Gold Bar Thieves

Puzzle Corner:
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My year in California is nearly up. Next year I will be at North Adams State College, Massachusetts; by the time this column is in print I'll be enroute, so all correspondence henceforth should be sent to me at the Department of Mathematics, North Adams State College, North Adams, Mass., 01247.

Some observations after a year in the West: The East is more formal, the West more relaxed. The weather at Santa Cruz is about perfect; but to be fair the California central valley is no bargain (*very* hot, muggy summer and deep fog in winter). California drivers are better than their Eastern counterparts—unless it snows (rarely except in the mountains), when they're awful; I have a story about a lady skidding sidewise up a mountain in a VW that . . . . The California higher education system is more extensive than any back East primarily because there are so few private universities; students here seem less pressured and less competitive than were my colleagues at M.I.T., and Alice says ditto for Brandeis. The televised sports coverage here stinks—only one hockey game a week, same for basketball, baseball, etc. I hear it's better in San Francisco, but in Worcester you see the Bruins. Also, no sports radio shows to rival "Calling all Sports" or the gone-but-not-forgotten "Sports Huddle." In fact, radio programming in general can't compare with Boston's. Alice, a strong "East" fan, has reminded me about the museums back home which dwarf the ones here, and I just remember how much better Eastern public transportation is. Hair is longer and blonder here (on both sexes) and people look more active—of course the weather has a great deal to do with this.

If this rambling essay has offended more people than it's entertained . . . well, it's my column. Please send problems and solutions to me at my new address.

Problems

A bridge problem from Michael Kay:

Jy1 Given these hands:

North:
♠ K Q J 10
♥ A K x x
♦ x x
♣ A x x

West:
♠ 9 8
♥ Q x x x
♦ J x x x
♣ x x x

East:
♠ A 7 6
♥ J x x
♦ Q x x
♣ J x x x

South:
♠ 5 4 3 2
♥ x x
♦ A K x x
♣ K Q x

West leads ♠ 9; East takes the first trick with the ♠ A and returns the ♠ 7. Can South make his contract of six spades?

Neil Cohen writes:

Jy2 Let P be a prime. Can P^2 divide $2^n - 1$ when P does not divide n?

This card problem—it has nothing to do with bridge—was submitted by David Merfeld:

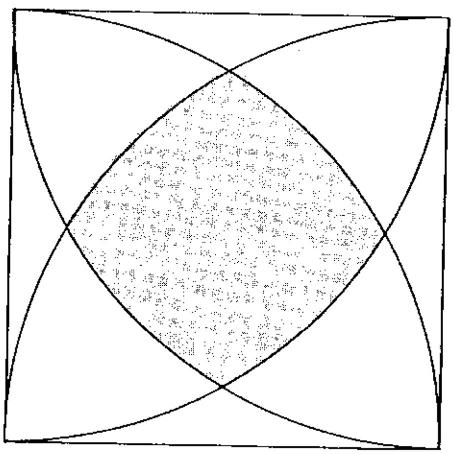
Jy3 Arrange a full deck or cards in any mixture of groups of three or more by kind or by consecutive sequence of the same suit (example: four hearts, four spades, and four diamonds; or eight spades, nine spades, and 10 spades). What is the maximum number of cards that can be left out such that they cannot be formed into groups of sequences nor added to those previously made?

John Bobbitt describes the following as "another Diophantine-type problem:"

Jy4 Seven thieves stole some gold bars. Unfortunately, when they started to divide the take it didn't come out even. But finally they figured out how to divide the bars: the first thief received one plus one-seventh of the remaining, the second man two plus two-sevenths, etc., the last man receiving seven plus seven-sevenths—i.e., all the remaining bars. In this way they didn't have to divide any bars. What is the smallest number of bars they could have stolen? And which man received the most?

A geometry problem comes from Charles Landau, who writes that it has been circulating around M.I.T. "for a while." Four of his friends solved it, each by a different method; average time was 10 minutes:

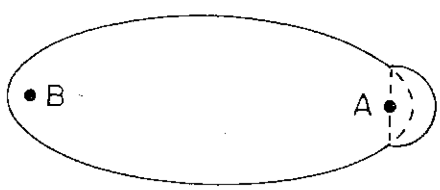
Jy5 Given a unit square with unit radius arcs drawn centered at each corner, find the exact area of the four-sided (shaded) space bounded by the arcs below:



Speed Department

Thomas F. McNally asks for the flaw in the following perpetual motion scheme:

SD1 Take a rather eccentric circular ellipsoidal shell ($a = b << c$) with a perfectly reflecting inner surface. Cut off one end perpendicular to the long axis through one of the two focal points. (A). Suspend two identical, small black bodies at the foci (A and B). Finally, join a perfectly reflecting hemisphere of appropriate radius to seal the open end.



