Noesis #43
November 1989

Dear Members:

I expect you have noticed the irregularity with which Noesis has been published in these last few months. The efforts of those members scheduled to be responsible for Noesis during the aforementioned period of time are much appreciated by me. I know I have been only minimally involved as an organizer, and I have not been good about mailing material to be included in these issues.

The reasons for these developments are complex and numerous. I have a new baby daughter. I have been seeking (and undertaking) new positions of employment. The relatively few moments I am allowed each day for scholarship I find difficult to use for anything but the most pleasurable of pursuits, e.g., mathematics, reading, and various other meditations.

Because of how important this society (whatever its name is today) and Noesis are to many other members and me, I believe it would be best if another editor could be found. Please, someone volunteer. I wait anxiously, and am

Your most humble and obedient, &c.,
Eric Erlandson

P. S. Jim Hajicek has voluteered to provide address labels to members whose month it is to put out Noesis.
P.P.S. That Dean Inada's November issue is so late is entirely my fault.

[To be fair, it was rather lazy of me to wait until someone sent me the material to start thinking about this issue. - Dean]

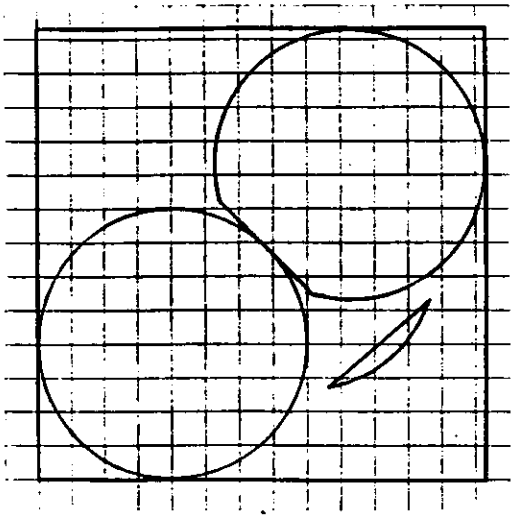
As we are running behind, the December issue may be delayed as well. (Unless C. M. Langan has already sent it out ahead of this one.)

BTW, I've heard that Omni has agreed to publish Ron's Titan test.

Problem submitted by Eric Erlandson.

I have taken the liberty of copying the following problem from Ogilvy's Excursions in Geometry which was published in 1967. It was originally posed by Mason Henderson a year or two earlier in an issue of The Journal of The American Mathematical Society. I have been unable to find out whether it has yet been solved for a simple formula or not. I shall share my answer when I have finished it.

Ogilvy neglects to mention that for up to a certain "h", the configuration shown below must be used.



A *disk* is a circle together with its interior points. Let A and B be equal disks. If A is cut by a chord into two pieces A_1 and A_2, what is the smallest square that covers A_1, A_2, and B placed so as not to overlap each other? If h is the height of the smaller piece of A, then the solution is known to depend on h and has been completely determined for some h. For instance, if h is large enough, a configuration like that of Fig. 110A will do, but for lesser h it is necessary to switch to Fig. 110B. The transition values of h are not known. A

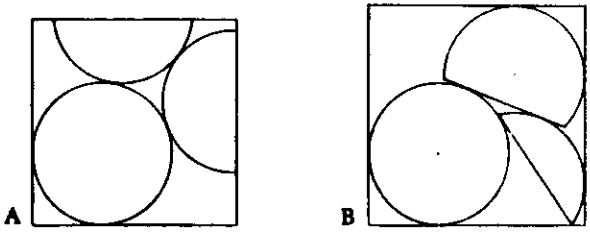


Fig. 110.

formula for the length of the edge of the square in terms of h is what is wanted here. In three dimensions the problem may be more difficult: Given two equal spherical balls, one sliced into two pieces by a plane, what is the smallest cubical box that will contain these three convex bodies?

Why Call It "The One-in-a-Million Society"?

