



2021

THE SOLUTIONS!

For ease of reference, this solutions document gives the original text of each puzzle, followed by the solution. For full details of this year's prize-winners, please visit the solutions webpage on the RSS site via the link below:

<https://rss.org.uk/news-publications/all-news/>

The RSS Christmas Quiz 2021 was devised and created by Dr Tim Paulden [email: timpaulden@gmail.com]

Puzzle 1: EVENLY MIXED [14 points]

Identify the eight items below, each of which contains a deliberate error. What special name connects them, and which words appearing in #2/#7/#8 are often regarded as the origin of the name (loosely speaking, in the case of #7)?

Finally, continuing the theme of #2, which four of the individuals (taken in order) reveal another much-loved ground-dwelling creature with a distinctive morning cry?

- 1. “D₂ W₄ B₅ P₆ H₄ A₁ G₄ T₄ D₄ B₂ B₈ W₄ C₁₁ A₃ P₆ O₈ A₃ A₃ T₃ M₁₁ G₈ T₄ C₇ U₂ L₄”**
- 2. “A₁ L₆ B₄ T₄ M₂ T₄ Y₃ L₄ M₂ I₂ I₁ B₇ T₄ Y₃ D₂”**
- 3. “A₃ I₂ E₇ B₃ L₄ R₅ S₅”**
- 4. “W₈ M₇ I₁ T₃ A₃ T₃ P₇ O₂ M₂ O₃ H₄ W₄ A₃ N₇ E₄”**
- 5. “I₁ D₁₀ O₂ W₄ Y₃ S₃ B₃ I₁ W₄ D₆ T₂ T₃ D₅ Y₄ H₄ T₂ S₃ I₂”**
- 6. “I₁ L₄ T₃ S₇ O₂ D₇ V₁₀”**
- 7. “N₆ C₃ L₄ I₂ T₃ P₄ O₂ T₃ F₆ W₇ A₃ S₉ O₂ A₁ N₃”**
- 8. “A₅ A₃ I₂ I₂ T₅ W₃ H₄ A₁ D₄ A₃ R₄ I₅ L₄ W₃ A₃ B₄ A₄ T₂ D₄ W₄ T₃ I₁₀ Y₃ O₂ O₅ L₄”**

PUZZLE 1 SOLUTION

A special puzzle to mark the birth of Evelyn Rose Paulden on 27 August 2021, as referenced in the front-matter to the quiz – see [here](#) for the announcement in The Times (which can be retrieved online by searching for ‘Evelyn’ and the quizmaster’s name).

Each item in Puzzle 1 is a quote/lyric from a famous female Evelyn, with the symbols in the puzzle indicating the initial letters of the constituent words, along with their word lengths (e.g. D₂ = DO, W₄ = WHAT, and so on). As stated in the puzzle, there is one deliberate error per quote – after correcting these errors, and re-inserting punctuation, the items are found to be:

1. DO WHAT YOU PLEASE. HAVE A GOOD TIME. DON'T BE BURDENED WITH CONVENTIONS AND PUBLIC OPINIONS AND ALL THE MEANINGLESS GESTURES THAT CLUTTER UP LIFE. [Evelyn Brent]
2. A LITTLE BIRD TOLD ME THAT YOU LOVE ME, AND I BELIEVE THAT YOU DO. [Evelyn Knight]
3. ART IS ETERNAL, BUT LIFE IS SHORT. [Evelyn De Morgan]
4. WHATEVER MUSCLES I HAVE ARE THE PRODUCT OF MY OWN HARD WORK AND NOTHING ELSE. [Evelyn Ashford]
5. I DISAPPROVE OF WHAT YOU SAY, BUT I WILL DEFEND TO THE DEATH YOUR RIGHT TO SAY IT. [Evelyn Beatrice Hall]
6. I LIKE THE SPARKLE OF THE VIBRAPHONE. [Evelyn Glennie]
7. NOBODY CAN LIVE IN THE PAST OR THE FUTURE WITHOUT BEING SOMETHING OF A NUT. [Evelyn Nesbit]
8. AFTER ALL, IT IS THOSE WHO HAVE A DEEP AND REAL INNER LIFE WHO ARE BEST ABLE TO DEAL WITH THE IRRITATING DETAILS OF OUTER LIFE. [Evelyn Underhill]

