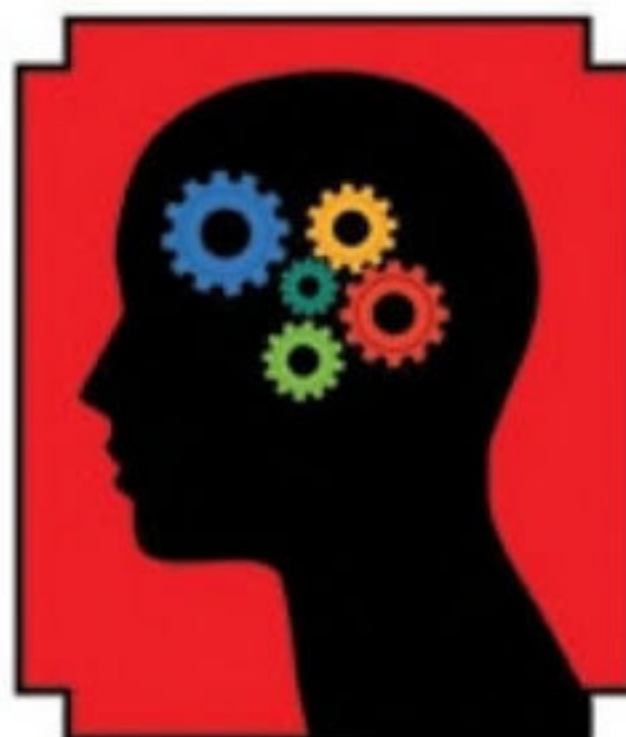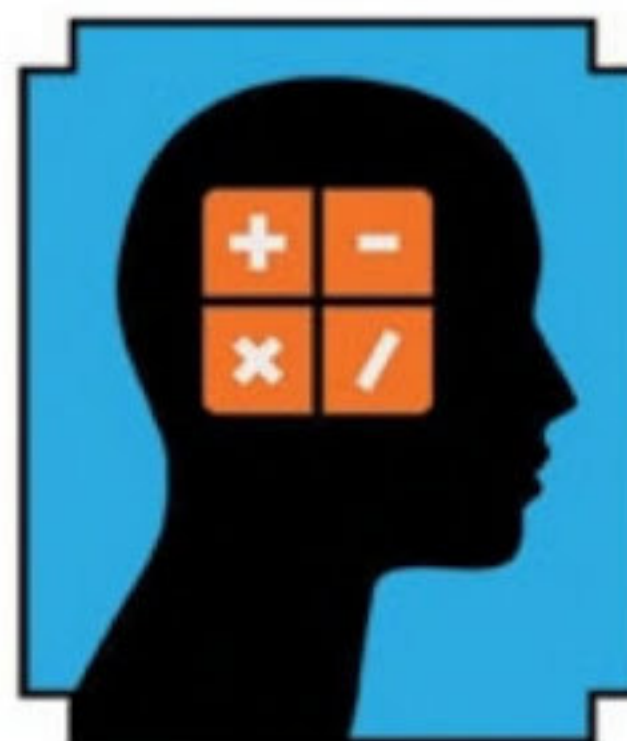'The perfect book to stimulate and challenge your brainpower' TONY BUZAN, INVENTOR OF MIND MAPPING

THE ULTIMATE
BRAIN TRAINER
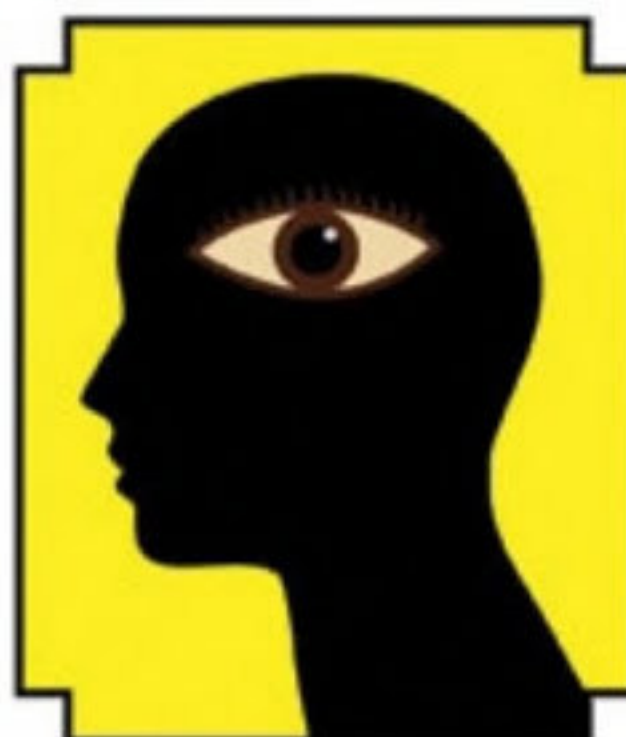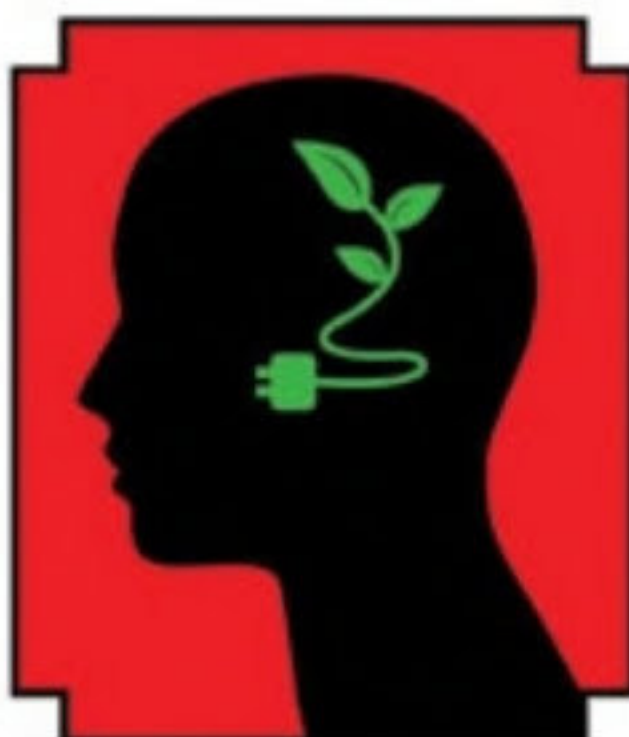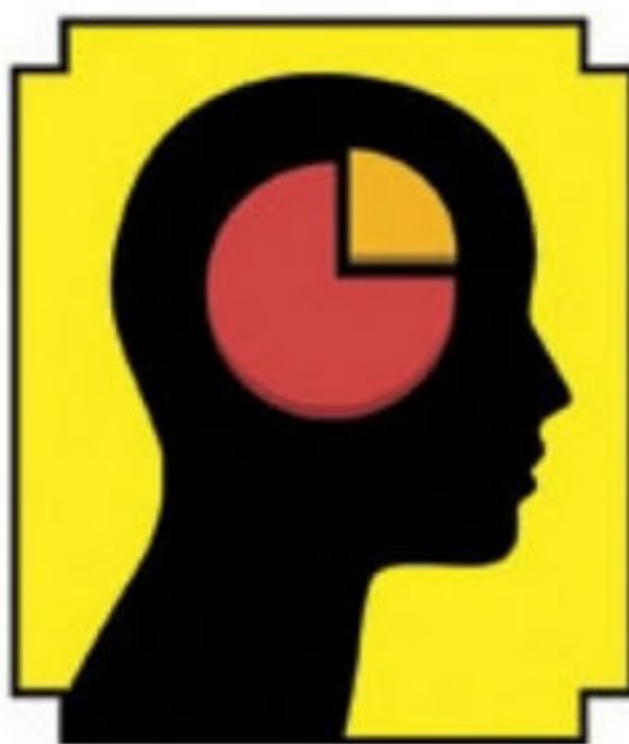## ABHINAV VERMA

MORE THAN 125 EXERCISES TO MAKE YOU SHARPER, QUICKER & SMARTER!

MAXIMIZE YOUR MULTIPLE INTELLIGENCES QUOTIENT!

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Dr. Kota Kartik: Puzzle nos: 35, 36, 37, 53, 54, 55, 56, 97, 98, 101, 102, 103
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Mind Maps: Page 187, The Structure of an Atom by Dhruv Sood;
Page 188, Number System by Arjun Iyer

Abhinav Verma asserts the moral right to be identified as the author of this work

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Contents

Introduction

EVERYONE IS BORN WITH his or her innate strengths, inclinations and aptitudes. Had Albert Einstein's parents forced him to be a good sportsman, he may have been a complete disaster. Many children are good at music and sports, and not as good at English and Mathematics; with others, it may be the opposite. Everybody possesses more or less of one or the other kind of intelligences and one tends to be good at things that one loves.

This book aims to provide an introduction to various kinds of intelligences, now in sum popularly known as 'Multiple Intelligences'. The theory of 'multiple' intelligences was proposed by American psychologist Howard Gardner in his 1983 book *Frames of Mind: The Theory of Multiple Intelligences* as a model of intelligence that differentiates it into specific 'modalities', rather than seeing it as dominated by a single general ability.