Ronald K. Hoeflin
P. O. Box 7430
New York, NY 10116

According to "Active High-I.Q. Societies," which is reproduced on the following page from issue 2 of the Four Sigma Bulletin, the membership of the Mega Society has decided no longer to claim to discriminate at the one-in-a-million level. But it apparently intends to retain the name "Mega Society" that I gave it. This is all the result of a years-long effort by Mr. Kevin Langdon to undermine the basic raison d'etre of that organization, which was that of being a one-in-a-million high-IQ society.

Now that the sixth norming of my Mega Test puts the one-in-a-million level on that test at a raw score of 43, a one-point upward adjustment of our minimum cut-off form 42 to 43, where it originally stood, makes this society a one-in-a-million organization. We are therefore in a position to assume the mantle of intellectual leadership which the Mega Society has cast aside. I feel that we can most effectively manifest our intention of adhering to a one-in-a-million admission standard by adopting as our name the unambiguous title: "The One-in-a-Million Society."

By coincidence, The Encyclopedia of Associations has just sent me a new form for updating information about our society for its next edition. The form had to be returned within 15 days, so I only had time to contact a few members by phone rather than conduct a leisurely discussion and vote on this name change. The members I contacted were amenable to the name change, but our editor asked me to supply this written explanation in order to share with you my rationale for this change.

[I don't seem to have the "following page" from the Four Sigma Bulletin. Whoever has it should probably send it to C. M. Langan for the next issue]

Dear Chris, August 9, 1989

You suggested that aesthetics can be reduced to physics by simply correlating color reports with brain patterns, for instance--perhaps somewhat analogous to lie detector methodology--so that we could eventually detect what subjective experience a person is having using the brain pattern alone.

This reminds me of the joke about two behaviorists who meet each other on the street. Says one behaviorist to the other: "You feel fine. How do I feel?"

The point is that at some point or other the subjective aspect of sensations has to enter the picture. The correlations alone merely say that two sensations are similar if the associated brain patterns are similar. But this does not tell you what the sensations are unless you experience them at least once yourself subjectively.

As an analogy, you can come across a given symbol or word in an ancient language repeatedly and surmise that it probably means the same thing in each occurrence, but this does not tell you what the word means unless the ancient language has been deciphered and can be translated into a familiar language, whence one can connect it with one's own subjective sensations.

Suppose a bunch of statisticians tried to create a "works of art" by attaching electrodes to people's heads and then detecting whether they felt pleasure or pain when certain colors or sounds were presented to them in various combinations. This might be great science but it would be lousy art. The great artist subjectively feels the impact of the color or sound patterns he is putting together, at least in terms of mental images if not actual colors and sounds.

Physics so simplifies the subjective aspect of its work that the physicist readily loses sight of the subjective dimension of his enterprise and may imagine, incorrectly, that it can be dispensed with entirely, or that it is non-cognitive in nature and hence has no interest intellectually, although it may have a purely emotional interest. But a great work of art--a Beethoven symphony, a Rodin sculpture, a Tolstoy novel--does require intelligence and not sheer emotion to be created and enjoyed. Even if one could translate a Beethoven symphony into mathematical language, it still has to be translated back into sounds to be properly understood and enjoyed. So the point I want to make is that art and physics are two separate cognitive enterprises--everything of cognitive interest does not reduce to the equations of theoretical physics.

Your view that there is only one possible universe is, as I mentioned in Chicago, tantamount to equating math with physics. So in your world view everything of cognitive interest apparently collapses into a one-dimensional physicalism. When I began my study of philosophy that is pretty much the same view I had. I was what Pepper would call a mechanist. It has taken years for me to work myself up to my present wider perspective.

Pepper is aware of your criticism of a purely classificatory approach such as his philosophy and mine seem to involve. He says in Concept and Quality (p. 430) that "As soon as a science takes on its mature mathematical form, it abandons classifications as a grown man

puts off childish things." But even in high-energy physics one still has such "classifications" as up, down, top, bottom, charmed, and strange quarks, which only a more mature theory such as superstring theory may eventually "explain" mathematically so that the different types of quarks become more intelligible as perhaps different phases of some single oscillating "string."

