



Christmas
QUIZ



2024

~ THE SOLUTIONS! ~

**Devised and created by
Dr Tim Paulden
(RSS Quizmaster)**

For ease of reference, this solutions document gives the original text of each puzzle, followed by the solution.

Please get in touch if you have any queries or corrections!

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RSS Christmas Quiz 2024: Our winning teams

First place (£150 donation)

Oliver Church and Liam Hughes

Nominated charity: Doctors Without Borders

Second place (£120 donation)

Susannah Williams and Benedict Howell

Nominated charity: The Brain Tumour Charity

Joint third place (3 × £30 donation)

Andrea Chlebikova and Oscar Gillespie

Nominated charity: Animal Aid (www.animalaid.org.uk)

Gerad Carter, Rosie Barron, and Molly Barron

Nominated charity: St Catherine's Hospice (www.stcatherines.co.uk)

James Taverner and Mattias Andersson

Nominated charity: Shelter

In view of the large number of strong entries this year, the charities nominated by other entrants finishing in the top 12 will also each receive a small donation.

In alphabetical order of charity:

£15 to Action Against Hunger
(nominated by **Alison Knott, Andy Knott, and Sam Knott**)

£15 to The Friary
(nominated by **Becky Russell**)

£15 to GiveWell UK's 'Top Charities Fund'
(nominated by **Matthew Aldridge and Phil Aldridge**)

£15 to International Otter Survival Fund
(nominated by **Andrew Lawson**)

£15 to Mind
(nominated by **Jim Myers**)

£15 to Neuroendocrine Cancer UK
(nominated by **Diana Caulfield and Ian Caulfield**)

£15 to Refugee Action York
(nominated by **Vincent Fish**)

Many congratulations to all our prize-winners!

Before finally unwrapping the solutions, we wanted to once again embrace the spirit of *making connections*, and share a few words from our winning teams.

Oliver Church and Liam Hughes (1st place) write: "We are delighted to have achieved first place in this year's RSS Christmas Quiz. The combination of puzzle themes we've never come across before (Puzzle 9: 4,2,4,2,4) and things in the deep recesses of our memory (Puzzle 6: (64-69) (70-74)) is always fascinating. We particularly enjoyed Puzzle 4 (*All For One*), which utilised a very common puzzle theme in a way we'd not come across before. The links made between different puzzles are also excellent, such as in Puzzle 11 (*Contours*) where these links allowed us to get the hidden word before we were able to solve the diagram – and, in turn, guessing the thematic word helped us to figure out how the puzzle worked. We'd like to say thanks to Tim for another fantastic set of puzzles."

Susannah Williams and Benedict Howell (2nd place) write: "Once again, this year's quiz provided a unique mix of puzzling fun, tinged with moments of frustration and utter ecstasy! The number of connections between these apparently individual puzzles really is the cherry on top of a perfectly crafted quiz. We're really happy with our performance – particularly given the shorter timeframe in which this year's competition took place. We enjoyed the theme of *ALBO* (it's a classic for a reason!) and the challenge of solving *All For One* (nicely assembled), *Contours* (a great penny-drop moment – for those who aren't tone deaf), and *Elementary*² (we need never read any Sherlock ever again). Our thanks to Tim (and Mike) for producing such a wonderful quiz and for the charitable donation, and congratulations to the new champions!"

Andrea Chlebikova and Oscar Gillespie (joint 3rd place) write: "We really enjoyed the challenge provided by this year's quiz, so thank you very much for running it, and congratulations to all the other prizewinners! The puzzles were varied in nature yet with a large number of seamless links between them, allowing us to give all the questions a proper go. It was particularly fun to be able to guess the answers to some puzzles based on the additional clues linking them to other puzzles / ideas (as we did for 3, 6 and 11), yet still be stumped by how the encoding worked until everything suddenly clicked into place. In some cases, it turned out we had brainstormed the right idea early on but did not persevere with actually testing it until much later – so our advice to teams for the future is not to dismiss any ideas without trying them first!"

Gerad Carter, Rosie Barron, and Molly Barron (joint 3rd place) write:

"Thanks once again to the setters for a thoroughly amusing, sometimes bemusing, Christmas quiz. We're absolutely chuffed to get a podium position! Favourites this year included *Elementary*² (which forced us to dust off our Python knowledge), *Contours* (which eluded us for most of the festive period, despite listening to many carols while solving), *Xmas '24* (a lovely logic puzzle), and *All For One* (which we finished at the 11th hour). A huge congratulations to the winners!"

Mattias Andersson and James Taverner (joint 3rd place) write: "Thank you very much once again for a fiendish and entertaining quiz with many satisfying 'penny-drop' moments along the way. This was our sixth time in a row entering the RSS Christmas Quiz – always a highlight of the year – and the first time we've ever featured among the prizewinners! We enjoyed the ingenuity and imagination that goes into the quiz each year, and marvelled at how the quiz-setter spots connections across disparate themes. Highlights for us this year included *All For One*, which seemed obvious once finally solved (but confounding until we spotted what was going on!), and *Elementary*² with its pleasing marrying together of the two themes. Many thanks for setting and running the quiz and for the generous charitable donations – we look forward to next year's puzzles!"

List of puzzles

Puzzle 1: (4)+(5)+(6) [5 points]

Puzzle 2: A HARDY PERENNIAL [5 points]

Puzzle 3: ONE FOR ALL [7 points]

Puzzle 4: ALL FOR ONE [11 points]

Puzzle 5: ALBO [5 points]

Puzzle 6: (64-69) (70-74) [8 points]

Puzzle 7: SUMMIT [9 points]

Puzzle 8: XMAS '24 [10 points]

Puzzle 9: (4,2,4,2,4) [9 points]

Puzzle 10: SPECIAL DELIVERY [8 points]

Puzzle 11: CONTOURS [11 points]

Puzzle 12: ELEMENTARY² [12 points]

Total points available: 100

Puzzle 1: (4)+(5)+(6) [5 points]

What three character names are shared by the following trios, and what message do they reveal when combined (roughly speaking)?

- **Pert K, Janine G, and Robert L (1966)**
- **Candace S, Claire H, and Matt R (2013)**
- **Tayler H, Mike V, and Daniel R (2019)**

PUZZLE 1 SOLUTION:

Each trio represents three characters called **Mary, Chris, and Thomas** who appeared together in a TV show or short (as detailed below). Combining them yields **Mary-Chris-Thomas** – a rough approximation (perhaps after one too many mulled wines) to **“Merry Christmas!”**

The puzzle title **“(4)+(5)+(6)”** simply clues the lengths of the three names, which contain 4, 5, and 6 characters respectively.

The three trios of characters can be found together in the following:

- *T.H.E. Cat* (specifically Series 1, Episode 14: *The Canary Who Lost His Voice* – see [here](#)), where Pert Kelton, Janine Gray, and Robert Loggia appear as **Mary** Bloodgood, **Chris** Martell, and **Thomas** Hewitt Edward Cat;
- *Blank Verse* (specifically Series 1, Episodes 10 and 13 – see [here](#) and [here](#)), where Candace Simon, Claire Hesselgrave, and Matt Reznek appear as **Mary** Fitton, **Chris** Marlowe, and **Thomas** Kyd;
- *In This Moment* (see [here](#)), where Tayler Hamilton, Mike Vezza, and Daniel Roebuck appear as **Mary, Chris, and Thomas** (no surnames supplied).

Numerous solvers noted the lovely festive link that *In This Moment* was filmed in Bethlehem, Pennsylvania, USA.

In terms of additional connections and observations:

- Some solvers mentioned that the relevant episode of *T.H.E. Cat* aired very close to Christmas Day (23 December 1966).
- A couple of solvers also noted that Tayler Hamilton (Mary from *In This Moment*) had another 2019 appearance in *The M.I.C.E in the Wall* (see [here](#)) – the similarity of this name to *T.H.E. Cat* is just a coincidence!

Puzzle 2: A HARDY PERENNIAL [5 points]

Identify the work that is marking a milestone anniversary this year, and whose word lengths follow the pattern below:

5 4 5 3 4 2 4 2
3 3 1 7 7 2 5 2
5 3 8 5 2 4
4 3 2 3 2 9

(Note: The '9' in the fourth row could also have been written as '6 3'.)

PUZZLE 2 SOLUTION:

The word lengths indicated can be found in Thomas Hardy's enduring (but not overly festive) poem **Christmas: 1924** (see [here](#)), which was written **100 years ago**:

*"Peace upon earth!" was said. We sing it,
And pay a million priests to bring it.
After two thousand years of mass
We've got as far as poison-gas.*

The puzzle title is a **pun on the author's name and the perennial nature of Christmas (and, sadly, the poem's subject)**, while the italicised note in the puzzle text is explained by the hyphenated final word: *poison-gas*.

In terms of additional connections and observations:

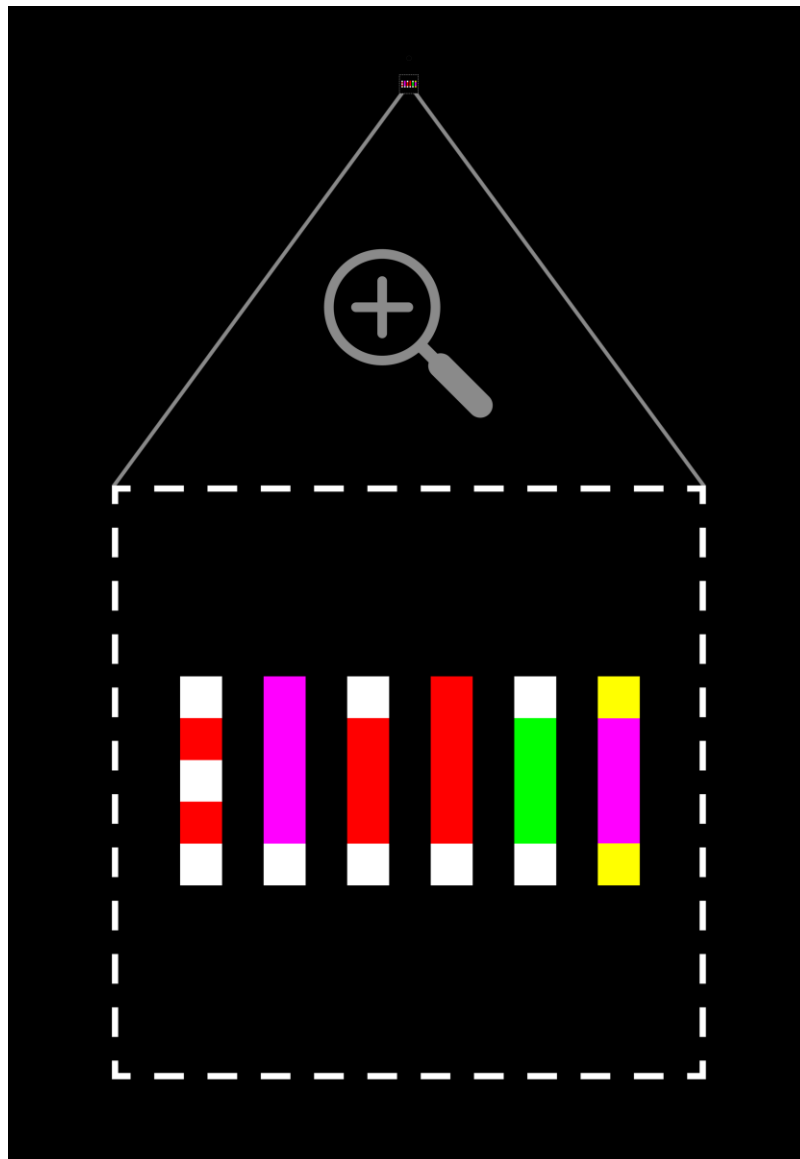
- Several solvers mentioned that the related words "*Peace on earth, good-will to men*" appear in Henry Wadworth Longfellow's poem *Christmas Bells*, written on Christmas Day in 1863.