The origin of the name “Evelyn” is considered by various sources to be “little bird” (as per #2 – see [here](#) or [here](#)), “hazelnut” (“a nut”, loosely speaking, as per #7 – see [here](#) or [here](#)), or “life” (as per #8 – see [here](#) or [here](#)).

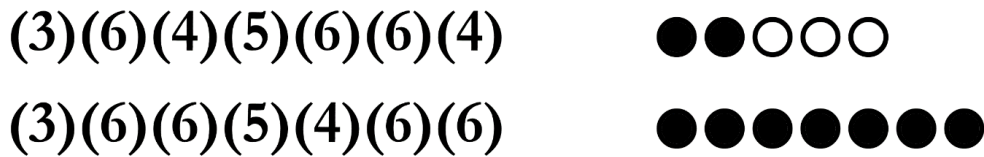
The eight erroneous symbols are respectively B₅ I₂ R₅ T₃ H₄ D₇ A₃ Y₃ (spelling “birthday”), echoing the birth theme of the puzzle, with the ‘corrected’ symbols simply being a permutation of these (Y₃ A₃ I₂ H₄ R₅ T₃ B₅ D₇). As a few eagle-eyed solvers noted, the three numbered parts referenced (“#2/#7/#8”) also represent the date of Evelyn Paulden’s birthday: 27/8. Some solvers noted the additional festive connection that Evelyn Nesbit was born on Christmas Day (in either 1884 or 1885).

The puzzle title, EVENLY MIXED, is itself a cryptic clue for EVELYN, with “mixed” being an anagram indicator for EVENLY (and also descriptive of one erroneous symbol being exchanged between the items).

Finally, the surnames of the Evelyns associated with items #2, #4, #6, #8 (echoing the “evenly” of the title) spell out KAGU – a bird (as per #2) from New Caledonia that, much like our wonderful new arrival, can be described as “a much-loved ground-dwelling creature with a distinctive morning cry” (see [here](#)).

Puzzle 2: ICSAR [7 points]

Explain the diagram below:



PUZZLE 2 SOLUTION

The puzzle title represents the well-known children's song "I Can Sing A Rainbow" – and the diagram represents the property that this song does not in fact specify the correct colour sequence for the visible light spectrum.

The top line represents the seven colours listed in the ICSAR song (Red, Yellow, Pink, Green, Purple, Orange, Blue), with the bracketed numbers indicating the respective word lengths (i.e. Red = (3), Yellow = (6), Pink = (4), and so on). The black and white dots shown on the right are peg notation (from the game of Mastermind – see [here](#)) indicating how this sequence would be scored when compared to the "true" sequence of colours in the visible light spectrum (Red, Orange, Yellow, Green, Blue, Indigo, Violet). The two black pegs indicate that the ICSAR sequence has two colours appearing in the correct position (namely, Red and Green), while the three white pegs indicate that there are three colours that appear in the true sequence, but in a different position (namely, Yellow, Orange, and Blue). The two remaining colours, Pink and Purple, do not receive any peg as they do not appear in the true sequence. The bottom line of the diagram represents the 'perfect' set of pegs (seven blacks) that would be achieved by the true sequence of colours (Red, Orange, Yellow, Green, Blue, Indigo, Violet), with the bracketed numbers once again representing word lengths.

Several solvers remarked that the use of pegs was appropriate as "I Can Sing a Rainbow" was sung by Peggy Lee in the 1955 film "Pete Kelly's Blues" (see [here](#)), while another noted that 2021 marked the 50th anniversary of the release of the first Mastermind pegboard game (see [here](#)).