Now consider the radiation and absorption of thermal energy from A and B. Half of the energy emitted by A strikes the hemisphere and is reflected back upon itself. The other half strikes the ellipsoid and is reflected to the other focus, B. Most of the radiation from B hits the ellipsoid and is absorbed by A. The fate of the small fraction of radiation (E) striking the hemisphere is not immediately clear, but for a sufficiently eccentric ellipsoid, this energy is negligible. So A receives

$\frac{1}{2}R_A + (1 - E)R_B \approx \frac{1}{2}R_A + R_B$,

and B receives

$\frac{1}{2}R_A + ER_B \approx \frac{1}{2}R_A$.

In equilibrium A and B must radiate as much as they receive; therefore, by the Stefan-Boltzman Law ($R = \sigma T^4$):

$(T_A/T_B)^4 = [(T_B{}^4 + \frac{1}{2}T_A{}^4)]/\frac{1}{2}T_A{}^4$,

$T_A = 2^{1/4}T_B$ (violating the Second Law of Thermodynamics).

Perpetual power could be obtained, for example, from a thermocouple between A and B. Even if the walls are not perfectly reflecting and A and B are not perfectly "black," it seems some free power should be obtainable.

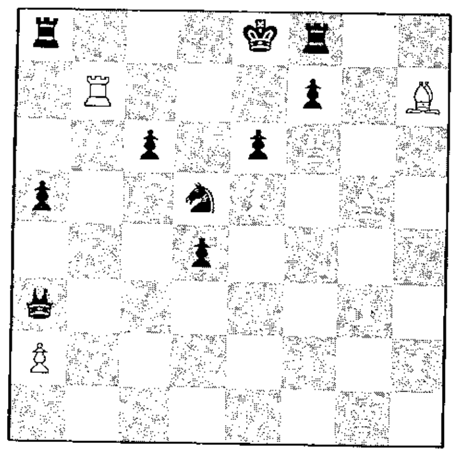
This one from Gilbert Shen should remind you of "casting out nines:"

SD2 Show that the actual number $(a_n a_{n-1} \ldots a_1)_8$ is divisible by 7 if and only if $(a_1 + a_2 + \ldots + a_n)$ is divisible by 7.

Solutions

The following are solutions to problems published in *Technology Review* for March/April, 1972:

66 Given the following, White to move and checkmate.



Captain George Martin (and other readers) pointed out correctly that the colors in the diagram as published (above) are in fact reversed; the proposer submitted a correct chessboard, which was reversed in the process of production. Captain Martin's solution:

The winning move is Q—QP (check). The replies are

A. 1. N—Q2
   2. Q—K7 (mate)

B. 1. Q—Q2
   2. R x Q (check), N x R
   3. Q x N (mate); or
   2. K—K1
   3. Q—K7 (mate)

And the Q-sacrifice, with all three attack-

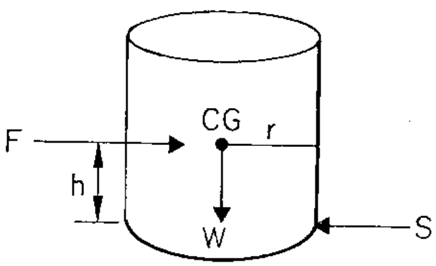
ing pieces cooperating:
C. 1. . . . P x Q
2. B—N6 (check) R—B2
3. B x R (check) K—B1
4. B—R6 (mate)

Another complete solution came from Walter I. Nissen, Jr. Bob Baird interpreted the incorrect diagram in an unintended manner, and the following readers chose the main line for their solutions: Gerald Blum, Edward Gaillard, Harvey Greenspan and B. Ronben, Peter M. Kendall, Stewart Levin, John W. Meader, Harry Zaremba, Ben Zuckerman, and the proposer, Peter J. Meschter.