One major criticism of the theory has been that Gardner denies the existence of intelligence as traditionally understood to be one general 'intelligence' and instead uses the word 'intelligence' where other people have traditionally used words such as 'ability' and 'aptitude'.

Defenders of the Multiple Intelligences theory argue that the conventional framework of intelligences is too narow, that its definition does not include the varied kinds of intelligence that people might possess, and so a broader definition would be more accurate. They say that the theory of Multiple Intelligences includes the different ways in which humans think and learn. They believe that the traditional definition is self-defeating as it usually defines intelligence as the cognitive or mental capacity of a person – and that would, logically speaking, include all forms of mental capabilities and qualities, not just the ones that are most visible, based on traditional Intelligence Quotient (IQ) tests.

Critics of the Multiple Intelligences theory say that this broader definition ignores the fact that the word intelligence has always denoted the kind of thinking skills that make one successful in school. Gardner has argued that by calling only linguistic and logical-mathematical abilities intelligences, one demeans artistic, musical and athletic abilities.

This book has the best of all aspects of problem-solving including the development of IQ. Through this book I have tried to answer many common IQ-related queries, which are raised by parents and students.

The puzzles and activities have been carefully designed after years of

research. They are designed not only to offer fun-based learning but also to ignite the thought process and teach various approaches towards solving problems. Apart from verbal and mathematical skills, the book includes games or exercises on 'estimation skills' and 'pluralization' as well. The book focuses more on the approaches to solving a problem rather than just presenting the solution itself.

Our education system focuses primarily on linguistic and mathematical intelligences. However, it is the purpose of education to cultivate and facilitate the growth of children into human beings who have the ability to reason at high levels. Education should cultivate the whole child—including head, heart and hand.

Puzzles have always fascinated humans. Research has come forward to suggest that puzzles sharpen the mind, improve memory, and keep the brain fit throughout life. If puzzles are to the brain what physical exercise is to the body, then let's do puzzles—not just for fun, but more importantly for brain fitness. And as with everything else, it's best to start now.

Abhinav Verma
Delhi

We should spend less time ranking children and more time helping them to identify their natural competencies and gifts and cultivate these. There are hundreds and hundreds of ways to succeed and many, many different abilities that will help you get there.
—Howard Gardner,
American developmental psychologist

THE SECRETS OF MULTIPLE INTELLIGENCES

In 1983, Howard Gardner, a world renowned developmental psychologist and the John H. and Elisabeth A. Hobbs Professor of Cognition and Education at the Harvard Graduate School of Education at Harvard University, proposed the notion that human beings have not just one type of intelligence, but several types. Gardner's definition of intelligence was 'a biopsychological potential to process information that can be activated in a cultural setting to solve problems or create products that are of value in a culture.'

Gardner described seven different types of intelligences in 1983, i.e., linguistic or verbal, logical or mathematical, musical, intrapersonal, interpersonal, spatial, and bodily-kinesthetic. Later on, he added an eighth intelligence as well: naturalistic. The puzzles presented in this book aim at exposing and building many of these different forms of intelligence.

Conventionally, intelligence quotient (or IQ) has been the main measure of intelligence and various tests had been worked out to evaluate it.

WHAT IS INTELLIGENCE QUOTIENT?

IQ is a score derived from one of several standardized tests designed to assess intelligence. The abbreviation 'IQ' comes from the German term Intelligenz-Quotient, coined by psychologist William Stern.

The man behind IQ was Alfred Binet, who was both a psychologist and a lawyer. His greatest accomplishment in the field of psychology led to what is now known as Intelligence Quotient or IQ. As a member of a French commission investigating educational concerns, he developed a test to measure the 'mental age ' (MA) of children entering school. Mental age refers to a child's current ability compared to other children of different ages. In other words, if a child responded to questions at about the same correctness as a nine-year-old, the child would be said to have a mental age of nine. This test was considered as the first intelligence test.

In 1914, William Stern, a German psychologist, proposed that by dividing the mental age of a child by his or her chronological age (CA), we could provide an easy-to-understand 'Intelligence Quotient.' This was again revised by Lewis Terman from Stanford University, US, who expanded the test for American subjects and multiplied the Stern formula by 100, leading

to the statistical definition of Intelligence: IQ=MA/CA*100. The test was later renamed the Stanford-Binet Intelligence Test, as it is known as today.
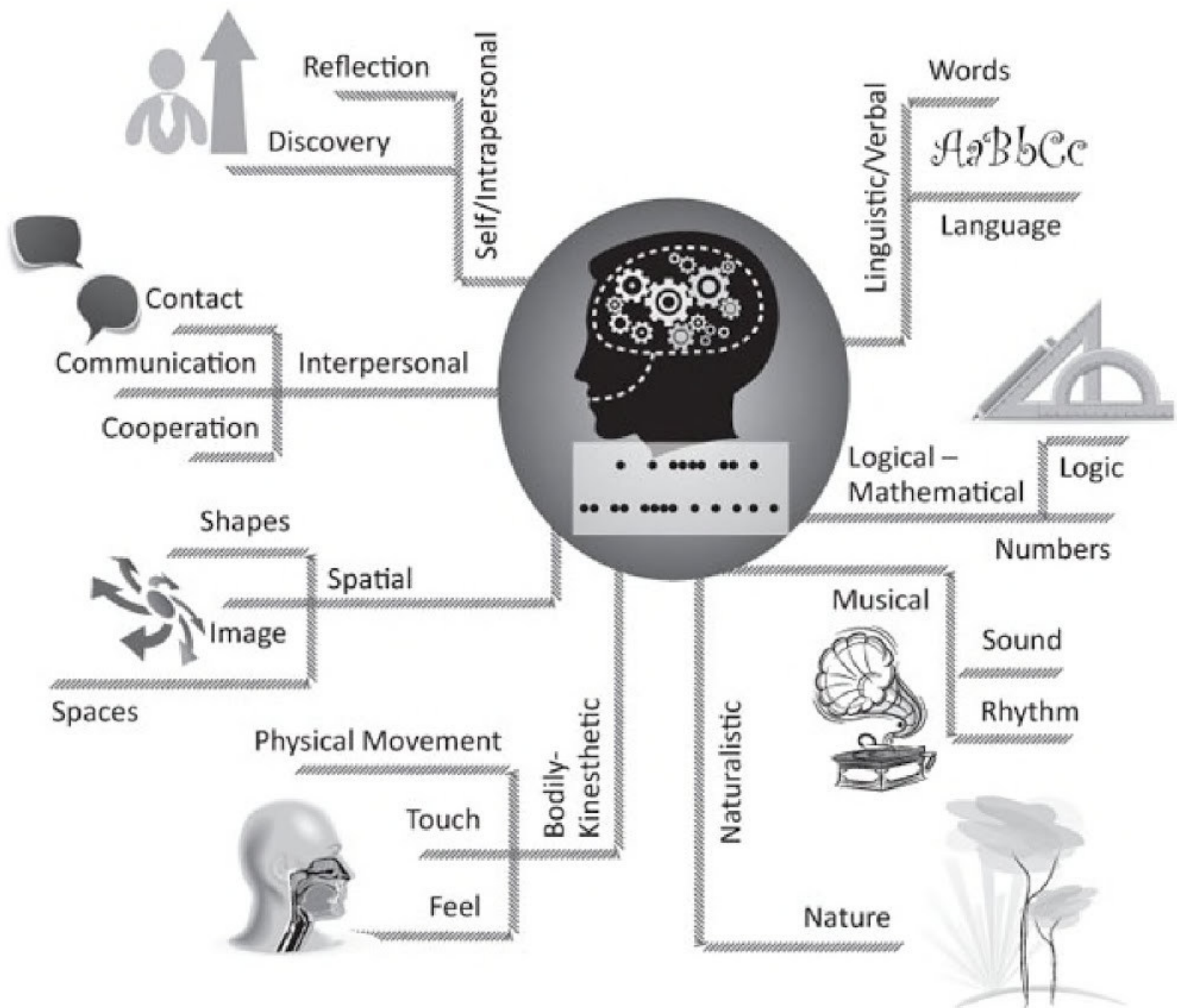
HOW DOES IQ HELP IN OUR LIFE?

A high IQ is an index of higher thinking skills and reasoning abilities. People with high IQ are able to form a holistic view of a problem and arrive at its solution or solutions better and quicker than the average population. IQ is influenced greatly by the upbringing and exposure of the child.

IQ is a tool that needs to be triggered. It is effective only when it is used or applied, and it depends on how you use it. The best output comes when this tool is applied to your area of interest. A faster reaction to tasks puts you above your counterparts, which helps in your chosen career as well. People with high IQ also have a faster response time to problems.