- Others noted that a 'hardy' plant is one capable of surviving the cold winter temperatures typical at Christmas.
- Along similar lines, a couple of solvers drew an interesting link between the puzzle title and the well-known German Christmas song *O Tannenbaum* ('O Christmas Tree'), whose modern lyrics were written in 1824 (see [here](#)), and are therefore also marking a milestone anniversary – this time of 200 years. (The quizmaster's understanding is that while a 'Christmas tree' would most accurately be described as a 'woody evergreen', it is also technically 'perennial'.)

Puzzle 3: ONE FOR ALL [7 points]

What six-letter name (with both ancient and modern connotations) is represented below, and how is this name also connected to the theme of a later puzzle via the number 12?

(Note: It is not necessary to zoom into the image to solve the puzzle.)

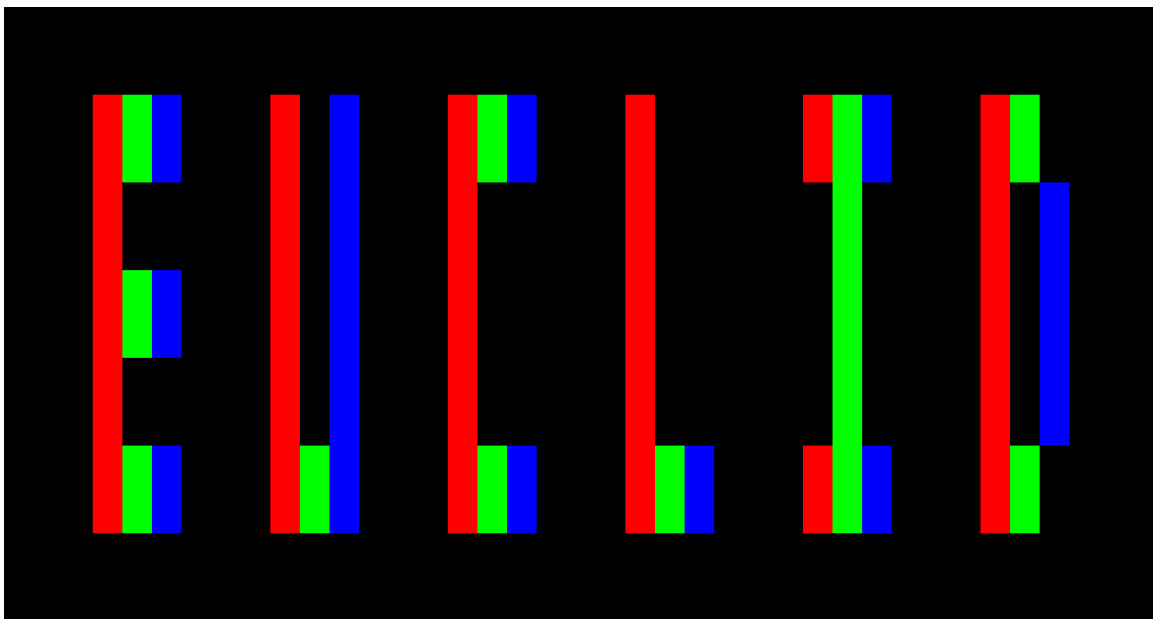


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PUZZLE 3 SOLUTION:

The name **EUCLID** is represented in the puzzle image, via Matt Sarnoff's 'Millitext' font. Each of the six coloured 'bars' is only one pixel wide and five pixels tall, but if a zoomed-in photograph were to be taken of these bars on an LCD computer screen (or at least, on certain screens), **the constituent red, green, and blue 'subpixels' would appear to form letters** – see [here](#) and [here](#). (The puzzle title, *ONE FOR ALL*, conveys the fact that a bar measuring one pixel in width is effectively representing all three channels – red, green, and blue.)

Specifically, the image below shows how the six bars in the puzzle would appear if we zoomed in close enough to see the red/green/blue subpixels making up each pixel (where, as usual, white = red + green + blue, magenta = red + blue, and yellow = red + green).



The styling of the puzzle image (including the black background and magnifying glass) not only represents the process of zooming in on this one-pixel font, but also evokes **the *Euclid* space telescope** launched in 2023 to probe the geometry of the Universe. Indeed, when the first mosaic image from the telescope was released in October 2024, the public were invited to "zoom into the first page of ESA *Euclid*'s great

cosmic atlas” (see [here](#)). The telescope’s name comes from the Greek mathematician Euclid, who wrote about the geometry of vision in *Optics* (see [here](#)) and is sometimes known as the ‘father of geometry’.

Moving on to last part of the puzzle text (“*how is this name also connected to the theme of a later puzzle via the number 12?*”), solvers needed to spot that **Euclid is track number 12 on the Sleep Token album *Take Me Back To Eden***, which features in Puzzle 9.

In terms of additional connections and observations:

- Solvers highlighted numerous links involving the mathematician Euclid – for instance, his treatise *The Elements* (see [here](#)) foreshadows the ‘elementary’ theme of Puzzle 12, and *Euclid’s theorem* (which asserts that there are infinitely many primes – see [here](#)) foreshadows the ‘prime’ theme of Puzzle 7.
- In keeping with the red/green/blue theme, several solvers noted that the *Euclid* telescope’s images are in fact constructed by combining separate red, green, and blue channels that represent measurements captured around certain wavelengths (see, for instance, the text [here](#)):

VIS [the VISible instrument] and NISP [Near Infrared Spectrometer and Photometer] enable observing astronomical sources in four different wavelength ranges. Aesthetics choices led to the selection of three out of these four bands to be cast onto the traditional Red-Green-Blue colour channels used to represent images on our digital screens (RGB). The blue, green, red channels capture the Universe seen by Euclid around the wavelength 0.7, 1.1, and 1.7 micron respectively. This gives Euclid a distinctive colour palette: hot stars have a white-blue hue, excited hydrogen gas appears in the blue channel, and regions rich in dust and molecular gas have a clear red hue.

Puzzle 4: ALL FOR ONE [11 points]

In the table below, the five white items (on rows 1 to 5) are standard, and the remaining items are non-standard.

Noting the puzzle's title, what is revealed by combining the four green items (symbolically) and the final white item (colloquially), and why is the red item appropriate?

Which of the items (nominally) depicted this scene in 1907 – and how is their first name linked to the name shared by Puzzles 1 and 5?

Finally, identify the rousing song – closely linked to the above theme – whose name could have provided an alternative title for this puzzle (or a variant thereof).

$28 \times 7 + 20 \times 9 + 12 \times 11 + 4 \times 13$
$4 \times 3 + 24 \times 5 + 36 \times 8$
$4 \times 2 + 8 \times 3 + 20 \times 4 + 16 \times 6 + 16 \times 8$
$28 \times 21 + 20 \times 23 + 12 \times 25 + 4 \times 27$
64×14
$4 \times 23 + 8 \times 24 + 16 \times 25 + 4 \times 27 + 16 \times 29 + 12 \times 33 + 4 \times 35$
$16 \times 6 + 16 \times 8 + 16 \times 10 + 4 \times 11 + 8 \times 13 + 4 \times 16$
$4 \times 9 + 8 \times 10 + 16 \times 11 + 4 \times 13 + 16 \times 15 + 12 \times 19 + 4 \times 21$
$4 \times 4 + 8 \times 6 + 16 \times 8 + 4 \times 9 + 16 \times 12 + 16 \times 16$
$4 \times 16 + 8 \times 17 + 20 \times 18 + 16 \times 20 + 16 \times 22$

PUZZLE 4 SOLUTION:

Each row represents a **chess piece** via its **mobility on an empty chessboard**. The first five items are the standard chess pieces (excluding the pawn), and the last five are non-standard pieces from the variant **Musketeer Chess** (see [here](#) for details) – this connection is clued by the puzzle title *ALL FOR ONE*, which evokes the well-known motto of *The Three Musketeers* in the book by Alexandre Dumas (particularly if combined with Puzzle 3's title, *ONE FOR ALL*).

For each chess piece, the multiplications appearing within the calculation represent the number of squares from which a particular number of moves are possible, and these multiplications are ordered by increasing number of moves. For instance, the first item ($28 \times 7 + 20 \times 9 + 12 \times 11 + 4 \times 13$) represents the Bishop, as there are 28 squares from which 7 moves are possible, 20 squares from which 9 moves are possible, 12 squares from which 11 moves are possible, and 4 squares from which 13 moves are possible (namely, the centre squares). Similarly, items 2 to 5 represent the King, Knight, Queen, and Rook respectively. (Numerous websites give visualisations of these patterns of numbers – see, for instance, the blog [here](#).) Note that these first five pieces are ordered alphabetically (by name or symbol – both are equivalent), and we always obtain an answer of 64 if we sum up the first numbers of each product (e.g. $28 + 20 + 12 + 4 = 64$ for the Bishop), because this is the total number of squares – this property was in fact noted by a few solvers who didn't spot the chess link. Moreover, the first numbers of each product are all multiples of 4, due to the 4-fold rotational symmetry of the chessboard (and the inherent symmetry in the movements of the pieces) – a property that is echoed by the number of the puzzle also being '4'.

Returning to the table, the remaining five items are specific pieces from the variant Musketeer Chess (see [here](#)) with the calculation following exactly the same structure as above:

Item 6 (in red): **Dragon** [known in other variants as an Amazon]

Items 7 to 10 (in green): **Hawk, Archbishop, Leopard, Chancellor**

As instructed in the puzzle text, combining the symbols of the green pieces (H, Ar, Le, Ch) and the final white piece (the Rook – or colloquially, the Castle) leads us to **Harlech Castle** in Wales. It is therefore appropriate that the table follows **the colour scheme of the Welsh flag**, with white at the top, green at the bottom, and the red Dragon (item 6) in the middle. As many solvers noted, there is also a prominent dragon sculpture (called 'Dewi') located near Harlech Castle.

Joseph Knight (whose name echoes item 3) painted Harlech Castle in 1907 (see [here](#)), and **Joseph** is a fitting Christmas counterpart to Mary – the shared name in Puzzles 1 and 5. (Partial credit was given to those who referenced George Davison's photogravure print from 1907, and noted the Bishop of the same name – see [here](#) and [here](#).)

Finally, the rousing song is **Men of Harlech** – appropriate because chess pieces are known as 'men' (and thus, the green items could be considered 'men of H-Ar-Le-Ch').

Some solvers noted, *en passant*, that the final output from each calculation gives the total number of different moves that each type of piece can make (assuming that only the start square and end square matter, and ignoring complications such as castling). For the standard pieces (i.e. items 1 to 5), the resulting values are shown below – note that these match the numbers given by others online (see, for instance, [here](#)), so this offered one possible route for solvers to break into the puzzle.

Bishop=560

King=420

Knight=336

Queen=1456

Rook=896

(While it is no surprise that Bishop+Rook=Queen, it is more curious that Bishop+Knight=Rook – a coincidence previously noted [here](#).)