67 Three tumblers stood on a table in an earthquake; one was full, one half full, and one empty of water. After the shocks subsided, two tumblers had fallen, one was standing unaffected; which one? If each tumbler was cylindrical, 2" dia. by 6" high, of uniform thickness, weighing 130 g. empty and 430 g. full, what depth of water would give it maximum stability and what seismic acceleration would have left it erect while tumbling two others?

A controversy. Since I'm no expert, here are both sides. This minority report is from Bob Baird:

The full tumbler did not tumble. One's first impression is that the most stable tumbler is the one with the lowest center of gravity, but stability is directly related to the level of fluid. This is clear from the diagram:



A seismic force S applied is matched by an equal and opposite force F. Since the moments about the point on which S is applied must be zero, $Fh = Wr$. Since

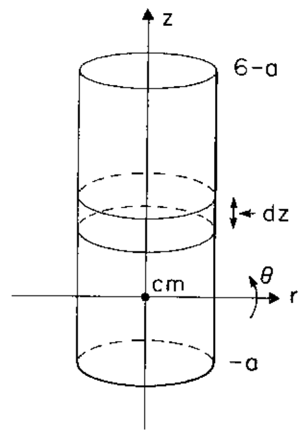
$r = 1$, we have
$F = S = W/h$.

W, the total weight, is the sum of the tumbler's weight (130 g.) and the weight of the fluid (50d, where d is the height of the fluid); h, the height of the center of gravity, is the composite of the tumbler's center of gravity (130 at 3") and the fluid's center of gravity (50d at d/2). Obviously, W decreases faster as a function of d than h does. Therefore the force required is at a maximum when d is at a maximum. Thus the more fluid there is, the greater the force required to tip the tumbler. In fact, 143.3 g. are required to tip the full tumbler. Slightly less force is required to tip the other two. The movement or spillage of fluid as the tumbler tips has no effect on the relative force required to begin the movement.

For the majority we have Allen W. Wiegner, who proposes that the partly-filled tumbler was the one still standing; his analysis:

Let t = thickness
q = acceleration due to the earthquake
r = radius (1")
h = height of fluid
H = height of tumbler (6")

and know that water weighs 50 g./cu. in. The volume of the glass is given by $2\pi rtH + \pi r^2 t = 12\pi t + \pi t = 13\pi t = 130$ g., or $t = 10/\pi$, or 20 g./in. of height plus 10 g. for the bottom.



In the diagram, consider the center of mass (cm) at the origin: it extends from $z = -a$ to $z = (6 - a)$.

$$\int_0^{6-a} 2\pi r\, tz\, dz = \int_0^a 2\pi r\, tz\, dz + a\pi r^2 t.$$

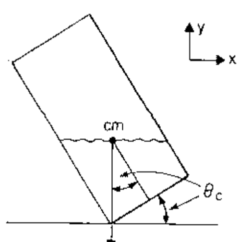
Plugging in, $2\int_0^{6-a} z\,dz = 2\int_0^a z\,dz + a$, or

$$z^2 \Big|_0^{6-a} = z^2 \Big|_0^a + a;$$

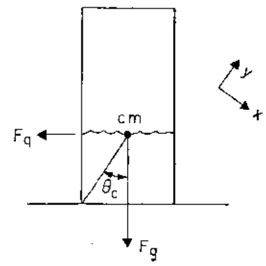
$36 - 12a + a^2 = a^2 + a$, and $a = 36/13 = 2\ 10/13''$ from the bottom, when the glass is empty. With liquid in the glass, the analysis becomes

$$\int_0^{6-a} 20\, z\, dz + \int_0^{h-a} 50\, z\, dz + \int_0^a 20\, z\, dz + \int_0^a 50\, z\, dz + 10a,$$

or $5h^2 - 10ha - 26a + 72 = 0$. When the glass is full, $h = 6$; $5h^2 - 10ha - 26a + 72 = 0$; and $a = 2\ 40/43''$ full. For best earthquake resistance, we seek the lowest cm. Obviously, if cm is minimum, the liquid is at the level of cm. Setting $h = a$, $5h^2 + 26h - 72 = 0$, and $h = 2$. Therefore, 2" of fluid is the condition of maximum stability.



