

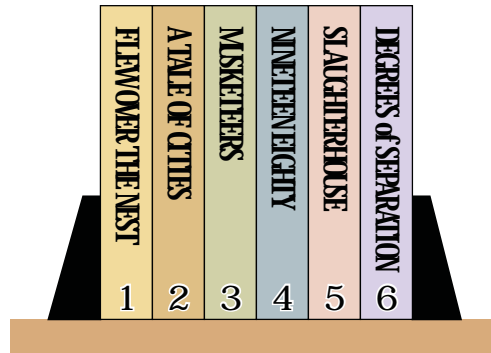
bogglers

by scott kim

Logic? No Problem!

What's your problem-solving style—brute force or careful reasoning? Either approach may work, but as this month's collection of puzzles demonstrates, you'll usually get the answer more quickly, and elegantly, if you use logic to break things down.

JOY OF SIX

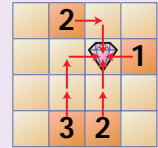


Six books sit side by side on a shelf. Put the books in order so that the sequence of the numbers on their spines satisfies each of the following conditions.

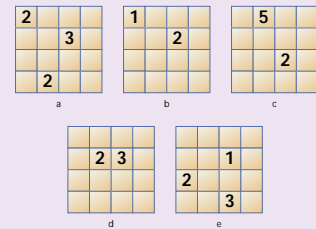
- [Easy]** Rearrange the books so adjacent book numbers differ by at least 3 and the number of the leftmost book is as small as possible.
- [Easy]** Rearrange the books again, this time so adjacent book numbers add up to no more than seven, and the number of the leftmost is as small as possible.
- [Challenging]** Rearrange the books yet again, this time so adjacent book numbers form two-digit numbers that cannot be divided evenly by 3, 4, or 5. For instance, the order 1-2-3-4-5-6 fails on several counts: The two-digit number 12 divides evenly by 3 and 4; the number 45 divides evenly by 3 and 5; and 56 divides evenly by 4.

WHAT LIES BENEATH

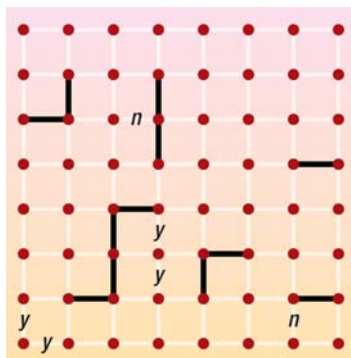
Math educator and researcher Tom O'Brien developed a computer game called "Treasure Hunt" to teach logical thinking skills to elementary school students. The goal is to find a precious gem that is hidden underneath one of 16 squares in a four-by-four grid. When you touch a square of the grid, a number appears revealing the shortest distance from the square to the treasure as measured in horizontal and vertical steps. For example, the numbers in the grid above show the distance to the treasure from four different squares. (Each arrow represents one step.) There can be several different paths of equal length from a particular square to the jewel.



- [Easy]** Is there enough information provided to find the treasure in each of the following grids? If so, where is the treasure? If not, where might the treasure be? And if there is more than enough information provided, which numbers are unnecessary?



- [Challenging]** What is the greatest number of squares you can touch and still not be able to determine for certain where the treasure is?
- [Challenging]** What is the best strategy for finding the treasure? In other words, how few squares can you touch and still be sure to find the treasure?



LINES OF REASONING

In the grid at left, constructed by Glenn Iba, find a single closed path that passes through every red dot and includes all of the black lines. You can deduce the solution through logic. To set off on the right path, first try answering these questions.

- [Easy]** Grid lines marked *y* must be black. Why?
- [Challenging]** Grid lines marked *n* must not be black. Why?

- [Difficult]** Complete the path, which must be a single closed loop that includes every red dot and all of the black lines. The solution is unique.
- [Unsolved]** The 12 black lines drawn into the grid at left force a unique solution. If you were starting this puzzle with an empty grid (without any black lines drawn in), what would be the minimum number of black lines required to force a unique solution?

