

I have sent your resume to the Transition office with a strong recommendation. Please keep me posted as to any progress and communication you hear from them.

Thanks for taking the time to write. See you soon I hope.

Sincerely,

Governor John H. Sununu

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never be built because such a machine would destroy itself before it was created, Dr. Thorne said. "But we show in our paper that with wormholes this does not have to happen," he said.

The question of whether or not wormholes could be used for cosmic voyages through space and time hangs on one issue, the physicist said: whether or not a theoretical relationship called the "averaged weak energy condition" can be violated. If this mathematical relationship, which relates to subtleties of quantum theory, can be violated — and Dr. Thorne believes this is possible — then wormholes could hypothetically be used for travel.

Vast though the philosophical implications might be of the breakdown of physical causality in a hypothetical time machine, Dr. Thorne and his collaborators brush them aside.

"We're not forced to confront any philosophical implications because this is theoretical physics, not philosophy," he said. "It may turn out that the averaged weak energy condition can never be violated, in which case there could be no such things as traversible wormholes, time travel or a failure of causality. It's premature to try to cross a bridge before you come to it."

THE NEW YORK TIMES, TUESDAY, NOVEMBER 22, 1988

3 Scientists Say Travel in Time Isn't So Far Out

By MALCOLM W. BROWNE

COULD some advanced civilization devise a tunnel that would open shortcuts through space between distant regions of the universe or through time into the past?

The traditional reaction of most scientists to such notions is to dismiss them as naïve science fiction. But three theoretical astrophysicists have published a suggestion that the laws of physics might not prohibit such "wormhole" travel through space and time.

Dr. Kip S. Thorne and Dr. Ulvi Yurtsever of the California Institute of Technology and Dr. Michael S. Morris of the University of Wisconsin presented their startling conclusion in a recent paper in Physical Review Letters. This prestigious scientific journal is an official publication of the American Physical Society, and it accepts scientific papers for publication only after they have been rigorously reviewed by independent experts.

Dr. Thorne and his colleagues stopped short of predicting that anyone will ever travel through cosmic "wormholes." It has yet to be proved whether such travel is or is not theoretically possible, they contend. But such travel cannot now be ruled out, they said, although it will probably be possible to settle the issue one way or the other on theoretical grounds. Science would profit from a concerted effort to resolve the question, they said.

If travel into the past could be shown to be at least theoretically possible, the mere possibility would have profound philosophical and scientific consequences. Since a time traveller might theoretically be able to change events that occurred in the past, including his or her own birth, the rules of causality on which science is based would be thrown into confusion.

In summarizing the complex mathematical analyses presented in their report, the scientists concluded: "If the laws of physics permit an advanced civilization to create and maintain a wormhole in space for interstellar travel, then that wormhole can be converted into a time machine with which causality might be violatable. Whether wormholes can be created and maintained entails deep, ill-understood issues."

The possible existence of "wormholes" is a theoretical consequence of Einstein's General Theory of Relativity, which also providedthe theoretical basis for black holes, regions in space where the density of matter approaches infinity and where both space and time are warped in bizarre ways.

For ordinary journeys through space, the traveller must proceed through three dimensions of space and one dimension of time, following

a mathematically curved trajectory analogous to the trajectory a worm follows while crawling over the surface of an apple. But if a traveller could find a higher-dimensional shortcut where space was warped into a tunnel piercing the innards of the apple — a wormhole — the journey to a distant point on the surface could be greatly shortened. Such was the reasoning that has led to much speculation about wormholes during the past few decades, although scientists have never discovered a real one.

In 1935 Einstein and Nathan Rosen calculated that a super-dense object would curve spacetime (the combined mathematical representation of space and time) so tightly that a kind of "throat" would form connecting two different regions of space.

Relativity and theoretical astrophysics draw from a branch of mathematics called topology, which studies the deformations in geometric constructions. One such construction is a simple, two-dimensional surface that merges with a protruding "handle." The surface of the handle is actually a stretched and distorted extension of the two-dimensional surface. The surface of the handle of a coffee cup, for example, is actually an extension of the surface of the cup itself, despite its deformed shape.