In terms of further connections and observations:

- A few solvers noted that the above step of combining the four green pieces to make 'Harlech' could be seen as making '*all four one*' – a homophone of *ALL FOR ONE*.
- A handful solvers made the neat observation that Harlech Castle is a 'concentric' castle (see [here](#)), which echoes the roughly concentric pattern in the number of available moves as one proceeds from the edge of the board (lowest mobility) to the centre (greatest mobility).
- One solver noted that non-standard / unorthodox chess pieces (such as the Musketeer Chess pieces featuring in this puzzle) are sometimes termed 'fairy' pieces (see [here](#)) – a name with long-standing Christmas connotations.
- Some of the solvers who didn't spot the puzzle's chess theme wondered whether the puzzle title referenced Switzerland, which has the (unofficial) motto 'One for all, all for one' (see [here](#)), and curiously also has the dialling code +41.
- Finally, a few solvers noted the interesting parallels (pun intended) between "*The Three Musketeers Theorem*" in geometry (see [here](#)), and the geometric work of Euclid from Puzzle 3 – indeed, the theorem is often called *Legendre's second theorem* after A. M. Legendre, and was one of Legendre's many attempts to justify Euclid's fifth postulate, also known as the parallel postulate. (The footnote given at the above link highlights further connections between Alexandre Dumas and the history of mathematics.)

Puzzle 5: ALBO [5 points]

Can you complete the sequence below, which was trumpeted around the world 25 years ago? (Note that A and P have been omitted.)

M, E, R, T, S, M, J, ■

PUZZLE 5 SOLUTION:

The sequence contains the first letters of the names in the chorus of Lou Bega's 1999 hit ***Mambo No. 5 (A Little Bit Of...)***, with the puzzle title 'ALBO' representing the first letters of '***A Little Bit Of***' (which not only precedes each name in the chorus, but also appears in the song title and in the associated album title, *A Little Bit of Mambo* – see [here](#)):

A little bit of **Monica** in my life
A little bit of **Erica** by my side
A little bit of **Rita** is all I need
A little bit of **Tina** is what I see
A little bit of **Sandra** in the sun
A little bit of **Mary** all night long
A little bit of **Jessica** here I am
A little bit of **you** makes me your man

Y or **y** (for "you") is therefore the missing letter – this is also cheekily clued within the puzzle text's phrasing: "*Can you complete the sequence below...?*" As many solvers noted, it is also fitting that only 'a little bit of' each name has been provided – i.e. the first letter.

To explain the first sentence of the puzzle text, the song was a huge worldwide hit, and featured trumpets heavily – including within the lyrics, and in the cover art (see [here](#)). And despite Lou Bega claiming in the verse "I like Angela, Pamela, Sandra and Rita", he evidently didn't like

Angela and Pamela enough for them to feature in the chorus – hence the note that “*A and P have been omitted*”.

As noted within the Puzzle 4 solution, the name ‘Mary’ features in both Puzzles 1 and 5 – in Puzzle 1, it was the first of the three names forming ‘*Mary-Chris-Thomas*’, and in this puzzle, it is the sixth name in the *Mambo No. 5* chorus.

Finally, as several solvers noted, a further hint to the theme was provided by the puzzle number and number of points both being **equal to five**.

In terms of additional connections:

- Many solvers noted that the song’s 25th anniversary could also be regarded as a 75th anniversary, as Lou Bega’s 1999 release sampled Pérez Prado’s version of the song from 1949 – exactly 50 years prior (see [here](#)).
- A couple of solvers also noted that ‘*albo*’ (as per the puzzle title) is a poetic Spanish word for ‘*white*’ – echoing the appearance of *White Christmas* in Puzzle 11, and the snowflake theming of Puzzle 6.

Puzzle 6: (64-69) (70-74) [8 points]

A famous name is represented in the image below – can you decrypt it?

(How is this name connected to one of the items in another puzzle?)



PUZZLE 6 SOLUTION:

The city-scape in the image is Berlin, and the large snowflake at the top of the image is surrounded by six copies of the famous *Berlin-Uhr* ("**Berlin Clock**") or *Mengenlehreuhr* ("Set Theory Clock") – a public clock in Berlin that displays the time via illuminated lights (see [here](#)). The usual colours of the lights have been inverted, so they appear in wintry shades of blue rather than red and yellow.

Proceeding clockwise from the top-right, solvers should have found that the six clocks (echoing both the six-fold symmetry of the snowflake, and the number of the puzzle) show the following times:

09:18, 22:09, 14:07, 02:05, 18:12, 09:14

Converting the hours and minutes into letters in the standard way (e.g. 09:18 gives I + R) reveals the hidden name **IRVING BERLIN – an apt name to be spelled out by a 'Berlin Clock'**! The styling of the puzzle image is designed to evoke some of Berlin's songs: *White Christmas* (or possibly *Snow*) and *Blue Skies* (see [here](#)).

(There's a good reason we should begin in the top-right, with the '09:18' clock: if the twelve segments of the white 'clock face' in the centre of the snowflake are numbered 1 to 12, with 12 at the top, then the Berlin Clock that points into segments 1 and 2 provides letters 1 and 2 of the answer, the one that points into segments 3 and 4 provides letters 3 and 4, and so on.)

Turning to the final sentence of the puzzle text, the desired connection to another puzzle is that **Irving Berlin's *White Christmas* is one of the songs featuring in Puzzle 11**. (As several solvers noted, the 1954 film *White Christmas* – sometimes known as *Irving Berlin's White Christmas* – marked its 70th anniversary in 2024.)

Many solvers correctly noted that the puzzle title, (64-69) (70-74), is a reference to the ***Kryptos* sculpture at CIA headquarters** (see [here](#)), whose fourth and final passage remains unsolved. The sculpture's creator, Jim Sanborn, has revealed that letters 64-69 of this passage become BERLIN after decryption, and letters 70-74 become CLOCK –

thus, the puzzle title reads '**BERLIN CLOCK**'. (It is possible – but not certain – that the *Mengenlehreuhr* is the 'Berlin Clock' being referenced in the passage.)

A couple of solvers made the neat observation that Sanborn's follow-up clue (in 2020) was that letters 26-34 become NORTHEAST after decryption, and the above sequence indeed begins with the Berlin Clock positioned in the 'northeast' (i.e. the one reading 09:18). In addition, the quizmaster enjoyed one solver's suggestion that the name 'Sanborn' – spoken in a sufficiently bizarre accent – might be Mary's (Puzzles 1 & 5) two-word summary of the Nativity.

In terms of additional connections and observations, solvers highlighted many interesting links involving Irving Berlin, a selection of which are noted below:

- The father of Irving Berlin was a Jewish 'cantor' (see [here](#)), echoing the name of Georg Cantor, 'the father of set theory', who would surely have approved of the 'set-theory clock' that features in this puzzle.
- Irving Berlin provided music for the 1929 film *Sally*, which starred Pert Kelton from the first part of Puzzle 1 (see [here](#)). He also co-wrote (with Ivan Caryll – another Christmas homophone) the music for *The Canary* (see [here](#)), which echoes the name of the episode in the first part of Puzzle 1.
- In 1924 (i.e. 100 years ago – echoing Puzzle 2), he wrote *All Alone* (see [here](#)), which is synonymous with Puzzle 4's title, *ALL FOR ONE*.
- *Irving Berlin Inc* published *Draggin' the Dragon Drag* in 1927 (see [here](#)), echoing the Dragon at the centre of Puzzle 4 (although Irving Berlin himself did not write the song).
- One of Berlin's daughters was named Mary (see [here](#)), providing a further link to Puzzles 1 and 5.
- The title of his song *A Little Bit Of Everything* (see [here](#)) echoes the title (and theme) of Puzzle 5.

Puzzle 7: SUMMIT [9 points]

What does the table below enumerate? (The three missing digits in the final item should be determined.)

Hint: Luke 11:10.

3×1367827
$17 \times 373 \times 647$
2×2050327
$11 \times 13 \times 28711$
$2 \times 2 \times 2 \times 512761$
$2 \times 2 \times 5 \times 205171$
37×110819
$2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 23 \times 929$
43×95401
$4101■■■$

PUZZLE 7 SOLUTION:

The table represents the prime factorisations of the ten numbers below, which count **the number of times each digit (from 0 to 9) appears in the largest known prime of 41,024,320 digits** found in October 2024:

4,103,481 [number of 0s]

4,102,627 [number of 1s]

4,100,654 [number of 2s]

4,105,673 [number of 3s]
4,102,088 [number of 4s]
4,103,420 [number of 5s]
4,100,303 [number of 6s]
4,102,464 [number of 7s]
4,102,243 [number of 8s]
4,101,367 [number of 9s]

(The prime in question is a **Mersenne prime**, and known as M136279841 because its value is equal to $2^{136279841} - 1$. As some solvers noted, the number of this puzzle, 7, is also a Mersenne prime – namely, M3.)

As one might expect, the digit counts shown above are all different, but close to 4.1 million (i.e. 10% of the total number of digits).

Solvers needed to restore 367 (a prime) to the tenth number to create **4,101,367** (the number of 9s) – **this number is itself prime**, which explains why it appears as a single number in the table shown in the puzzle. One way to deduce that 4,101,367 is the final number is to find the sum of the first nine values in the table – as per the titular pun, instructing solvers to ‘*sum it*’ – and subtracting the result from 41,024,320.

(The puzzle title, *SUMMIT*, was also designed to convey that M136279841 is the **highest known prime to date**. One solver suggested that it might also represent the computational resources needed to find the prime – i.e. ‘*some I.T.*’)

In the hint, ‘*Luke*’ represents **Luke Durant**, who discovered the prime, and ‘**11:10**’ refers to the **date of initial discovery**, on which it was reported by the processor as ‘probably prime’ (see [here](#) for the extract below):

*After nearly a year of testing, Luke finally struck paydirt. On **October 11**, an NVIDIA A100 GPU in Dublin, Ireland, reported that M136279841 is probably prime. On October 12, an NVIDIA H100 in San Antonio, Texas, USA, confirmed primality with a Lucas-Lehmer test.*

For full credit, solvers should have noted that **the Luke 11:10 bible verse is also relevant to the theme of seeking and finding**: “*For every one that asketh receiveth; and he that seeketh findeth; and to him that knocketh it shall be opened.*” (As some solvers noted, the words in the verse are spoken by Jesus, whose birth is celebrated at Christmas.)

Finally, a couple of solvers made some delightful connections to the titles of Puzzle 3 and Puzzle 4 (*ONE FOR ALL* and *ALL FOR ONE*): a Mersenne prime such as M136279841 is ‘*one for all*’ when expressed in binary, in the sense that all of its binary digits equal 1; at the same time, the ten seven-digit numbers given in the puzzle (and their total, 41,024,320) all begin with the digits 41..., so could accurately be described as “*all 41...*” (a homophone of *ALL FOR ONE*).