Puzzle 3: LAWFULLY RELATED [7 points]

The twelve items listed below fall naturally into two groups of six – how, and what’s the connection to the title?

BAT

ECHO

PO

SAILBOAT

FEARLESS

CHRISTMAS

ARSENAL

EDDY

HATE

JUSTICE

DUSTY

OWL

PUZZLE 3 SOLUTION

The two groups of six are defined by the property that each item can follow either “A BOY CALLED...” (BAT, PO, SAILBOAT, CHRISTMAS, ARSENAL, HATE) or “A GIRL CALLED...” (ECHO, FEARLESS, EDDY, JUSTICE, DUSTY, OWL) to form the name of a film, book, album, or artist.

The puzzle title, “LAWFULLY RELATED”, is a (suitably festive) reference to Henry Lawfull, who played the title role of “A Boy Called Christmas” in the recent 2021 film adaptation (see [here](#)). Each of the items in the puzzle – by virtue of also being “A Boy/Girl Called...” – may therefore be said to be “Lawfull-y related”.

Several solvers noted the existence of a 1959 book entitled “A Girl Called Evelyn” by Theresa Charles (the pen-name of Irene Mossop / Charles John Swatridge – see [here](#)), which provides a neat link back to the theme of Puzzle 1.

Lastly, two solvers mentioned the (entirely coincidental) property that the final letters of the items in the puzzle are {E, L, O, S, T, Y}, with each letter occurring exactly twice – but this property doesn’t provide a unique or natural way to divide the twelve items into two groups.

Puzzle 4: BEAT IT [4 points]

Identify the next two elements of the sequence represented below:

..., B, S, M, C, Q, S, ...

PUZZLE 4 SOLUTION

The sequence represents musical notes of different durations, abbreviated to their initial letter only, with the number of beats (as per the title) halving each time.

The six given letters respectively represent the Breve, Semibreve, Minim, Crotchet, Quaver, and Semiquaver (with the ellipsis at the start of the sequence simply indicating that longer notes than a Breve are possible). The next two elements of the sequence are therefore D and H, representing the Demisemiquaver and Hemidemisemiquaver (see [here](#)).

As one solver noted, the title and theme of the puzzle echoes back to Evelyn Glennie from Puzzle 1 – a famous Scottish percussionist.

Puzzle 5: GREAT WHITE (2021) [5 points]

Identify the collection of numbers shown below. (The two hidden numbers represent England.)

3, 6, 9, 12, 18, 23, 42, 44, 49, 52,
56, ■, 67, 71, 76, 80, 81, 82, ■, 88

PUZZLE 5 SOLUTION

The twenty given numbers are the goal times from the England women's football team's celebrated 20–0 victory over Latvia on 30 November 2021. This particular match set a number of records (see [here](#)), including Ellen White becoming England women's all-time top goal-scorer (as referenced in the puzzle title).