FOR BOGGLERS SOLUTIONS, TURN TO PAGE 87. FOR MORE BOGGLERS PUZZLES, GO TO WWW.DISCOVER.COM.





BOGGLERS SOLUTIONS

JOY OF SIX

This puzzle is adapted from my mobile phone game Daily Puzzle, recently published in North America by Sorrent (www.sorrent.com).

1. The correct order is 3-6-2-5-1-4. Book 4 must be next to book 1, and 3 must be next to 6, which means the six books can be only in the order 4-1-5-2-6-3 or (backwards) 3-6-2-5-1-4. The answer is 3-6-2-5-1-4, the order with the smallest leftmost number.

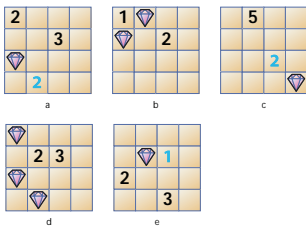
2. The correct order is 3-4-2-5-1-6. Book 6 can be next to only book 1. Book 5 can be next to only books 1 or 2. So the sequence 6-1-5-2 (or backwards, 2-5-1-6) must be part of the answer, followed or preceded by books 3 and

4 in either order. So, the answer with the smallest leftmost number is 3-4-2-5-1-6.

3. The order is 5-3-1-4-6-2. The first book must be 5, because 5 cannot be the second digit of any of the two-digit numbers (any two-digit number ending in 5 is evenly divisible by 5). The second book must be 3, because all other options yield a two-digit number divisible by 3 or 4. The third book cannot be 4, because the sequence 5-3-4 leaves 6, 2, and 1, which in any combination will give at least one two-digit number that is divisible by 3 or 4. So the only sequence of books that satisfies the condition is 5-3-1-4-6-2.

WHAT LIES BENEATH

1. The numbers that aren't necessary to solve the puzzle appear in blue.



2. Four is the greatest number of squares you can touch without uncovering the treasure.



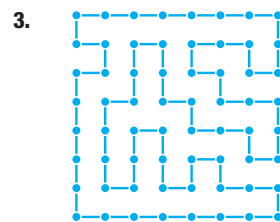
3. Two squares are always enough. First touch a corner square. The number will reveal which diagonal the treasure lies on. (A 2 in the top-left-corner square would show that the treasure is on the diagonal that runs from the third square in the top row to the third square in the first column.) Then touch a square at one end of the diagonal. This will tell you where along the diagonal the treasure is hidden.

LINES OF REASONING

This puzzle is adapted from my *2005 Brainteasers Page-A-Day* calendar (Workman Publishing).

1. If each red dot is part of the loop, then each red dot must have two black lines coming out of it. So the two y lines in the lower-left corner must both be black because they are the only two lines that touch the corner dot. (This applies, of course, to all four corners of the grid.) The other two y lines must be black because the dot that is common to both cannot be connected any other way without creating an "illegal" three-way junction—illegal because a three-way junction would not allow for a continuous loop through the puzzle.

2. The upper n line cannot be black, because it would then create a three-way junction. The lower n line cannot be black because, as mentioned above, there must be two black lines coming out of the bottom-right-corner dot—filling in the lower n line would separate square loop, and the solution requires one continuous loop.



4. I don't know what the best answer is.



resources

Visit the Web sites of the institutions mentioned in the article: the Field Museum (www.fieldmuseum.org); the Chicago Botanic Garden (www.chicagobotanic.org); and the Morton Arboretum (www.mortonarb.org).

Search the virtual herbarium: www.vplants.org.

54 SAVING EDEN

"Reviving Iraq's Wetlands." Andrew Lawler in *Science*, Vol. 307, pages 1186–1189; February 25, 2005.

"The Restoration Potential of the Mesopotamian Marshes of Iraq." Curtis J. Richardson et al. in *Science*, Vol. 307, pages 1307–1311; February 25, 2005.

