Give your brain a workout with this month’s testing puzzles, with the chance of a prize for the correct answer.

Thinking Cap
by David Sandham

Puzzle 1: A Random Walk Down Cheese Street
A mouse starts a maze at A. Each time she comes to a junction, she chooses one of the available paths at random. When she reaches one of the three exits (B, C or D) the test is over. Only one exit (D) has cheese.

If someone bets you evens that the mouse will reach the cheese, should you take the bet? The prize for the clearest explanation why.

To be clear, the mouse is unable to smell where the cheese is, selects the paths entirely at random, never turns back or retraces her steps, and continues until reaching an exit, where the game is over. An evens bet is where the player, if correct, receives a pay-out of their original stake plus an amount equal to it, but if incorrect, their stake is lost.

Puzzle 2: The Height of a Pyramid
As the pharaoh’s chief engineer, you must quickly estimate the height of a pyramid using a straight staff and the sun’s shadow.

The staff is 6ft long and casts a shadow of 9ft 7in. At the same time of day, the length of the pyramid’s shadow, from the centroid of its base (which is also the point where a line dropped vertically from its apex would meet the base), is 770ft.

What is the height of the pyramid?

Puzzle 3: Fibonacci Primes?
It would be very useful for mathematicians to have a simple way of generating prime numbers. Can the Fibonacci series help? The next number in the Fibonacci series is generated by adding together the previous two numbers: 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89 …

The series of prime numbers (those which can only be divided by 1 and by themselves) starts:
2, 3, 5, 7, 11 …

Now, where p is a prime number, is every pth number of the Fibonacci series prime?

For example, the third number of the Fibonacci series is 2, which is prime; the 5th is 5, which is prime; the 7th is 13, which is prime; the 11th is 89, which is prime. Does this always hold?

Puzzle 4: True or False?
Starfish have five arms and a mouth, and are sensitive to touch, light and temperature, but have no brains.

One reader who sends the correct answer to the prize puzzle to engtechmag@theiet.org with ‘March Thinking Cap’ by 15 March 2019 will win two books from The MIT Press’s Essential Knowledge Series (below). The winner will appear in the June issue of E&T. For solutions, go to bit.ly/eandt-thinking-cap after the closing date. Full terms and conditions at bit.ly/eandt-competitions. The November issue winner was Neal Oliver.