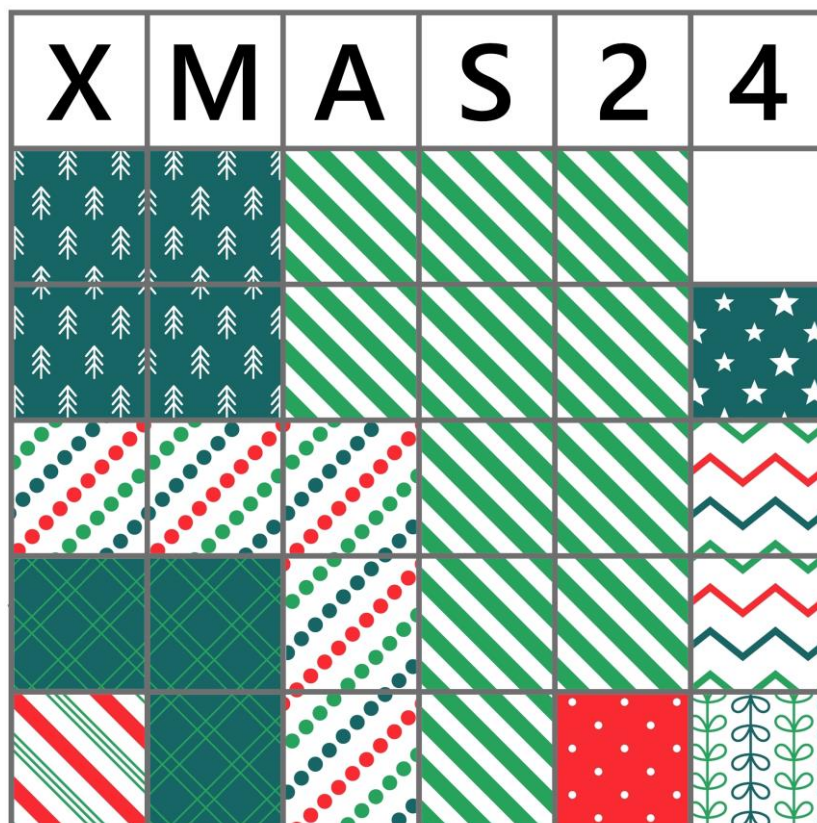
In terms of additional connections and observations:

- Several solvers noted that Euclid from Puzzle 3 not only demonstrated the infinitude of the prime numbers (as mentioned earlier) but also made advances relevant to Mersenne primes specifically, as encapsulated by the *Euclid-Euler theorem* (see [here](#)). As described in the ‘History’ section given at the above link, Euclid’s result involves ‘*a finite geometric series beginning at 1 with ratio 2*’ – exactly the type of geometric series that features in Puzzle 8, as we shall see shortly.
- One solver also mentioned that an earlier Mersenne prime record set in 2016 (M74207281) was found using computers at the ‘Lee’s Summit’ campus of the University of Central Missouri (see [here](#) and [here](#) for details), echoing the puzzle title.

Puzzle 8: XMAS '24 [10 points]

Contributed by *Dr Mike Paulden*

After carefully arranging her family's nine Christmas gifts beside their tree, Professor Geri Comet hands each family member a copy of the diagram below, which depicts the front-profile view of the pile of gifts (with gridlines added). She explains that each gift is a cuboid and is thus represented by a square or rectangle of cells within the diagram – although a gift may be partially obscured by other gifts in front of it. Furthermore, each gift sits either on the floor (i.e. touching the bottom edge of the grid) or on top of another gift, with overhang permitted.



Professor Comet then tells her bewildered family that it is possible to fill in the 6×6 grid such that the symbols **X, M, A, S, 2, 4** appear exactly once in each row and column (note that the first row is already complete) and the 'scores' of the nine gifts form a geometric sequence. The 'score' of a gift is defined as the sum of **all of its cells** (not just the visible cells) when digits are scored 'as is' and letters are scored based on

their alphabetic position. For instance, if the 2×2 region in the bottom-left corner contained the symbols M, S, 2, and 4, then the green 2×2 gift located there would receive a score of $13+19+2+4 = 38$, even though only three of its four cells are visible due to the 1×1 gift sitting in front. *(Note: It is easy to see that these particular gifts must have sizes of 2×2 and 1×1 respectively, but some gifts in the puzzle may be larger than they first appear.)*

Can you figure out how Professor Comet's grid should be completed, and determine the score associated with each gift?

PUZZLE 8 SOLUTION:

As many solvers noted, the Professor's name ('**Geri Comet**') is an anagram of '**geometric**' – in addition, 'Comet' is one of Santa's reindeer (see [here](#)), and 'Geri' evokes the *Spice Girls* (at least in the UK), who make an appearance in Puzzle 12. The puzzle title, *XMAS '24*, is not only a reference to **Christmas 2024**, but a callback to Puzzle 2, which featured the poem **Christmas: 1924**. Some further connections are noted towards the bottom of this solution write-up.

The unique solution to the puzzle is shown below, with three of the gifts having a greater extent than the original puzzle diagram suggests: the gift with green and white stripes really measures 5×5, and sits entirely behind all the gifts on the left [see yellow corners]; the gift with jagged lines really measures 3×1, with its lowest cell hidden by the 1×1 gift in the bottom-right [see pink corners]; and the gift with stars really measures 1×2, and is sat precariously on top of the gift with jagged lines, with its left cell hidden behind the gift with green and white stripes [see orange corners]. The sizes of the remaining gifts are as they appear: three measure 1×1, two measure 2×2, and one measures 3×3. It can readily be checked that the scores of the nine gifts are then 1, 2, 4, 8, 16, 32, 64, 128, and 256.

X	M	A	S	2	4
A	2	M	4	S	X
4	A	2	X	M	S
M	4	S	A	X	2
S	X	4	2	A	M
2	S	X	M	4	A

Many different solution paths were possible – the one presented here is based closely on the elegant approach taken by our 2024 winners, Oliver Church and Liam Hughes. In the below, the notation $rXcY$ denotes row X and column Y in spreadsheet notation (so, for instance, $r6c1$ is the cell in the bottom-left corner).

Note, firstly, that the nine scores must be 1, 2, 4, 8, ..., 256: indeed, if the ratio of the geometric sequence is the rational number p/q (expressed in its lowest terms, with $p > q$), then p^8 and q^8 must divide opposite ends of the sequence for all of the scores to be integers, and it's easy to see that only $p=2$ and $q=1$ are small enough. (The total of all 36 symbols in the grid is $63 \times 6 = 378$, which is smaller than either $2^9=512$ or $3^8=6561$.)

Since each row and each column sums to 63, the 256-gift must measure 5×5 (as a 4×6 region – or smaller – would generate a score no greater than $63 \times 4 = 252$, and a 5×6 region is incompatible with the white cells).

The gift with green and white stripes has a score of at least 167 (as the sum of the 5×3 region from $r2c3$ to $r6c5$ is $((63 \times 3) - (1 + 19 + 2)) = 167$), so this must be the gift with score 256, and it must sit in the bottom-left 5×5 region running from $r2c1$ to $r6c5$, where we can easily check it will indeed have a sum of $(63 \times 5) - (24 + 13 + 1 + 19 + 2) = 256$. Importantly, this means that the gift with green and white stripes sits 'behind' the four gifts on the left of the diagram.

Given the above, the gift with trees can only have hidden cells if it measures 5×2 and sits on the floor – however, this would give it an invalid score of $(63 \times 2) - (24 + 13) = 89$, so it does in fact measure 2×2 and it is sitting on the 3×3 gift with multi-coloured dots.

We observe now that scores of 1, 2 and 4 must be associated with single-cell gifts (as we are not allowed to repeat symbols in a row or column). Similarly, the only valid way to make a score of 8 is a 2×2 gift containing $\{A, A, 2, 4\}$, and the only valid way to make a score of 16 is a 3×1 or 1×3 gift containing $\{A, 2, M\}$. It follows that the only possible score options for a 2×2 gift are 8, 32, or 64 (since 128 and 256 are too high to attain).

Consider now the two 2×2 gifts on the left. One of these 2×2 gifts must have a score of 64 – if they were 8 and 32, then the two leftmost columns could sum to at most $8+32+24+13+19+24 = 120$, which is less than the required total of $63 \times 2 = 126$. We also see that whichever 2×2 gift on the left has a score of 64, it cannot contain the symbols $\{M, M, S, S\}$, as there is already an M in column 2 (at $r1c2$), so it must instead contain $\{2, S, S, X\}$. We can then deduce that the other 2×2 gift on the left must have a score of 8, and contain $\{A, A, 2, 4\}$ – if it had a score of 32 instead, then the two leftmost columns would sum to at least $64+32+24+13+1+2 = 136$, which exceeds $63 \times 2 = 126$.

It follows that the two 2×2 gifts on the left together contain the symbols $\{A, A, 2, 2, 4, S, S, X\}$ in some order – and given that $r1c1 = X$ and $r1c2 = M$, we see ‘by Sudoku’ that $r4c1 = M$ and $r4c2 = 4$.

Now consider the 3×3 gift with coloured dots, which has a score of either 32 or 128 (as 64 and 256 have already been accounted for). If this 3×3 gift has a score of 32 (and thus the 2×2 bottom-left gift has a score of 8), then we’d need the cells $r4c3$, $r5c3$, and $r6c3$ together to sum to $(32 - (8+13+4)) = 7$, but that is impossible as column 3 already contains an A (at $r1c3$). Thus, the 3×3 gift with coloured dots has a score of 128.

It follows that the 2×2 gift in the bottom-left must have a score of 64, and contains $\{2, S, S, X\}$ (since a score of 8 would require $r4c3$, $r5c3$, and $r6c3$ together to sum to $(128 - (8+13+4)) = 103$, which is too high). Clearly, the 1×1 gift with red and green stripes sitting in the bottom-left corner must score 2, which then resolves the bottom-left 2×2 : $r6c1 = 2$, $r5c1 = S$, $r6c2 = S$, $r5c2 = X$. It follows that $r4c3$, $r5c3$, and $r6c3$ together must sum to $(128 - (64+13+4)) = 47$. We also know that $r1c3 = A$, and so $r2c3$ and $r3c3$ together sum to $(63 - (47+1)) = 15$, and must therefore be $\{2, M\}$ in some order.

Shifting attention briefly to the 2×2 gift with trees, we now know this must have a score of 8, and contain $\{A, A, 2, 4\}$ in some order – in particular, we know that the A in $r3$ appears at either $r3c1$ or $r3c2$.

We are now approaching the final stage of the solve. Observe that the red gift with white dots is the only remaining possibility for a score of 4,

as we know that the gift with a score 4 must comprise a single cell, and the gift with stars (visible at $r3c6$) and the gift with bows (visible at $r6c6$) are both ruled out by the 4 already in column 6 (at $r1c6$). Therefore, $r6c5 = 4$. Similarly, the gift with bows in the bottom-right is the only remaining possibility for the gift receiving a score of 1 – note that the gift with stars (at $r3c6$) is ruled out by the A in row 3 appearing at either $r3c1$ or $r3c2$. Therefore, $r6c6 = A$.

Since $r2c3$ and $r3c3$ contain $\{2, M\}$ in some order, we deduce ‘by Sudoku’ that $r6c3 = X$ and $r6c4 = M$, and it follows similarly that $r4c3 = S$ and $r5c3 = 4$.

We know the gift with score 16 must measure 3×1 or 1×3 , and contain the symbols $\{A, 2, M\}$ – it cannot be the gift with stars, since the A in row 3 and the A in column 6 are already accounted for (and are too far away to be part of the same 3×1 or 1×3 gift). Therefore, the only remaining possibility is that the gift with jagged lines really measures 3×1 , and comprises cells $r4c6$, $r5c6$, and $r6c6$, with the lowest cell being hidden by the gift with bows sitting in front. It follows that $r4c6 = 2$ and $r5c6 = M$.