INTELLIGENCE TESTING: HISTORY & DEVELOPMENT

Psychologists and scientists have always been interested in measuring

intelligence, as this is the one distinct quality that sets humans apart from other animals, or their closest ancestors. There have been many people who have helped in developing methods to test intelligence.
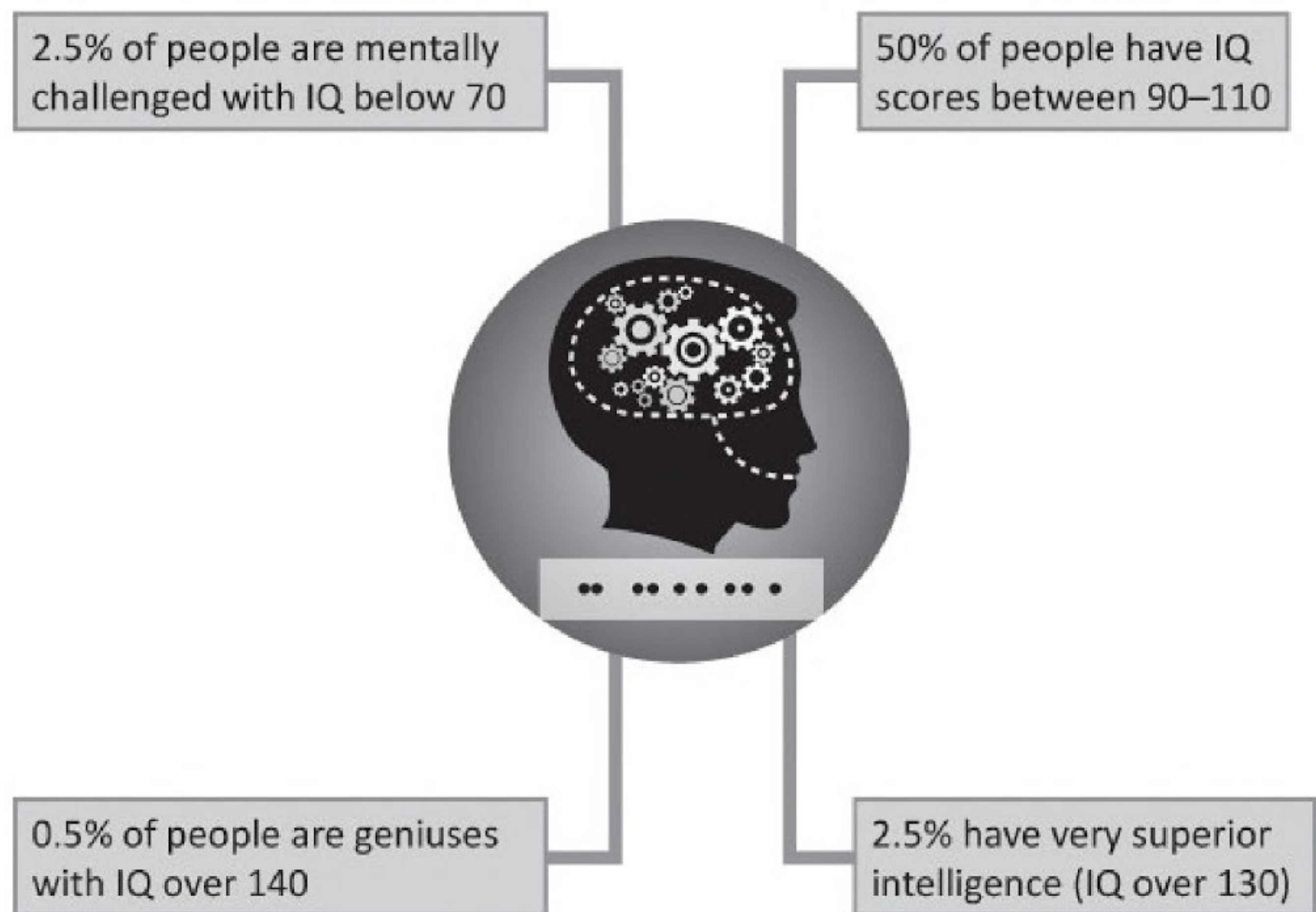
1. FRANCIS GALTON: MEASURING INTELLIGENCE

A half-cousin of Charles Darwin, Francis Galton (1822–1911) is considered to be the father of the study of individual differences. For Galton, measurement of intelligence was to be as direct as possible a measure of underlying intelligence. Hence, Galton suggested reaction time as a feasible approach and pursued various sensory– motor measurements.

2. ALFRED BINET: FIRST INTELLIGENCE TEST

Known as the Father of IQ Testing, Alfred Binet (1857–1911) is celebrated in history as the man who created the first 'intelligence test' in the form we know it today. In 1905, he produced the Binet– Simon Scale tests, with Theodore Simon, a French psychologist and psychometrician. Binet took a pragmatic approach, choosing a series of 30 short tasks related to everyday problems of life, such as naming parts of the body, comparing lengths and weights, counting coins, assessing which of several faces is 'prettier', naming objects in a picture, digit span (the number of digits a person can recall after being shown a long list), word definitions, filling in the missing words in sentences and so on. The supposition was that all these tasks involved the basic processes of reasoning.

The tests were arranged according to increasing levels of difficulty. Each level of tests matched a specific developmental level – all tests at a given level were capable of being solved by any normal child in that age group. The test results proved to be co-related to other criteria, such as results of school exams, assessments by teachers, and so on.

2.5% of people are mentally challenged with IQ below 70		50% of people have IQ scores between 90–110

0.5% of people are geniuses with IQ over 140		2.5% have very superior intelligence (IQ over 130)

3. LEWIS TERMAN & WILLIAM STERN: IQ SCORES

Lewis Terman (1877–1956) of Stanford University, US, decided to develop Binet's test further. He found that the age norms developed for schoolchildren in France did not work very well for Californian ones. So he revised the test by adapting some items, adding others, establishing new age norms, and extending the upper-age limit to 'superior adults'. This became the Stanford-Binet Revision 1916 and this is when the term Intelligence Quotient (IQ) first appeared. IQ was a score meant to quantify intelligence functioning to allow comparison among individuals. To arrive at an IQ score, Terman relied on a formula expressing the relation between an individual's mental age and chronological age, developed in 1912 in Germany by William Stern (1871–1938).

4. ROBERT YERKES: US GROUP ARMY TESTS

At the beginning of World War I, when the US Army wanted an assessment of the intelligence of a large numbers of recruits, the Stanford–Binet Test proved time-consuming and costly for large-scale use. A committee was formed in 1917 with Robert Yerkes (1876–1956), an American psychologist, as its head. He assembled a staff of 40 psychologists, including Terman, to develop a group intelligence test. This gave birth to the US Group army tests: the Army Alpha and Army Beta tests. The Army Beta test was used on

non-English-speaking and illiterate people. Instructions to the test were given by demonstration or pantomime, rather than orally or in writing. In the end, more than a million people were tested, but not until late in the war. Thus the work had little effect on the war, but it contributed to enhancing the status of psychology.

5. CHARLES SPEARMAN: TWO-FACTOR THEORY

English psychologist Charles Spearman (1863–1945) analyzed the relationships among experimental intelligence tests, using 'factor analysis'. He argued that people who do well in some intelligence tests also do well in a variety of tasks involving vocabulary, Mathematics and visual–spatial abilities. He emphasized that those who did poorly on one intelligence test tended to do badly on other intelligence tests too. He proposed a 'two-factor' theory of intelligence. The first was General Ability (g), required for performance of mental tests of all kinds; he called this a kind of 'mental energy' that underlies the specific factors. The second was Special Abilities, required for performing just one kind of mental test. For example, scores on a verbal comprehension test are largely determined by one's level of general intelligence, but affected by one's specific ability to perform verbal comprehension tasks.

6. DAVID WECHSLER: INTELLIGENCE SCALES

American psychologist David Wechsler (1896–1981) felt that the Binet scales were too verbally loaded for use with adults, so with inspiration from the US Army Alpha test, he designed a test with sub-tests to measure both verbal and non-verbal abilities. He adopted a mean score of 100, since the Stanford–Binet metric had become universally accepted. The original Wechsler–Bellevue test in 1939 had proved quite successful in civilian and military applications. In 1949, Wechsler came up with the Wechsler Intelligence Scale for Children (WISC) and in 1955, he worked out a revision of the adult scale named the Wechsler Adult Intelligence Scale (WAIS). Much later he produced a scale that could be used with pre-primary children.

8. LOUIS LEON THURSTONE:
PRIMARY MENTAL ABILITIES

Louis Leon Thurstone (1887–1955) accepted Spearman's hypothesis of a general factor, but he disputed its importance. He identified seven 'primary

mental abilities' that he judged to be more important than others:

• Verbal Comprehension: Vocabulary, reading, comprehension, verbal analogies, and so on

• Word fluency: The ability to generate and manipulate quickly a large number of words with specific characteristics, as in anagrams or rhyming tests

• Number: The ability to carry out mathematical operations quickly and accurately

• Space: Spatial visualizations as well as the ability to transform spatial figures mentally

• Associative Memory: Rote memory

• Perceptual Speed: Quickness in perceiving visual details, anomalies, similarities, and so on

• Reasoning: Skill in a variety of inductive, deductive and arithmetical reasoning tasks

Thurstone's tests have largely dropped out of use because they were not able to predict academic or occupational performance accurately over and above general intelligence.