Topology permits the existence of "handles" in higher-dimensional space as well as in two-dimensional surfaces like the outsides of coffee cups (although higher-dimensional handles are impossible to visualize in a literal way).

Topological considerations of higher-dimensional space and time have led to speculation that a signal or object might pass along a handle as a shortcut between regions distant in space or time or even between parallel, mutually invisible universes. These hypothetical connecting tunnels through space and time would be wormholes.

Among the many astrophysicists Dr. Thorne and his colleagues consulted during the yearlong preparation of their wormhole report was Dr. Robert M. Wald, a prominent theoretical physicist at the University of Chicago. Dr. Wald said in an interview that spacetime "handles" spontaneously spring into and out of existence at the "quantum level" — the ultrasmall world of subnuclear particles.

Within such a minuscule region, which is far smaller even than an atom, quantum "fluctuations" continuously occur; particles spontaneously jump into and out of existence or change in character. The dramatic changes that go on inside the microstructure of what scientists call the "quantum foam" are not generally observed in the ordinary world because their scale is too small and their collective averaged effects cancel each other out.

But experiments have shown, Dr. Thorne said in an interview, that events within the "quantum foam" can be manipulated to some extent, producing effects observable in the "classical" world — the everyday world we can see and touch. Perhaps someone some day might even grab a fleeting quantum wormhole and make use of it in our large-scale frame of existence.

"One can imagine an advanced civilization pulling a wormhole out of the quantum foam and enlarging it to classical size," the scientists wrote. To keep the wormhole from snapping shut the instant it was created, the researchers suggested application of an arcane quantum effect on the electromagnetic field in the wormhole that might be induced by putting plates of gold or copper at opposite ends of the wormhole.

If the two ends of a traversible wormhole happen to be near each other, the scientists said, the hole could be used as a time machine. By pulling on one of the mouths either gravitationally or electrically, superbeings might accelerate the mouth to nearly the speed of light, reverse its direction, and return it to its point of origin. Because of the relativistic slowing-down of time experienced by any object moving at high speed, the mouth that traveled out and back would have aged less than the mouth that stayed behind. A traveller moving from the stationary mouth through the wormhole to the mouth that had made a speedy round trip would thus "travel backward in time and thereby, perhaps, violate causality."

Previous studies by some theorists of the possibility of time travel have concluded that a time machine could

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THE TITAN TEST

by Ronald K. Hoeflin
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Introduction

The Titan Test is a challenging, untimed, unsupervised intelligence test for brighter-than-average adults that you can take at home in your spare time. It consists of the best problems from six preliminary tests that were tried out on volunteers between 1985 and 1988. Its primary purpose is to serve as an admissions test for various high-IQ societies, but you are welcome to try it out of sheer curiosity or for the pleasure of it. A twin to this test, the Mega Test, was published by Omni magazine in 1985, is mentioned in the Guinness Book of World Records, is accepted for admission purposes by seven high-IQ societies, and will be sent to anyone who attempts this test. The names and addresses of eleven high-IQ societies, including the seven that accept the Mega Test, will be listed on the score report form for the Titan Test. If and when I am informed that the Titan Test will also be accepted for admission purposes by these organizations, this fact will also be indicated on the score reports.

Instructions

Answer sheet: Put your answers on one side of a single sheet of 8½ by 11 inch paper arranged in two columns numbered 1-24 and 25-48.

Information requested: In the upper righthand corner of your answer sheet give your name, address, age, sex, and (optionally) your scores on any previously taken IQ or aptitude tests, specifying the name of each test. (Note: Mega Test scores should be reported only in raw-score form, not as an IQ or percentile.)

Time limit: There is no time limit, but it would be reasonable to spend about one month on the test.

Guessing: When you are uncertain of an answer, there is no extra penalty for guessing rather than leaving the item blank.

Reference aids: You are encouraged to consult any books you like to solve the problems but should not ask any advice from others.

Calculating devices: You should not use any calculating device or computer to solve any of the problems--except pencil, paper, and your own brain.