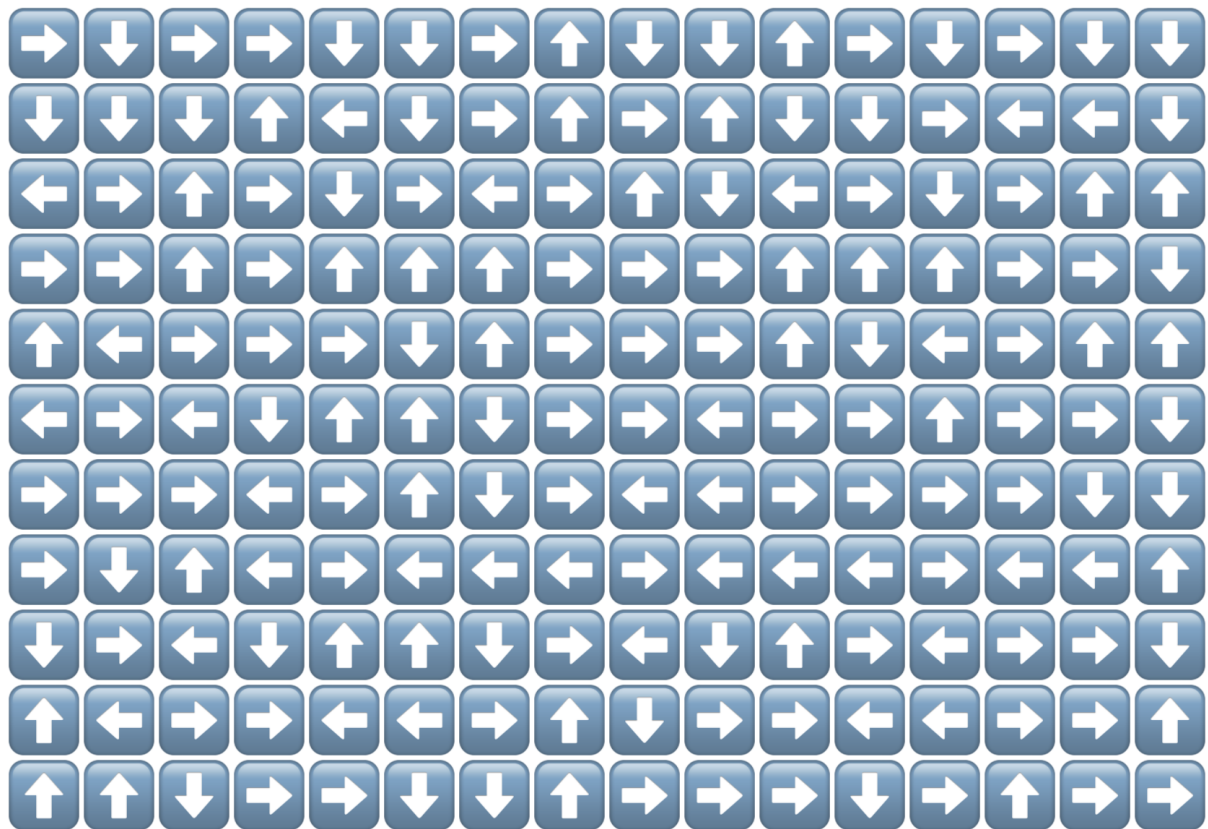
(Note: The title could also reference the England team as a whole, whose first colours are white – especially as this particular performance broke the national record for largest victory in a senior international football match. Credit was given for either interpretation.)

The title also contains an intentional element of misdirection – there was a 2021 film entitled “Great White” (see [here](#)), but this has nothing to do with the theme.

The two obscured numbers – 61 and 84 – “represent England” in a double sense, as these were the two goals scored by forward Beth England (see [here](#)).

Finally, as noted by a couple of solvers, one surprisingly effective way to identify the collection of numbers is to type a suitable chunk (e.g., “67, 71, 76, 80, 81”) into Google (or your favoured search engine), and then click on “Images”.

Puzzle 6: USELESS RULES [20 points]



- Actress who played Betty in a festively titled comedy film (based on a play named after a beverage), and who has the same first name as someone in an earlier puzzle
- Alternative album released in 2008 that was livestreamed in January 2021, with the recording being released under another name (often used to describe those whose power is superficial)
- Celebrated footballer with a body part located at `///those.bitters.landed`
- Children's author whose 1957 book features a green creature who steals Christmas gifts and decorations
- Engineer who won a prestigious award in the 1950s, a few years after Kermit and Orville
- European country where a special 'Christmas juice' dominates December's soft-drink sales