9. RAYMOND CATTELL:
FLUID & CRYSTALLIZED INTELLIGENCE

In 1963, British and American psychologist Raymond Cattell (1905– 1988) suggested two related but distinct components of general ability: Fluid Intelligence, and Crystallised Intelligence. Fluid intelligence (called 'primary reasoning ability') is the ability to see relationships, as in analogies, and letter and number series. Crystallized intelligence is acquired knowledge and skills or 'factual knowledge' Fluid intelligence decreases with age while the latter increases with it. According to him, mathematicians and scientists, who need fluid intelligence, produce their best work in their 20s and 30s, while those in the field of history, philosophy and literature produce their best work in their 40s, 50s and beyond as they have accumulated more knowledge.

10. J.P. GUILFORD: MANY, MANY FACTORS

American psychologist Guilford (1897–1987) refused to acknowledge the existence of any general factor at all. Instead, he proposed that intelligence comprises 150 elementary abilities. These abilities are made up of a combination of three dimensions that he called:

• Operations: what a person does (6 types)
• Contents: the material on which operations are performed (these are of 5 types)
• Products: the form in which information is stored and processed (5 types)

Guilford proposed that each combination of a specific operation, a specific type of content and a specific type of product defines a unique type of intelligence. In later versions of his theory he proposed even more types of intelligence. However, due to the impractical implications of such a model, Guilford's theory has not significantly influenced the psychological testing of intelligence.

11 & 12. PHILIP VERNON AND JOHN CARROLL: HIERARCHICAL APPROACHES

Vernon (1905–1987) accepted that both Spearman (single g factor) and Thurstone (multiple primary mental abilities) were right and suggested that intelligence can be described as comprising abilities at varying levels of generality. At the highest level is g as defined by Spearman, while at the next level there are 'major group factors', including abilities such as verbal–educational ability needed for successful performance in subjects like English, History and Social Studies; and practical–mechanical ability needed for successful performance in subjects as draughtsmanship and car mechanics. At the third level are 'minor group' factors, obtained by subdividing the major group factors. At the lowest level of hierarchy are specific factors of the kind identified by Spearman. American psychologist John Carroll (1916–2003) proposed the three-stratum model of cognitive ability (similar to Vernon's). Both these hierarchical descriptions of intelligence filled in the gaps between the extreme approaches of Spearman and Thurstone.

13. HOWARD GARDNER: MULTIPLE INTELLIGENCES

Howard Gardner (1943–) supports Thurstone's notion that intelligence comes in different packages. Gardner's concept of intelligence is that there are seven different types of intelligences, each independent of the others. He has played around with this number and over time has increased and decreased the number.

LOGICAL–MATHEMATICAL INTELLIGENCE

Mathematics and logic are often considered rare skills, seen only in a gifted few. Mathematical and logical intelligence is the ability to understand mathematical and logical problems quickly. This intelligence involves being able to calculate and work out relationships and connections between different items. People with a high level of mathematical and logical intelligence enjoy mental challenges, seek solutions to logical, abstract and mathematical problems, and have good deductive reasoning skills. These people excel at games involving skill and strategy such as chess, Rush Hour and Quirkle, and other brain games such as the Rubik's Cube.

Logical reasoning is closely linked to general intelligence and, within it, to fluid intelligence. Fluid intelligence or fluid reasoning is the capacity to think logically and solve problems in novel situations, independent of acquired knowledge. The very act of analyzing information in a logical, systematic manner is evidence of this kind of intelligence.

Of course, everyone knows the two famous people who were able to formulate laws using mathematical equations: Isaac Newton and Albert Einstein. Individuals with logical–mathematical intelligence display the main traits listed below:

- Excellence in Mathematics or related subjects
- Ability to utilize mathematical skills in everyday life
- Ability to utilize logical reasoning skills while solving problems
- Excellence in strategic games and brain games
- Quickness in mathematical calculations done mentally
- Organization and process-orientation: a sytematic and procedure-oriented way of thinking and of solving problems that may be placed before one.

The good news is that mathematical–logical intelligence can be worked on and improved. You can learn the process-oriented way of thinking and hone it by regularly practising solving puzzles and posers. You can enhance your logical-mathematical intelligence by:

• Experimenting with available data and looking at it from different perspectives

• Solving brain games as well as strategy-oriented games

• Trying to solve mathematical problems in your head

• Playing mathematical computation games such as chess

• Playing games like Sudoku and solving other mathematical puzzles and exercises.

1. TOWER OF HANOI

The 'Tower of Hanoi' is also referred to as the 'Tower of Brahma'. It was invented by the French mathematician Edouard Lucas in 1883. He was inspired by a legend that tells of a Hindu temple where this pyramid puzzle might have been used for the mental discipline of young priests.

The legend goes that at the beginning of time, the priests in the temple were given a stack of 64 gold discs, each one a little smaller than the one beneath it. Their assignment was to transfer these 64 discs from one of the three poles to another, with the condition that a larger disc could never be placed on top of a smaller disc. When they finished their work, the legend goes, the temple would crumble to dust and the world would vanish.

If we do the math, even if the priests were able to move the discs at the rate of one disc per second, using the smallest possible number of moves, it would take them $2^{64}-1$ seconds or roughly 585 billion years or 18,446,744,073,709,551,615 turns to finish!

OBJECTIVE: Move the three discs from Tower 1 to Tower 3 in the least number of moves.
RULES: a) Only one disc can be moved at a time.
b) A bigger disc can never be placed on a smaller one.
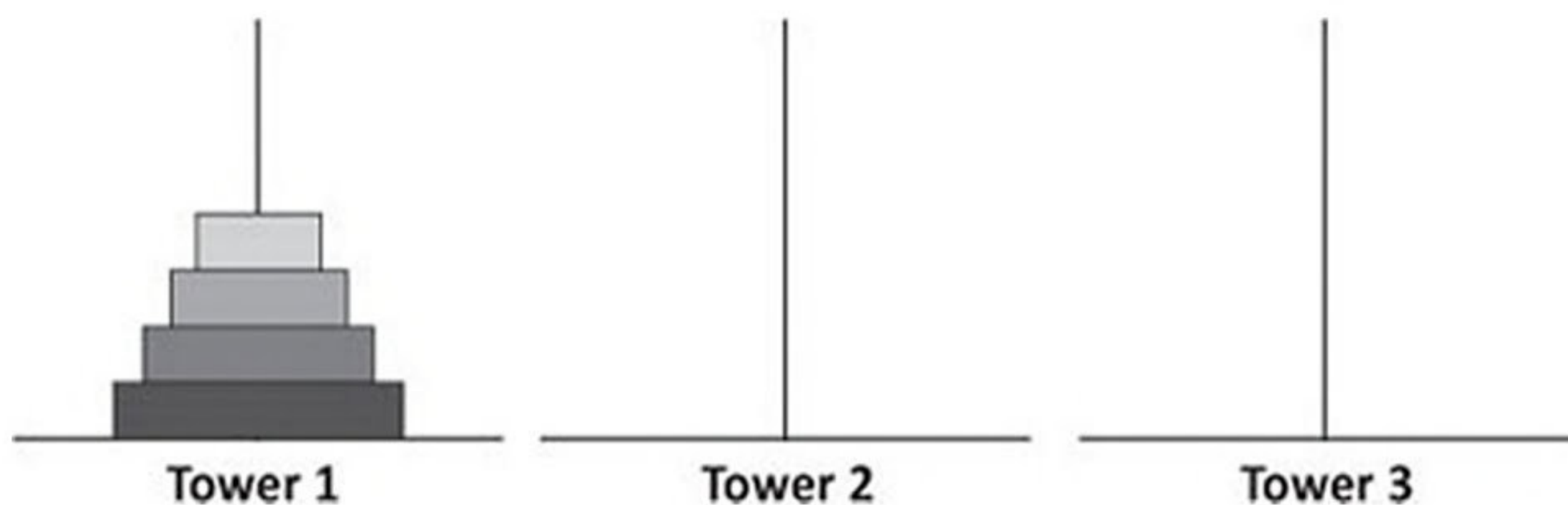What are the least number of moves in which you can do that?

