

College Guild

PO Box 696, Brunswick, Maine 04011

Logic, Puzzles, and Games

Unit 3 of 6

Puzzles

It has been said that solving a riddle is like using clues to find a treasure chest, while a **puzzle** is like opening the chest itself. Puzzles are problems that are solved with a variety of different strategies including rearranging or connecting pieces, or filling in missing words or numbers. These problems are meant to challenge us in a fun way. Allow frustration to wash off of you and consider taking more time with these before you submit your work to us. Keep in mind that recreational puzzles are created to give you a no risk opportunity to feel clever, and are not intended to make you feel bad about yourself. We hope you have as much fun solving them as we did finding and creating them.

You Can't Spell Puzzle Without "U"

1. If you were writing for College Guild what sort of puzzles would you want to include and why? Maybe you have a favorite kind of puzzle from the past or ones that you like now. If so, describe it in detail and provide an example if you can. If you can't think of an example to share, continue on with the unit and come back to this question at the end.

2. Yasmin and Caleb are arguing over what is the best way to present a puzzle to someone. Yasmin believes that you should tell someone how difficult the puzzle is beforehand, while Caleb thinks that the difficulty level should not be revealed at the start. Give at least one reason that supports what Yasmin is saying, and at least one for Caleb's belief. If you had to choose one of their positions, who would you support?

It's a Numbers Game

In our first round of puzzles you will be greeted with three different number puzzles that will get your brain stirred up. As with any problem, do your best to solve them. Remember even walking away from a problem and coming back to it later might be good at times.

3. Lucky Sevens: If you write out the numbers 1 to 1000, how many times will you write the number 7?

4. May the "Fours" be with You: Using only four 4's and the operations of adding, subtracting, multiplying, and dividing, make the numbers one through ten.

5. "Bee-Ware": Female honeybees come from a fertilized egg while male honeybees come from an unfertilized egg. That is, female honeybees have a mother and a father, while male honeybees have only a mother. How many grandparents does a male honeybee have? How many great-great grandparents? How many great-great-great grandparents?



Seek and Ye Shall Find

Spaniard Pedro Ocón de Oro is credited with inventing a word search back in the 1960s. His Sopa de letras (“Soup of Letters”) was a smash hit and appeared in numerous books and newspapers. You already had a taste of some of his work in the last unit, he is also credited as inventing the Rebus. Just like the honeybees, this idea has given birth to generations of other puzzles involving splitting up and separating a mess that you are given.

6. Find the words by circling them in the puzzle below. Some of the words include answers to the last unit’s riddles so you can check your answers. If you haven’t finished those yet you might not want to peek yet.



patience
rebus
egg
pascal

recursion
riddle
mountain
domino

midpoint
sunflower
reasoning
dissection

equilateral
darkness
games
fill

deduction
time
pattern
piece

conundrum
fish
handshake

People are not just interested in solving puzzles, but inventing new ones. In 2024 New York Times Games research director Juliette Seive was looking to add on to the success of the game WORDLE. In discussing the project with her partner, they felt that the realm of word searching was not fully tapped into. Their idea, STRANDS, has become a popular hit. The puzzle is increased in difficulty as the words you are searching for are not provided, only a clue that links the words together. Once completed there will be one special word called a Spangram that starts and ends on the border of the puzzle. Here is a simple example to show you how it begins and the solution.

Title: "Pick Me"

B	A	N	A
N	A	I	T
F	R	U	L
I	E	E	P
M	L	A	P

The Solution

B	A	N	A
N	A	I	T
F	R	U	L
I	E	E	P
M	L	A	P

Notice in the solution the letters for the words BANANA, APPLE, and LIME are found. Pay attention to the way the words are formed, in particular LIME on the lower left corner. You are allowed to link letters diagonally to form the words. However, the words cannot cross over each other. The letters remaining form the Spangram, FRUIT in this case, which link all the words together into a common theme, including the title: Pick Me.

