

The Tower of Puzzles

Logic Games Workshop

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Cover art: M. C. Escher, Tower of Babel

The Descents

Introduction: At the Top

Descent 1: Logic

Descent 2: Mathematics

Descent 3: Words

Descent 4: Games

Descent 5: Space

Descent 6: At the Bottom

1 At the Top

Ferdinand the monkey, chief architect of the Tower, was in a state of total panic. For only moments ago, for the seventh time in as many days, the Tower had shaken. The first shakings had been only the slightest of tremors, easily missed by those monkeys who, unlike Ferdinand, did not have their senses constantly monitoring the security of the Tower's structure. But the shakings had grown stronger and today the Tower had swayed like a tree branch in the wind. Pacing his room frantically at the top of the Tower, sweat dripping from his furry brow, Ferdinand pondered what the cause of the shakings might be. But he was at a loss. A careful and logical builder, Ferdinand was confident that the sections of the Tower constructed under his guidance were as safe as possible. The problem, it seemed, lay below.

The Chairmonkey came by soon after, looking every bit as worried as Ferdinand himself. 'My dear Ferdinand', the Chairmonkey began, 'We are worried. We have trusted you for many years. But now with all this shaking, many monkeys are talking. They doubt your logic, your abilities.' Ferdinand was shocked. After all these years of service, the thought that his competency as an architect was being called into question was a painful one. 'Madame Chairmonkey', responded Ferdinand, 'This is not my fault. The problem, it seems, lies below.' Scratching her head, the Chairmonkey thought this over. In the past, the Chairmonkey, herself an astounding logician, had often marveled at Ferdinand's sharp mind and building prowess. But Ferdinand was getting older and perhaps his mental faculties were not what they used to be. The Chairmonkey decided to put Ferdinand to a quick test.

'Ferdinand, do you mind if I ask you a few questions?'

'But of course.'

The Chairmonkey's Quiz

1. The old monkeys always said that the height of the Tower doubles every year and that it will take one thousand years to complete the Tower. If they are right, how many years will it take to build half of the Tower's total height?
2. What comes once in a minute, twice in a moment but never in a thousand years?
3. Five bananas are in a basket. How do you divide them among five monkeys so that each monkey gets a banana, but one remains in the basket?
4. Every day, engineer monkeys are given fifty-nine nuts and bolts. The nuts come in bags of nine while the bolts come in bags of four. How many bolts are engineer monkeys given?

The next few lines depend on how well you did on the quiz....

'Brilliant Ferdinand. You have still got it! However, just to be sure, the Bureau of Building has also requested that you take a written test. It should be no problem for you.'

or 'A little rusty, Ferdinand, but do not worry. I did put you on the spot after all. The Bureau of Building has also requested that you take a written test. You will have more time to think about your solutions.'

or 'O Ferdinand! Have you really lost your marbles! Well you can have another chance. The Bureau of Building has also requested that you take a written test. I hope things go better this time around!'

The Bureau of Building Test

1. An engineer monkey has six pairs of red work gloves and six pairs of blue work gloves in a drawer. Without looking at the drawer, how many gloves must the monkey take out to be sure that she has a matching pair of gloves?

2. At the top of The Tower, the temperature often drops in the early evening. Can you go from WARM to COLD in only four steps by changing only one letter at a time to form a new word in each step?

W A R M

— — — —

— — — —

— — — —

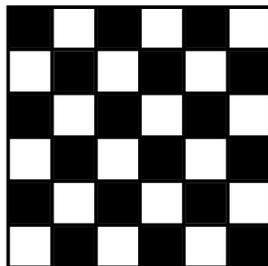
C O L D

3. What weighs more: a pound of feathers or a pound of bricks?

4. For your latest building project, you are given six chains, each of which has five links. To complete the project, you will need to join the chains into one large circular chain. What is the least number of links that you will have to cut open and close to form the circular chain?

5. A painter monkey was about to start painting a new section of The Tower. Three onlookers gathered and asked the painter what color he would use. The painter replied that he would use either red, brown, or green and that the onlookers should try to guess the color. The following guesses were made: 'It is not red'; 'It is either brown or green'; 'It is brown'. The painter told the onlookers that at least one of the guesses was right and at least one of the guesses was wrong. What color will the painter use?

6. Below is the tiled floor design in the lobby of the Bureau. How many squares are on the floor?



7. Can you think of a proper English sentence that uses the word 'and' five times consecutively?

8. A carpenter monkey worked a certain number of hours one day and over the next four days, worked one more hour each day than on the previous one. After five days, the carpenter monkey had worked 55 hours. How many hours did the carpenter monkey work on the first day?

9. You are given some matches and two ropes, each of which takes exactly one hour to burn if lit on one its ends. The ropes are not of even width or length so burning half of the rope, for example, does *not* mean that half an hour has passed. By burning the ropes, how can you measure 45 minutes?

10. The younger monkeys (defiant as they are!) now say that in the first year of building, The Tower increased its height by a half, in the second year by a third, in the third year by a quarter, and so on. If they are right, how many years did it take The Tower to grow to one hundred times its original height?

2 Descent: Logic

Later in the evening, Ferdinand was summoned to meet the Chairmonkey and the ministers of the Bureau of Building in a secret location at the top of The Tower. To the ministers' delight, the Chairmonkey began the meeting by describing Ferdinand's impressive performance on their test earlier that day. The Chairmonkey then mentioned how Ferdinand thought that the cause of the shaking lay below, turning to Ferdinand to fill in the details. 'Yes, yes, Madame Chairmonkey and ministers of the Bureau', Ferdinand cut in, 'the problem, it seems, lies below. I am sure of it. I am confident in all that I have built and all that has been built under my supervision. The problem is not at the top of The Tower. I am sure it is below.'