To figure θ_c, the critical tipping angle, consider that as the tumbler tilts, cm remains in a constant position (ignoring "sloshing"). The tumbler tumbles when cm goes outside the edge of the tumbler. For the condition of maximum stability, when cm is 2", $\tan\theta_c = ½$ and $\theta_c \approx 26°$; for cm $\approx$ 3" from the bottom (full or empty glass), $\tan\theta_c = 1/3$ and $\theta_c \approx 18°$.



For the tumbler to remain upright, the (x) component of F_g (see drawing above) must exceed the (−x) component of F_q. Or,

$F_g \sin\theta_c \geq F_q \cos\theta_c$.
Let $F_g = M_g$ and $F_q = M_q$, then
$\tan\theta_c \geq q/g$. For the partially-filled glass, $q \leq g \tan\theta_c \leq ½ g$. For the full or empty glass,

$q \tilde{<} g \tan\theta_c \tilde{\leq} 1/3$ g.

Thus a seismic acceleration between (approx.) 1/3 g and 1/2 g would cause one tumbler to stand while the others fell; 1/2 g would tumble all but the most stable.

Voting with the majority were Winslow Hartford, Harry Zaremba, and the proposer, R. Robinson Rowe.

68 Given the number of spheres along a single edge, how many spheres are contained in a pyramid with an equilateral triangular base?

Unanimity again. The following is from James L. Fidelholtz: The base of the pyramid consists of (pick one side) the n spheres on that side, plus the (n − 1) in the row next to the first, plus . . . plus the single sphere at the apex of the equilateral triangle. The layer above that consists of the (n − 1) spheres along one side, plus the (n − 2) in the next row, plus . . . plus the single sphere at the apex. The last layer consists of the single sphere at the top. The kth layer contains a total of

$$\sum_{j=1}^{k} i = [k(k+1)]/2 \text{ spheres (easily}$$

proved by induction). Therefore, the n layers (if there are n spheres along one side of the base, and we have a regular pyramid, there must be n layers) contain a total of

$$\sum_{j=1}^{n} [j(j+1)]/2 = ½ Q, \text{ where}$$

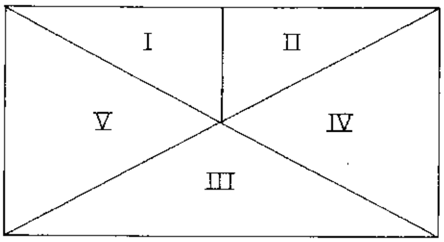
$Q = \sum_1^n j^2 + \sum_1^n j$. The first part of $Q = [n(n+1)(2n+1)]/6$ (again, easily shown by induction). The second part of $Q = [n(n+1)]/2$. Therefore, expanding, combining terms, and factoring again,

the total number of spheres is
$[n(n + 1)(n + 2)]/6$.

Also solved by Bob Baird, Gerald Blum, H. Greenspan and B. Ronber, J. Stewart Harris, Winslow Hartford, Stewart Levin, M. Sacid Ozker, Claude Rabache, Mitchell Serota, William L. Thoen, Allen W. Wiegner, Ben Zuckerman, and the proposer, Harry Zaremba.

69 Consider a rectangle with sides a and b, each of arbitrary length and with $a \neq b$. Inscribe five and only five triangles in the rectangle; each triangle must have two and only two sides wholly in common with two other triangles. Identify the position of the five triangles if the ratio of their areas is n, $n + 1$, $n + 2$, $n + 3$, $n + 4$; $n > 0$. Find the ratio(s) and show that no other satisfying ratio(s) exist(s).

The following is from Stewart Levin:



Since the sum of IV and V equals the sum of I, II, and III, which equals the amount ½ ab, we have
$(n + g) + (n + h) + (n + k) = (n + d) + (n + e)$,
where $g, h, k, d, e \in \{0, 1, 2, 3, 4\}$,
$n = (d + e) - (g + h + k)$; but for this to be positive, and since $d + e + g + h + k = 10$, we have $(d + e)$ is greater than $[10 - (d + e)]$, which means that $(d + e)$ is greater than 5. But this is only possible for
$d,e = 3,4 \ldots n = 4$; and
$d,e = 2,4 \ldots n = 2$. Thus the only other possible sequence of integers satisfying this problem (in addition to 4:5:6:7:8, which was involved in **SD1** of the same issue March/April issue) is 2:3:4:5:6. Of course, this result holds only for the triangles as arranged in the diagram. I shall now show that this is the only possible arrangement satisfying the conditions of the problem:

1. No cross-corner triangles are allowed, since they could have only one side in common with another triangle; thus triangles can have a base on only one side of the rectangle (or part of a side).
2. No triangles can be wholly in the interior of the rectangle, for then it would have three sides in common with other triangles. Thus each triangle has only one and only one base on a side of the rectangle.
3. At least one side of the rectangle has two or more different triangles situated on it. This is a consequence of having five triangles and only four sides on the rectangle.
4. No side of the rectangle can have three or more triangles based on it; for if there were three or more on one side, adding at least three (at least one for each of the remaining three sides) comes out with at least six triangles where there can be only five. Therefore, at least one side of the rectangle has exactly two triangles based on it.
5. No more than one side can have two triangles on it; for then adding at least two more triangles for the two remaining sides gives the contradiction of having six triangles. Therefore, the rectangle has three sides with one triangle based upon each and one side with two triangles based on it.
6. The conditions of the problem and of no cross-corner triangles rules out the two-on-one triangles having no sides in common; therefore, they have one side in common.
7. There can be at most one point in the interior of the rectangle where vertices of the triangles meet. Since at least three triangles would have to meet at each of the points, this means that there would have to be at least six triangles, again a contradiction. This means that triangle vertices can meet at most at one place in the interior of the rectangle.
8. If the third vertices of the two-on-one-side triangles met in a corner of the rectangle (they cannot meet on the middle of an edge of the rectangle, for then the rectangle would have two sides with two triangles on them), then the triangle on the side closest to that corner would be a cross-corner triangle, which is not allowed. Therefore, the two-on-one triangles have adjoining vertices in the interior of the rectangle. This situation leads to at least two other triangles meeting at that point (the two-on-one triangles form an angle less than 180°), which immediately leads to the situation in the diagram.

Also solved by Bob Baird, James L. Fidelholtz, John Lowdenslager, and Harry Zaremba.

70 Why is it not possible to propel jets of water against fins on the outside of a turbine to propel the turbine to power an electric dynamo, create electricity, and with that electricity power the jets?

Harry Zaremba puts a stop to this machine; he writes: This system of electric power generation would certainly not be able to sustain itself. All the electrical energy would be dissipated in friction and heat loss, but—most important—a 100 per cent conversion of energy from the jets to the turbine could never be achieved due to the necessity to return the water instantly to the energy level it had before reaching the pumps. This is impossible, and the equipment would coast to a disconcerting permanent stop.

Better Late Than Never

Solutions to the following problems have been received:

51 Greg Bernhardt refuses the published solution (see *Technology Review* for May, p. 65), which he says is "erroneous in at least two places." He writes:

The most glaring mistake concerns the throw-in at the end of the hand. At this point, West has refused the spades twice and South has just taken West's ♠K with his ♠A. The remaining cards are:

West:	*South:*
♥ K J 7	♠ 10 5
♣ K Q	♥ A Q 3

South can safely lead one spade, with West discarding a club. If South leads his remaining spade, West can safely discard the ♥7 instead of the club. Then South must lose one of his three hearts to West and West can cash the club for down one. South does no better by keeping a spade—West can still lead back his club and force South to finesse himself again in hearts for down one. The other mistake is when West is put in with the ♦J much earlier in the hand. You assume that West must lead a heart from his hand when a club lead will work perfectly well. The hands with West on lead look like this:

North:
♠ 7 3
♥ 5 4 2
♦ 10 9 7

West:
♠ K 6
♥ K J 7 6
♣ K Q

South:
♠ A J 9 5
♥ A Q 10 3

South must rough the club lead somewhere. If he roughs on the board, he gives up hope of using the diamonds and must still lose a spade and heart. If he roughs in his hand and pitches his ♥2 from dummy, he is still in trouble, for West can still keep him off the board. West has a complete count of South's spades. If South leads the ♠J or ♠9, West ducks and concedes his ♠K in favor of two heart tricks, for he can still get out of his hand with a club, as explained earlier. If South leads the ♠5, West can safely take it with his ♠K and return a spade because he knows South will be forced to overtake dummy's ♠7 with one of his remaining spades (he has no small spades). On top of that, South then loses two hearts for down two (or possibly a heart and club) for down two. I suggest that there is no way to make contract.