7. Solve the Strands puzzle below using the title of the puzzle as the only clue.

Title: "Harmony"

G	A	R	I	N	I
U	T	L	S	N	A
I	O	U	R	T	B
V	I	M	N	T	U
T	N	E	O	I	C
E	A	R	M	D	A
N	H	P	Y	M	R
O	H	O	L	X	U

Computer programs assist publications to construct puzzles for their readers, but making a puzzle on your own gives you a chance to be creative and become part of the experience. It is a puzzle to create a puzzle. You might find that this could take a while to design. Try to enjoy the challenge and that might mean taking more time with it.

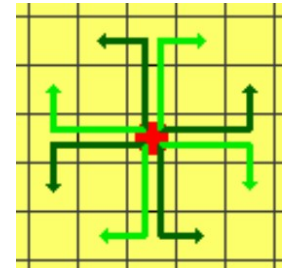
8. Make your own Strands puzzle for us to solve. You can make your grid of letters small as in the example Pick Me or larger such as in the example Harmony. You may want to begin with your title and the Spangram word first be sure all the letters get used in your grid as well. It also is more fun for us if you don't tell us the solution.

Fill It Up

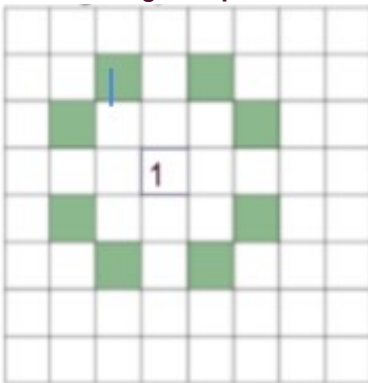
Another puzzle structure is to take a frame and to fill it. Jigsaw puzzles and crosswords are two examples of hugely popular puzzles with this design. Here is one that you likely aren't familiar with called the Knight's Tour Puzzle. It begins by knowing the way the knight piece moves in the game of chess. The piece can move only in an "L" shaped pattern of two squares in any direction and one square to the right or left, as shown in the picture below.



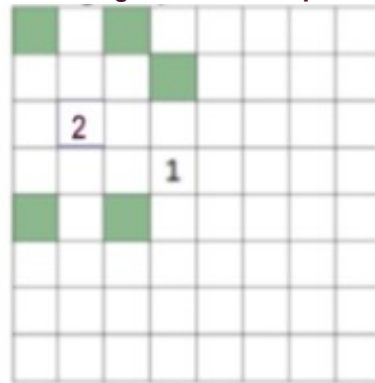
In the Knight's Tour Puzzle you can start with the knight in any place on a chessboard. Your challenge is to get the piece to visit as many squares as you can without landing on any previous square you visited. This puzzle has been studied for over a thousand years and has gotten interest from computer scientists in studying how computers can search for information with a program. Below you see an *unsuccessful* attempt to solve the Knight's Tour. This attempt ended after only twenty-two squares out of the sixty-four were reached. The progress stopped because any further move would place the knight on a square that was already visited.



Starting in Square 1



Choosing to move to Square 2



Hit a dead end after 22 moves

		22			20	
				21	17	19
13	2	15		11		
		12	1	16		18
3	14		10	5		
		4			9	6
			8			
					7	

9. Try to solve the Knight's Tour. You might find a pencil with an eraser handy. Start by making a square divided into the classic sixty-four square chess board. Place a 1 just as was shown above and continue placing numbers according to the way the knight moves in the game. Place numbers though a different path than the one shown. Be patient and persistent. See if you can reach more than twenty-two squares. Can all sixty squares be reached? If you are enjoying this, begin with the knight on a different square to begin and see if it makes the question harder or easier.