Ferdinand's comments made the ministers uneasy. For as long as they could remember, the monkeys had always lived at the top of the ever-growing tower. There was always *growth*, always *progress*. Never *descent*. But now it seemed that descent was inevitable. If Ferdinand was right and the shaking was to be stopped, someone would have to travel downward. The ministers debated their options back and forth. Some of the older ministers thought they should just wait and see if the shaking would go away. To send someone down would be too risky and, even worse, it would be a step backward for the entire colony, a regress. But the younger ministers felt that the shaking could no longer be ignored. The shaking had, after all, been getting stronger. The Tower might even collapse. Finally the Chairmonkey spoke: 'Ferdinand, go home and pack a basket with a few bananas. In the morning, one of us will come and fetch you to take you to the Orangutan-sage. You have heard of the Orangutan-sage, haven't you? He is a master of logic. You will talk to him and he will prepare you for your descent. For you must travel downward. Good luck, Ferdinand.'

The meeting ended and Ferdinand went home but could not sleep. In the morning, he packed a basket of bananas and one of the ministers of the Bureau came by to fetch him as planned. By noontime, Ferdinand stood before the Orangutan-sage, a massive, fat ape with a grey and orange beard and glossy eyes. The Orangutan-sage was sitting on a big pile of hay, some of which was being chewed between his thick lips. Ferdinand approached the Orangutan-sage with reverence.

'Orangutan-sage, I come to seek your counsel. They are sending me down,' Ferdinand began humbly.

'You are Ferdinand the great architect or you are *not* Ferdinand the great architect' The Orangutan-sage spoke, hay falling from his mouth.

'I am Ferdinand. Will you help me?'

'Well, I am the great Orangutan-sage, the great Orangutan-fool, or neither! Tell me architect, what world is this?'

'I do not follow you.'

'What *possible world* is this architect? Is the sky blue or not? Is hay delicious or not? Are you talking to a fat old Orangutan or not? Tell me architect, what world is this?'

'Sure the sky is blue, hay is tasty and you are, well, a bit plump. But I still do not understand you.'

'Then listen carefully architect, for you still have much to learn.'

The Orangutan-sage proceeds to give Ferdinand a lesson on logic using the following examples...

example. A pile of bananas was stolen. The thief had to be either Hubert, Henry, Harry, Hillary or Hannah. When questioned, each monkey made three statements:

Hubert: 'I did not take the bananas', 'I have never stolen anything in all my life', 'Hillary did it'

Henry: 'I did not take the bananas', 'I have my own bananas', 'Hannah knows who did it'

Harry: 'I did not take the bananas', 'I've never met Hannah before', 'Hillary did it'

Hillary: 'I am not guilty', 'Hannah did it', 'Hubert is lying when he said I stole the bananas'

Hannah: 'I did not take the bananas', 'Henry took the bananas', 'Harry knows I did not do it. He has known me all his life'

Later each of the monkeys admitted that two of their statements were true and one was false. Who stole the bananas?

example. Three monkeys Sam, Sally and Sigmund are sitting on a tree branch. One has a brown tail, one has a grey tail, and one has a black tail. Given the following facts, can you figure out which monkey has what color tail?

- (a) Sam is either a macacque monkey or a marmoset.
- (b) Macacque monkeys have only grey tails.
- (c) If Sally has a brown tail, then Sam does not have a grey tail.
- (d) Marmoset monkeys do not have black or brown tails.

After the lesson...

The lesson ended and the Orangutan-sage calmly resumed chewing on the hay. Meanwhile Ferdinand sat back in amazement. Never before had he confronted such intellectual clarity, such logical elegance. Only the Chairmonkey herself came close to having such abilities.

'Thank you Orangutan-sage! I have learned so much from you.'

'Do not thank me so fast, architect. For in this world, you said earlier that you were to head downward. Yes, downward and *not* upward. If you wish, I can show you a way. But first you must show me what you have *really* learned.'

The Orangutan-sage's Test

1. In a remote corner at the top of The Tower, there lives a tribe of chimpanzees and a tribe of gorillas. The chimpanzees always tell the truth and the gorillas always lie. Two monkeys of the same tribe were once asked if they were hungry and they gave the following replies: 'We are both hungry', 'I am not hungry'. Was the first monkey hungry or not? What about the second one?

2. Another two monkeys from the same tribe in that remote corner of The Tower were asked the same question. The first monkey replied: 'At least one of us is hungry'. The second monkey replied either 'I am hungry' or 'I am not hungry' but this reply has long since been forgotten. Nevertheless, at the time the monkeys were asked, the questioner was able to determine whether each of the monkeys was hungry. Was the first monkey hungry or not? What about the second one?

3. A wandering monkey was lost in that remote corner of The Tower and came across three native monkeys hiding in the bushes. Without seeing whether they were chimpanzees or gorillas, the wandering monkey asked them if they were chimpanzees (hoping to find an honest monkey to get directions from!). The three replied in turn: 'Two of us are chimpanzees', 'Only one of us is a chimpanzee', and 'The monkey who just spoke is telling the truth'. Who were the chimpanzees?

4. Another pile of bananas was stolen. This time the suspects were Hubert, Hillary and Hannah. They each made the following statements in turn:

Hubert: 'Hillary did not steal the bananas'

Hillary: 'That is true.'

Hannah: 'Hubert did not steal the bananas'

Later it was revealed that the thief actually told the truth but someone else lied. Who stole the bananas?

5. Dana and three of her friends, all of whom were different kinds of monkeys, decided to plant new trees in their gardens at the top of The Tower. Each friend chose a different type of tree and planted it on a different day of the week in a different part of their garden. Given the following facts, can you figure out the name of each kind of monkey, the kind of tree they planted, and where in the garden and on what day of the week it was planted?