Comments on this problem have also come from Earl V. Beven, David E. Borenstein, Robert C. Camp, James Flemming, John Kreuttner, Solomon L. Pollack, Glenn Stoops, and Herve Thiriez.

52 This is the one about the action of a helium-filled balloon tied to the floor of a decelerating railroad car. In the March/April issue I wrote, "Everyone says the balloon moves forward, but I disagree. I feel that the air in the car will go forward creating a high-pressure area forcing the balloon backwards." All subsequent correspondence supports my contention (which was not precise), and R. Robinson Rowe has now added the needed precision:

For a working model, I presume a railroad car with rigid boundaries enclosing a prism of air 50 ft. long at standard conditions. The width and height are not relevant, as the analysis can be confined to a subprism of unit cross section $1 \times 1 \times 50$ ft., made up of 50 unit cubes of air. Each cube of air weights 0.08072 lb., which I will round to 0.08 lb., so that the subprism weighs 4 lb. We must deal with absolute pressures, which are 2120 lb./ft.^{2}. The subprisms are surrounded with like subprisms, which balance the forces acting on the long faces; but each end of the subprism is in contact with the end-wall of the car, where the reaction is 2120 lb. Now presume a deceleration at the constant rate of 0.5 g. (that is, about 16 ft./sec.^{2}). When equilibrium is reached, the decelerating force will be 0.5×4 lb. $= 2$ lb. This will be the difference between the reaction at the forward end of the car and the reaction at the rear end of the car, these becoming 2121 and 2119, respectively. For these reactions to exist, air densities must change, and it can be shown that density will vary linearly from one end to the other. Presuming also that change in air density is adiabatic and isoentropic, PV must be constant. The volume of a cube at the rear of the car expands to 2120/2119 ft.^{3}, which is also the measure of its new length, and at the head end it becomes 2120/2121 ft.^{3}. If x is the distance from the rear end, the change in length of cubes can be expressed as $1.000472 - 0.00001888\ x$. Its integral is $1.000472\ x - 0.00000944\ x^2$. Then the change in distance from rear end to any cube is $0.000472\ x - 0.00000944\ x^2$, for which the maximum, at $x = 25$, is 0.0059 ft., or about 1/14 in. At this equilibrium, the linear variation of pressure means less pressure on the rear of the balloon than on its front, and the string leans backward. But at first, when the air is moving forward, it will impel the balloon with it. Like a string under a suddenly applied load, the air will overreact, to perhaps double the 1/14 in., and oscillate with a damped vibration approaching the equilibrium condition, with the balloon responding in phase. A small but definite "wobble."

I must also include the engineering approach, from Edward J. Sheldon: I was shocked, appalled, and aghast (not to mention amused) when I read your solutions to the balloon in the decelerating railway car. I immediately concluded that the problem could be solved experimentally. Today my daughter came home from the April 19 parade (held of course on April 17) with a lighter-than-air balloon perched on top of a string; this was half of the experimental equipment needed. Unfortunately, I did not have a railway car available so substituted my trusty Toyota. Enlisting the aid of my son to hold the balloon, I proceeded with the experiment. The car was driven at a rate of about 20 m.p.h., the balloon stabilized, and then the brakes were applied. The balloon went to the rear! This experiment was repeated at least three times with similar results; further, when the car was accelerated the balloon went forward. Why were you wrong? Because you only *felt* ("I feel . . .") the correct answer. As you are a mathematician, the thought of actually performing a scientific experiment may well have been repugnant. However, as an engineer, I had no such qualms; and it can now be stated as fact that the balloon moves backward.

Other responses have come from Gerald Blum, Ralph Brown, T. Stewart Harris, Joseph Horton, Rowland Johnson, R. A. Pease, Barry Skeist, and Michael D. Zuteck.

54 Walter I. Nissen, Jr.

55 R. Robinson Rowe kindly sent me a copy of his solution, the original having been lost due to a mix-up in numbering. Indeed, he submits two solutions which together are far too long for the space available for this or any other installment of "Puzzle Corner." But here is his introductory comment: "This problem would have been skipped as likely to yield at best a dual formulation, separately for odd and even arguments. I had played around with similar problems and had had to resort to 'oddtorials'—like factorials, but continued products of odd numbers. I was even confused by ambiguity of some of the questions. But it had one redeeming feature—it reminded me of my own sock-sorting sorties, I being an elderly widower served by a once-a-week housekeeper who leaves my socks hanging on the line with the rest of the laundry. So I went to work. When a function didn't formulate, I computed the hard way up to $N = 7$—a reasonable limit for once-a-week laundry."