10. Share your thoughts on the Knight's Tour Puzzle.

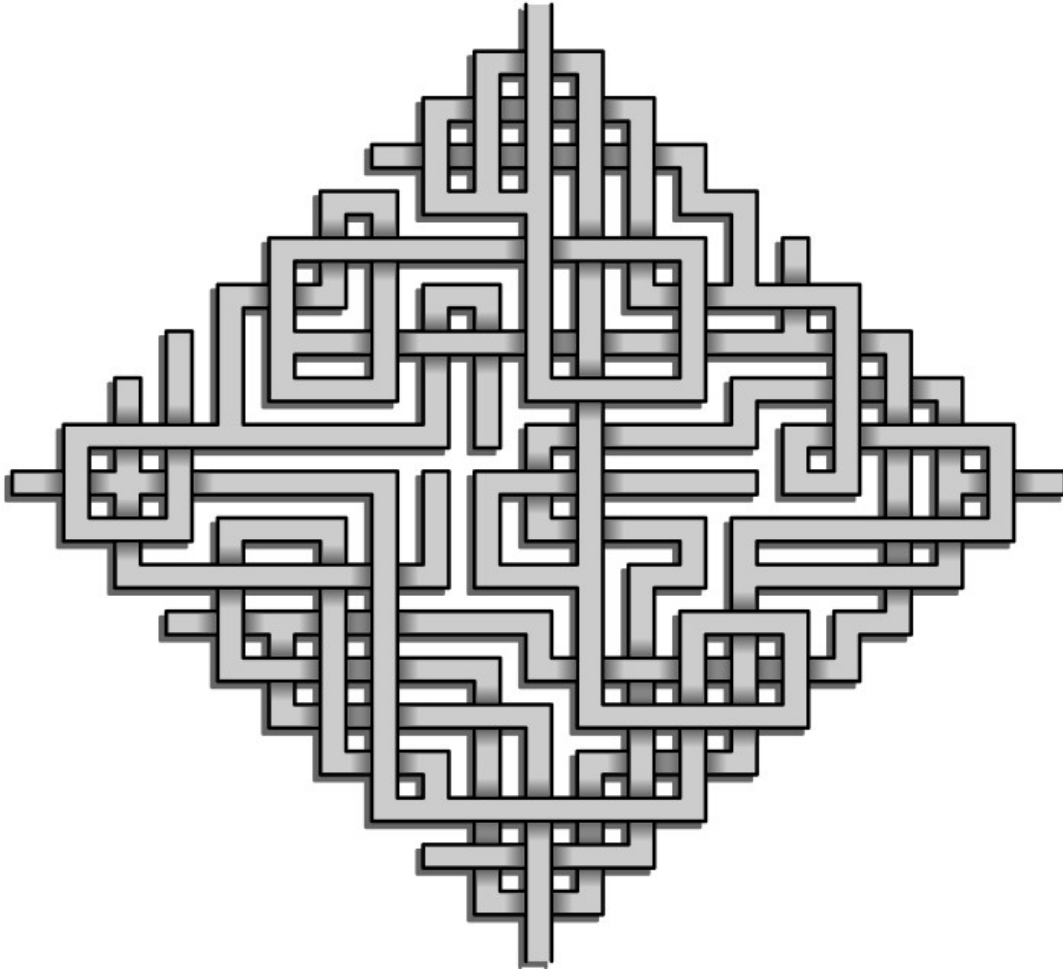
Travel About

It might "amaze" you learn that mazes have been around for over three thousand years. Perhaps that isn't so surprising though as we often can get lost as we move about a city, an unfamiliar building, or out on a hike in the woods. The satisfaction of finding your way out of a maze may make up for being lost and frustrated during the ordeal. In this section we explore puzzles that involve movement through a framework.

11. Tell us a story about a time in your life where you were lost. How old were you, who was with you, what caused you to become so lost? If you would rather, make up a story where a person gets lost. Write a few paragraphs to set the scene and make us feel for the characters who are lost.

12. Begin at the top of this weaving maze and exit through the bottom. For an added level of challenge, count as you are solving it and let us know how many seconds it took you to reach the exit.