- (a) Wanda, who was not a chimpanzee, did not plant her spruce tree in the south.
- (b) Tracy planted her tree before the baboon but after the monkey who planted the ash tree.
- (c) The mandrill, whose name was not Dana, planted her tree in the north, but not on Friday.
- (d) Rhonda did not plant her tree on Monday.
- (e) The tamarin planted her tree before the monkey who planted her tree in the east.
- (f) Rhonda did not plant the cherry tree.
- (g) The trees were planted, in chronological order, as follows: the chimpanzee, in the west, Wanda, the maple tree.

	Chimp	Mandrill	Tamarin	Baboon	Ash	Cherry	Maple	Spruce	North	East	South	West	Monday	Wednesday	Thursday	Friday
Rhonda																
Dana																
Tracy																
Wanda																
Monday																
Wednesday																
Thursday																
Friday																
North																
East																
South																
West																
Ash																
Cherry																
Maple																
Spruce																

6. [CHALLENGE] Three young monkeys are playing outside in the mud. When they are finished, they come inside and their mother tells them that at least one of them has mud on their forehead. Assume that all three monkeys have muddy foreheads and each young monkey cannot see their own forehead (there are no reflective surfaces!) but can see the foreheads of their other two playmates. The mother then asks over and over: ‘Can you tell for sure whether you have mud on your forehead?’ What happens? How would your answer change if there were only two muddy monkeys? How about if there was only one?

After Ferdinand answered the final question of the test correctly, the Orangutan-sage was pleased. Beckoning the architect to come closer, he waddled off the hay pile. Then with a quick sweep of his tail, the Orangutan-sage scattered the hay to one side. Ferdinand came closer. Where the pile once stood, there was now a gaping hole in the ground (the Orangutan-sage was a fat monkey indeed!). Ferdinand leaned over and looked into the hole but could see no bottom. And as he stared into the darkness, Ferdinand heard the Orangutan-sage ask: ‘If a monkey carried my burden, he would break his back. I am not rich but leave silver in my track. What am I?’ Then to Ferdinand’s surprise and before he had the time to think of an answer, the Orangutan-sage pushed him into the hole. Sliding downward, the last thing Ferdinand could hear was the Orangutan-sage’s laughter growing fainter and fainter.

3 Descent: Mathematics

Ferdinand slid down through the darkness. Alone with his thoughts, he felt a mixture of fear and curiosity. All of his life, Ferdinand had lived and worked at the top of The Tower. As chief architect, he knew its nooks and crannies better than most. But now he slid into the unknown. When he was a child, he had been captivated by the legends of ancient builders who had built up The Tower in earlier days. His heroes had been Gladius the gorilla who built a section of the tower entirely out of glass so that it shown like a crystal in the midday sun; and Silas the spider monkey who constructed solid walls from only the thinnest pieces of iron. Perhaps in his journey downward, Ferdinand thought, he might be lucky enough to see their constructions. But who knew what else he would find below? As his thoughts wandered to the potential dangers that awaited him, fear crept into Ferdinand’s heart.

Then quite suddenly, Ferdinand had no time to think at all for after a sharp final bend, he came sliding out of the tunnel and fell into a thick pool of silver slime. When he finally came to, Ferdinand found himself in a large rectangular room lit by long fluorescent tubes that ran along the high ceiling. At regular intervals along the walls, Ferdinand could make out many doors, each marked by a different number. And though he could not see all the way to the far end of the room, the entire floor seemed to be covered by a thick layer of the silver slime that had softened his fall. Noticing movement in the distance, Ferdinand strained his eyes and could just make out two forms advancing towards him. Slowly by slowly, the forms got bigger until Ferdinand recognized them as two gigantic snails. With nothing else to do, Ferdinand waited patiently until the giant mollusks hovered above him. Ferdinand marveled at the beautiful spiral shape of their shells, an exquisite example of the Fibonacci sequence in nature.

‘H-e-l-l-o s-t-r-a-n-g-e-r, I a-m L-u-k-u a-n-d t-h-i-s i-s m-y b-r-o-t-h-e-r S-o-p-p-o,’ one of the snails drawled, ‘W-e h-a-v-e n-o-t h-a-d a v-i-s-i-t-o-r f-o-r q-u-i-t-e s-o-m-e t-i-m-e. W-e-l-c-o-m-e. S-o-r-r-y a-b-o-u-t t-h-e s-l-i-m-e, t-h-o-u-g-h n-o-t-h-i-n-g c-o-u-l-d b-e d-o-n-e a-b-o-u-t i-t r-e-a-l-l-y.’

‘That’s okay,’ replied Ferdinand. ‘It broke my fall.’

‘I s-u-p-p-o-s-e y-o-u a-r-e n-o-t h-e-r-e t-o s-t-a-y, a-r-e y-o-u? J-u-s-t t-r-a-v-e-l-l-i-n-g t-h-r-o-u-g-h, I s-u-p-p-o-s-e? S-u-c-h a p-i-t-y,’ Soppo chimed in.

‘Yes, I must keep going downward. Have you felt the shaking here? It has scared us monkeys living above. I am trying to find its cause.’

‘A-h-h-h-h-h-h-h-h, t-h-e s-h-a-k-i-n-g-s. Y-e-s, w-e t-o-o h-a-v-e f-e-l-t t-h-e-m. T-h-e-y c-r-e-a-t-e w-a-v-e-s i-n t-h-e s-l-i-m-e. Q-u-i-t-e b-e-a-u-t-i-f-u-l, r-e-a-l-l-y. W-e-l-l i-f y-o-u w-i-s-h t-o k-e-e-p g-o-i-n-g d-o-w-n-w-a-r-d, y-o-u w-i-l-l n-e-e-d o-u-r h-e-l-p,’ Luku continued.

