Man, Bricks, Leaky Boat, Swimming Pool...

Puzzle Corner
by
Allan J. Gottlieb

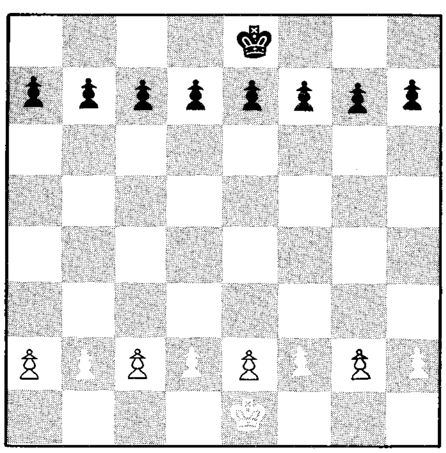
PERM 1, which started out as **O/N 3** last fall (using 1, 9, 7, and 3 and any other mathematical symbols, construct expressions yielding as many numbers as possible) has been a great success; I literally receive mail every day on that problem alone. In the March/April issue, where I first presented the solution, some answers using a decimal point were printed. Now I've become persuaded to disallow such solutions, and below (see "Better Late Than Never") are corrections to substitute new solutions. In addition, many new numbers are presented.

I would especially welcome a proof of **MAY 2**—i.e., that **PERM 1** is possible for all integers. Better still would be a constructive algorithm. Such an algorithm would reduce **PERM 1** to the "hard case" —i.e., no greatest integers function.

The proposer has sent in two corrections to **M/A 4**. For one thing, his name is spelled Bumby (we had it Bumbry). A more serious correction is that the questions need not be addressed one to each guard; the only limitation is that there be at most three questions.

Problems

JUN 1 Harry Nelson would like to know the minimum number of moves needed to reach the following position:



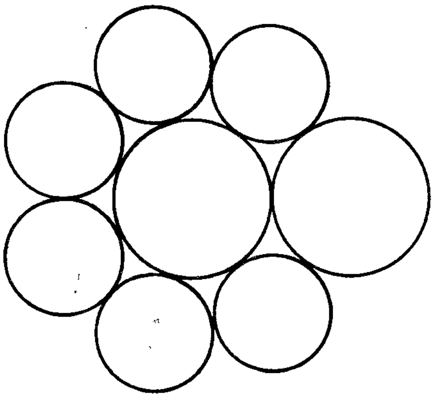
JUN 2 The following is from William Thompson, Jr.:
Consider a regular pentagon whose sides have unit length. Draw the five diagonals of the pentagon thus creating a five-pointed star (a pentagram) which in turn encloses a smaller regular pentagon. If this process is repeated indefinitely show that the sum of the perimeters of the infinity of regular pentagons so created, including that of the original one, is 5ϕ units where ϕ is the so-called golden mean $[= \frac{1}{2}(1 + \sqrt{5})]$ and that the sum of the perimeters of the infinity of pentagrams so created is ten units.

JUN 3 The following—a puzzle consisting of 256 squares (16 x 16)—is submitted by Mark Yellon (See diagram on this page.) Certain numbers are entered in 64 of these squares (four on each line). You are to enter in the open squares all the missing numbers from 1 to 256 (no duplications), so that the total of all the numbers in each horizontal row, the total of all the numbers in each vertical row, and the total of the numbers on each of the two diagonal rows (corner to corner) will equal 2,056 in each of the three categories.

JUN 4 The following is submitted by Roy Schweiker:
A man is sitting in a wooden rowboat in his swimming pool. Both the pool and the boat have gauges on them to measure the water level. How does each gauge reading change as the water level changes, when:
1. The man sits in the boat?
2. The man loads the boat with bricks?
3. The man drops all the bricks overboard into the pool (consider hydrostatic effects only)?
4. The boat develops a fast leak and swamps?

JUN 5 The following was submitted by Gary Ford:
Two large coins and six small coins are placed on a table, each just touching its neighbors as shown in the sketch at the top of the next page. What are the relative diameters of the coins? (Mr. Ford writes that he discovered the problem while counting change; the coins involved were quarters and dimes. The problem has now

256							45	32							205
			248			43			26			197			
	246			41							28			199	
					47	46			31	30					
		66			147					162			115		
	74		72									117		123	
		71		153							172		118		
68							145	164							113
144							93	112							189
		139		85							104		186		
	134		140									185		183	
		142			95					110			191		
					227	226			211	210					
	58			229							216			11	
			60			231			214			9			
52							225	212							1



circulated among his colleagues for about two months without solution, although they have found some tenth-degree polynomials having roots that solve the problem.)

