PuzzleCorner

Today is Thursday, and this Saturday will be a big day for our family: my older son, David, has his Bar Mitzvah. He seems pretty calm about it, and certainly his performance at the run-through on Tuesday inspires confidence. We shall see. I still remember well the night he was born; it is hard to believe that was almost 13 years ago. Anyway, congratulations David, in advance, on a job well done.

It is now Monday, and the congratulations were earned. I think the parents did OK as well. Indeed, David told us after the reception that the musicians we picked over his desire for a DJ playing rap music (a true oxymoron) "were not as bad as I expected," the highest compliment we could hope for. Moreover, last night before going to bed, he thanked Alice and me for giving him a wonderful Bar Mitzvah. Moments like those make up for a lot of the annoyances that accompany child-rearing (at least our child-rearing), and have put the family into a positive mood for the (shudder) teenage years ahead.

Problems

M/J 1. We begin with a bridge problem from Jorgen Harmes who wants you to make six spades when West leads the 10 of clubs.

```
              North
           ♠  A K Q J
           ♥  K J 8 6 5 3 2
           ♦  7
           ♣  Q
    West                   East
♠  6 3                 ♠  4
♥                      ♥  A Q 10 9 7 4
♦  K Q J 9 5           ♦  8 3
♣  10 9 7 4 3 2        ♣  J 8 6 5
              South
           ♠  10 9 8 7 5 2
           ♥
           ♦  A 10 6 4 2
           ♣  A K
```

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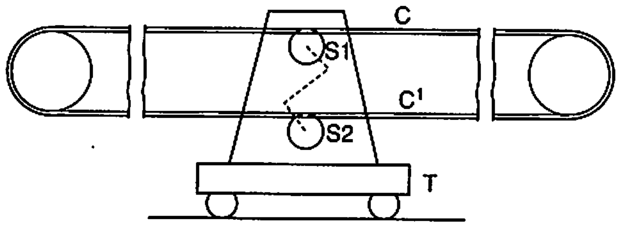
M/J 2. James Abbott likes to play with trains, gear trains that is, and offers us the following challenge.

A traveling carriage T is connected to an endless chain CC[1], which engages identical sprockets S1 and S2. The sprockets are connected to each other by a gear train whose ratio is defined by the number of revolutions of S2 for one revolution of S1. The sign of this ratio is considered positive when S1 and S2 rotate in the same direction.



By suitably altering the gear train, a variety of motions can be imparted to the carriage.

Letting C refer to the *upper* run of the chain, determine the gear ratio (magnitude and sign) for the following six conditions:

1. T moves in the same direction as C, at half the speed of C.
2. Same, but at twice the speed of C.
3. T moves in a direction opposite to that of C, at half the speed of C.
4. Same but at twice the speed of C.
5. T remains motionless regardless of the speed of C.
6. T can be moved freely in either direction (by separate forces) but the chain cannot be budged.

M/J 3. How's your geometry? Gordon Rice asks how many primitive Pythagorean triangles are there whose inscribed circle has diameter 1992. Recall that 6, 8, 10 is not a primitive Pythagorean triangle since it is simply a multiple of 3, 4, 5.

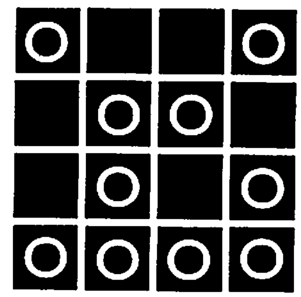
Speed Department

Tim Shepard wonders approximately how many iterations will the following C program execute (for concreteness, assume IEEE standard arithmetic).

```
int main ( int argc, char *argv[] ) {
  double i = 0.0 , sum = 0.0 ;
  do {
    i = i + 1.0 ;
    sum = sum + 1.0 / i ;
  } while ( sum < 100.0 ) ;
}
```

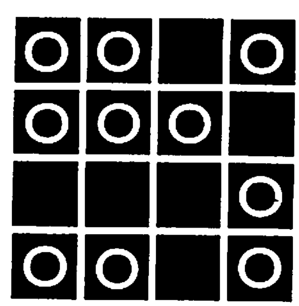
Solutions

Jan 1.



In the figure above the 10 circles are placed so that there are 10 rows, columns, and diagonals that each contain an even number (2 or 4) of circles. In 1928 Sam Loyd asked how to place the 10 circles so as to obtain the maximum number of rows, columns, and diagonals containing an even number of circles. Nob Yoshigahara, in the spirit of today's "less is more" generation, asks you to place the 10 circles so as to obtain the minimum number of rows, columns, and diagonals containing an even number of circles.

Several readers found a solution with zero such rows, columns, and *main* diagonals. Perhaps the problem should have been clearer: we want to consider all diagonals, not just the two with four entries. However, all the solutions received that solved the problem as intended, did have zero odd rows, columns, and main diagonals, so in fact these solutions solve both interpretations of the problem. The following solution, from Gardner Perry, contains one odd (non-main) diagonal. A computer search by Donald Savage has determined that this solution is the best possible.



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Puzzle

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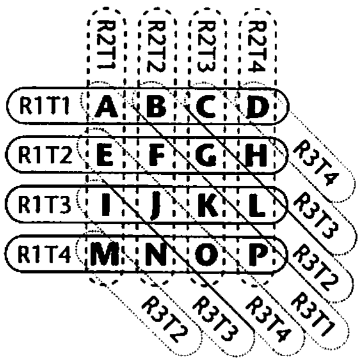
Jan 2. Jerome Dausman, a former U.S. Monopoly champion, was asked by Parker Brothers to judge a regional championship, which consists of three rounds of play each with four tables. When there are 16 contestants the following pairings are used.