- Former Le Mans coach who represented France in Switzerland, a few days before turning 24
- German city whose mayor has the same surname and first initial as a famous mathematician
- K-pop song with nearly 1.8 billion views on YouTube, from a group whose name combines (0,0,0) and (255,192,203)
- Mid-80s computer game whose inlay card features a rhyme of ten lines ending with the following words: take, make, dare, lair, will, fill, fast, past, slow, go
- Mythical apprentice rumoured to have broken a textile apparatus in the late 18th century
- Norwegian ice hockey defender who executed a stick-breaking tackle in May 2021
- Pop song whose video features the singer drawing a heart on a steamed-up mirror, touching a light-blue phone, and standing on the surface of a swimming pool
- Three-syllable song title that links Lennon, Duffy, and Milburn
- Title shared by a Canadian mockumentary and an episode of Star Trek: Discovery
- UK city whose high street features an 8ft bronze statue of a cartoon character (plus his sidekick)
- Widely derided film starring JT (RF), GA (RS), and BA (IB)

Who's left over – and how are they connected to Bethlehem?

PUZZLE 6 SOLUTION

Solvers should have noted the remarkable property that each of the seventeen answers is constructed only from the eight 'directional' letters {N, S, E, W, U, D, R, L} – that is, the four points of the compass and the four keyboard directions – once punctuation and any accents on foreign characters are ignored. In order, the seventeen answers are as follows:

- ELLEN DREW – who played Betty Casey in “Christmas in July”, based on Preston Sturge’s 1931 play “A Cup of Coffee” (see [here](#)), and who shares the same first name as Ellen White from Puzzle 5
- NEW SURRENDER – the name of the 2008 album by Anberlin performed via livestream in January 2021, and released as “Paper Tigers” (see [here](#))
- UWE SEELER – whose foot (or rather, a large statue thereof) is located at the what3words address indicated (see [here](#))
- DR SEUSS – author of “How the Grinch Stole Christmas!” (see [here](#))
- WENDELL E REED – winner of the 1955 Wright Brothers medal (see [here](#)), a few years after Kermit Van Every (1948) and Orville Albert Wheelon (1951)
- SWEDEN – home of the popular Christmas soft-drink Julmost (see [here](#))
- RENE DEREUDDRE – manager of Le Mans FC between 1964 and 1976, and a member of the France team competing at the 1954 FIFA World Cup in Switzerland (see [here](#))
- DRESDEN – whose mayor, Dirk Hilbert (see [here](#)), has the same surname and first initial as the mathematician David Hilbert
- DDU-DU DDU-DU – the popular K-pop song (see YouTube video [here](#)) from the group Blackpink, with the triples of numbers in the clue representing the colour codes for black and pink respectively (see [here](#))
- UNDERWURLDE – with the specified rhyme appearing on the inlay card underneath the word BEWARE (see [here](#))
- NED LUDD – the person from whom the Luddites supposedly took their name (see [here](#))
- ERLEND LESUND – whose tackle on Rodrigo Abos in May 2021 snapped the Latvian’s stick (see [here](#))
- NEW RULES – with singer Dua Lipa performing the specified actions at approximately 0:37, 0:51, and 2:30 in the video (see [here](#))
- WELL WELL WELL – which is Track 8 on “John Lennon/Plastic Ono Band” by John Lennon (see [here](#)), Track 4 (and lead single) on “Endlessly” by Duffy (see [here](#)), and Track 1 on “Well Well Well” by Sheffield band Milburn (see [here](#))
- NEW EDEN – the title of the mockumentary created by Evany Rosen and Kayla Lorette (see [here](#)) and the title of Season 2, Episode 2 of Star Trek: Discovery (see [here](#))
- DUNDEE – whose high street features a large bronze statue of Desperate Dan and his sidekick Dawg, with Minnie the Minx lurking nearby (see [here](#))
- RUNNER RUNNER – featuring Justin Timberlake as Richie Furst, Gemma Arterton as Rebecca Shafran, and Ben Affleck as Ivan Block (see [here](#))