Multiple attempts: You may try the test no more than once. If you are dissatisfied with your score, it is recommended that you try the Mega Test.

Scoring fee: There is a $25.00 scoring fee, which is necessary in order to finance the wide distribution of the test. Make check or money order payable to "Ronald K. Hoeflin."

Mailing address: Mail your answer sheet, scoring fee, and two stamped, self-addressed envelopes to the address given at the top of this page.

Score reports: Your total raw score (number of problems solved correctly) will be sent to you immediately. Your IQ and percentile performance vis-a-vis the general population will be sent whenever sufficient data has accumulated about previous test scores.

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Verbal Problems

Analogies

For each of the following 24 verbal analogies, write the word or prefix that best completes the analogy. For example, in the analogy Fish : Mermaid :: Vulture : ? the best answer would be Harpy, and in the analogy Man : Woman :: Andro- : ? the best answer would be Gyno-.

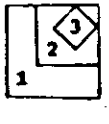
1. Eye : Ophthalmo- :: Navel : ?
2. Catch-22 situation : Heller :: Sour-grapes attitude : ?
3. God : Theology :: Final events : ?
4. Tire : Retread :: Parchment : ?
5. All is one : Monism :: All is self : ?
6. Lacking money : Penurious :: Doting on one's wife : ?
7. Sword : Damocles :: Bed : ?
8. Thing : Dangerous :: Spring : ?
9. Hollow victory : Pyrrhic :: Hollow village : ?
10. Pillar : Obelisk :: Monster : ?
11. 4 : Hand :: 9 : ?
12. Gold : Malleable :: Chalk : ?
13. Easy job : Sinecure :: Guiding light : ?
14. Leg : Ambulate :: Arm : ?
15. Mosquito : Malaria :: Cannibalism : ?
16. Hear : See :: Temporal : ?
17. Astronomy and physics : Astrophysics :: History and other disciplines (e.g., economics, statistics, data processing) : ?
18. Jekyll : Hide :: Eloi : ?
19. Universe : Cosmo- :: Universal laws : ?
20. Set of sets not members of themselves : Russell :: Darkness of the night sky in an infinite universe : ?
21. Teaching : Uplifting :: Pedagogic : ?
22. Language games : Ludwig :: Piano concerti for the left hand : ?
23. Idols : Twilight :: Morals : ?
24. Sweetness : Suffix :: Boatswain : ?

Spatial Problems

Two-dimensional Patterns

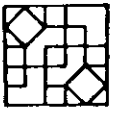
What is the minimum number of squares--unfolded, uncut, unmarked, opaque, and lying flat on top of one another--that would be sufficient to create each of the following patterns, including the bottom square in your total?

Example:

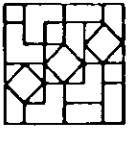


25.

26.



27.



Three-dimensional Patterns

28. If each side of a tetrahedron is an equilateral triangle painted white or black, five distinct patterns are possible: all sides white, all black, just one side white, just one black, and two sides white and two black. If each side of an octahedron is a white or black equilateral triangle, how many distinct patterns are possible?

29. Suppose 27 identical cubes are glued together to form a cubical stack as illustrated at right. If one of the small cubes is omitted, four distinct shapes are possible: one where the omitted cube is at a corner of the stack, one where it is at the middle of an edge of the stack, one where it is at the middle of a side of the stack, and one where it is at the core of the stack. If two of the small cubes are omitted rather than just one, how many distinct shapes are possible?

30. Suppose a diagonal is drawn across each side of a cube from one corner to the other, as illustrated at right. How many distinct patterns are possible, considering all possible orientations of the diagonals?

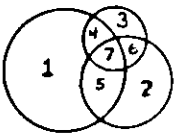
Slice and Dice

31. A perfectly spherical onion is sliced by six perfectly straight knife strokes, the pieces thereby formed never being moved from their original positions. What is the maximum number of pieces into which the infinitessimally thick spherical layer of outer skin of the onion can thus be divided?