Speed Department

R. Robinson Rowe:

SD 1 The following was submitted by R. Robinson Rowe:

If every day the papa bull eats a third of a bale of hay and the baby bull eats a fifth of a bale, how much does the mama bull eat, if she eats half the sum or twice the difference of what papa and baby eat?

SD 2 Judith Q. Longyear wants you to find the next few terms in the following sequence:

Solutions The following are solutions to problems published in February:

FEB 1 Find a way for South to make four hearts given a lead of ♠ K:

	North	
	♠ A 5 ♥ 7 6 5 3 2 ♦ K 7 2 ♣ A 8 2	
♠ K Q 10 9 8 4 3 ♥ Q J 8 ♦ 8 3 ♣ 10		♠ 7 6 ♥ — ♦ Q J 10 9 5 ♣ K Q J 7 6 3
	♠ J 2 ♥ A K 10 9 4 ♦ A 6 4 ♣ 9 5 4	

The following is submitted by Bill Speaker:

The problem deal need not have specified ♠K opening lead. Four hearts can be made with either North or South declarer against any opening lead. The simplest approach is described first. Regardless of opening lead, declarer takes all his top tricks, including two trump, two diamonds, one club, and one spade. When declarer next leads a spade, West must win to prevent North-South from making an overtrick. West must lead either a spade or a heart. Declarer must refuse both a trump lead and the first spade lead. On the first spade lead, declarer must slough a club from one hand and a diamond from the other. On the second spade lead, declarer can rough in one hand and void the other hand in clubs. A cross-rough in diamonds and clubs is now established to make the hand. If West has retained his remaining trump, he can take it at any trick. The easiest alternate play permits declarer to delay drawing trumps until after West has won the second spade lead. Declarer plays the first and second spade lead as before, setting up his cross-rough. When declarer has a chance to play trump, declarer must force West to win the third round of trump, even if West has saved the ♥8. West must again lead spades, and declarer is waiting with an effective cross-rough.

Also solved by R. Robinson Rowe, Jim Marlin, John Chandler, George Holderness, Richard Bator, Thomas Mauthner, Michael Kay, Richard Hess, N. Poffenberger, John Dawson, and the proposer, Winslow H. Hartford.

FEB 2 Find all the primes of the form $a^4 + 4b^4$.

The following is submitted by Richard Hess:

$p = a^4 + 4b^4 = (a^2 + 2ab + b^2)(a^2 - 2ab + 2b^2) = (a^2 + 2ab + 2b^2)(a - b)^2 + b^2$.

Without loss of generality a and b can be taken as non-negative integers. For p to be a prime number, either (1) or (2) must be true:

(1) $a^2 + 2ab + 2b^2 = 1 \Rightarrow a = 1, b = 0, p = 1$; or

(2) $(a - b)^2 + b^2 = 1 \Rightarrow$ either $a = 1, b = 0, p = 1$ or $a = 1, b = 1, p = 5$.

Then the only two solutions are:

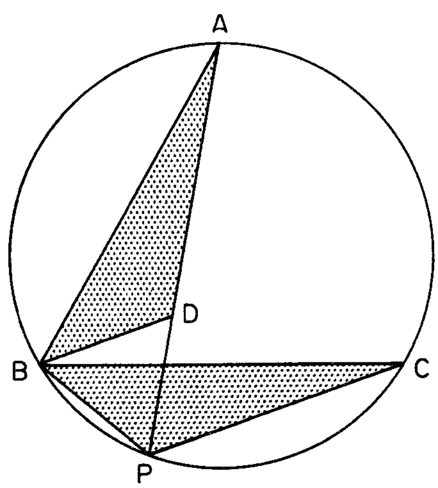
$a = 1, b = 0, p = 1$

$a = 1, b = 1, p = 5$.