Soppo and Luku proceed to give Ferdinand a lesson on probability, arithmetic and algebra using the following examples...

example. A mother snail has two children, at least one of which is male. What is the probability that both children are male?

example. There are three chests of drawers, each containing two drawers. In one chest, both drawers contain a snail shell. In another chest, both drawers are empty. In the last chest, one drawer contains a snail shell and one drawer is empty. Suppose you pick a chest at random and open one of the drawers and find a snail shell. What is the probability that the second drawer in the chest contains a snail shell as well?

example. You buy two buckets of silver slime for 50 snail shells each. Later, you were offered 60 snail shells for one and sold it, changed your mind, and bought it back for 70 snail shells. You then sold it for 80 snail shells. The other bucket of slime was not selling so you reduced it to 10% below what you originally paid for it and managed to get rid of it. Did you make or lose money on the transaction?

example. A grandmother was feeling generous so she gave a total of 100 snail shells to her five grandchildren. Starting with the youngest, each got 2 snail shells more than the next younger one (*i.e.*, the second youngest got two snail shells more than the youngest). How much did the youngest grandchild get?

After the lesson...

After going through the last example, Soppo and Luku bid Ferdinand to follow them as they glided away. With Ferdinand wading knee deep in the slime behind them, the snails soon came to a door marked with the number 16. On the wall beside the door was a small silver plaque. Stopping beside it, the brothers spoke in unison: ‘Y-o-u a-r-e v-e-r-y c-l-e-v-e-r s-t-r-a-n-g-e-r b-u-t e-v-e-n f-o-r y-o-u, f-i-n-d-i-n-g y-o-u-r w-a-y d-o-w-n-w-a-r-d w-i-l-l b-e d-i-f-f-i-c-u-l-t. L-i-s-t-e-n c-a-r-e-f-u-l-l-y. E-a-c-h d-o-o-r i-n t-h-i-s p-a-r-t o-f T-h-e T-o-w-e-r i-s m-a-r-k-e-d b-y a n-u-m-b-e-r. E-t-c-h-e-d i-n-t-o a p-l-a-q-u-e b-e-s-i-d-e t-h-e d-o-o-r i-s a-l-s-o a p-u-z-z-l-e. S-o-l-v-e t-h-e p-u-z-z-l-e c-o-r-r-e-c-t-l-y a-n-d y-o-u w-i-l-l k-n-o-w t-h-e n-e-x-t d-o-o-r t-o g-o t-h-r-o-u-g-h. I-f y-o-u s-o-l-v-e e-n-o-u-g-h p-u-z-z-l-e-s c-o-r-r-e-c-t-l-y, y-o-u w-i-l-l c-o-m-e t-o a s-t-a-i-r-c-a-s-e w-h-i-c-h w-i-l-l t-a-k-e y-o-u d-o-w-n. G-o-o-d l-u-c-k, s-t-r-a-n-g-e-r.’

Thanking the snails, Ferdinand looked up at the silver plaque beside door 16 and began his way through the maze.

The Maze of the Snails

1. A mother snail has two children, a green one and a grey one. The green one is male. What is 18 times the probability that both are male?

2. Jules collects four different kinds of snail shells and she has hundreds of each kind. What is the minimum number of shells one would have to steal from Jules to be sure of getting at least five shells of the same kind?

3. Julia also collects snail shells. One day, a thief stole a third of Julia's snail shells. Then another thief stole two-thirds of the remaining snail shells. There were then twelve snail shells left. Before the robbery, Julia was going to add one more shell to her collection and then sell the snail shells at a price of 5 snail shells for one coin. How many coins did Julia expect to make from the sale?

4. A group of monkeys were in a fancy restaurant eating some snails (yuck!). The bill came to 24 coins of equal value which the monkeys agreed to split equally. But they then discovered that two of the monkeys had slipped out without paying so the remaining monkeys had to each put in one more coin. Later they were joined by seven more monkeys. How many monkeys were then at the table?

5. There are ten chests of drawers, each containing three drawers. Each of the three drawers contains either a snail shell (S), a gold coin (G), or is empty (E). The distribution is as follows: SSS, SSE, SSG, SEE, SEG, SGG, EEG, EGG, EEE, GGG. Suppose you pick a chest at random and open one of the drawers and find a snail shell. What is 6 times the probability that when you open another drawer in the same chest you also find a snail shell?

6. There are ten bags, each containing 10 snail shells. In 9 bags, each of the shells weighs 1 gram. In one bag, each of the shells weighs 0.9 grams. Given an electronic scale which gives you the exact weight of whatever is placed on it, what is the least number of times that you must use the scale to determine which of the bags contains the lighter shells?

7. Two very slow trains were heading towards each other on the same track, the east-bound train traveling at 5 miles/hour and the west-bound train traveling at 6 miles/hour. The trains were originally 33 miles apart. Meanwhile, a very fast snail leapt off the front of the east-bound train and headed east at 7 miles/hour. When it finally reached the west-bound train, the snail immediately turned around and headed west until it reached the east-bound train, and so on. How many miles will the snail have traveled before the trains meet (and crush the poor snail!)?

8. [CHALLENGE] Combine the three numbers in each group to get the same result in each of the three groups. You can use addition, subtraction, multiplication, division and exponentiation and the usual order of operations apply. What is the result?

Group 1: 19, 26, 1

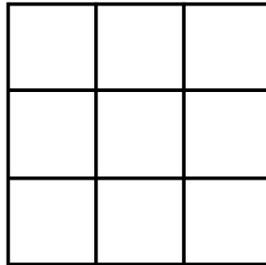
Group 2: 20, 22, 23

Group 3: 31, 7, 2

9. [CHALLENGE] Place the numbers 1-9 in the following blanks to make the equation correct. Each digit should be used exactly once and operations should be carried out strictly from left to right and *not* in the usual order of operations. What is the digit in the rightmost blank?

$$_ - _ \div _ + _ \div _ + _ \div _ \times _ - _ = 72$$

10. [CHALLENGE] Arrange the solutions to Problems 1-9 in the magic square so that every straight line including the diagonals sums to the same number. What is this number?