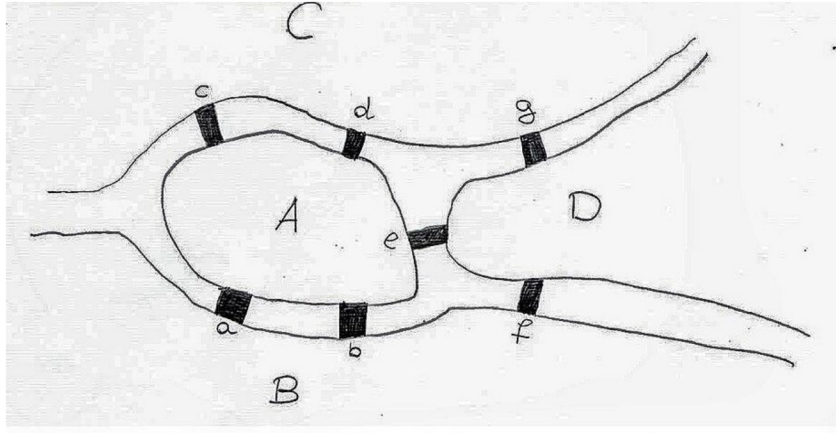
START



EXIT

Through our participation in the College Guild, we join the ranks of notable thinkers who communicate through written communication. One such pairing were two mathematicians in the 18th century, a Prussian (Russian) named Heinrich Kuhn and Switzerland's Leonard Euler (pronounced Oiler). Euler is regarded as one of the brightest minds of all time. Their letters to each other included a puzzle which Kuhn believed would accelerate his country's math and science program. The curiosity is known as the Königsberg Bridge Problem and its solution involves tracking a path through the Prussian city by the same name. Euler responded reluctantly at first, writing, "This type of solution bears little relationship to mathematics and I do not understand why you expect a mathematician to produce it rather than anyone else, for the solution is based on reason alone, and its discovery does not depend on any mathematical principle."

13. Give the Königsberg bridge problem a try yourself. Use the map below. Beginning at any of the starting points on land, marked with the capital letters A, B, C, or D. Travel over all seven bridges marked with lower case letters a, b, c, d, e, f, and g in any order you like as long as you don't go over the same bridge twice. You must end up in the same place that you started. Draw your final solution if you discovered it.



You may have realized as Heinrich Kuhn did, that this was not an easy question. Euler, although seemingly annoyed by the question, went on to prove that there was no way to solve this particular bridge problem. An unexpected result of this conversation led to a completely brand new mathematical subject called Graph Theory. This branch of mathematics is used to this day to determine the best routes for traffic, wiring a new building, and in studying the pathways in the brain.

14. Determine if one more bridge added to the map can make the solution possible. If you feel as if that is still impossible, add yet another bridge to make the trip possible. Draw a picture of the new map and the path over the bridges that solves it. For a deeper challenge write down a "rule" that has to be present in a map to make the solution possible.

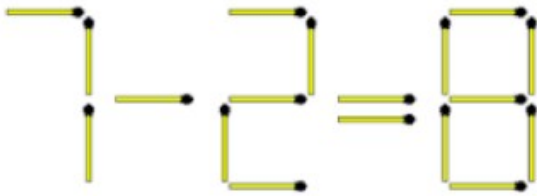
Get Fired Up!

One hundred years ago "Friction Lights" were invented by British pharmacist John Walker. Soon after they were sold under the name "Lucifers" in boxes with puzzles printed on them to promote their sales. Today we call Walker's invention by a different name, the matchstick. Before we challenge you to solve these devilish puzzles, appreciate the simplicity of using only sticks to create the puzzle. To create a physical copy of these puzzles you wouldn't even need a box of matches, you could use toothpicks, pencils, strips of paper, or sticks off the ground. Some of the best ideas ever come from the simplest elements. Think about the game of soccer and how popular it is. All you need is a ball and you can play; sneakers and goalposts are optional!