Finally, the only way for the gift with stars to have a score of 32 (which is the last remaining score) is for it to really measure 1×2 and comprise the cells $r3c6 = S$ and $r3c5 = M$ (i.e. it sits on top of the gift with coloured jagged lines, overhanging on the left, and this overhang is hidden behind the large 5×5 gift with green and white stripes). From here, it’s straightforward to fill in the remainder of the cells ‘by Sudoku’ to give the final solved grid shown above.

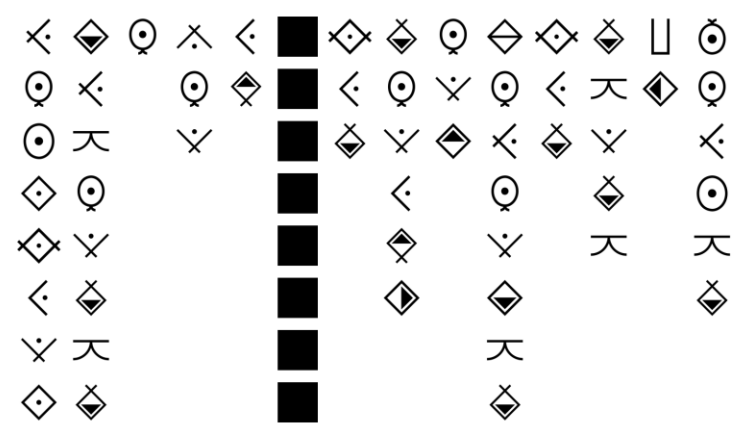
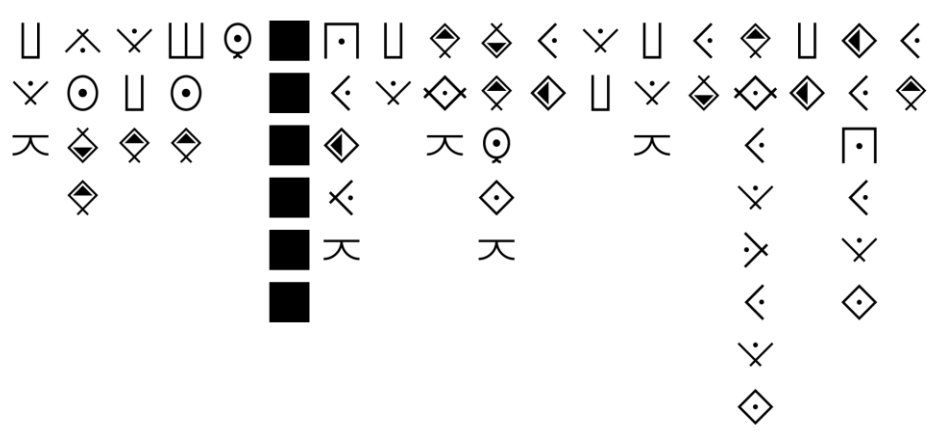
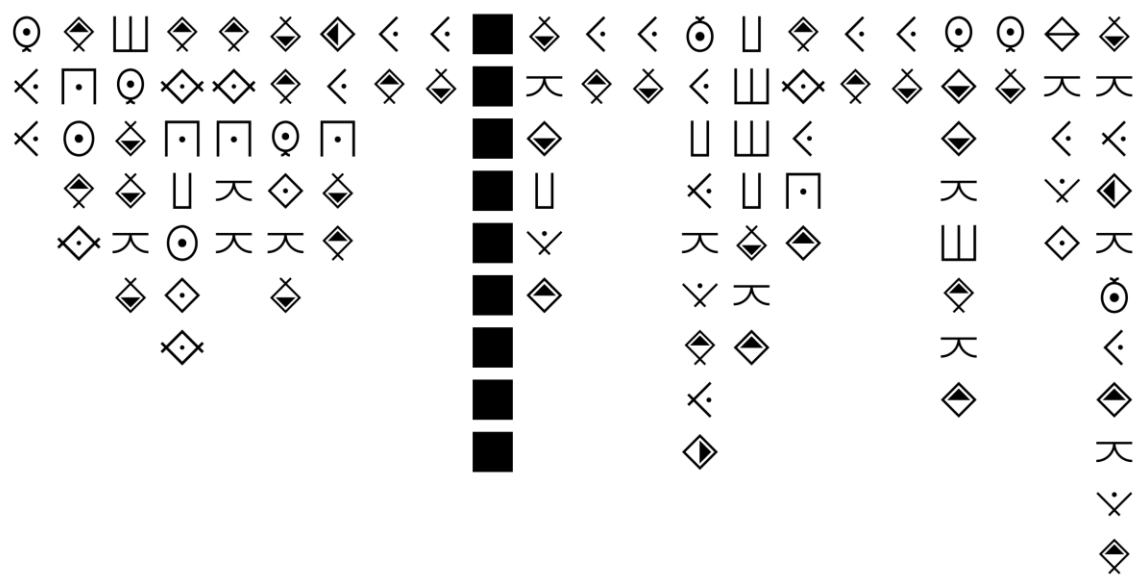
In terms of additional connections and observations:

- Many solvers noted that the sum of the six symbols in the puzzle (and thus, the sum of each row or each column) is 63 – although this is not a Mersenne prime like the number in Puzzle 7, it is a Mersenne number because it has the form $2^n - 1$. Similarly, adding up the scores associated with the nine gifts gives a total of 511 – another Mersenne number. Other solvers focused on the powers of two themselves, noting that the puzzle number (8) is itself a power of 2, and drawing a link back to Puzzle 4, in which the number 64 was central to finding the solution.

- Several solvers mentioned that the geometry of the gift arrangement and the appearance of a 'geometric' sequence provide a connection back to Euclid in Puzzle 3 (the 'father of geometry'), while others noted that the structure used in the puzzle grid is a Latin square (see [here](#)), which provides a link to the statistician R. A. Fisher, whose surname appears as an answer in Puzzle 12.
- Finally, one resourceful solver speculated that the name '*Geri Comet*' might be a reference to Geri Halliwell winning a Comet Award in 2001 for 'Best International Female Singer' (see [here](#)), and performing *It's Raining Men* (cf. the 'men of H-Ar-Le-Ch' in Puzzle 4) over in Germany. (It would have been the 'icing on the cake' if the award ceremony had taken place in Berlin (Puzzle 6) rather than in Cologne!)

Puzzle 9: (4,2,4,2,4) [9 points]

Whereabouts (specifically) is this puzzle taking us?



PUZZLE 9 SOLUTION:

The puzzle image contains three quotes – each with one word to be determined – that have been **encoded in the rune-based cipher used by the band Sleep Token** for their third album, ***Take Me Back To Eden*** (see [here](#)). The puzzle title, (4,2,4,2,4), represents the word lengths in this album title, and as noted earlier, ***Euclid*** (the solution to Puzzle 3) is track number 12 on the album.

The decoded quotes (with the obscured words emboldened) are:

“ALL TRUTH PASSES THROUGH THREE STAGES. FIRST IT IS **RIDICULED**. SECOND, IT IS VIOLENTLY OPPOSED. THIRD, IT IS ACCEPTED AS BEING SELF-EVIDENT.” – Arthur Schopenhauer

“ONE MUST NOT PUT A **LOADED** RIFLE ON THE STAGE IF NO ONE IS THINKING OF FIRING IT.” – Anton Chekhov

“LAUGHING CLEANSSES A MAN: IT **RESTORES** HIS SANITY AND BALANCES HIS SENSE OF VALUES.” – Leonard Bernstein

Interpreting the three missing words as the **what3words** designation ///ridiculed.loaded.restores takes us (back) to the **Eden Project** in Cornwall (see [here](#)) – **echoing the name of the Sleep Token album**.

In terms of additional connections and observations:

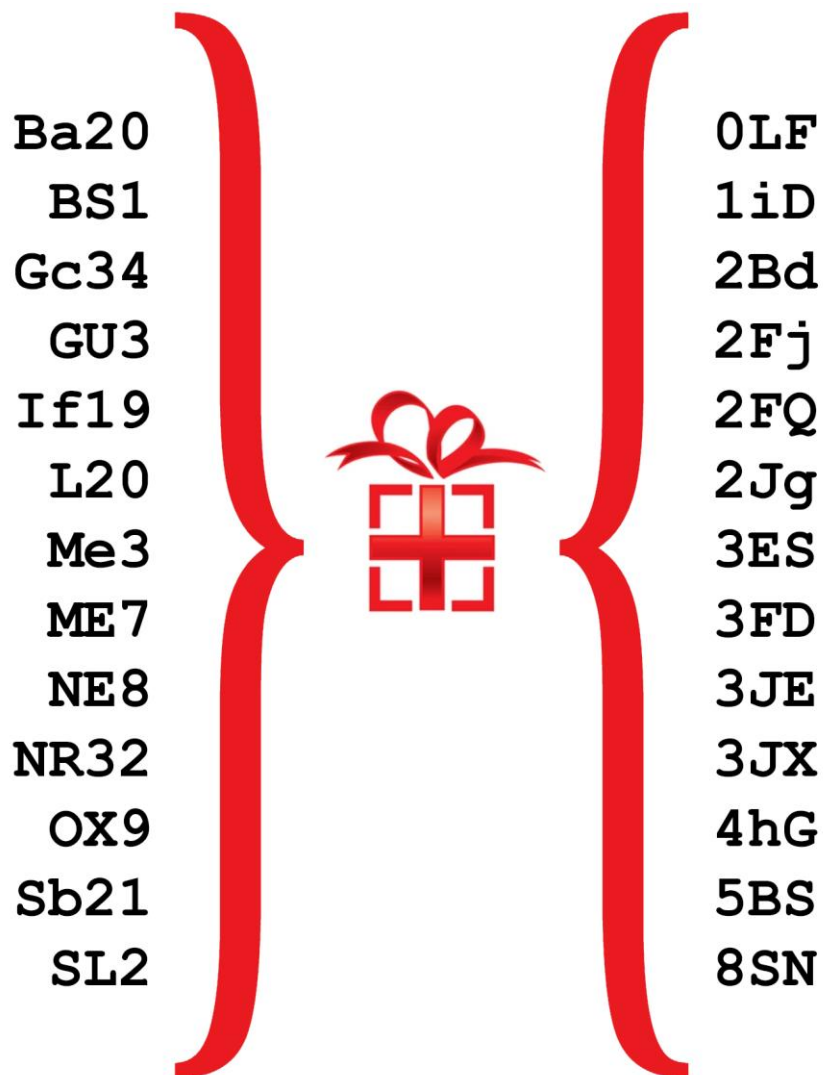
- Solvers who did not spot the Sleep Token theme provided a range of interesting and entertaining interpretations for the puzzle title (4,2,4,2,4), including ‘*Word by word by word*’, ‘*West of East of Eden*’, and ‘*Sure as eggs is eggs*’ – the latter suggestion being a reference to the Eden Project’s huge egg-shaped granite sculpture called ‘Seed’ (see [here](#)). Some solvers also noted that the repeated 2s and 4s in the title were fitting for a quiz at the end of 2024 (see also Puzzles 2 and 8), and that they summed to 16 – a power of two (echoing Puzzle 8).
- It is an amusing coincidence that the 2024 Courier Business Conference, which focused on the economic potential of ‘Eden Project Dundee’, happened to take place on 24 April 2024 – its date in

month/day/year notation was therefore 4/24/24, exactly matching the numbers in the puzzle title (see [here](#)).