Also solved by Jim Marlin, R. Robinson Rowe, R. E. Crandall, Frank Rubin, Douglas Hoylman, Neil Cohen, Eric Jamin, Richard Bumby, and Winslow E. Hartford.

FEB 3 Let ABC be an equilateral triangle inscribed in a circle. Choose any point P on the arc from B to C. Prove that PA = PB + PC.

The following was submitted by Robert Pogoff:



Lay off PD = PB. An angle inscribed in a circle is measured by half of the arc subtended by its sides. Therefore angle BPD = 60°, and

Triangle BPD is equilateral,

Angle BDP = 60°,

Angle BDA = 120° (supplementary angles)

Angle BPC = 120° (since arc BAC = 240°)

Angle BDA = angle BPC

Angle BAP = angle BCP (both are measured by half of arc BP)

Angle ABD = angle CBP (third corresponding angles of triangles)

BA = BC (given)

BAD ≅ BCP (the shaded triangles are approximately equal)

DA = PC (corresponding sides) (1)

PD = PB (by construction) (2)

Adding (1) and (2) yields

PA = PC + PB

Also solved by Eric Jamin, Frank Rubin, R. Robinson Rowe, Jim Marlin, Richard Hess, John Chandler, Ben Rouben, Yvon Neptune, Edward Dennison, John Rule, Dan Jaffe, Gary Venter, Gregorio Hernandez, Mary Lindenberg, Roberta Klein, Harry Zaremba, Henry Lieberman, Paul Kaschube, Winslow H. Hartford, and the proposer, Allen Anderson.

FEB 4 Find a seven-fold homonym in the English language (or six-fold, if proper nouns are excluded).

Neglecting proper nouns and multi-word homonyms (e.g., Foe Rays), the maximum was nine by Mary Youngquist: Ere, air, e'er, eyre, are, ayer, ayr, ayre, heir, and are (the metric measure).

Also solved by Richard Hess, R. Robinson Rowe, Neil Cohen, John Moore, George Delury, Winslow H. Hartford, and the proposer, Jerome Miller.

FEB 5 The parcel post box size is limited by the total of length and girth (twice the width plus the depth) while air baggage is limited by the total of the three dimensions. Say, for example,

$P_M = L + 2W + 2D = 84$

$A_M = L + W + D = 62$

What is the largest volume box that can be shipped either way (a) generally, and (b) with P_M and A_M as above?

The following was submitted by John E. Prussing:

For the parcel post box, one maximizes the volume $V = LWD$ by maximizing $H = V + \lambda(L + 2W + 2D - P_M)$

Setting $\partial H/\partial L = \partial H/\partial W = \partial H/\partial D = 0$ yields optimal values

$L^* = 2W^* = 2D^* = P_M/3$.

The Lagrange multiplier, λ, can be interpreted as the sensitivity of the maximum volume V^* to a change in the constraint P_M.

$\lambda = -dV^*/dP_M = -(P_M/6)^2$

Numerically, for $P_M = 84$, $V^* = P_M^3/108 = 5488$.

For the air baggage problem, a similar analysis yields

$L^* = W^* = D^* = A_M/3$,

$\lambda = -dV^*/dA_M = -(A_M/3)^2$,

$V^* = (A_M/3)^3 = 8827$ for $A_M = 62$.

Also solved by Richard Hess, Harry Zaremba, Dan Jaffe, Ben Rouben, Frank Rubin, Eric Jamin, A. M. Handwerker, Winslow H. Hartford, and the proposer, Smith D. Turner.

Better Late Than Never

Comments and solutions have been received as follows:

JAN 2 Emmet Duffy

JAN 5 John Rule

J/A 5 S. D. Conner has supplied an elementary proof.

Four corrections have been received for **PERM 1:**

$97 = 1 + (9 + 7) \cdot 3!$

$98 = (9 + 3! - 1)7$

$99 = 97 + 3 - 1$
$103 = 9!/7! + 31$

Eric Jamin has extended the list up to 256, using the greatest integer function for only 20 of these. Tim Mann, using the greatest integer function, has reached 407. Their results follow:

From Mr. Jamin:

$150 = 9 \cdot 17 - 3$
$151 = 3!!/9 + 71$
152 =
$153 = 17 \cdot 3 \cdot \sqrt{9}$
$154 = 7 \cdot (31 - 9)$
155 =
$156 = 9 \cdot 17 + 3$
$157 = (\sqrt{9}! - 1)! + 37$
$158 = (3 - 1) \cdot 79$
$159 = 9 \cdot 17 + 3!$
$160 = 1 \cdot (3!! - 7!/9)$
$161 = 3!! - 7!/9 + 1$
$162 = (7 - 1) \cdot 3 \cdot 9$
163 =
$164 = 91 + 73$
$165 = 7 \cdot (3 + 1)! - \sqrt{9}$
166 =
$167 = 173 - \sqrt{9}!$
$168 = 9!/3 \cdot (7 - 1)!$
$169 = 13^{(9-7)}$
$170 = 173 - \sqrt{9}$
$171 = 7 \cdot (3 + 1)! + \sqrt{9}$
172 =
$173 = 179 - 3!$
$174 = 7 \cdot (3 + 1)! + \sqrt{9}!$
$175 = 7 \cdot (19 + 3!)$
$176 = 179 - 3$
$177 = 7 \cdot (3 + 1)! + 9$
178 =
$179 = 173 + \sqrt{9}!$
$180 = 9 \cdot (17 + 3)$
181 =
$182 = 7 \cdot (3 \cdot 9 - 1)$
$183 = (3! - 1)! + 7 \cdot 9$
184 =
$185 = (\sqrt{9}! - 1) \cdot 37$
$186 = 3 \cdot (71 - 9)$
187 =
$188 = 3 \cdot 7 \cdot 9 - 1$
$189 = 1 \cdot 9 \cdot 7 \cdot 3$
$190 = 19 \cdot (7 + 3)$
$191 = 197 - 3!$
$192 = 3 \cdot (7 \cdot 9 + 1)$
$193 = (\sqrt{9}! - 1)! + 73$
$194 = (3 - 1) \cdot 97$
$195 = \sqrt{9} \cdot (71 - 3!)$
$196 = 7 \cdot (3 \cdot 9 + 1)$
$197 = 917 - 3!!$
$198 = 9 \cdot (3 \cdot 7 + 1)$
$199 = (3! - 1)! + 79$
$200 = 197 + 3$
$201 = 7!/(3 + 1)! - 9$
202 =
$203 = 197 + 3!$
$204 = 17 \cdot (9 + 3)$
205 =
206 =
$207 = 9 \cdot (17 + 3!)$
$208 = 3!! - (7 + 1)^{(\sqrt{9})}$
$209 = 9 \cdot (3 + 1)! - 7$
$210 = 3 \cdot 71 - \sqrt{9}$
$211 = 7 \cdot 31 - \sqrt{9}!$
212 =
$213 = 3 \cdot (9!/7! - 1)$
$214 = 7 \cdot 31 - \sqrt{9}$
$215 = 3 \cdot 9!/7! - 1$
$216 = (7 + 1) \cdot 3 \cdot 9$
$217 = (3! - 1)! + 97$
$218 = 73 \cdot \sqrt{9} - 1$
$219 = (7 - 1)^3 + \sqrt{9}$
$220 = 73 \cdot \sqrt{9} + 1$
$221 = 37 \cdot \sqrt{9}! - 1$
$222 = (7 - 1)^3 + \sqrt{9}!$
$223 = 7 \cdot 31 + \sqrt{9}!$
$224 = (\sqrt{9}!)^3 + 7 + 1$
$225 = 9 \cdot ((7 - 3)! + 1)$
$226 = 7 \times 31 + 9$
227 =
$228 = (37 + 1) \cdot \sqrt{9}!$
229 =
230 =
$231 = 7 \cdot (9 + (3 + 1)!)$
$232 = 3!!/\sqrt{9} - 7 - 1$
$233 = (\sqrt{9}!)^3 + 17$
$234 = (7 - 1) \cdot 39$
235 =
$236 = 3 \cdot 79 - 1$
$237 = 1 \cdot 3 \cdot 79$
$238 = 7 \cdot (31 + \sqrt{9})$
$239 = 3!!/\sqrt{9} - 1^7$
$240 = 3 \cdot (79 + 1)$
$241 = 3!!/\sqrt{9} + 1^7$
$242 = 3^7/9 - 1$
$243 = (7 - 1)!/3 + \sqrt{9}$
$244 = 3^7/9 + 1$
245 =
$246 = 3!!/\sqrt{9} + 7 - 1$
$247 = 19 \times (7 + 3!)$
$248 = 3!!/\sqrt{9} + 7 + 1$
$249 = (7 - 1)!/3 + 9$
$250 = (\sqrt{9})^{(3!-1)} + 7$
$251 = 971 - 3!!$
$252 = 7^3 - 91$
$253 = 3! \times \sqrt{9}! \times 7 + 1$
254 =
$255 = (9 + 3!) \cdot 17$
$256 = (9 + 7)^{(3-1)}$