So if you can tolerate such primitive concepts as the six types of quarks in modern physics, surely I'm not being too obtuse to propose five phases of a purposive act. What makes a purposive act relevant to metaphysics is that knowledge <u>of</u> <u>something</u> is always <u>knowledge</u> of something, i.e., we cannot slice off the "knowledge" aspect as if it were irrelevant. And all knowledge derives from one or another of the phases of a purposive act, in my view: aesthetic knowledge from the fifth phase, mathematical knowledge from the fourth, etc.

The mathematization of this primitive five-fold classificatory schema can already be viewed as well under way in the form of the various basic types of logic: deontic, modal, many-valued, etc.

Just as types of subatomic particles are not isolated brute facts but have interrelationships that are gradually being filled in by research, it stands to reason that the major cognitive domains of art, mathematics, etc., might have similar underlying interrelationships. That philosophy has as its traditional "branches" aesthetics, ethics, epistemology, and inductive and deductive logic might to the casual observer seem like an accidental collection of completely unrelated subjects. My theory suggests how they are all interrelated, just as physicists seek for interrelationships among the types of subatomic particles.

Can my theory be falsified? Ask yourself how any complex theory can be falsified. Isolated contradictions do not falsify it, just as a minor mechanical difficulty need not have discouraged the Wright brothers while they were developing powered flight.

Heavier-than-air flight simply cannot be "refuted"--witness the flight of birds, for instance. But propeller-driven flight might have been abandoned by the Wright brothers if they had encountered massive and repeated failures.

Purposive acts exist as surely as does the flight of birds, but how useful they will be to philosophers, like the usefulness of the plane to post-1903 mankind, is something that only time will tell.

Think of all my different interpretations of philosophical structures in terms of the purposive act. These are like different primitive models of heavier-than-air craft. Some may prove more "airworthy" than others. I have encountered many philosophical structures that have not proved amenable to analysis in terms of the structure of a purposive act. So even I can see that some of my "models" are unairworthy for the outset. But to insist that my entire theory must in some sense be "falsifiable" is like insisting that heavier-than-air flight be "falsifiable." I think falsifiability is not a completely clear or completely adequate criterion of cognitive worth, as you seem to assume it is. Heavier-than-air flight was not truly falsifiable either before 1903 and even less so after 1903. If anyone in <u>1989</u> argued for the falsifiability of propeller-driven aircraft, he'd clearly be a crank or a lunatic, or some fatuous paradox-poser, perhaps.

My theory <u>cannot</u> be falsified, but this does not mean either (1) that my theory is worthless, or (2) that my theory is perfect, just as the Wright brothers' biplane was not falsifiable yet was neither worthless nor perfect.

Ron

The Lessons of Allais Revisited

Chris Cole

There are four comments that I would like to make in response to Eric Hart's article on the Allais paradox.

First, Eric states that the ability to self-program does not make brains non-universal computers. I agree with this.

Second, Eric states that the pre-programming of brains similarly does not make brains non-universal. I agree with this also.

Third, Eric states that people analyze the choice in the Allais paradox on the "bird in hand" or "double or nothing" basis. I agree with this. However, the odds in this case are not two to one. My point is simply that a perfectly rational being would not be blinded by the large sums involved.

Fourth, Eric states that the value of money is subjective. I agree with this, but note that the Allais paradox was constructed by Allais to take this into account. Allais constructed the paradox to point up the difficulty with the independence axiom, which states that choice between two alternatives should only depend upon how the alternatives differ.

The independence axiom is a requirement for rational decision making. People do not always follow it. This is a problem for economists who are in the business of modeling human behavior. This is also a problem for the people who are not being rational, because they can be lured into sucker bets.

What does this tell us about the prospects for constructing an intelligent neural network? It tells us that there is more to it than simply building a complex neural network and releasing it into the world to learn. Teaching an artificial intelligence may be an exceedingly difficult task. It might help to pre-program some things, in analogy to the visual cortex, such as the axioms of rational choice.