Anachronisms: DuPont, Delaware, and Ralph Nader

Book Review:
Brooke Hindle, Killian Visiting Professor, M.I.T., 1971-72

Pierre S. du Pont and the Making of the Modern Corporation
Alfred D. Chandler, Jr., and
Stephen Salsbury
Harper and Row, New York, N.Y., 1971, $17.50

The Company State: The Nader Study Group Report on Du Pont in Delaware
Center for Responsive Law, Washington, D.C., 1971, 2 vols., $25.00

These two volumes demonstrate two very different responses to a single corporate subject—Du Pont and the du Ponts; in methods and standards, they have little in common. The first represents a milestone in historiography; it is one of the best business biographies yet written. The second reports the Du Pont excursion of the "Nader raiders." The relative usefulness of the two approaches depends in part on the perspective of the reader; but the impact of the second as a social document must surely be compromised by its shortcomings as history.

A Corporate, Not Personal, History

Chandler and Salsbury have reached literally inside the mind of Pierre du Pont to interpret his role in transforming both Du Pont and General Motors into their modern corporate form. This study is based upon voluminous records, notably upon the recently organized personal and business writings of Pierre du Pont and upon personal interviews conducted by Chandler. (Some readers of *Technology Review* will recall that Chandler was on the M.I.T. faculty from 1950 to 1963.)

This is an account of a man who went into the powder yard of his family firm as soon as he graduated from M.I.T. in 1890, left to demonstrate a peculiar organizing ability in steel and street car companies, and returned in 1902, soon emerging as the major architect of Du Pont development. He established organizational patterns in the company and arranged acquisitions and agreements in the industry which permitted Du Pont to respond to a series of challenges and to emerge from each with a larger and stronger role.

Pierre's acceptance of the presidency of General Motors in 1920 carried him into a business with which he had only limited and recent connections. The automobile industry was in its infancy and was altogether a different sort of enterprise from Du Pont; Pierre undertook leadership as a business manager. He not only reorganized the sprawling empire efficiently but also worked effectively in developing sound product policy, market strategy, and technological experimentation and innovation. Here, as at Du Pont, he demonstrated genius in backing the best men, especially John J. Raskob, who had also served in Du Pont, Alfred P. Sloan, Jr., and Charles F. Kettering.

A major achievement of the authors lies in maintaining an interesting, and often exciting, narrative despite the tortuous tangle of financial negotiation and arrangement which, in less adept hands, would become the dullest form of history. Something of the outlook and character of Pierre, the man, emerges, too, although a conscious decision was taken not to probe his personality or to write a full-scale personal biography. This is, perhaps, the greatest weakness of the book; more understanding of the man himself does seem needed. Without discoursing upon his attitudes toward social responsibility and ethics, the authors sharply note Pierre du Pont's sense of bafflement with government and external criticism which seemed to challenge his own integrity and rectitude.

The Impact of Economic Concentration

It is precisely the social effects of the actions of Pierre's successors that concern the Nader Study Group, but their project examines a different world through markedly different lenses. *The Company State* is a combination of a lawyer's or debater's brief with a journalistic exposé. It shows little interest in history, ethical motivation, or understanding for its own sake. The objective is action, and the basis is an investigation undertaken to discover what faults could be found in the relationships between the Du Pont Company and family and the communities within Delaware.

Du Pont, of course, makes a wonderful target. Much has been uncovered that is blatantly wrong, undesirable, or short of the ideal. Fundamental aspects of the Delaware pattern are offensive to the American sense of democracy and equality. So great a concentration of economic power within a single company and family must have a pervasive impact upon every aspect of politics and life in a state as small as Delaware and a metropolis as modest as Wilmington.

Despite the earnestness and general ring of truth characterizing the *Report*, the lack of the objectivity Chandler and Salsbury enforce upon themselves is conspicuous. All of the minuses discovered are included in the summation, while some of the pluses are discounted. For example, one would assume that an unusually high rate of retention of employees would be praiseworthy—here it becomes evidence of paternalistic restrictions upon freedom; one would assume that Du Pont's support of the University of Delaware would be beneficial—here it is contrasted with the failure to support equally the predominantly black Delaware State; one would assume that