Ferdinand passed through the final door and to his relief, saw a small staircase in the corner of the room. Wiping the silver slime off his furry feet, he started to descend the stairs. Despite the kindness of the snail brothers Luku and Soppo, he was pleased to be leaving their slimy lair.

4 Descent: Words

The staircase kept on going down, seemingly without end. Ferdinand had already walked down thousands of identical steps in silence and the monotony and loneliness of the descent was making him depressed. Originally inspired by the novelty and danger of his journey, Ferdinand was having second thoughts. Why had he been given the responsibility of finding the source of the shakings? After all, he had worked tirelessly as chief architect at the Top of the Tower his entire life and the shakings were surely no fault of his own. And what was so important about his mission in the first place? Perhaps the shakings would still just stop altogether.

When the silence did brake, it was from a steady rhythmic ticking deep beneath him. At first, Ferdinand could barely make out the ticking above his footsteps but as he continued down, the sound increased until it filled the stairwell. Tick tick tick tick. With every step, the ticking grew louder and louder. Tick tick tick tick. Soon the ticking sounded like firecrackers and the stairs reverberated with the sound. Tick tick tick tick. The sound was becoming almost unbearable. Tick tick tick tick. Ferdinand considered heading back up the stairs but the thought of the long climb made his legs shake. Tick tick tick tick. Continuing downward, the stairwell began to light up. Tick tick tick tick. Ferdinand's head was pounding. Tick tick tick tick.

After a few final stairs, Ferdinand came upon the source of the ticking. His jaw dropped and a great sadness welled up inside of him. At the bottom of the staircase was a long rectangular room with row upon row of long wooden desks. Side by side on each desk was thousands of typewriters. Behind them sat thousands of monkeys typing furiously, their furry heads bobbing up and down above the keys. As Ferdinand entered the room, they barely noticed him. There were old monkeys and young ones, baboons and bonobos. But all of the monkeys looked dirty and tired, with bags under their eyes and the arched backs of primates that had sat at their long wooden desks for far too long. They looked defeated. Closest to Ferdinand was an elderly tamarin wearing a pair of cracked spectacles balanced precariously at the end of his nose. The tamarin was busy typing with one hand while shuffling through an enormous stack of papers frantically with the other.

‘Good sir, may I ask what you are doing?’, Ferdinand asked gingerly.

The tamarin barely looked up. ‘Working on the word progressions. Don’t you know that?’

‘How could I? I have just gotten here.’

At this, the tamarin stopped typing and looked at Ferdinand directly. The emptiness in his eyes was devastating. ‘I have been working on the word progressions all my life and have not even solved a single one. Not even one.’ The tamarin shook his head. ‘It makes me very sad. Maybe I should turn to word pairs. But Ceres does those and he hasn’t solved one either! Maybe patterns or poems, or even rebuses...’ the tamarin mumbled.

‘Maybe I can help’, answered Ferdinand, shrugging his shoulders.

Ferdinand proceeds to solve the following word puzzles (and learns a bit about algorithms while doing so)...

example. Can you go from POOR to RICH in only seven steps by changing only one letter at a time to form a new word in each step?

```

P O O R
- - - -
- - - -
- - - -
- - - -
- - - -
- - - -
R I C H
```

example. Can you find one four-letter word that fits all three word pairs below?

```

B A C K _ _ _ _ S O M E
L E F T _ _ _ _ W O R K
F O R E _ _ _ _ S H A K E
```

example. Soppo likes indigo but not blue. He likes origami but not kites. He likes forms but not shapes. According to the same rule, does Soppo like tomatoes or avocados?

example.

My first is in sugar but not in tea
My second in swim but not in sea
My third in an apple and also a pear
My fourth in ring and also hare
My last in ten but not in herd
My whole an intelligent word

example. Can you solve the following rebus?



example. Can you solve the following rebus?



After Ferdinand finishes the puzzles...

After Ferdinand had typed up the solutions to these word puzzles, the old tamarin went positively crazy. With renewed vigor, the tamarin waved the typed sheets hysterically and cried at the top of his lungs: 'Brothers! Sisters! He's done it! Each of the puzzles has been solved!'. At first, the other monkeys paid the tamarin little attention, continuing to type away as if nothing was happening. But when the tamarin started running along the top of one of the long wooden desks, shoving the papers in each monkey's face along the way, he could no longer be ignored. Soon a crowd had gathered around Ferdinand. The tired monkeys came to him with their puzzles and longing eyes, hoping he could be of some help.

The Monkeys' Word Puzzles

1.

My first is in father but not in dad

My second in lass and also lad

My third in low but not in we

My last in live but not in be

If in my whole no one believes

For thirteen weeks I will give you leaves

2. Luku likes orange but not purple. He likes torches but not chandeliers. He eats berries but not fruits. According to the same rule, does he like Byron or Keats?

3. Can you think of an algorithm that solves word poem problems? What about rebuses?

4. Can you go from DAWN to DUSK in only five steps by changing only one letter at a time to form a new word in each step?

D A W N

— — — —

— — — —

— — — —

— — — —

D U S K

5. In each of the following word pairs, a different word can be placed between the two words on the line to make two new words or common phrases. The number of letters is indicated by the dashes. What are the four words?

B A C K _ _ _ _ R O B E
D O O R _ _ _ S T O N E
P A D _ _ _ _ S T E P
S A W _ _ _ _ W H E E L

6. Luku and Soppo both eat salt but not pepper. They like being cuddled but not kicked. They like to absorb but not exude. According to the same rule, do they like a dwarf or an elf?

7. Can you go from THINK to BRAIN in only seven steps by changing only one letter at a time to form a new word in each step?