Tower 1   Tower 2   Tower 3

^ stands for 'raised to the power'
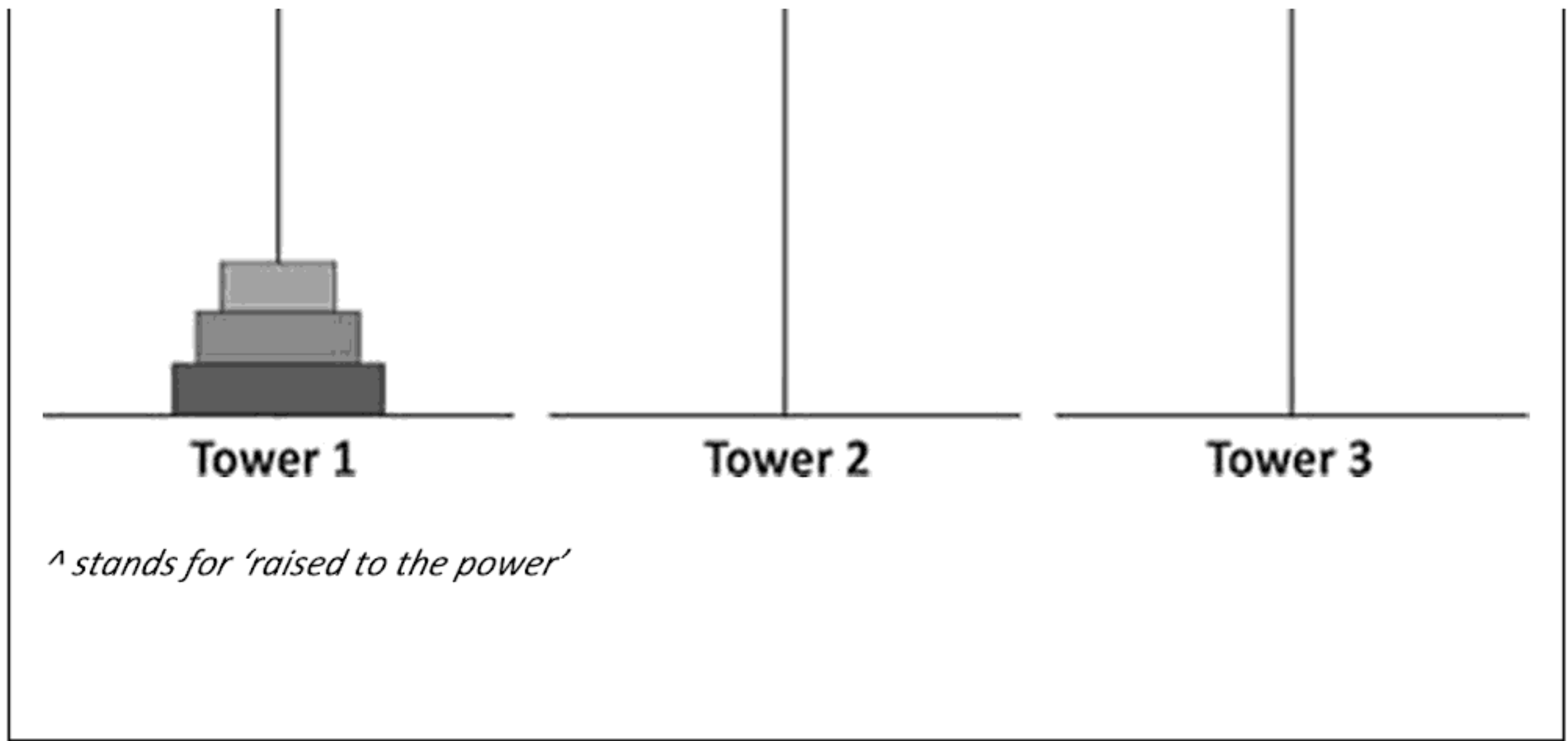
2. TOWER OF HANOI WITH FOUR DISCS

OBJECTIVE: Move the 4 discs from Tower 1 to Tower 3 in the least number of moves.

RULES: a) Only one disc can be moved at a time.
b) A bigger disc cannot be placed over a smaller one. Tower 1 Tower 2 Tower 3

Tower 1   Tower 2   Tower 3

Daydreamers are good at solving complex problems. Studies also show that daydreaming about a bright future will give you a boost instantly when you are feeling low.

3. RESTRUCTURING

OBJECTIVE: Can you make this figure face upside down by moving only three basketballs?
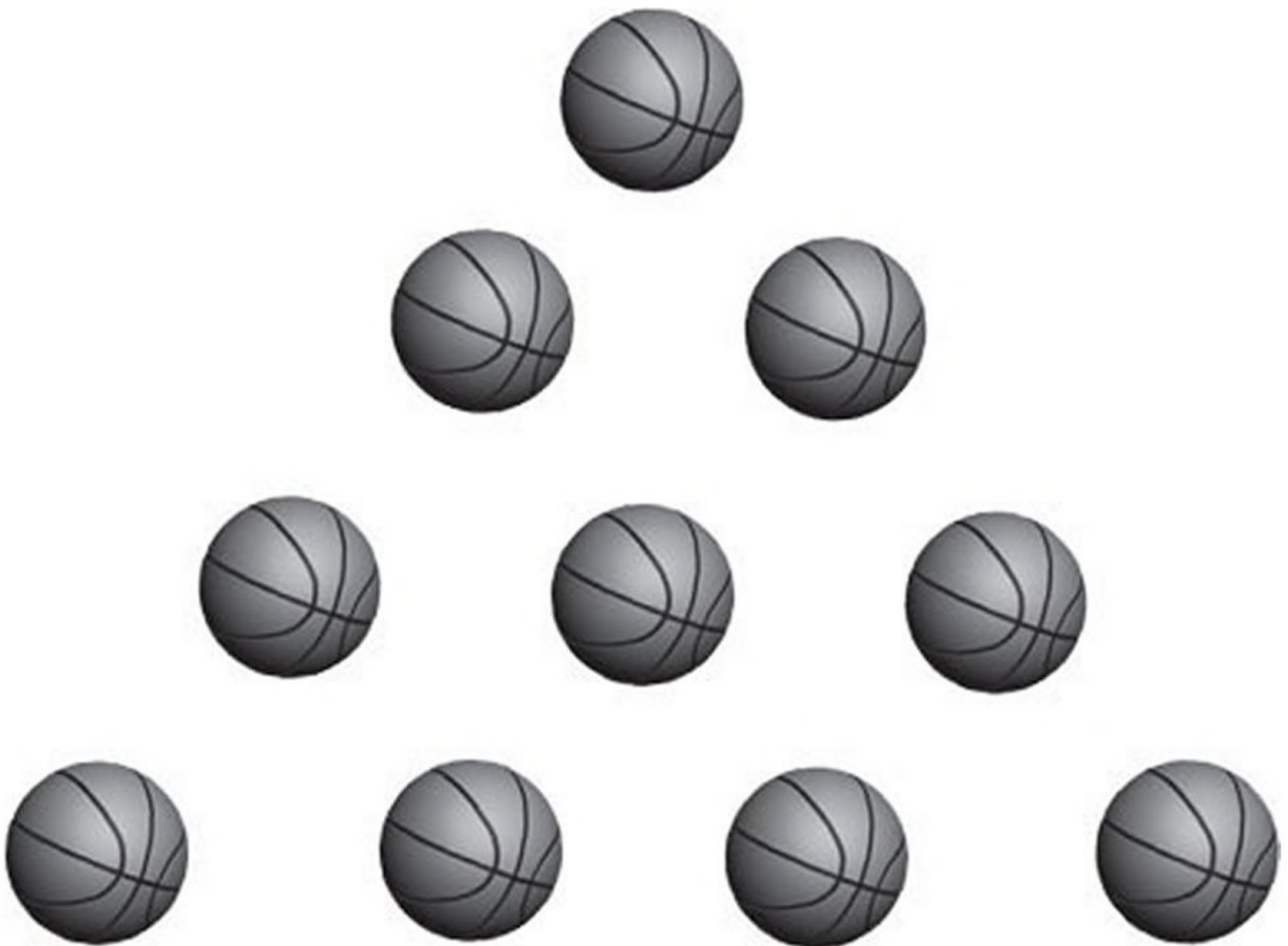
This problem is aimed at testing one's ability to identify a pattern in sequential images and then predict the next image to follow.

OBJECTIVE: The star and the ring are moving in a set pattern across the images. Identify the pattern and figure out the next image from the options given below.