Using the greatest integer function:

$152 = (7 + [\sqrt{3}]) \cdot 19$
$155 = (\sqrt{9} + [\sqrt{7}]) \cdot 31$
$163 = 7 \cdot [\sqrt{3!!}] - 19$
$166 = [\sqrt{3! \cdot 7!}] - \sqrt{9}! - 1$
$172 = 7 \cdot [\sqrt{3!!}] - 9 - 1$
$178 = 7 \cdot [\sqrt{3!!}] - \sqrt{9} - 1$
$181 = [\sqrt{3! \cdot 7!}] + 9 - 1$
$184 = 7 \cdot [\sqrt{3!!}] + \sqrt{9} - 1$
$187 = 7 \cdot [\sqrt{3!!}] + \sqrt{9}! - 1$
$202 = 3 \cdot [\sqrt{7!}] - 9 + 1$
$205 = 3 \cdot [\sqrt{7!}] - \sqrt{9}! + 1$
$206 = 3 \cdot [\sqrt{7!}] - \sqrt{9} - 1$
$212 = 3 \cdot [\sqrt{7!}] + \sqrt{9} - 1$
$227 = 9 \cdot [\sqrt{3!!}] - 1 \cdot 7$
$229 = [\sqrt{9!/7}] + 3 - 1$
$230 = [\sqrt{9!/7}] + 1 \cdot 3$
$235 = 9 \cdot [\sqrt{3!!}] + 1^7$
$245 = (\sqrt{9}! - 1) \cdot 7^{[\sqrt{3!}]}$
$254 = [\sqrt{3!}] \cdot ((\sqrt{9}! - 1)! + 7)$

From Mr. Mann:

$257 = (9 + 7)^{[\sqrt{3!}]} + 1$
$258 = [\sqrt{3!}]^{(9-1)} + [\sqrt{7}]$
$259 = [7!/19] - 3!$
$260 = [\sqrt{3!!}] \cdot (\sqrt{9} + 7) \cdot 1$
$261 = (7 + 3 - 1) \cdot \left[\sqrt{\sqrt{9!}}\right]$
$262 = [7!/19] - 3$
$263 = [7!/19] - [\sqrt{3!}]$
$264 = [7!/19] - [\sqrt{3}]$
$265 = [7!/19] \cdot [\sqrt{3}]$
$266 = [7!/19] + [\sqrt{3}]$
$267 = [7!/19] + [\sqrt{3!}]$
$268 = [7!/19] + 3$
$269 = [\sqrt{(9-1)!}] + [\sqrt{7!}] - 1$
$270 = (7 - 1) \cdot \left[\sqrt{\sqrt{3!!}}\right] \cdot 9$
$271 = 91 \cdot 3 - [\sqrt{7}]$
$272 = 91 \cdot 3 - \left[\sqrt{\sqrt{7}}\right]$
$273 = 91 \cdot 3 \cdot \left[\sqrt{\sqrt{7}}\right]$
$274 = 91 \cdot 3 + \left[\sqrt{\sqrt{7}}\right]$
$275 = 91 \cdot 3 + [\sqrt{7}]$
$276 = 3 \cdot \left(91 + \left[\sqrt{\sqrt{7}}\right]\right)$
$277 = (31 \cdot 9) - [\sqrt{7}]$
$278 = (31 \cdot 9) - \left[\sqrt{\sqrt{7}}\right]$
$279 = (31 \cdot 9) \cdot \left[\sqrt{\sqrt{7}}\right]$
$280 = (31 - 9) + \left[\sqrt{\sqrt{7}}\right]$
$281 = (31 \cdot 9) + [\sqrt{7}]$
$282 = [\sqrt{7!}] \cdot (\sqrt{9} + 1) + [\sqrt{3!}]$
$283 = [\sqrt{7!}] \cdot (\sqrt{9} + 1) + 3$
$284 = ([\sqrt{7!}] + 1) \cdot (7 - \sqrt{9})$
$285 = 17^{[\sqrt{3!}]} - \sqrt{9}$
$286 = (31 \cdot 9) + 7$
$287 = 17^{[\sqrt{3!}]} - \left[\sqrt{\sqrt{9!}}\right]$
$288 = 17^{[\sqrt{3!}]} - \left[\sqrt{\sqrt{9}}\right]$
$289 = 17^{[\sqrt{3!}]} \cdot \left[\sqrt{\sqrt{9}}\right]$
$290 = 97 \cdot 3 - 1$
$291 = 97 \cdot 3 \cdot 1$
$292 = 97 \cdot 3 + 1$
$293 = \sqrt{9}! \cdot 7^{[\sqrt{3!}]} - 1$
$294 = \sqrt{9}! \cdot 7^{[\sqrt{3!}]} \cdot 1$
$295 = \sqrt{9}! \cdot 7^{[\sqrt{3!}]} + 1$
$296 = (9 - 1) \cdot 37$
$297 = 9 \cdot ([\sqrt{3!!}] + 7) \cdot 1$
$298 = 17^{[\sqrt{3!}]} + 9$
$299 = ([\sqrt{9!}]/[\sqrt{7}]) - 3 + 1$
$300 = \sqrt{9}! \cdot \left(7^{[\sqrt{3!}]} + 1\right)$
$301 = ([\sqrt{9!}]/[\sqrt{7}]) \cdot 1^3$
$302 = ([\sqrt{9!}]/[\sqrt{7}]) + 1^3$
$303 = ([\sqrt{9!}]/[\sqrt{7}]) + 3 - 1$
$304 = ([\sqrt{9!}]/[\sqrt{7}]) + 3^1$
$305 = ([\sqrt{9!}]/[\sqrt{7}]) + 3 + 1$
$306 = ([\sqrt{9!}]/[\sqrt{7}]) + 3! - 1$
$307 = ([\sqrt{9!}]/[\sqrt{7}]) + 3! \cdot 1$
$308 = ([\sqrt{9!}]/[\sqrt{7}]) + 3! + 1 = 317 - 9$
$309 = ([\sqrt{9!}]/[\sqrt{3!}]) + 7 + 1$
$310 = 31 \cdot (\sqrt{9} + 7)$
$311 = ([\sqrt{9!}]/[\sqrt{7}]) + [\sqrt{(3! - 1)!}]$
$312 = 319 - 7$
$313 = 39 \cdot \left[\sqrt{\sqrt{7!}}\right] + 1$
$314 = ([\sqrt{9!}]/[\sqrt{7}]) + 13$
$315 = 9 \cdot 7 \cdot \left[\sqrt{\sqrt{3!!}}\right] \cdot 1$
$316 = 317 - \left[\sqrt{\sqrt{9}}\right]$
$317 = 317 \cdot \left[\sqrt{\sqrt{9}}\right]$
$318 = 317 + \left[\sqrt{\sqrt{9}}\right]$
$319 = 319 \cdot \left[\sqrt{\sqrt{7}}\right]$
$320 = 319 + \left[\sqrt{\sqrt{7}}\right]$
$321 = 319 + [\sqrt{7}]$
$322 = 317 + \left[\sqrt{\sqrt{\sqrt{9!}}}\right]$
$323 = 317 + \sqrt{9}!$
$324 = (19 - [\sqrt{3}])^{[\sqrt{7}]}$
$325 = \left(\left[\sqrt{\sqrt{9!!}}\right] + \left[\sqrt{\sqrt{7}}\right]\right) \cdot 13$
$326 = 317 + 9$
$327 = 319 + \left[\sqrt{\sqrt{7!}}\right]$
$328 = (9 - 1)! \Big/ \left[\sqrt{\sqrt{3!!}}\right]! - \left[\sqrt{\sqrt{7!}}\right]$
$329 = (9 - 1)! \Big/ \left[\sqrt{\sqrt{3!!}}\right]! - 7$

(*Continued on p. 61*)

ment contracts because of government policy regarding patents and innovation.