The Anthropic Principle

Chris Cole

It should come as no surprise to the members of the Society that we appear to disagree on a number of subjects. And I'm not talking about religion or politics, either. As an example:

Marble Problem
- 67%: Hart, Langan
- Unsolvable: Cole, Inada

Newcomb's Problem
- One Box: Inada
- Two Boxes: Cole

Niels Bohr used to say that "the opposite of a deep truth is a deep truth." I used to find this humorous remark somewhat disturbing. After all, if we disagree about deep truths, are we not building on foundations of sand? Over the years, I have become more complacent. I am not alone in noticing that foundations seem to be independent of practical applications. I once asked Feynman about a form of the Marble Problem. He said that he had come up with a way of thinking about problems like that, but he forgot what it was!

However, I have a glimpse of an explanation for this phenomenon. We are familiar with the answer to the question: why is the universe the way it is? The Anthropic Principle states that this is because if it were any other way, we could not live in it. I wish to extend the Anthropic principle to answer a question of Einstein's: why can we comprehend the universe? My extension to the Anthropic Principle is: because if it were incomprehensible, we would not be thinking about it.

This leads to the following idea: perhaps we are only thinking about the "part" of the universe that is comprehensible. Perhaps much of the universe is incomprehensible. Perhaps deep truths are incomprehensible. This is getting objectionably vague, but I thought I'd throw it out there for you to reject or consider, as you like.

Quantum Philosophy - I

Chris Cole

There are a number of philosophical problems implied by the physics of quantum phenomena. This is not to say that classical physics did not have philosophical problems. Indeed, classical physics had the worst kind of philosophical problems: it was demonstrably wrong. In this sense, quantum physics is an advance. However, there are several ways that quantum physics is confusing, some of which I want to discuss in this series of articles.

I will start with two problems: First, the problem of Schrodinger's cat, and second, the problem of Bell's theorem. These problems may in fact be the same, which would be nice. But more on that later.

The problem of Schrodinger's cat, in its most general form, is the following: The quantum wave function does not determine the result of a measurement; the act of observation "collapses" the wave function to an eigenstate of the measurement operator. The mathematics of this "collapse" is not part of quantum theory; the "collapse" is associated somehow with the boundary between quantum and classical physics, and is carried out in an entirely ad hoc fashion.

Before the collapse, the wave function was a superposition of eigenstates with weights that represented the complex square roots of the probabilities of various measurements. After the collapse, the results of the measurement are known, and the only surviving eigenstate is the one corresponding to the eigenvalue that was actually measured. This does not violate conservation of energy, momentum, etc. because the weight of the selected eigenstate is increased to one.

This collapse is particularly mysterious in the case of Schrodinger's cat: a cat so unforunate as to be sharing a box with a fiendish device that will instantly dispatch the cat upon the decay of a radioactive atom. After a while -- on the order of the half life of the atom -- is the cat dead or alive? Quantum theory describes the situation as a superposition of states: in one the cat is alive, in the other, dead. When we open the box to observe the cat, the wave function collapses to one of the two states. But surely the cat was already either dead or alive. Why should the theory depend so much on our looking in the box? What if we never look? What if people never existed? What if something else looked into the box? Isn't the cat aware of his own existence?

Most physicists view such questions as foolish. It suffices that if they need to know the answer to the question, thay have a theory to calculate it. They know that even if they do not know how to define the exact boundary between quantum and classical physics, they know that a collapse will occur somewhere and they can get the right answer. It practice, it is not a problem. However, it seems to me that there is only one world, and that the distinction between a quantum and classical physics is bogus. I am sure that a more complete description of reality will eliminate the needs for these "collapses."

Bell's theorem is the following: it is not possible to reconcile the existence of an objective external reality with the exclusion of non-local instantaneous action-at-a-distance. Either observation creates reality, or local causality is violated.