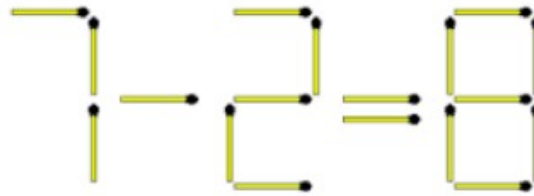


15. Follow the instructions for each of these matchstick mysteries. When you finish, make a sketch of what the matchsticks looked like afterwards. Which was your favorite?

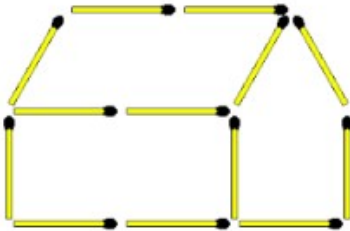
Puzzle A: Remove two matchsticks to make this equation true.



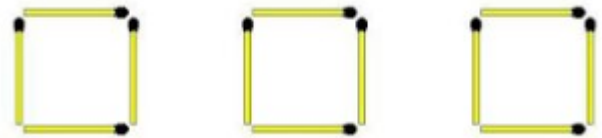
Puzzle B: Move one matchstick to make this equation true.



Puzzle C: Move two matches to get the house to face a different way.



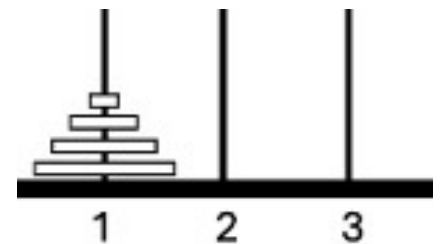
Puzzle D: Move two matches and remove one match to make the word ONE.



Piece Be With You

In the ancient city of Varanasi, in northern India, a logic puzzle was said to have been invented to test the mind power of its citizens. Today it is most commonly known as the Tower or Hanoi problem.

The Towers of Hanoi challenge is typically played with rings, the goal being to get every ring from peg 1 onto peg 3 by moving only one ring at a time, and never a larger ring onto a smaller ring. The rings can be picked up and placed on any peg. Since you don't have the puzzle in front of you, you could make it with slips of four different sized pieces of paper labeled from smallest to largest, A, B, C, and D. You could also play with four different sized coins.



16. Solve the Tower's Puzzle with 4 rings in as few moves as possible. Once you think you have the quickest solution, provide us with the number of total moves and show how the "paper rings" changed stacks using the letters to assist your explanation. To give you an idea of how efficient you can be, if the tower had only three rings it would take 7 moves ($2^3 - 1 = 7$), while a tower of five rings would take a minimum of 31 ($2^5 - 1 = 31$) moves.

The solution for three rings is shown here as an example. Write your answer for four rings in a similar way.

START

A		
B		
C		
1	2	3

MOVE 1

B		
C		A
1	2	3

MOVE 2

C	B	A
1	2	3

MOVE 3

	A	
C	B	
1	2	3

MOVE 4

	A	
	B	C
1	2	3

MOVE 5

A	B	C
1	2	3

MOVE 6

		B
A		C
1	2	3

MOVE 7 DONE!

		A
		B
		C
1	2	3

Self-Reflection Exercise

17. What was the most interesting thing you learned about in Unit 3 Puzzles?

18. Has completing this unit changed you in any way, if so, how?

https://commons.wikimedia.org/wiki/File:Honey_Bee_Line_Drawing.jpg

https://commons.wikimedia.org/wiki/File:Knight_move.png

https://commons.wikimedia.org/wiki/File:WHITE_CHESS_KNIGHT-ROOK.svg

<https://shorturl.at/BZevQ>

https://en.wikipedia.org/wiki/Carl_Gottlieb_Ehler

[https://commons.wikimedia.org/wiki/File:Matchbox_\(AM_679922-8\).jpg](https://commons.wikimedia.org/wiki/File:Matchbox_(AM_679922-8).jpg)

https://commons.wikimedia.org/wiki/File:Euler_fig_1.jpg <https://commons.wikimedia.org/wiki/File:Hanoi1.png>

https://commons.wikimedia.org/wiki/File:Kakuro_black_box.svg