T H I N K

— — — — —

— — — — —

— — — — —

— — — — —

— — — — —

— — — — —

B R A I N

8.

My first is in fish but not in snail
My second in rabbit but not in tail
My third in up but not in down
My fourth in tiara but not in crown
My fifth in tree you plainly see
My whole a food for you and me

9. Can you solve the following rebuses?

→ SECRET
SECRET
SECRET

I ■ S

O _ ER _ T _ O _

M CE

M CE

M CE

By the time Ferdinand had solved the final word puzzle, not a single typewriter was in use. Thousands of monkeys stood in silence, not quite knowing what to do with themselves. ‘Fellow monkeys, now that your work is done, I urge you to go upward,’ Ferdinand implored them. ‘Go back the way I came. At the top of The Tower, there are many more monkeys like me. The air is fresher there, the buildings cleaner. I have built many of them myself. Go upward now.’ But the monkeys just shuffled around a bit and stayed where they were. After a minute or so, a small monkey finally spoke from the back of the crowd. ‘I know’, she said, ‘We’ll make new puzzles. Then we can get back to our typing.’ There were murmurs of agreement from the rest of her fellow typists and, to Ferdinand’s horror, the monkeys slowly headed back to their desks to start developing new puzzles. The old tamarin, passing by in the surge of monkeys, saw the confusion and sadness in Ferdinand’s face and stopped for a moment: ‘Come Ferdinand, don’t look so sad. I know you wanted to be our saviour, to see us happy like the rest of you up at the top. But what are we really going to do up there? These puzzles, this typing, it is all we know. If you want to continue your journey downward, there is an old elevator in the back over there. Take it down to the bottom floor. But us tired old monkeys will stay here. Bye, Ferdinand. Thank you.’ And with that, the tamarin disappeared into the furry mass.

5 Descent: Games

Heading downward in the elevator, Ferdinand started to weep. The strain of the journey was wearing him down and the very thought of the enormous room filled with tired typing monkeys made his heart hurt. By the time the elevator reached the bottom floor, Ferdinand did not even care what awaited him there.

When the metal doors did slide open, Ferdinand had to cover his eyes to block out the beams of sunlight streaming into the elevator. Having spent days in the dark, Ferdinand was blinded by the sunlight. After his eyes adjusted, Ferdinand stepped out of the elevator and into a small circular chamber whose walls and floor were made entirely of glass. It could only be the work of Gladius the gorilla! It was breathtaking. Scurrying along the floor were hundreds and hundreds of white mice. Noticing Ferdinand, the mice suddenly stopped moving and hundreds of little furry white faces peered up at him with bright curious eyes. For the first time in days, Ferdinand smiled.

‘Hello there little ones’, Ferdinand greeted them shyly.

‘Well hello to you!’ the mice all replied in unison.

An awkward silence followed and Ferdinand’s smile faded.

‘What’s the matter monkey?’, one of the mice asked, ‘You look so sad.’

Thinking back to the typewriters upstairs, Ferdinand sighed. ‘I suppose you have some riddles for me to solve, don’t you?’

The mice were quiet for a while but soon began to talk softly with each other: ‘Riddles? Riddles? He thinks we want him to solve riddles. Why would we want him to do that? Riddles? What riddles?’

Then another of the mice spoke to Ferdinand, ‘Sorry monkey, we don’t have any riddles.’ The mouse paused and looked confused, but soon continued, ‘But you are welcome to stay here for a while and play logic games with us. No, we don’t have riddles but we do have many very fun games...’

At once, all of the other mice chimed in together, ‘Yes yes, come and play with us monkey. Yes yes yes! Come and play with us!’

Ferdinand plays logic games with the mice...

Ferdinand was having a ball. Just when he'd had enough of one of the logic games, there was a new game to play and a new mouse to play it with. What delightful creatures! As he played the various games, the mice would crawl up his back and play with his ears and eventually the whole room would collapse into laughter. The shakings and typewriters seemed very far away.

Then it happened: another shaking. In an instant, game pieces were flying through the air and the mice were scurrying back and forth as the glass walls of the room began to totter. Ferdinand's thoughts snapped back to his mission. Not wanting to waste any more time, Ferdinand asked the closest mouse how to travel further downward. The mouse led him back into the elevator. Climbing up the elevator wall, the mouse gnawed at a panel until it came loose, exposing a big red button. The mouse pushed the button and the doors closed. Amid the shaking, Ferdinand and the mouse started to descend.

6 Descent: Space

At first, Ferdinand and the mouse remained in silence as the elevator continued its way down. But when the elevator showed no signs of stopping, the mouse finally turned to Ferdinand and spoke:

'Hi Ferdinand. I am Fievel. It is nice to see you again.'

Ferdinand was taken aback. 'See me again?!? Pardon me Fievel, but I do not think we've ever met before. And how do you know my name anyway? I don't remember ever telling it to you.'

'You haven't met me but I have met you,' Fievel replied. 'You are quite famous at the top.'

Thinking of his good reputation at the top of The Tower made Ferdinand happy. 'So you have been to the top, then? Did you and your fellow mice like it up there? As you surely know, I have built many of the buildings there.'

'Yes, they are beautiful. But it was just me, alone. You see, the other mice do not like to travel much. They are happy enough in their little glass room with their games and their laughter. Me, I have always been something of an explorer. I have been to the very top of the Tower and to its very bottom as well. It is an interesting place, this home of ours.'

Ferdinand was amazed. 'So you must know where we are going. Tell me please, what is it like?'

Fievel's eyes twinkled. 'O Ferdinand, you are an impatient monkey! But I will tell you anyway. This elevator will take us to an old, ancient part of The Tower. It is right near the very bottom. You won't recognize it from your fancy constructions at the top. It is only a bunch of old stones, moss and spiders. But I like it down there. I find it peaceful. Luckily for us, Gladius was a curious monkey as well and built this elevator to go down there. I still fondly remember taking many trips with him.'