Read reports from the United Nations Environmental Programme: "The Mesopotamian Marshlands: Demise of an Ecosystem" (www.grid.unep.ch/activities/sustainable/tigris/report.php) and "Desk Study on the Environment in Iraq" (www.eldis.org/static/DOC12118.htm).

60 EXTREME STATES

"Near-Death Experiences and the Temporal Lobe." Willoughby Britton and Richard R. Bootzin in *Psychological Science*, Vol. 15, No. 4, pages 254–258; April 2004.

"Near-Death Experience in Survivors of Cardiac Arrest: A Prospective Study in the Netherlands." Pim van Lommel et al. in *The Lancet*, Vol. 358, No. 9298, pages 2039–2045; December 15, 2001.

Melvin Morse's Web site has a list of his publications, as well as his critique of conventional approaches to the study of end-of-life issues: www.melvinmorse.com.

75 REVIEWS

To read more about "the finest natural music on the planet," see *The Singing Life of Birds: The Art and Science of Listening to Birdsong* by Donald Kroodsma (Houghton Mifflin, 2005). For the duffers among us, Simon Barnes supplies an irreverent survey in *How to Be a (Bad) Birdwatcher* (Pantheon, 2005).

A lyrebird fact sheet, from the National Parks and Wildlife Service of New South Wales, Australia: www.nationalparks.nsw.gov.au/npws.nsf/Content/Lyrebirds.

Arthur I. Miller is the author of *Einstein, Picasso: Space, Time, and the Beauty That Causes Havoc* (Basic Books, 2001), a dual biography.

View images from the Chandra X-ray Observatory at chandra.harvard.edu.

Before Victoria: Extraordinary Women of the British Romantic Era by Elizabeth Campbell Denlinger (The

New York Public Library/Columbia University Press, 2005) is the elegantly illustrated exhibition catalog.

Pandora's Breeches: Women, Science & Power in the Enlightenment by Patricia Fara (Pimlico, 2005) examines the lives of some early women scientists.

Further background on Anna Atkins appears at www.com/masters/a/atkins-anna.html and photography.about.com/library/weekly/aa060302b.htm.

For more "Poems on Conchology and Botany" by Sarah Hoare, see www.conchsoc.org/funbase.htm?row2col1=rhymes3.htm.

Read about Mike and Doug Starn's current and future exhibits: www.starnstudio.com.

Follow a century of discoveries at Cold Spring Harbor Laboratory: www.cshl.edu/genetics100/timeline.html.

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Tom O'Brien's games Treasure Hunt, Find It, and Mystery Three are available for Palm devices at www.handmark.com and www.handango.com. (Site licenses are available at www.professortobbs.com or 74055.652@compuserve.com.) Treasure Hunt was first described in "Fasten Your Seat Belts" by Thomas O'Brien and Judy Barnett (*Phi Delta Kappan*, November 2003) and in "Hold On to Your Hat" by the same authors (*Mathematics Teaching* [U.K.], June 2004).

88 X

"The DNA Sequence and Analysis of Human Chromosome 13." A. Dunham et al. in *Nature*, Vol. 428, pages 522–528; April 1, 2004.

Ben Fry's home page: acg.media.mit.edu/people/fry/.

A Web page on chromosome 13 with links to information: www.ornl.gov/sci/techresources/Human_Genome/launchpad/chrom13.shtml.

The National Institutes of Health's Genetics Home Reference Web site: ghr.nlm.nih.gov/chromosome=13.

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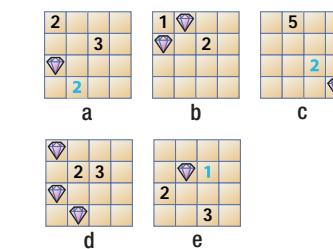
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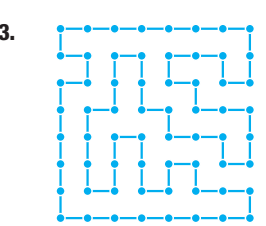
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4. Glenn Iba recently found a grid with just eight lines that forces a unique solution (see www.discover.com). Is there a solution with fewer lines? No one knows (yet).