A New Plan for Coupling Industry to Innovation

Many potentially useful ideas, products, and processes are tied up in government and university laboratories because no effective mechanism has been available for their commercial exploitation by industry. It is in recognition of this fact that M.I.T. established the M.I.T. Development Foundation, Inc., as a Massachusetts charitable corporation. This organization represents an effort to expedite the public use of some of the achievements of research conducted at M.I.T. and by its alumni and perhaps at other institutions in the Boston area and by independent inventors. The purpose is to expedite the so-called technology transfer process, to generate new, technically-based enterprises, and to bring resulting benefits to both the community and M.I.T. The initial financing of the Development Foundation was from a group of sponsoring organizations interested in supplying venture capital and, perhaps more important, in assisting in the market appraisal processes and the analyses of new technologies to determine their potential usefulness. These organizations are interested in developing windows on new technologies, and most of them have organized divisions or departments whose sole responsibility is to lend some form of financial support as well as marketing and management assistance to new, technical ventures outside the firm.

The M.I.T. Development Foundation, Inc., is an example of a new kind of organization which should permit effective coupling between the industrial and academic sectors of society. This experiment is clearly unproven as a successful solution to this complex problem of technological transfer but may at least lay the groundwork for future programs. No doubt other approaches should also be tried for expediting the public use of technology and for encouraging closer relations between government, industry, and our universities to this end. It is an issue which unfortunately goes far beyond the limited, traditional horizons of *Launching New Products in Competitive Markets.*

Richard S. Morse is President of the M.I.T. Development Foundation, Inc.

Puzzle

Continued from p. 59

$330 = 7^{\sqrt{9}} - 13$

$$331 = (7+1)! \Big/ \left[\sqrt{\sqrt{3!!}}\right]! - \left[\sqrt{\sqrt{\sqrt{9!}}}\right]$$

$332 = 9 \cdot 37 - 1$
$333 = 7^3 - 9 - 1$
$334 = 7^3 - 9 \cdot 1$
$335 = 7^3 - 9 + 1$
$336 = 7^3 - \sqrt{9}! - 1$
$337 = 7^3 - \sqrt{9}! \cdot 1$
$338 = 7^3 - \sqrt{9}! + 1$
$339 = 7^3 - \sqrt{9} - 1$
$340 = 7^3 - \sqrt{9} \cdot 1$
$341 = 7^3 - \sqrt{9} + 1$
$342 = 7^3 - 1^9$
$343 = 7^3 \cdot 1^9$
$344 = 7^3 + 1^9$
$345 = 7^3 + \sqrt{9} - 1$
$346 = 7^3 + \sqrt{9} \cdot 1$
$347 = 7^3 + \sqrt{9} + 1$
$348 = 7^3 + \sqrt{9}! - 1$
$349 = 7^3 + \sqrt{9}! \cdot 1$
$350 = 7^3 + \sqrt{9}! + 1$
$351 = 7^3 + 9 - 1$
$352 = 7^3 + 9 \cdot 1$
$353 = 7^3 + 9 + 1$

$$354 = 7^3 + \left[\sqrt{\sqrt{\sqrt{\sqrt{9!}}}}\right]! + 1$$

$$355 = 71 \cdot \left[\sqrt{\sqrt{3!!}}\right] \cdot \left[\sqrt{\sqrt{9}}\right]$$

$356 = 7^{\sqrt{9}} + 13$

$$357 = 71 \cdot \left[\sqrt{\sqrt{\sqrt{9!}}}\right] + [\sqrt{3!}]$$

$$358 = 71 \cdot \left[\sqrt{\sqrt{3!!}}\right] + \sqrt{9}$$

$359 = 19^{[\sqrt{7}]} - [\sqrt{3!}]$
$360 = 19^{[\sqrt{7}]} - [\sqrt{3}]$
$361 = 19^{[\sqrt{7}]} \cdot [\sqrt{3}]$
$362 = 19^{[\sqrt{7}]} + [\sqrt{3}]$
$363 = 19^{[\sqrt{7}]} + [\sqrt{3!}]$
$364 = 91 \cdot (7 - 3)$
$365 = 371 - \sqrt{9}!$