- Some solvers noted that Arthur Schopenhauer (with whom the first quote is associated) wrote a treatise entitled *On Vision and Colours*, providing a connection back to Puzzle 3. Another solver noted that one of the most famous examples of the 'Chekhov's gun' principle (referenced in the second quote) arises in the film *The Fifth Element* (see [here](#)), which gives a link to the 'elementary' theme of Puzzle 12. Finally, Leonard Bernstein (with whom the third quote is associated) not only wrote *My Twelve Tone Melody* to mark the 100th birthday of Irving Berlin from Puzzle 6 (see [here](#)), but also wrote the opera *Trouble in Tahiti* (see [here](#)), whose title provides a link to TAHITI – one of the answers in Puzzle 12.
- A couple of solvers noted the interesting coincidence that one of the outspoken critics of the what3words system is called Terence Eden (see, for instance, [here](#)).
- Finally, one solver suggested that one of the lines of 'poetry' sometimes associated with the Sleep Token runes – "*I am hunting something and in turn that same thing is hunting me*" – echoes the theme of 'seeking and finding' expressed in Puzzle 7 (via the *Luke 11:10* quote), and could even be said to describe the process of cracking a 'puzzle hunt' such as the RSS Christmas Quiz.

Puzzle 10: SPECIAL DELIVERY [8 points]

(Note: The solution to this puzzle comprises two words of five letters, as shown below the diagram.)



Which item in this puzzle has historically been known by several names, one of which echoes an item in Puzzle 4?

Finally, which festive-sounding name (modulo pronunciation) might one associate with the puzzle's solution?

PUZZLE 10 SOLUTION:

Solvers needed to match up the left and right strings (after substituting the rogue lower-case letters appropriately with upper-case letters – see below) to form the **postcodes of roads named after Christmas** (Christmas Lane, Christmas Crescent, and so on):

BH20 4RG = Christmas Close, Wareham [with a = H and h = R]

BS1 5BS = Christmas Steps, Bristol

GU34 3FQ = Christmas Close, Alton [with c = U]

GU3 3FD = Christmas Crescent, Guildford

IP19 0LF = Christmas Lane, Linstead [with f = P]

L20 2JA = Christmas Street, Liverpool [with g = A]

ME3 8SN = Christmas Lane, Rochester [with e = E]

ME7 1TD = Christmas Street, Gillingham [with i = T]

NE8 2BS = Christmas Place, Gateshead [with d = S]

NR2 3JX = Christmas Lane, Lowestoft

OX9 2FY = Christmas Lane, Thame [with j = Y]

SO21 3ES = Christmas Hill, South Wonston [with b = O]

SL2 3JE = Christmas Lane, Slough

As shown above, the lower-case letters a to j are respectively replaced by H, O, U, S, E, P, A, R, T, and Y, thereby spelling out the suitably festive **HOUSE PARTY** (with the first word, HOUSE, also being appropriate given the address theme). The red present in the diagram (which doubles up as a plus sign) is also in keeping with the theme of delivering gifts.

Bristol's **Christmas Steps** has many historical names (see [here](#)), including Queen Street (or Queene Street) – echoing the **Queen** in Puzzle 4.

The name **Noel** – close to the festive “Nöel”, though with a different pronunciation – may evoke happy / harrowing memories (delete as applicable) of the 90s TV show **Noel’s House Party**, hosted by Noel Edmonds.

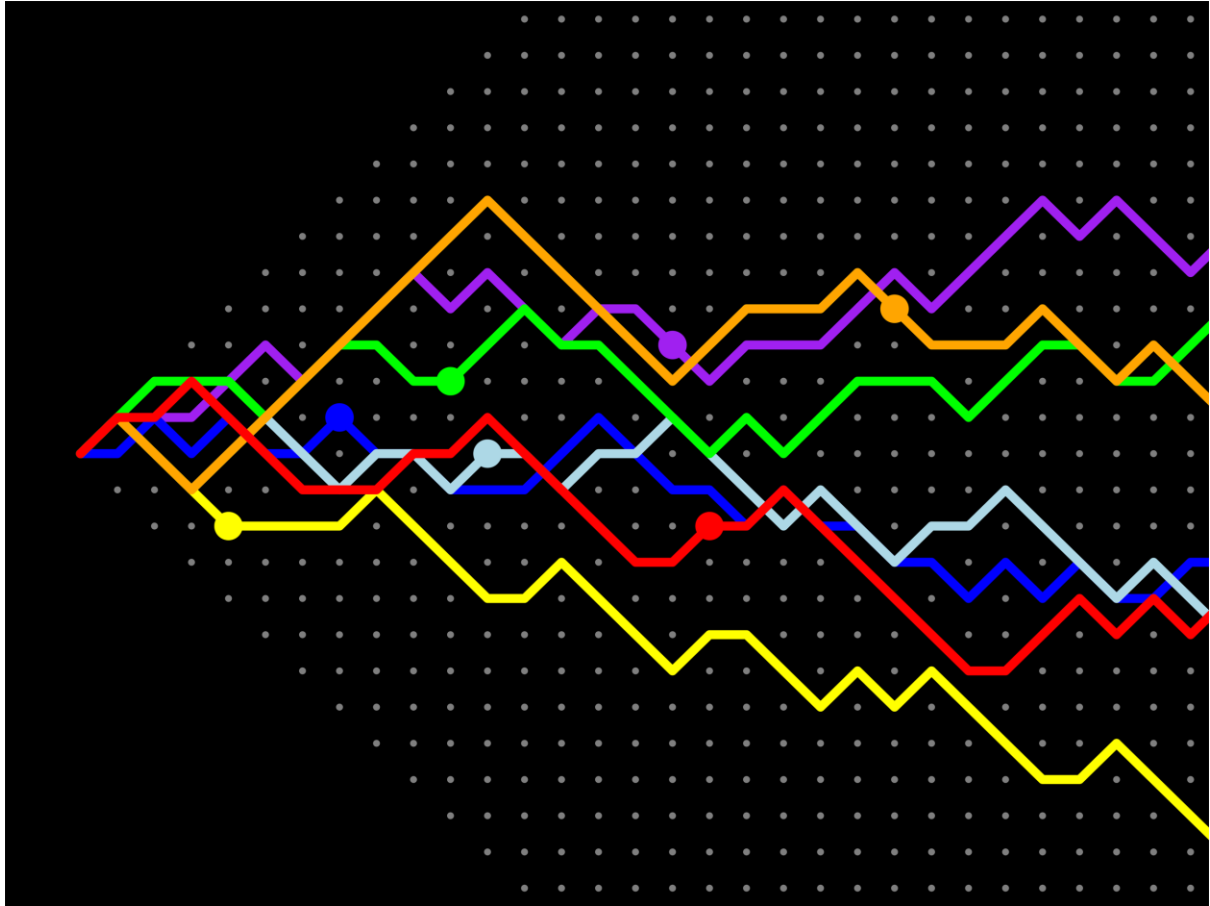
In explaining the puzzle title, solvers should ideally have noted not only the postal theme, but that Noel Edmonds famously made ‘special deliveries’ on Christmas Day to unsuspecting families in **Noel’s Christmas Presents** (the final instalment from 1999 can be seen [here](#) – watch at your own risk). Many alternative explanations for the title were accepted – including the observation that Christmas itself marks a ‘special delivery’ in the form of Jesus’s birth.

In terms of additional connections and observations:

- A few solvers noted that Bristol’s Christmas Steps can be linked to a second chess piece from Puzzle 4, since the name of its historic pub ‘The Three Sugar Loaves’ (now rebranded as ‘The Christmas Steps’) echoes the ‘sugarloaf helmet’ worn by a Knight (see [here](#) and [here](#)).
- Another solver drew a connection back to Puzzle 2, noting that the short comedy entitled *A Special Delivery* (see [here](#)) features a ‘Hardy’ – not Thomas Hardy, but Oliver Hardy of *Laurel & Hardy* fame.
- Some solvers also noted that the overall ‘gifting’ theme of the puzzle parallels the collection of gifts in Puzzle 8.
- Finally, one solver speculated that the large red punctuation braces in the puzzle might symbolise Santa’s ‘red braces’ – presumably worn while making his own special deliveries around the globe.

Puzzle 11: CONTOURS [11 points]

Explain the diagram below, and thus reveal the hidden seven-letter word.



— — — — —

Explain how a related name can be created by combining the name of a U.S. state (whose abbreviation begins this puzzle's solution) and the first half of an earlier puzzle's solution.

In what sense might an object associated with this puzzle's solution sometimes offer a 'puzzle' of its own?

Finally, what is the fruity connection between this puzzle's solution (at least under one interpretation) and an earlier puzzle's solution?

PUZZLE 11 SOLUTION:

Each coloured line represents the **melodic contour of a well-known Christmas song**, when regarded as a sequence of upward / downward / repeated notes, ignoring both the rhythm and the size of jumps – in other words, we have a graphical display of each song's **Parsons code** (see [here](#)). Several solvers discovered that the *Musipedia* website (see [here](#)) has a 'contour search' tool for song identification. The seven songs are listed below in 'rainbow' order (which is the order in which they are 'stacked'), with the word corresponding to the large 'dot' emboldened:

Red: *We Wish You A Merry Christmas*

Parsons code: *URUDDDRRURUDDDDRURUDDDDDRUUDUDU

*We wish you a merry Christmas / We wish you a merry Christmas / We **wish** you a merry Christmas ...*

Orange: *White Christmas*

Parsons code: *UDDUUUUUUUDDDDDUURRUDDRRUDDUDD

*I'm dreaming of a white Christmas / Just like the ones I used to know / Where the tree tops glisten / **And** children listen ...*

Yellow: *Jingle Bells*

Parsons code: *UDDDRRRUDDDRUDDDURDDUDUDDDRUDD

*Dashing through the **snow** ...*

Green: *Once In Royal David's City*

Parsons code: *UURRDUURDRUUDRDDDUDUURRDUURDRUU

*Once in royal David's city / **Stood** a lowly cattle shed ...*

Pale blue: *Silent Night*

Parsons code: *UDDUDDURDURDURUDDDDUDDURUDDDUDD

*Silent night, holy night / All is calm, **all** is bright ...*

Blue: *Fairytale Of New York*

Parsons code: *RUDUDRUDRDRRUUDDRDUDRDRDUDUDRUR

*It was Christmas Eve, babe / **In** the drunk tank ...*

Purple: *O Little Town Of Bethlehem*

Parsons code: *URRUUDUUUDUDDURDDURRUUDUUUDUDDU

*O little town of Bethlehem / How still we see thee **lie** ...*

(As many solvers noted, the puzzle title *CONTOURS* reflects the fact that the Parsons code is formally known as the *Parsons code for melodic contours* – see [here](#). Note also that *White Christmas* by Irving Berlin appears as the second item in this puzzle, as mentioned in the solution to Puzzle 6 – its colour in the diagram (orange) happens to be a mix of the red and yellow colours of the Berlin Clock.)