1   2   3   4
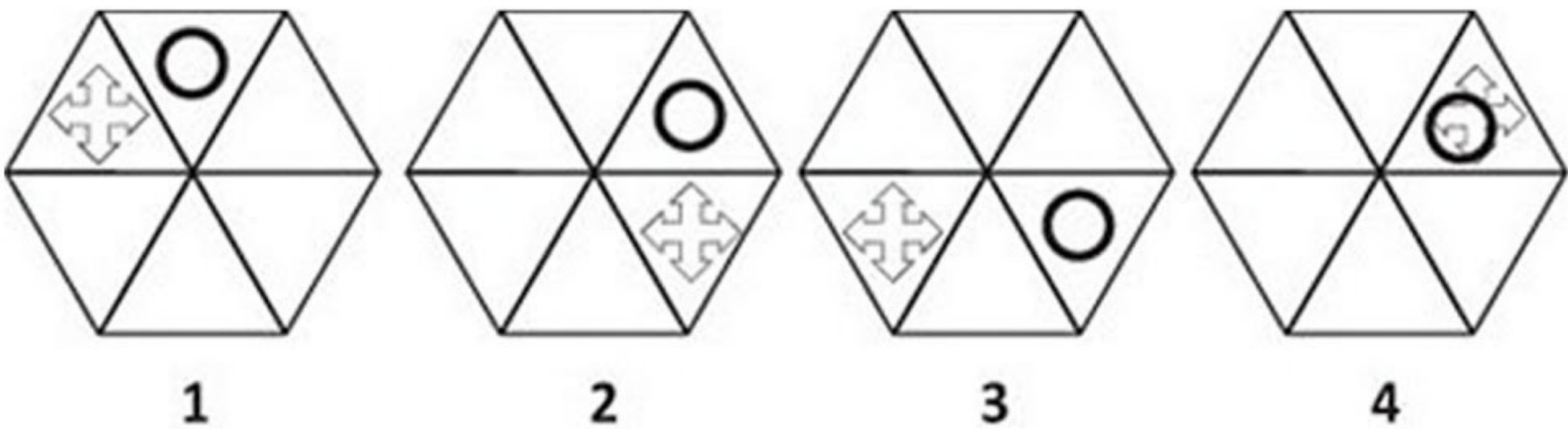
a   b   c   d

5. G-FORCE

This is a Physics-based problem that shows the impact of gravity in a real-time scenario, where a wooden block is kept on three different kinds of ramps.

OBJECTIVE: In which of the cases shown below would the wooden block go the farthest when one lets go of it?

1
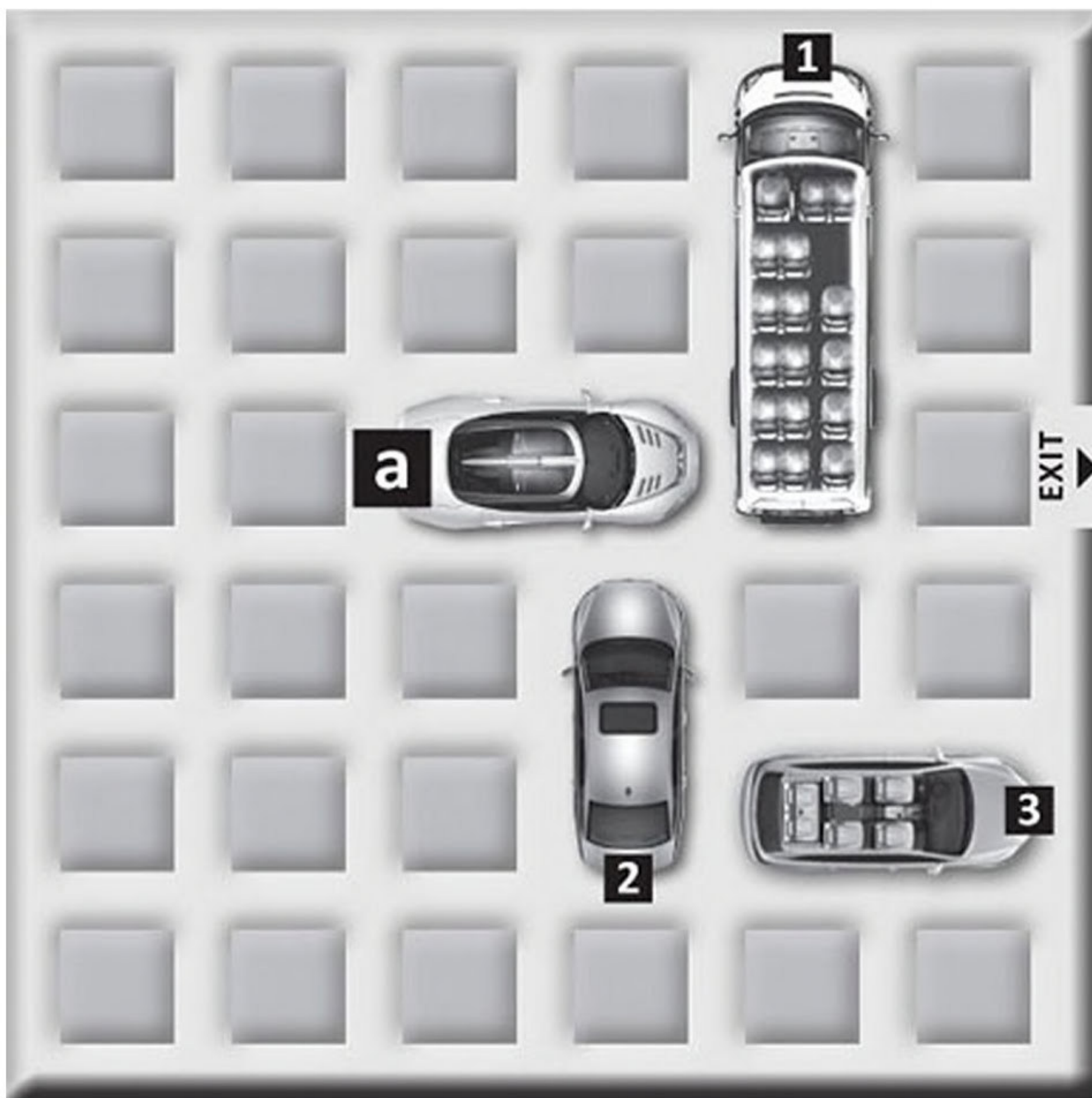
2

3

6. RUSH HOUR

OBJECTIVE: Get Car 'a' out of the parking lot in the least possible moves.

RULES: a) Car a can only move forwards or backwards and get out only through 'EXIT'.
b) Horizontally placed vehicles can move forwards or backwards.
**c) Vertically placed vehicles can move upwards or downwards.**

After Albert Einstein died, pathologist Dr Thomas Harvey studied his brain. They found a relatively higher percentage of glial cells for every neuron in Einstein's brain. That's why Einstein had better thinking abilities and conceptual skills!

8. TREE MAZE

A maze is a puzzle that is in the form of a complex passage through which one must navigate to find a way out. People have always found mazes very fascinating. One can see mazes near monuments, in crop fields, large gardens and so on. A classic example is the hedge maze at Longleat Stately Home in the UK.
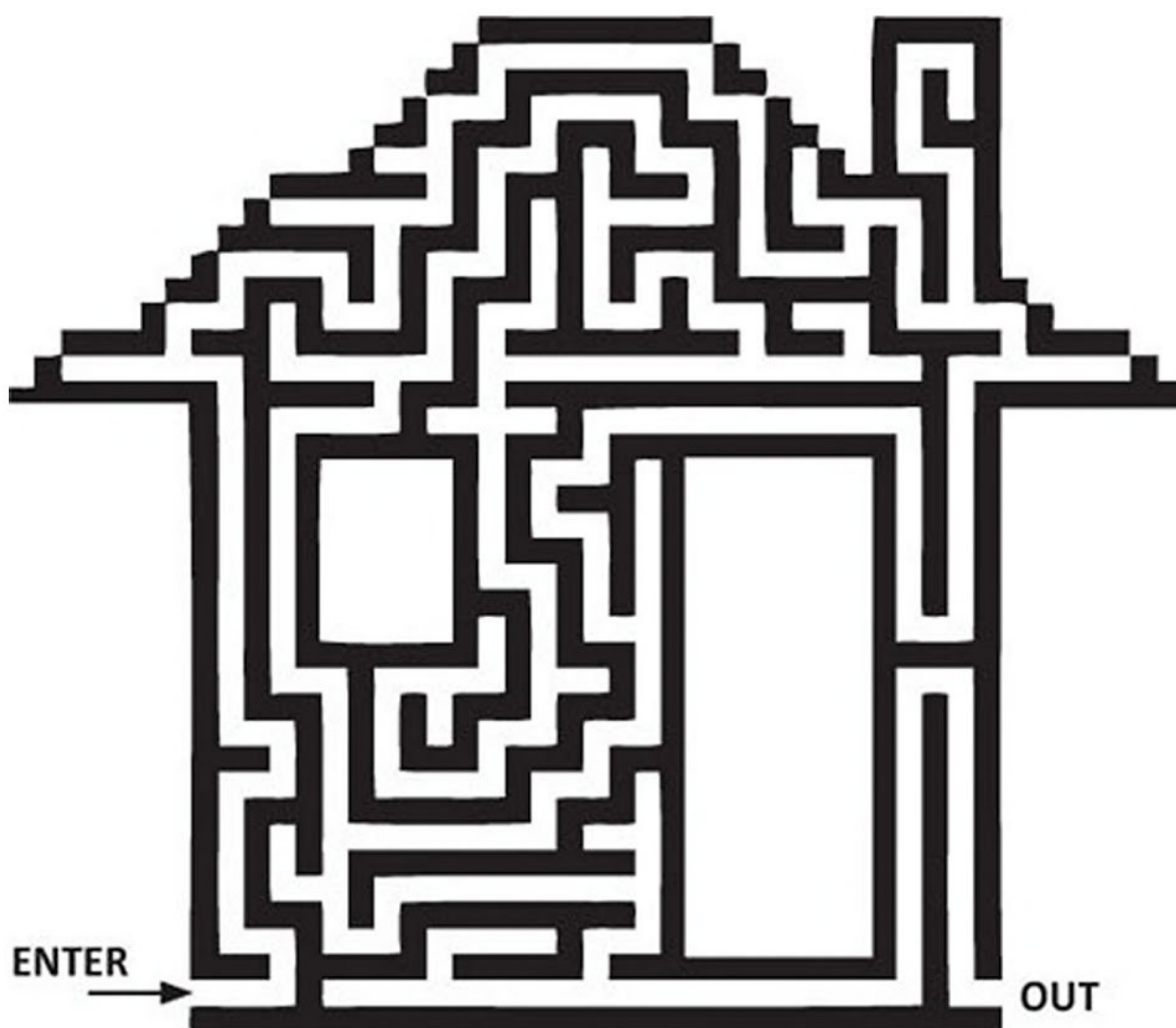
OBJECTIVE: Find your way out of this maze.