$$366 = 371 - \left[\sqrt{\sqrt{\sqrt{9!}}}\right]$$

$367 = 19^{[\sqrt{7}]} + 3!$
$368 = 371 - \sqrt{9}$

$$369 = 371 - \left[\sqrt{\sqrt{9!}}\right]$$

$$370 = 371 - \left[\sqrt{\sqrt{9}}\right]$$

$$371 = 371 \cdot \left[\sqrt{\sqrt{9}}\right]$$

$$372 = 371 + \left[\sqrt{\sqrt{9}}\right]$$

$$373 = 371 + \left[\sqrt{\sqrt{9!}}\right]$$

$374 = 371 + \sqrt{9}$

$$375 = ([\sqrt{7}] + 1) \cdot \left[\sqrt{\sqrt{\sqrt{9!}}}\right]$$

$$376 = 371 + \left[\sqrt{\sqrt{\sqrt{9!}}}\right]$$

$377 = 371 + \sqrt{9}!$
$378 = 379 - 1$
$379 = 379 \cdot 1$
$380 = 379 + 1$

$$381 = 371 + \left(\sqrt{\left[\sqrt{\sqrt{\sqrt{9!}}}\right]!}\right)$$

$$382 = ([7!/13]) - \left[\sqrt{\sqrt{\sqrt{9!}}}\right]$$

$$383 = 391 - \left[\sqrt{\sqrt{7!}}\right]$$

$384 = 391 - 7$
$385 = \sqrt{9} \cdot [\sqrt{3!}]^7 + 1$

$$386 = ([7!/13]) - \left[\sqrt{\sqrt{9}}\right]$$

$387 = \sqrt{9} \cdot ([\sqrt{3!}]^7 + 1)$

$$388 = ([7!/13]) + \left[\sqrt{\sqrt{9}}\right]$$

$389 = 391 - [\sqrt{7}]$

$$390 = 391 - \left[\sqrt{\sqrt{7}}\right]$$

$$391 = 391 \cdot \left[\sqrt{\sqrt{7}}\right]$$

$$392 = 391 + \left[\sqrt{\sqrt{7}}\right]$$

$393 = 391 + [\sqrt{7}]$

$$394 = 79 \cdot \left[\sqrt{\sqrt{3!!}}\right] - 1$$

$$395 = 79 \cdot \left[\sqrt{\sqrt{3!!}}\right] \cdot 1$$

$396 = 397 - 1$
$397 = 397 \cdot 1$
$398 = 397 + 1$

$$399 = 391 + \left[\sqrt{\sqrt{7!}}\right]$$

$400 = [\sqrt{3}] \cdot [\sqrt{(9-1)!}] \cdot [\sqrt{7}]$
$401 = [\sqrt{3}] + [\sqrt{(9-1)!}] \cdot [\sqrt{7}]$
$402 = [\sqrt{3!}] + [\sqrt{(9-1)!}] \cdot [\sqrt{7}]$
$403 = 3 + [\sqrt{(9-1)!}] \cdot [\sqrt{7}]$
$404 = ([\sqrt{3!}] + [\sqrt{(9-1)!}]) \cdot [\sqrt{7}]$

$$405 = \left[\sqrt{\sqrt{3!!}}\right] + [\sqrt{(9-1)!}] \cdot [\sqrt{7}]$$

$406 = 3! + [\sqrt{(9-1)!}] \cdot [\sqrt{7}]$
$407 = [\sqrt{3!}] \cdot [\sqrt{(9-1)!}] + 7$

Responses have also come from Joseph Chalverus, James Klucar, Roberta Klein, Stuart D. Casper, Dan Jaffe, Donald Gray, John Moore, Dennis Reinhardt, Daniel Feldan, Jason Horowitz, Thomas Bennett, Willard Welch, Jim Marlin, Ben Rouben, Paul Kebabian, Morrie Gasser, Brian and William Filter, Morton Nadler, Herve Thiriez, Richard Hess, Frank Rubin, Robert Weiner, R. Robinson Rowe, Greg Girolami, Peter Goziner, Gary Ford, Tim Moody, Smith D. Turner, Edward Chor-Cheung Wong, and William Wing-Cheung Wong.

Speed Problem Solutions

SD 1 The answer is not 4/15 bale; mama bulls are a null set.

SD 2

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