The first letters of the seven words marked by the dots spell out **WASSAIL** – an apt choice for a puzzle featuring Christmas songs, as the word’s various meanings include the following (see [here](#) – note that further information appears in the ‘Did you know?’ section):

“to sing carols from house to house at Christmas”;

“an early English toast to someone’s health”;

“a hot drink that is made with wine, beer, or cider, spices, sugar, and usually baked apples and is traditionally served in a large bowl especially at Christmastime”;

“riotous drinking / revelry”.

Wassailing is also closely linked to Twelfth Night, which this year fell on Sunday 5 January 2025 (see [here](#)) – hence this being the official closing date for the 2024 RSS Christmas Quiz.

Turning now to the three shorter questions at the end of the puzzle:

- WASSAIL begins with the letters ‘WA’ – the abbreviation for the state of Washington. If we combine ‘Washington’ with the first half of Puzzle 6’s solution (i.e. the ‘Irving’ from ‘Irving Berlin’, who also wrote the second song in this puzzle – *White Christmas*), we obtain **Washington Irving**, who was widely credited with inspiring the revival of Christmas in America, and wrote about a wassail bowl in *Old Christmas – From the Sketch Book of Washington Irving*.
- There are a couple of different senses in which an object associated with ‘wassailing’ may offer a puzzle of its own. Credit was given to solvers who either highlighted Henry Ernest Dudeney’s puzzle **‘The**

Wassail Bowl' (#362 in *Amusements In Mathematics*), which is available [here](#) and shown below in italics, or who mentioned the notion of '**puzzle wassail bowls**' with multiple spouts, in which the challenge was to drink the contents without getting drenched (see [here](#), and the related article on puzzle jugs [here](#)).

***362 – The Wassail Bowl.** One Christmas Eve three Weary Willies came into possession of what was to them a veritable wassail bowl, in the form of a small barrel, containing exactly six quarts of fine ale. One of the men possessed a five-pint jug and another a three-pint jug, and the problem for them was to divide the liquor equally amongst them without waste. Of course, they are not to use any other vessels or measures. If you can show how it was to be done at all, then try to find the way that requires the fewest possible manipulations, every separate pouring from one vessel to another, or down a man's throat, counting as a manipulation.*

As noted by several solvers, the solution to Dudeney's puzzle involves 11 manipulations, which is fitting for Puzzle 11.

- Finally, **apples** (or apple trees) provide a fruity connection between this puzzle's solution and the solution of Puzzle 9. As noted above, the drink 'wassail' often contains **apples or cider** (see [here](#)) and there is also a specific type of wassail called an '**Apple Wassail**' or 'Orchard Wassail' (see [here](#)) that involves singing, dancing and drinking around apple trees. And of course, **the forbidden fruit in (the Garden of) Eden**, as per Puzzle 9's solution, is often represented as **an apple**.

Puzzle 11 proved to be the trickiest puzzle in the 2024 RSS Christmas Quiz, with fewer than half of all teams identifying the song-based theme. Some teams figured out that the seven-letter solution must begin with 'WA' (via the Washington Irving connection), which led to various educated guesses, including WALPOLE, WALLACE, and WALDORF. The last of these was a particularly interesting guess: in the hotel sector, the name 'Waldorf' is often followed by 'Astoria' (see [here](#)) which also happens to be a book by Washington Irving (see [here](#)), and moreover, a 'Waldorf salad' contains apples (see [here](#)). These spurious connections were unfortunately made even more plausible by the fact that the words

'Waldorf salad' and 'Berlin ballad' (the latter echoing *White Christmas*) appear together in Cole Porter's song *Anything Goes*, and the fact that the puzzle title *CONTOURS* is an anagram of 'croustons' – a cruel twist of fate indeed to those who ended up down the rabbit-hole.

In terms of additional connections and observations:

- A few solvers provided further links to Puzzle 9, either by highlighting the existence of an apple variety called 'Eden' (see [here](#)), or noting that 'wassailing' (to ward off evil spirits from the apple trees and ensure a good harvest) actually takes place in the Eden Project's orchard (see [here](#)). A couple of solvers also noted that wassail is typically served in a 'vessel' such as a wassail bowl, echoing the name of the Sleep Token frontman, Vessel (see [here](#)).
- Apple trees could be considered '*hardy perennials*' (indeed, they are among the hardiest of all fruit trees – see [here](#)), which provides a link back to Puzzle 2, and some solvers also suggested that Thomas Hardy's novel *Under the Greenwood Tree* itself features a form of 'wassailing' (see [here](#)).
- A handful of solvers linked Euclid from Puzzle 3 to the apple tree / orchard theme by highlighting the mathematical construction called *Euclid's Orchard* (see [here](#)), and along more literary lines, some solvers mentioned that the last play written by Anton Chekhov (from Puzzle 9) was entitled *The Cherry Orchard* (see [here](#)).
- Others noted that *Fairytale of New York* (the fifth of the seven songs in this puzzle) evokes the name 'The Big Apple' – yet another apple-themed connection – and echoes the 'fairy' chess pieces in Puzzle 4. In addition, some solvers linked *New York* to the 'house party' theme of Puzzle 10, noting that Noel Edmonds presented a spin-off show called *Noel's New York House Party* (see [here](#) for a video). To complete the cycle of connections, several solvers noted that one might serve the beverage 'wassail' at such a house party.

- Finally, linking back to Puzzle 4, some solvers noted that the *Mari Lwyd* is a wassailing folk custom in Wales, with 'Mari' being considered by some to be a reference to Mary, the mother of Jesus (see [here](#)) – this provides a further link back to Puzzles 1 and 5, in which the name 'Mary' appears.

Puzzle 12: ELEMENTARY² [12 points]

Each of the ten answers in this puzzle – indicated by the black boxes below – can be composed in a specific way (with the numbers indicating the associated sum), and each one also appeared initially in a particular collection (with the visible letters indicating the surrounding context).

...NWTSMOAWSH■■■■■■■WASBBAPDFW...	$\Sigma=202$
...TMAAFTBCTW■■■■■■■DOTMDFTTOA...	$\Sigma=142$
...OAHHATDISS■■■■■■■HSTWDASLWW...	$\Sigma=222$
...ATSDAHRIMC■■■■■■■ALASGAMCII...	$\Sigma=147$
...FJMFHASFAC■■■■■■■TOTIOBHWTP...	$\Sigma=161$
...WBPKIMHHCY■■■■■■■YFTBJSUAL...	$\Sigma=149$
...AHRLOWCTBI■■■■■■■WSWSUIHGAI...	$\Sigma=190$
...TATIWRRTTSH■■■■■■■FTWCAHUNOE...	$\Sigma=149$
...IIASBWTSFT■■■■■■■HSHHSIGOIS...	$\Sigma=110$
...WAIFMIWEML■■■■■■■MSRACTLOAF...	$\Sigma=258$

Determine the ten answers with the aid of the clues below and the note on the next page (which should be briefly explained):

- One answer is the surname of a famous statistician; another answer is the first name of a famous mathematician.
- One answer is an album featuring a Christmas number one; another answer is a band from the same era who grabbed headlines in 2024.
- One answer is a city that previously hosted the Summer Olympics; another answer is an island located around 9,000 km from that city.
- One answer is a crop sometimes planted as a Christmas tradition; another answer may be provided by a cup of mulled wine or a roaring fire.
- One answer is a name that is central to the puzzle's theme; another answer describes what his creator produced two years prior (AEUTVCITD).

Note: Three of the ten answers are associated with the same item in the collection – this item's title ends with a whole number. Furthermore, this item prominently features the name that is common to Puzzles 1 and 5, and another puzzle's solution also receives an early mention. Two of the remaining seven answers are associated with the item in the collection whose title ends with a homophone of another answer.

Finally...

- In what sense does one of the answers contain an item in the collection?
 - How is the item associated with the tenth answer particularly appropriate for this puzzle?
 - What word – fittingly for the festive period – is ultimately revealed by the ten answers?
-

PUZZLE 12 SOLUTION:

All ten answers in this puzzle are **doubly 'elementary'** – not only can they be built by **concatenating the symbols of chemical elements** (with the numbers given in the puzzle being the sums of the associated atomic numbers), but they also **appear somewhere within the collection of Sherlock Holmes books if we concatenate the initial letters of successive words** – hence '*appeared initially*' in the puzzle text. (As many solvers noted, the phrase "*Elementary, my dear Watson*" is often associated with Holmes, but does not appear in any of the books written by Sir Arthur Conan Doyle.) As noted earlier, the '*elementary*' theme also echoes the title of *The Elements* by Euclid (from Puzzle 3).

As an illustration of this dual mechanism, the first answer, WARMTH ("*provided by a cup of mulled wine or a roaring fire*") – can be formed uniquely by combining the chemical elements **W + Ar + Mt + H**, whose atomic numbers sum to $74 + 18 + 109 + 1 = 202$ (as indicated), and the word WARMTH also appears in the initial letters of the following extract from *The Hound of the Baskervilles* (in which the initial letters have been capitalised and emboldened for clarity – note that the **red** letters provide the answer, while the **blue** letters are the 'surrounding context' mentioned in the puzzle text – in this case, 'NWTSMOAWSH' and 'WASBBAPDFW'):

... **N**ow **W**ith **T**he **S**ubdued **M**anner **O**f **A** **W**ell-trained **S**ervant. **H**e **W**as **A** **R**emarkable-looking **M**an, **T**all, **H**andsome, **W**ith **A** **S**quare **B**lack **B**eard **A**nd **P**ale, **D**istinguished **F**eatures. "**W**ould ...

The full set of ten answers appears below, following the notation used for the example above – in each case, the associated clue is specified at the top, along with any supplementary information.

Clue: "Provided by a cup of mulled wine or a roaring fire" (see [here](#))

...**NWTSMOAWSHWARMTHWASBBAPDFW**... $\Sigma=202$

W + Ar + Mt + H = 74 + 18 + 109 + 1 = 202

... **N**ow **W**ith **T**he **S**ubdued **M**anner **O**f **A** **W**ell-trained **S**ervant. **H**e **W**as **A** **R**emarkable-looking **M**an, **T**all, **H**andsome, **W**ith **A** **S**quare **B**lack **B**eard **A**nd **P**ale, **D**istinguished **F**eatures. "**W**ould ...

[Source: *The Hound of the Baskervilles*]

Clue: "An album featuring a Christmas number one" (2 Become 1 – see [here](#))

...TMAAFTBCTWSPICEDOTMDFTTOA... $\Sigma=142$

$$S + P + I + Ce = 16 + 15 + 53 + 58 = 142$$

... The Milliner's Address, And Felt That By Calling There With Straker's Photograph I Could Easily Dispose Of The Mythical Derbyshire. "From That Time On All ...

[Source: *The Adventure of Silver Blaze*]

Clue: "A city that previously hosted the Summer Olympics" (see [here](#))

...OAHHATDISSATLANTAHSTWDASLWW... $\Sigma=222$

$$At + La + N + Ta = 85 + 57 + 7 + 73 = 222$$

...Of A Horse's Ham, And To Do It Subcutaneously, So As To Leave Absolutely No Trace. A Horse So Treated Would Develop A Slight Lameness, Which Would ...

[Source: *The Adventure of Silver Blaze*]

Clue: "The surname of a famous statistician" (Sir Ronald Fisher FRS – see [here](#))

...ATSDAHRIMCFISHERALASGAMCII... $\Sigma=147$

$$F + I + S + H + Er = 9 + 53 + 16 + 1 + 68 = 147$$

...And That She Detected A Hollow Ring In My Congratulations, For I Saw Her Eyebrows Rise A Little, And She Glanced At Me Curiously. "If I...