← ENTER
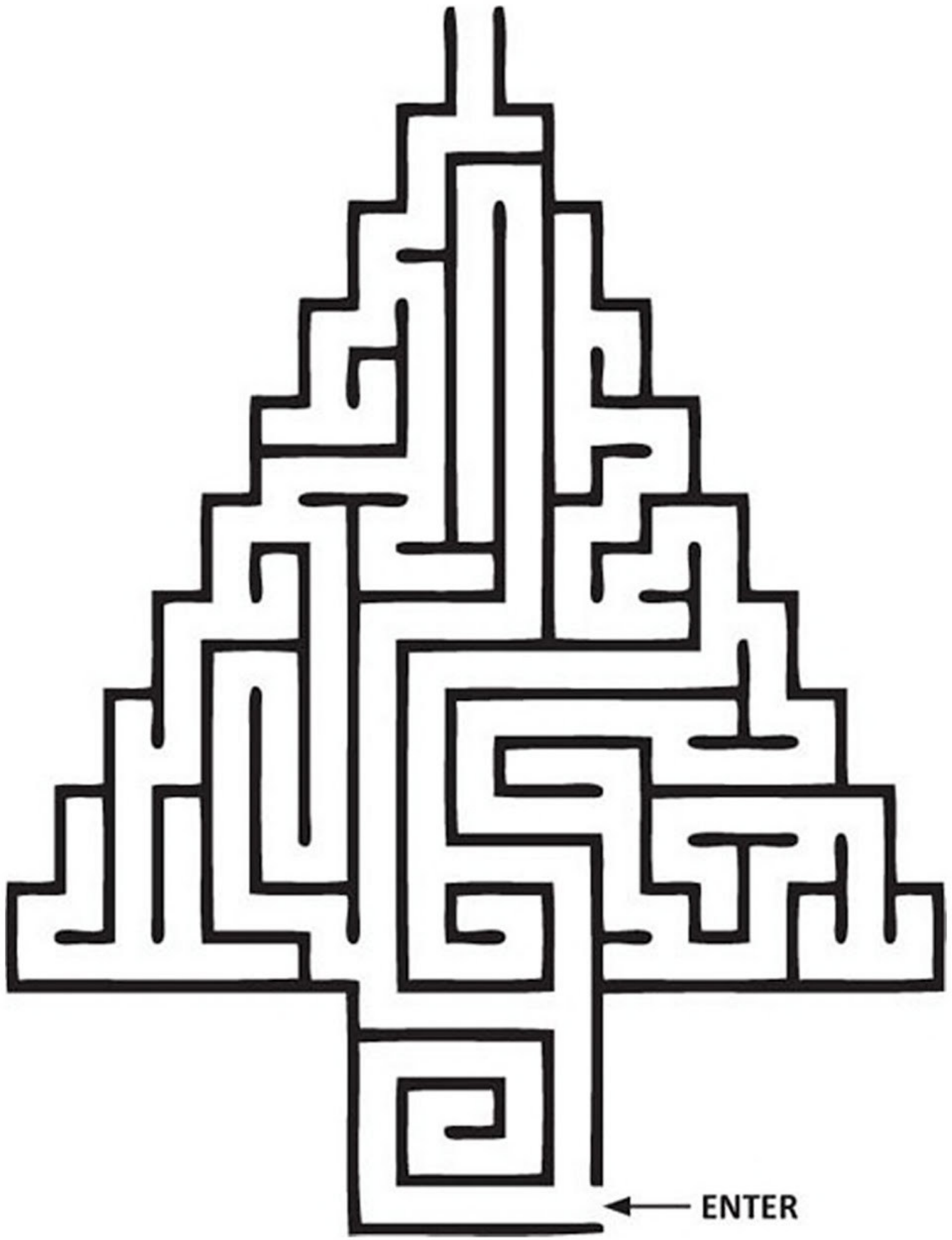
OBJECTIVE: Find your way out of this maze, preferably without using a pencil.

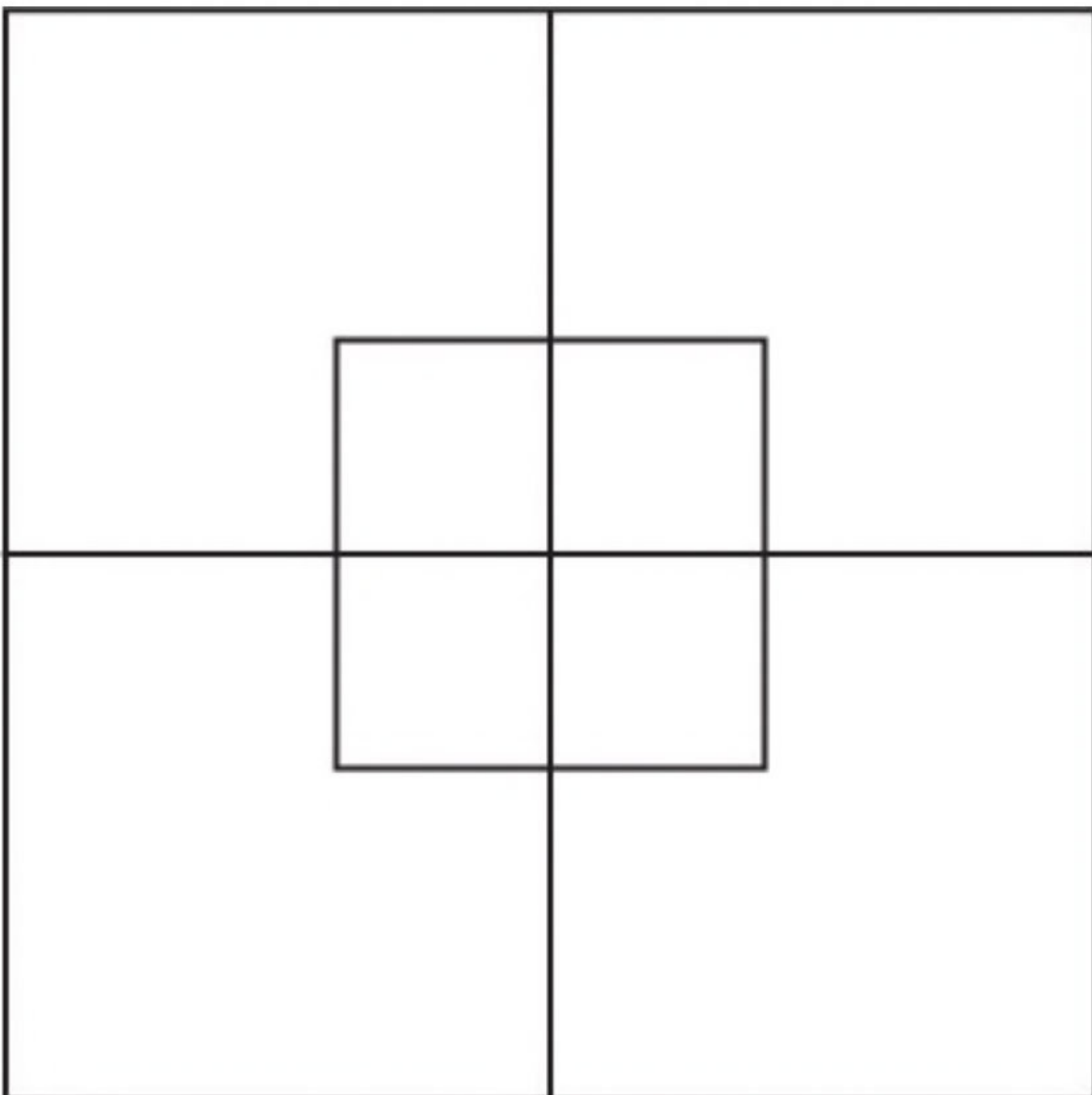ENTER
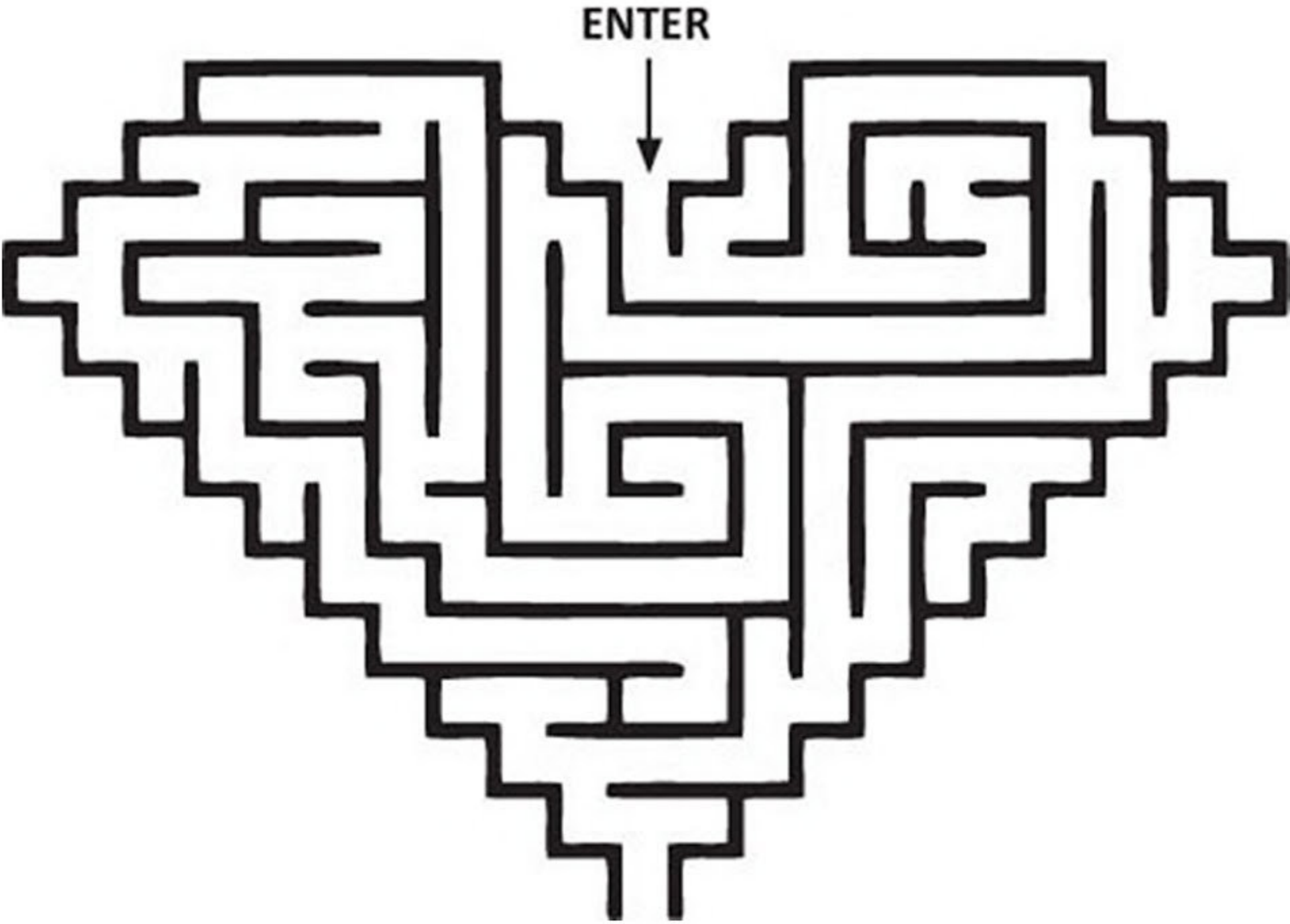
OBJECTIVE: Find your way through this maze.