Bell proves this with the following set up: a spinless particle at rest decays into two particles with spin, which must because of energy and momentum conservation be traveling away from the original particle's location in opposite directions. The spin of one particle is measured, and immediately the spin of the other particle is known (it must, by conservation of spin, be the opposite of the first). Picking an arbitrary direction perpendicular to the motion of the particles, we call this zero degrees. Then we can put a magnetic field across the direction of motion of the particles and measure the deflection of the particle, either up (zero degrees) or down (180 degrees). We can of course rotate the magnetic field, and measure the deflection at any angle from zero to 180 degrees.

Now, suppose we define "passing N degrees" as deflecting positively when the magnetic field is oriented N degrees from zero. For example, if the magnetic field is oriented 45 degrees from our arbitrary zero direction, then the particle "passes 45 degrees" if it deflects up (45 degrees), and it does not pass if it deflects down (225 degrees). If one of the particles pass at 45 degrees, the other particle will not pass at 45 degrees, since the spins must be opposite.

With these definitions, we can check the following inequality:

P(pass 0, not pass 45) + P(pass 45, not pass 90) >= P(pass 0, not pass 90)

This is an example of the tautology from probability theory:

P(A and B) + P((not B) and C) >= P(A and C)

Unfortunately, when we compute the probabilites, we find the inequality is violated! And not violated by a little bit, either.

This seems to leave us with one of two possibilites (Bell's theorem): either a particle cannot be said to be able to both pass 0 and not pass 45 at the same time, because one cannot measure both properties at the same time ("observation creates reality"), or an instantaneous influence passes from one particle to the other when it is measured ("non-local causality").

I have one objection to Bells' theorem: it seems to rely heavily on the quantum mechanics of spin, a highly non-intuitive subject. I am currently investigating the version of the theorem without spin.

Assuming the theorem can be formulated without spin, it leaves us perched on the horns of a dilemma. Either we give up locality and acquiesce to what Einstein called "spooky action-at-a-distance", or we have to admit that a particle cannot be said to simultaneously possess the ability to pass a field at zero degrees and a field at 45 degrees. But how could the particle know which one we were going to measure? What if we do not measure either one, does the particle have no spin? What if we do not measure anything, does the particle not exist?

These questions may remind you of those posed during the discussion of Schrodinger's cat. The two problems seem somehow related. I will discuss this and other issues in future installments.

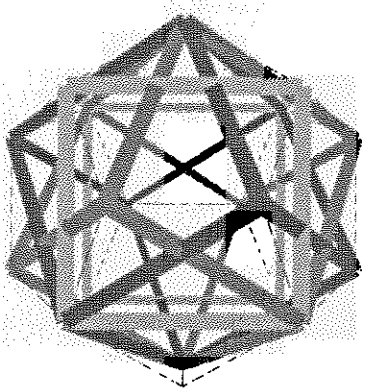
Ok, so you may be bored with the 3 interpenetrating cubes problem by now, since everyone seems to be familiar with the solution, a solution that is so symmetric it seems to force an otimality proof.

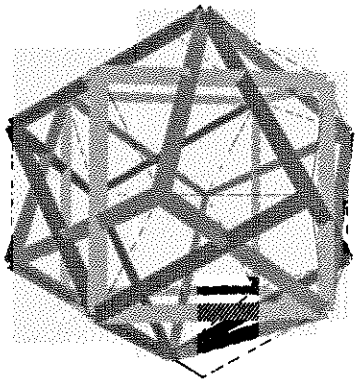
What some members have found surprising, however, is that their solution may not be the same as everyone elses.

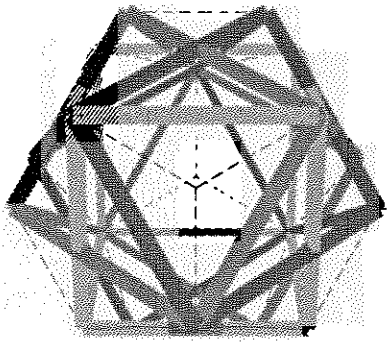
One solution puts the corners of the cubes at the corners of a dodecahedron, each pair being joined along the long diagonal. Interestingly, doing the same thing with 2, 4 and 5 cubes seems to give the maximum number of volumes for those cases as well.