(The oval R3T2 contains the players who are to sit at table 2 during round 3.) This solution has no player playing the same opponent more than once. There were 14 contestants at the championship Dausman was to judge, so the decision was made to have two three-player tables and two four-player tables in each of the three rounds. An added requirement was that each player would sit at at least one three-player table and at at least one four-player table during the three rounds. Find a set of pairings so that the number of players to meet an opponent more than once (a "second pairing") is minimized?

This one is not so easy. Len Schaider's solution, printed below, has only two second pairings (meaning that four players are involved in second pairings). I received solutions with no second pairings, but they had either a player sitting at only three-player tables or a player sitting at only four-player tables, contrarary to the requirements of the problem given above. Schaider writes:

Given the rules of two three-player tables and two four-player tables, two contestants have to sit out each round. After selecting six "generic" groups (1–6) to sit in round one, some of the choices for rounds two and three become fixed. In the diagrams below, T3x is one of the two three-player tables and T4x is one of the two four-player tables; OUT indicates the two players sitting out that round.

For example, given the seating in R1, then groups 1 and 2 must sit at T4x during R2 or R3 and groups 3 and 4 must sit at T3x during R2 or R3. (See case A1). In R3, players 1 and 2 may sit at different T4x tables but that does not affect the answer.

Now, players 5 and 6 must sit at T3x in one round and at T4x in the other round. There are many choices for players 5 and 6, except that they cannot sit together at the same T3x table in either round because that would constrain one of the 3/4 players. So, there are two basic ways the 5/6 players can sit as shown in cases A2-A3. In case A2, players 5/6 sit at the T3x table in different rounds and in case A3, they sit at the T3x table in the same round. In both cases A2 and A3, there are many ways that players 1256 can sit at the four-player tables but these will not affect the answer.

	CASE A1			CASE A2		CASE A3	
	R1	R2	R3	R2	R3	R2	R3
T3A:	111	34-	34-	345	346	345	34-
T3B:	222	34-	34-	34-	34-	346	34-
T4A:	3333	12--	12--	126-	125	12--	1256
T4B:	4444	12--	----	12--	----	12--	----
OUT:	56	--	--	--	--	--	--

With this as a basis, the seating in R2 and most of the seating in R3 can be completed without having any "second pairings" as shown in the case Bx diagrams below:

		CASE B2		CASE B3	
	R1	R2	R3	R2	R3
T3A:	111	345	346	345	34-
T3B:	222	342	34-	346	34-
T4A:	3333	1263	125-	1234	1256
T4B:	4444	1234	1234	1234	1234
OUT:	56	14	--	12	--

In both Bx cases, the 1/2 and 3/4 players that sat with each other in R2 switch places to avoid "second pairings" in R3. However, the remaining two seats cannot be filled without the "second pairing" problem. For example, in case B3 above, the open seats at the T3 tables can only be filled by 1/2 or 3/4 player. If a 1/2 person is seated, it would be a person that sat with the 3/4 person at one of the T4x tables in R2. (The 1/2 players that sat out R2 have to sit at a T4x table in R3). If a 3/4 person sits in an open seat, it would be a person that sat with the 3/4 person at the T4x tables in R1. Any variations of the 1256 people between the T4x tables does not avoid the "second pairing" problem, so the only solution will have two sets of "second pairings" in R3, as shown with 16 unique players in case C:

	CASE C			
	R1	R2	R3	
T3A:	ABC	GKO	IMH	<== second pairing, H and I
T3B:	DEF	HLP	JNK	<== " " , K and N
T4A:	GHIJ	ADIN	CFOP	
T4B:	KLMN	BEJM	AEGL	
OUT:	OP	CF	BD	

Better Late Than Never

1994 A/S 1. Robert Norton remarked that the published solution is correct (rarely are such remarks sent; this time the solution confirmed his personal "trip to becoming a Life Master in the ACBL"). However Jorgen Harmse sees it a little differently. You can write to the editors for a copy of Harmse's analysis.

1995 JAN SD. Several readers noted that circles are not the only figures with property given (e.g., equilateral triangles also cannot pass through a similar cutout). Another big advantage for round manhole covers is that they are easy to roll.

Other Responders

Responses have also been received from B. Bruno, S. Chilton R. Fieldhack, M. Fountain, T. Giuffrida, C. Goodwin, J. Harmse, W. Hartford, R. Hess, M. Lindenberg, R. Norton, K. Rosato, A. Rosen, and I. Shalom.

Proposer's Solution to Speed Problem

It will run forever, 1/i quickly gets so small that its addition to sum has NO effect.

becoming serious about music. He has resumed trumpet lessons, and recently formed a brass quartet.

Courtney Moriarta works for the Conservation Services Group in Boston, which helps Boston Edison's residential space heat customers to save energy. Courtney moved to Weston, Mass., in January with her fiancé, Kent Lundberg, '92, and Hazel, their pet rabbit. They will marry in May. . . . As for myself, I also recently spent some time in Weston (my home town) for the Weston High School alumni/ae swim meet, at which Dinesh Lathi, '92, Vijay Lathi, '94, and I re-enacted three-fourths of our speedy 1987 medley relay (only a bit slower this time). Dinesh is attending Harvard Business School and Vijay is working toward a master's degree.

Chantell (Wyland) Kuhlmann is at the Los Angeles Air Force Base with Renee (Mong) Miller, who continues to provide so much