Ferdinand interrupted, 'You knew Gladius?!? But that was thousands of years ago...'

Fievel laughed. 'Yes, we mice can grow quite old. Gladius was a very kind, very serious monkey. And very smart. You kind of remind me of him, actually. Anyway, Gladius would always take the elevator down and I would sometimes accompany him. He never got very far, though.'

'What do you mean?'

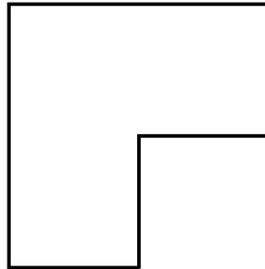
'You'll see, Ferdinand.'

Soon after, the elevator came to a creaking halt. Ferdinand looked over and saw that Fievel's eyes were dancing with anticipation. When the doors finally opened, the monkey and mouse stepped out into a dark tunnel with crude stone walls. Fievel's description was not inaccurate. The stones were covered with a thick

layer of lichen and small spiders hurried across them. Ferdinand thought that his eyes must be playing tricks on him because the stones themselves seemed to be glowing faintly. Far into the tunnel, Ferdinand could hear the steady dripping of water but the air was otherwise still and silent. A deep peacefulness settled upon the pair. Fievel turned to Ferdinand slowly, his eyelids droopy, ‘Monkey, I am going to leave you know. But before I go, there is something I forgot to mention. You see how the stones glow? Well monkey, the stones down here are alive. It is a strange thing. I do not quite understand it myself but you will get used to it. They are full of wisdom, these old stones. As you pass through these tunnels, you will speak with them. I have only a few small words of advice before I go.’

Fievel proceeds to give Ferdinand some advice for solving spatial puzzles using the following examples...

example. Gladius the gorilla was building a new (all-glass!) house for his four daughters. How can he divide the total area below into four identical sections of equal size and shape?



example. One of Gladius’ daughters Wanda passed away and though she was not a bad monkey, she was not a particularly good one either. Waiting in the reception room of monkey hell, the monkey-devil came out to meet her. ‘Wanda’, said the monkey-devil, ‘You have not been a bad monkey but you have not been a particularly good one either. So I will give you a chance to get out of here.’ The two entered another room off to the side of the reception. In the middle of the room was a giant circular table and next to the walls were many sacks of coins. The monkey-devil continued, ‘We are going to play a game. We will take turns putting coins down flat on the table. I will put down a coin and then you will put down a coin, and so on. The coins cannot overlap and they cannot hang over the edge of the table. The last person to put down a coin wins, or equivalently, the last person who can no longer put a coin down on the table loses. Since you have never played this game before, I will also let you decide if you want to play first.’ Does Wanda have a winning strategy for the game, *i.e.*, a way of playing so that she always beats the monkey-devil?

After the advice...

‘Now go on monkey, and good luck!’, Fievel wished Ferdinand before, with a final wiggle of his tail, disappearing under some stones and leaving Ferdinand to himself once more. Sad to see his little friend go but still feeling the peacefulness of this part of The Tower, Ferdinand began to walk slowly through the tunnel, at times putting his hands against the cold walls to feel his way through the darkness. Eventually Ferdinand

came to a dead-end as a massive stone blocked the passage. The stone glowed particularly bright. Just as Ferdinand began to turn around to head back the way he came, he heard a gentle rumbling voice. The stone itself was talking!

‘You have come far, young monkey, very far. We have been waiting for you for some time now. Almost since the first monkeys began to build The Tower, no-one has come down here. Fievel, of course, comes to see us every now and again. It is always a pleasure to have him around. And many years ago, Gladius would come too. The great Gladius! A great fool he turned out to be. Perhaps you are also a fool. We will soon see.’

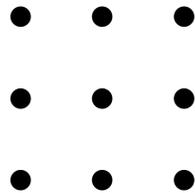
Ferdinand was speechless. This was the first time in his life that a stone had talked to him.

‘Listen, young monkey. We know that you have answered many puzzles on your journey already. But answer some more and we stones will move for you. If you wish to reach the bottom of The Tower, to end your journey, this is the only way. If you wish to find out what has caused the shakings that have worried you monkeys at the top, this is the only way.’

The Maze of the Stones

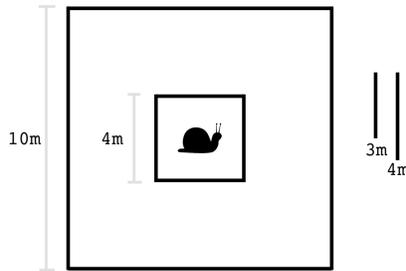
1. How can you cut a cylindrical cake into eight equal pieces with only three cuts?

2. By drawing four straight lines can you cover the 9 dots?

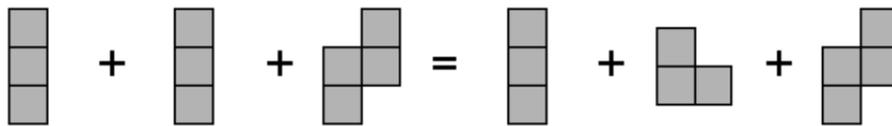


3. In a large flat field at the top of The Tower, there is a maple tree, a cherry tree and an ash tree. The maple tree is 10 meters from the cherry tree and the cherry tree is 10 meters from the ash tree. What is the probability that the ash tree is closer to the maple tree than the cherry tree?