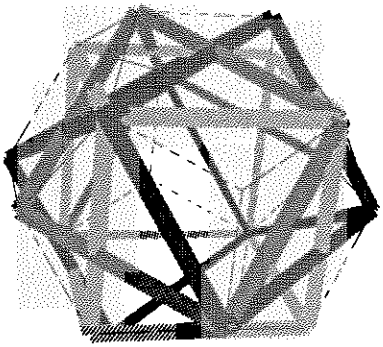
Another solution rotates each cube by 45 degrees from the unit cube. along the x, y, and z axes. Each pair is joined ar the middle of opposite edges, which meet at 90 degrees.

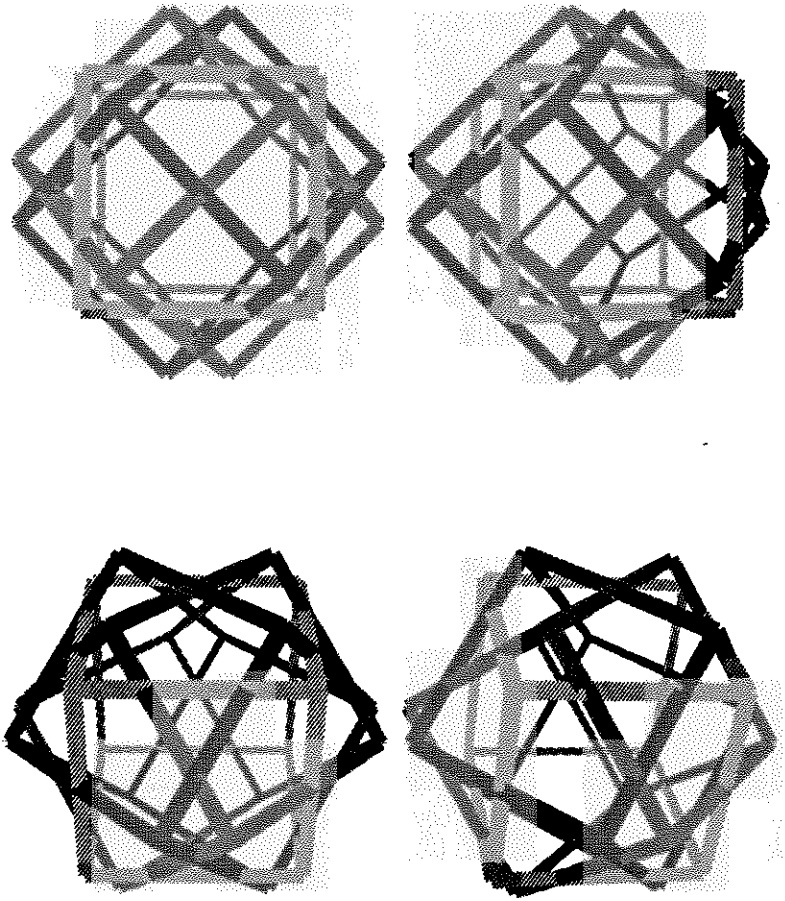
I have attempted to depict them here as wire frame stereo pairs.











Hmm, looking at them, it seems that these two solutions may not be so different after all. It looks to me like one can be continuously deformed into the other by sliding the contact points along the edge.

[From rec.puzzles on usenet:]

Article 4915 of rec.puzzles:
Path: peregrine!henry.jpl.nasa.gov!elroy.jpl.nasa.gov!ames!elan!ido
From: ido@elan.elan.com (Ido Hardonag)
Newsgroups: rec.puzzles
Subject: cups on spinnig table
Message-ID: <660@elan.elan.com>
Date: 10 Nov 89 19:15:52 GMT
Organization: Elan Computer Group, Inc., Mountain View, CA
Lines: 13

On a round table, with a big hole in the center are four cups spaced equally apart. You are blindfolded in the center of the table and your goal is to set all the cups to be the same(either upright or up-side-down). On each turn you can choose two cups, touch them and decide wether you want to turn one, both or none. Between turns the table spins so you dont remember the position of the cups.