[Source: *The Sign of the Four*]

Clue: "A crop sometimes planted as a Christmas tradition" (see [here](#))

...FJMFHASFACWHEATTOTIOBHWTP... $\Sigma=161$

$$W + He + At = 74 + 2 + 85 = 161$$

... Father Joseph. My Father Had A Small Factory At Coventry, Which He Enlarged At The Time Of The Invention Of Bicycling. He Was The Patentee ...

[Source: *The Five Orange Pips*]

Clue: "An island located around 9,000 km from [Atlanta]" (see [here](#))

...WBPKIMHHCYTAHITIYFTBJSUAL... $\Sigma=149$

$$Ta + H + I + Ti = 73 + 1 + 53 + 22 = 149$$

... With Black Peter's Knife In My Heart." "How Came You There?" Asked Holmes. "I'll Tell It You From The Beginning. Just Sit Me Up A Little ...

[Source: *The Adventure of Black Peter*]

Clue: "A name that is central to the puzzle's theme" (Dr Watson – see [here](#))

...AHRLOWCTBIWATSONWSWSUIHGAI... $\Sigma=190$

$$W + At + S + O + N = 74 + 85 + 16 + 8 + 7 = 190$$

... A Hammer, Rudely Lashed On With Coarse Twine. Beside It Was A Torn Sheet Of Note-paper With Some Words Scrawled Upon It. Holmes Glanced At It ...

[Source: *The Sign of the Four*]

Clue: "The first name of a famous mathematician" (Blaise Pascal – see [here](#))

...TATIWRTTSHBLAISEFTWCAHUNOE... $\Sigma=149$

B + La + I + Se = 5 + 57 + 53 + 34 = 149

... *Taken **A**back **T**hat **I** **W**as **R**eady **T**o **T**hink **S**he **H**ad **B**een **L**ed **A**way **I**n **S**ome **E**xtraordinary **F**ashion **T**hat **W**as **C**lean **A**gainst **H**er **U**sual **N**ature. **O**ne **E**xplanation ...*

[Source: *The Problem of Thor Bridge*]

Clue: "A band from the [1990s] who grabbed headlines in 2024" (see [here](#))

...IIASBWTSFTOASISHSHSIGOIS... $\Sigma=110$

O + As + I + S = 8 + 33 + 53 + 16 = 110

... *It **I**n **A** **S**mall **B**rochure **W**ith **T**he **S**omewhat **F**antastic **T**itle **O**f **'A** **S**tudy **I**n **S**carlet."**"**
He **S**hook **H**is **H**ead **S**adly. **"I** **G**lanced **O**ver **I**t," **S**aid ...*

[Source: *The Sign of the Four*]

Clue: "Describes what [Dr Watson's] creator produced two years prior (AEUTVCITD)" (see [here](#) – AEUTVCITD are the initial letters of the title)

...WAIFMIWEMLTHESISMSRACTLOAF... $\Sigma=258$

Th + Es + I + S = 90 + 99 + 53 + 16 = 258

... ***W**as **A**n **I**ntrusion, **F**or **M**y **I**talian **W**as **E**ven **M**ore **L**imited **T**han **H**is **E**nglish, **S**o **I** **S**hrugged **M**y **S**houlders **R**esignedly, **A**nd **C**ontinued **T**o **L**ook **O**ut **A**nxiously **F**or ...*

[Source: *The Final Problem*]

Solvers should then have briefly explained the 'note' given in the puzzle text as follows:

- Three of the answers (FISHER, WATSON, and OASIS) are associated with *The Sign of the Four*, whose title ends with a whole number.
- *The Sign of the Four* prominently features the name Mary (from Puzzles 1 and 5) via the main character, Miss Mary Morstan – Dr Watson falls in love with her, and she later becomes Mary Watson (see [here](#)). Neatly tying in with Watson's 'love-story', the book's early mention of Euclid (Puzzle 3's solution) reads: "*Detection is, or ought to be, an exact science, and should be treated in the same cold and unemotional manner. You have attempted to tinge it with romanticism, which produces much the same effect as if you worked a love-story or an elopement into the fifth proposition of Euclid.*"

- Two of the other answers (SPICE and ATLANTA) are associated with *The Adventure of Silver Blaze* – the last word in this title, Blaze, is a homophone of BLAISE.

The puzzle, and the 2024 Christmas Quiz, closes by asking solvers to make three further observations linked with endings or finality – signposted by the word “*Finally...*” in the puzzle text:

- As shown above, the penultimate answer – OASIS – results from combining the initial letters in **O**f ‘**A** Study **I**n **S**carlet’. It therefore contains (and specifically ‘finishes’ with) ‘A Study in Scarlet’ – the first of the Sherlock Holmes books, and thus “*an item in the collection*”.
- Referring to the list of answers above, we see “*the item associated with the tenth answer*” is *The Final Problem* – an appropriate choice for Puzzle 12, as this is the final puzzle in the 2024 RSS Christmas Quiz.
- Lastly, taking the final letters of the ten answers (as clued by “*ultimately revealed*”) reveals the fittingly festive ten-letter word **HEARTINESS**.

In terms of additional connections and observations:

- Several solvers noted the various links between Puzzle 11 and 12 – with the most common observation being that plenty of Christmas HEARTINESS (as per the solution to Puzzle 12) is required for effective wassailing, and that SPICE is often an ingredient of wassail (in the beverage sense). An alternative approach would have been to note that the word ‘wassail’ (in Puzzle 11) originally means ‘good health’ (see [here](#)), which is closely linked to the word HEARTINESS. A few solvers also noted that something which is ‘hardy’ (as per Puzzle 2, which featured Thomas Hardy) can be said to have HEARTINESS, in the sense of ‘strength’ or ‘robustness’.
- SPICE is an appropriate word to ‘appear’ within the initial letters of *The Adventure of Silver Blaze*, since curried mutton plays an important role in the plot. In addition, the second of the four elements making up the word SPICE (= S + P + I + Ce) is phosphorus (P), which plays an important role in the plot of *The Hound of the Baskervilles*.

- Noting the appearance of '2 Become 1' on the SPICE album, a few solvers suggested that Puzzle 3 could similarly be titled '3 Become 1' (or '1 Becomes 3', depending on your perspective).
- While the chemical element Silver occurs in the title of *The Adventure of Silver Blaze*, it does not feature in any of the strings of chemical symbols used for the ten answers above. As a few solvers noted, many athletes received a 'silver' in ATLANTA, during the 1996 Summer Olympics.
- In place of the observation on the previous page that OASIS contains *A Study In Scarlet*, some solvers noted that the city of ATLANTA has a Sherlock Holmes society called 'Wisteria Lodge' (see [here](#)), named after *The Adventure of Wisteria Lodge* (see [here](#)) – thus, in a sense, ATLANTA could be said to contain that item. Others noted the surprising fact that parts of the story *The Adventure of the Yellow Face* are set in ATLANTA. One solver also noticed that the song *White Christmas* originally appeared in the musical *Holiday Inn* (see [here](#)), and that its namesake hotel chain (see [here](#)) is headquartered in ATLANTA (see [here](#)).
- Numerous links have been made to Mary and Joseph throughout the course of the Quiz, and this puzzle shamelessly adds a few more. Starting with the 'Josephs', we note firstly that the surrounding context for the fifth answer (WHEAT) begins with the words 'Father Joseph', and secondly, that the character of Sherlock Holmes was based on the surgeon and lecturer Joseph Bell (see [here](#)), whose first name and surname both have Christmas connotations. Solvers also noted two further instances of 'Mary' – firstly, Sir Arthur Conan Doyle was baptized in St Mary's Cathedral in Edinburgh (see [here](#)), and secondly, his short story *J. Habakuk Jephson's Statement* popularised the mystery of the *Mary Celeste* (see [here](#)). One solver also noted the neat coincidence that Mary Watson (mentioned earlier) has a near-namesake in Irving Berlin's musical *White Christmas*, in the shape of the character Martha Watson (see [here](#)).
- A few solvers wondered whether the surrounding context for the fifth answer (WHEAT) should have ended with the letters HWAP (*He Was A Patentee*) rather than HWTP (*He Was The Patentee*) – in fact, the latter

is correct, as per the puzzle text, if one refers back to the original source in *The Strand Magazine* (see the right-hand column of the image [here](#)).

- Several solvers noted that Euclid not only receives a mention in *The Sign of the Four* (as per the quote given above), but also in the very first Sherlock Holmes Story, *A Study In Scarlet* – “His conclusions were as infallible as so many propositions of Euclid.”
- A few solvers noted that answer number 5 comes from *The Five Orange Pips* – echoing Puzzle 5 of the main quiz, in which the puzzle number was also suggestive of the answer.
- Many solvers noted that one of the Gallagher brothers in OASIS has the first name ‘Noel’ (see [here](#)), providing a link back to Puzzle 10.
- Briefly jumping back to the discussion of the ‘forbidden fruit’ within the solution to Puzzle 11, under various other (primarily Islamic) interpretations, the forbidden fruit is not depicted as an apple but as WHEAT, as per the fifth answer to Puzzle 12 (see [here](#)).
- One solver highlighted that the controversial story of long-distance runner Dorando Pietri at the 1908 Summer Olympics provides an unexpected connection between Sir Arthur Conan Doyle and Irving Berlin (from Puzzle 6) – the former wrote an article in the Daily Mail on the topic, while the latter dedicated the song *Dorando* to the runner (see [here](#)).
- In reference to the fourth answer – FISHER – a few solvers mentioned that the name of *Fisher’s geometric model* (sometimes called the *Fisher-Orr model*) offers a neat link back to the ‘geometric’ themes introduced in Puzzle 3 and Puzzle 8. Other solvers drew a link with the chess theme of Puzzle 4, noting that the surname of Ronald FISHER is homophonic to that of Bobby FISCHER – the eleventh World Chess Champion.
- On a similar theme, some solvers mentioned the structural similarity between the concatenation of chess symbols in Puzzle 4 (where, for example, H+Ar+Le+Ch gives Harlech) and the concatenation of chemical elements in Puzzle 12, with one solver even noting that four

of the six chess pieces (B, K, N, P) and four of the ten Musketeer Chess pieces (H, Ar, U, Ca) share their symbols with chemical elements. In fact, summing the atomic numbers of the three 'elementary' chess pieces that appear in Puzzle 4 (namely, B=5, K=19, and N=7) gives 31 – also known as the Mersenne prime M4 (cf. Puzzle 7).

- Lastly, some solvers noted that *The Final Problem* appears as the twelfth and final story in *The Memoirs of Sherlock Holmes* (see [here](#)), echoing not only the twelve puzzles comprising this Christmas Quiz, but also the various other notable appearances of the number 12 across the quiz, such as:
 - The clock-based styling of Puzzle 6 (and the 12 letters in the resulting solution);
 - Leonard Bernstein's song *My Twelve Tone Melody*, composed for the 100th birthday of Irving Berlin;
 - *Euclid* being track 12 (of 12) on Sleep Token's *TMBTE* album;
 - Noel Edmonds giving out 12 special presents to count down the 12 days of Christmas;
 - The entry deadline for the quiz being Sun 5 January 2025 – *Twelfth Night*.

The RSS Christmas Quiz 2024 was created and edited by the RSS Quizmaster, Dr Tim Paulden. Many thanks to all those who participated in this year's competition!