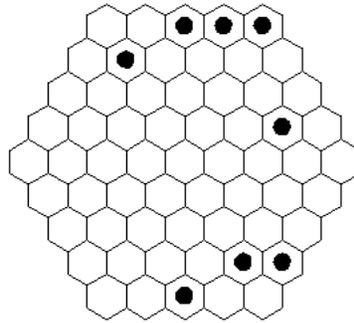
4. Luku is stranded on a square island surrounded by a square moat as pictured below. You are on the outer shore and have only two planks of wood measuring 4 meters and 3 meters respectively. Using the wood, how can you securely cross the moat and rescue Luku? Be sure to check that your solution works!



5. Can you add the shapes on the left hand side of the equal sign and those on the right hand side of the equal sign to make the same shape?

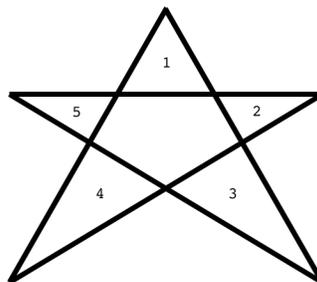


6. Draw a path that passes through each blank hexagon exactly once. The path can only change direction when it hits a hexagon containing a dot, a hexagon containing part of the path so far, or the edge of the grid.



7. How can 7 trees be planted so that there are 6 rows of trees in a straight line with each row having 3 trees?

8. [CHALLENGE] A regular pentagram has 5 disjoint triangles (*i.e.*, 5 triangles that do not overlap). By adding just two straight lines, can you go from 5 to 10 disjoint triangles?



As the final stone rolled out of the way, Ferdinand heard another voice, this one even deeper than the others: ‘Well done, Ferdinand. Well done. You are almost at the bottom of The Tower now, just a short walk more. We have been hoping that you would get this far. We are very pleased.’ At once, all of the stones began to glow even brighter and a gentle humming filled the air. Ferdinand walked a little further down the passage and came to its end. There was a simple wooden door. Despite the moss and spiders that permeated the rest of the tunnels, the door was perfectly clean, as if nothing had touched its surface for many years. Filled with a sense of accomplishment and anticipation, he put his furry hand on the knob and pulled it open.

7 Descent: At the Bottom

[PUZZLES TO BE DETERMINED...]

‘Ferdinand?’

‘Yes.’

‘Look upward. What do you see?’

‘A tower, a tall one. I used to live at the top.’

‘Yes.’

‘It has been a long journey. I am tired.’

‘You will rest now.’

‘There are trees, and the sea. It is very beautiful here.’

‘It is.’

‘The shakings. What has caused them? I cannot return to the top of the Tower before I know for sure. We monkeys have been very worried. So very worried...’

‘Look at the bottom of the Tower, Ferdinand.’

Ferdinand began to walk around the Tower’s base. The stones of the outer wall were ancient and broken and as Ferdinand ran his furry hand along them, they crumbled under his touch. A few feet in front of him, a small section of the wall suddenly collapsed and Ferdinand was startled by the great noise and giant plumes of dust that quickly rose into the air. The Tower shook. But Ferdinand climbed over the rubble and continued circling the base. Every so often, Ferdinand came upon another section of the wall that had caved in or a section of the wall that looked like it was about to collapse. Though the top of the Tower was sturdy and strong, the bottom had been neglected and contained numerous holes and cracks. Fievel the mouse, who had been following closely behind Ferdinand, resumed their conversation.

‘Ferdinand, as you can see, there is not much time left. The Tower is too old and the bottom has been decaying for many years as the Tower got taller and taller. Other than me, you are the first one down here for thousands of years.’

‘But Fievel, what will happen to the monkeys at the top? And the snail brothers Soppo and Luku? And the typists and your fellow mice? Will they perish?’

Fievel just shook his head.

‘We must go and warn them. If we travel quickly, they too can come and join us at the bottom. Then we can all work hard, repair the foundation, fix our home.’

Fievel remained silent.

‘Well if we cannot fix the Tower’, Ferdinand continued, ‘perhaps we can build a new one. Of course, it will

take many years but we did build this one after all.'

'I am not so sure Ferdinand.'

Again the Tower shook. This time, massive stones began to fall from the sky as they came loose from the Tower wall. As the stones landed, the ground trembled under their impact. Within seconds the air was full of dust. Ferdinand and Fievel could barely see. It was only with quite a bit of luck that the stones did not hit them. And by now, the Tower was teetering dangerously as the collapsing walls were radically shifting its weight. Over the pounding noise and through the thick dust, Ferdinand shouted at Fievel fearfully:

'Fievel! I am scared! This is no good, no good at all! I do not know if the Tower will stay standing.'

Even Fievel was frightened. 'Neither do I. Ferdinand, we must head for safety. The Tower is about to fall. I have seen this coming for some time. I told you earlier how I have traveled from the top of the Tower to its bottom and back again. All along the way, I have talked to everyone I could find about the sorry state at the bottom. But no one would listen. I even tried to speak to you, many years ago, before you monkeys had felt the shakings at the top. But you were busy working on a new building or something like that.'

'I am sorry Fievel. If only I had known...'

'Hush Ferdinand. Those were beautiful buildings you were constructing. In any case, it does not matter now.'

'But what about the creatures remaining in the Tower. What will happen to them?'

'Look back, Ferdinand.'

Ferdinand turned around. By now he and Fievel had retreated far enough from the Tower that Ferdinand could see everything: the bottom of the Tower was still cloaked in a layer of dust as its walls continued to give in. But above this, Ferdinand could make out thousands of colorful parachutes streaming out of the Tower. It was a spectacular sight. Like a vibrant river flowing downward from the sky. Ferdinand imagined his fellow monkeys jumping off the top with their blue and red parachutes and further down, the typists, snails, and mice parachuting downward as well. Fievel must have warned them all. But as the colorful river just flowed and flowed, the Tower rocked with increasing violence. Eventually, the river of parachutes stopped and only the dust and tremors remained.

And then the Tower fell, crashing into the sea.