32. A tetrahedral lump of clay illustrated at right is sliced by six perfectly straight knife strokes, the pieces thereby formed never being moved from their original positions. What is the maximum number of tetrahedral pieces that can thus be formed, counting only pieces that are not further subdivided?

33. Consider a torus, a doughnut-shaped solid whose surface is formed by a circle rotated about an axis in the same plane as the circle that does not intersect the circle. And consider a Möbius strip, a one-sided surface formed by holding one end of a rectangle fixed, rotating the opposite end through 180 degrees, and attaching it to the fixed end. Suppose such a torus is sliced three times by a knife that each time follows the path of a Möbius strip whose curvature is absolutely uniform, lacking any kinks or undulations. Into how many pieces at maximum can such a toroidal solid thus be divided if the pieces are never moved from their original positions?

Interpenetrations



34. Three interpenetrating circles yield a maximum of seven pieces, as illustrated at right, not counting pieces that are further subdivided. At most how many pieces that are not further subdivided can be formed when three circles and two triangles all interpenetrate?

35. If a cube and a tetrahedron interpenetrate, what is the maximum number of pieces (i.e., completely bounded volumes) possible, counting only pieces that are not further subdivided?

36. If two right circular cones and one right circular cylinder interpenetrate, what is the maximum number of pieces (i.e., completely bounded volumes) possible, counting only pieces not further subdivided?

Numerical Problems

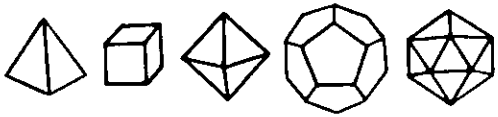
Probabilities

37. Suppose you are truthfully told that ten marbles were inserted into a box, all of them identical except that their colors were determined by the toss of an unbiased coin (i.e., a coin that has a 50 percent chance of turning up heads and a 50 percent chance of turning up tails at any given toss). Each time the coin turned up heads a white marble would have been placed in the box and each time tails a black one. You are not allowed to inspect the marbles while they are in the box, but you may select a marble at random, take it out of the box in order to inspect its color, then return it to the box and mix it thoroughly with the other marbles before again selecting a marble at random for inspection. If you inspect ten marbles in succession in this manner and all turn out to be white, what is the probability to the nearest whole percent that all ten marbles in the box are white?

Suppose there is an ant at each vertex of a triangle and the three ants simultaneously crawl along a side of the triangle to the next vertex. The probability that no two ants will encounter one another is 2/8 since the only two cases in which no encounter occurs are when the ants all go left (clockwise)--LLL--or all go right (counterclockwise)--RRR. In the six other cases--RRL, RLR, RLL, LLR, LRL, and LRR--there will be an encounter. For the following five problems imagine there is an ant at each vertex of a polyhedron and that the ants all simultaneously crawl along one of the edges of the polyhedron to the next vertex, each ant choosing with equal probability among the edges that meet at its starting point. Determine the probability that no two ants will encounter one another either en route or at the next vertex for each of the following polyhedra, reducing the fraction to lowest common denominators (e.g., 2/8 in the foregoing example would be reduced to 1/4):

38. A tetrahedron.
39. A cube.
40. An octahedron.
41. A dodecahedron.
42. An icosahedron.

The following figures, from left to right, illustrate the polyhedra named at left, from top to bottom.



Number Sequences

Determine the value of (?) in each of the following sequences. For example, in the sequence 1 4 9 16 25 36 49 (?) the value of (?) is 64, and in the sequence 1 4 (?) 16 25 36 49 the value of (?) is 9.

43. $\frac{4}{10}$ $\frac{(?)}{100}$ $\frac{168}{1,000}$ $\frac{1,229}{10,000}$ $\frac{9,592}{100,000}$ $\frac{78,498}{1,000,000}$
44. 1 4 17 54 145 368 945 (?)
45. 0 6 21 40 5 -504 (?)
46. 2 15 1,001 215,441 (?)
47. 7 8 5 3 9 8 1 6 3 (?)
48. 1 2r πr^2 $4\pi r^3/3$ (?)

End of Test