ENTER →

OUT

Our DNA is said to be 98.4 per cent similar to that of chimpanzees and 70 per cent to that of slugs.

OBJECTIVE: Count the total number of squares in the figure below.

Grid puzzles are aimed at developing your calculation skills. An important thing to remember is the order of operations, BODMAS, which has to be followed at all times. BODMAS stands for Brackets, Order (meaning power, for e.g., 3^2 means 3 to the power 2), Divide, Multiply, Add and Subtract. In these problems, you need to calculate both horizontal and vertical equations. The challenge is to do this as fast as possible.

OBJECTIVE: Solve the equations in the grid puzzle below and fill in the blank squares.

2	+	7	+	6	=	
÷		-		+		
1	-	8	÷	4	=	
+		+		-		
5	+	9	÷	3	=	
=		=		=		

14. GRIDLIES AGAIN

OBJECTIVE: Solve the equations in the grid puzzle below and fill the blank squares. (See the previous problem for clues.)
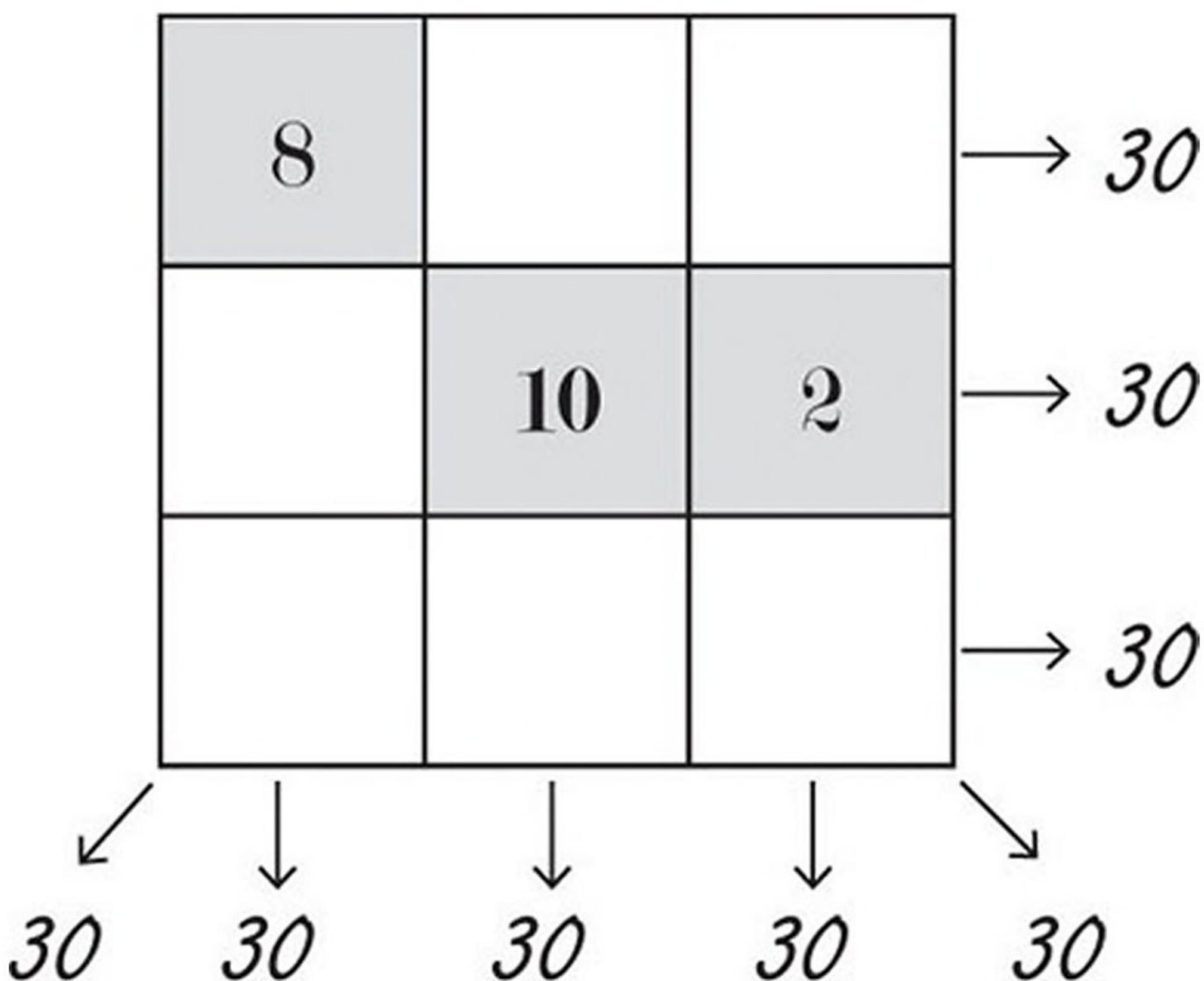
8	×	5	-	9	=
×	■	+	■	-	■
7	×	2	×	4	=
÷	■	-	■	×	■
1	+	6	÷	3	=
=	■	=	■	=	■

The human brain can stay alive for 4 to 6 minutes without oxygen.

16. MAGIC SQUARE 1

A magic square is a grid of numbers where the total of all numbers in a row, column or diagonal is the same. This number is called the 'magic number'.

OBJECTIVE: Use your mathematical skills to fill the empty squares. The magic number is 30.

8			→ 30
	10	2	→ 30
			→ 30

30 30   30   30   30

OBJECTIVE: Use your mathematical skills to fill the empty squares. The magic number is 45.

		9
18		24