What is the min number of tries to ensure that the cups will all be the same?

Ido Hardonag

[Note: You may assume that a bell rings when you succeed.]

[A cook of the puzzle, if you are allowed to cheat:]

Article 4931 of rec.puzzles:
Path: peregrine!henry.jpl.nasa.gov!elroy.jpl.nasa.gov!usc!ucsd!rutgers!cmcl2!lanl!opus!eiverson
From: eiverson@nmsu.edu (Eric Iverson)
Newsgroups: rec.puzzles
Subject: Re: cups on spinning table
Message-ID: <EIVERSON.89Nov12003521@hades.nmsu.edu>
Date: 12 Nov 89 07:35:21 GMT
References: <660@elan.elan.com> <5189@cs.yale.edu> <NIALL.89Nov11153054@aigyptos.nmsu.edu>
<5217@cs.yale.edu>
Sender: news@nmsu.edu
Organization: NMSU Computer Science
Lines: 41
In-reply-to: Reingold-Nicholas@cs.yale.edu's message of 12 Nov 89 03:52:38 GMT

SPOILERS

If you assume the cups have handles (coffee cups) you can solve the puzzle in 4 moves. The trick is orienting the handles of the cups you've touched such that 1=handle diagonally pointed out, 2=handle diagonally pointed in, 3=handle parallel with the table edge. If you label the vertices A-D with D adjecent to A, the puzzle can be solved as follows:
(Note: setting a cup equal to a number implies turning it over. It is assumed that both cups do not have to be touched at the same time.)

```
Step 1:
      touch A, touch B, A=1, B=1.
Step 2:
      touch A, touch C, A=2, C=2.
Step 3:
      touch A.
      IF A=1 THEN touch C, C=1, DONE.
      IF A is up THEN A=1, DONE.
      touch B.
      IF B is up THEN B=1, DONE.
      ELSE A=3.
Step 4:
      touch A.
      IF A is up THEN A=1, DONE.
      IF A=1 THEN touch C, C=1, DONE.
      IF A=2 THEN touch B, B=1, DONE.
      IF A=3 THEN touch D, D=1, DONE.
```

Of course if the table is spun vigorously enough to jiggle the cups, you could be in big trouble.

-Gruntpig

[And, a generalization:]

Article 5171 of rec.puzzles:
Path: peregrine!henry.jpl.nasa.gov!elroy.jpl.nasa.gov!ames!think!samsung!uunet!ibmpa!ghoti!lmb
From: lmb@ghoti.uucp (Larry Breed)
Newsgroups: rec.puzzles
Subject: Generalizing the rotating table
Message-ID: <3222@ibmpa.UUCP>
Date: 6 Dec 89 20:09:17 GMT
Sender: news@ibmpa.UUCP
Reply-To: lmb@ibmsupt.UUCP (Larry Breed)
Organization: IBM AWD Palo Alto
Lines: 23

Before I lost track of the thread on the rotating table problem, people were discussing how to generalize it. The other day I asked my friend Lyle if he knew the puzzle involving a rotating table and four glasses and ... he interrupted, "yes, that's a very good problem. I wrote a paper generalizing it to an n-sided table." Now I have a copy of the paper "Probing the Rotating Table", W. T. Laaser and L. Ramshaw, in _The Mathematical Gardner_, Wadsworth International, Belmont CA 1981. 22 pages.

The abstract states [for an n-sided table and a k-handed player]

> ... we will see that such a procedure exists if and only if the parameters k and n satisfy the inequality $k \geq (1-1/p)n$, where p is the largest prime factor of n.

The paper mentions (without discussing) two other generalizations: more than two orientations of the glasses (Graham and Diaconis) and more symmetries in the table, e.g. those of a cube (Kim).

Disclaimer: Don't blame my employer, blame:
Larry Breed (415) 855-4460
uucp: uunet!ibmsupt!lmb inet: ibmsupt!lmb@uunet.uu.net