Each of these answers is written ‘wordsearch-style’ somewhere within the grid provided, under the natural convention that an upward-pointing arrow represents N or U, a downward-pointing arrow represents S or D, a rightward-pointing arrow represents E or R, and a leftward-pointing arrow represents W or L. In keeping with the {N, S, E, W, U, D, R, L} theme, each answer is written horizontally or vertically

(either forwards or backwards), rather than diagonally. The ‘completed’ grid with all seventeen answers inserted is shown below, with orange shading added as a visual aid to highlight answers that are written ‘backwards’ (i.e., right-to-left for a horizontal answer, or bottom-to-top for a vertical answer), and green shading used for answers written in the usual direction (i.e., left-to-right or top-to-bottom):

E	D R E S D E N							S S U E S R D							D	
D	D D U L D E N							→	↑	↓	↓	→	←	←	D	
L	R	N E D E W E N							S W E D E N							U
R	E	N	R U N N E R R U N N E R											D		
U	L	E	R E D N E R R U S W E N											U		
W	E	W	D U N D E E					← → → ↑ → →						D		
R	E	R	W E N D E L L E R E E D											D		
E	S	U	W E L L W E L L W E L L											U		
D	E	L	D N U S E L D N E L R E											D		
N	W	E	E L L E N D R E W								← → →			U		
U	U	S	E R D D U E R E D E N E R													

As shown above, the entire grid is covered by the seventeen answers, except for the sixteen cells coloured light blue. The arrows on these remaining cells can readily be seen to encode the name RUSSELL WERNER LEE, the American photographer and photojournalist – and the connection to Bethlehem (as per the last sentence of the puzzle) is that he earned his bachelor’s degree from Lehigh University in Bethlehem, Pennsylvania (see [here](#)).

Finally, as many solvers noted, “USELESS RULES” is an apt puzzle title not just because it uses only the letters from the set {N, S, E, W, U, D, R, L}, as per all of the answers, but because the puzzle instructions are not particularly helpful!

Puzzle 7: HOT N COLD (35) [9 points]

Identify the following from their title appearances...

- ...in 690 only (though a related term appears in 8, 30, and 168)
- ...in 509 (but not in 219, 294, 472, 539, or 621)
- ...in 54, 283, and 467
- ...in 10, 76, 82, 132, 140–151, and dozens of others
- ...in 556 (but not in 215, 216, 504, or 598)
- ...in 163, 400, and 504 (but written here in the singular)
- ...in 110

Where would you find all seven together, in the order above?

PUZZLE 7 SOLUTION

The puzzle title, HOT N COLD, is apparently a reference to the well-known song by Katy Perry (see [here](#)) – but what is the relevance of the number 35 afterwards?

A little digging reveals that the idiom “to blow hot and cold” originates from one of Aesop’s Fables, “The Satyr and the Traveller” / “The Man and the Satyr” (see [here](#)), which is number 35 in the aptly named Perry Index of these fables (see [here](#)).

Solvers should then have deduced that the seven items given in the bulletpoints refer to the following other entities from the Perry Index:

- BOAT, which appears only in the title of “Man in Boat” (690) – the other numbers referenced (8, 30, and 168) all involve the related term “Ship”
- VOICE, which appears in “The Peacock complains to Juno about his Voice” (509) – the other numbers referenced rule out both “Peacock” and “Juno”

- FIRE, which appears in “The Snails in the Fire” (54), “The Fire-Bearing Fox” (283), and “The Satyr and Fire” (467)
- LION, which appears in “Fox and Lion” (10), “The Stag and the Lion in a Cave” (76), “Ass, Cock, and Lion” (82), “The Dog who would chase a Lion” (132), and numerous others
- BUTTERFLY, which appears in “The Butterfly and the Wasp” (556) – the other numbers referenced rule out “Wasp”
- BEE, the singular form of “Bees”, which appears in “Zeus and the Bees” (163), “The Bees and the Shepherd” (400), and “The Bees and the Drones get Judgment from the Wasp” (504)
- HERO, which appears in the title of “The Hero” (110)

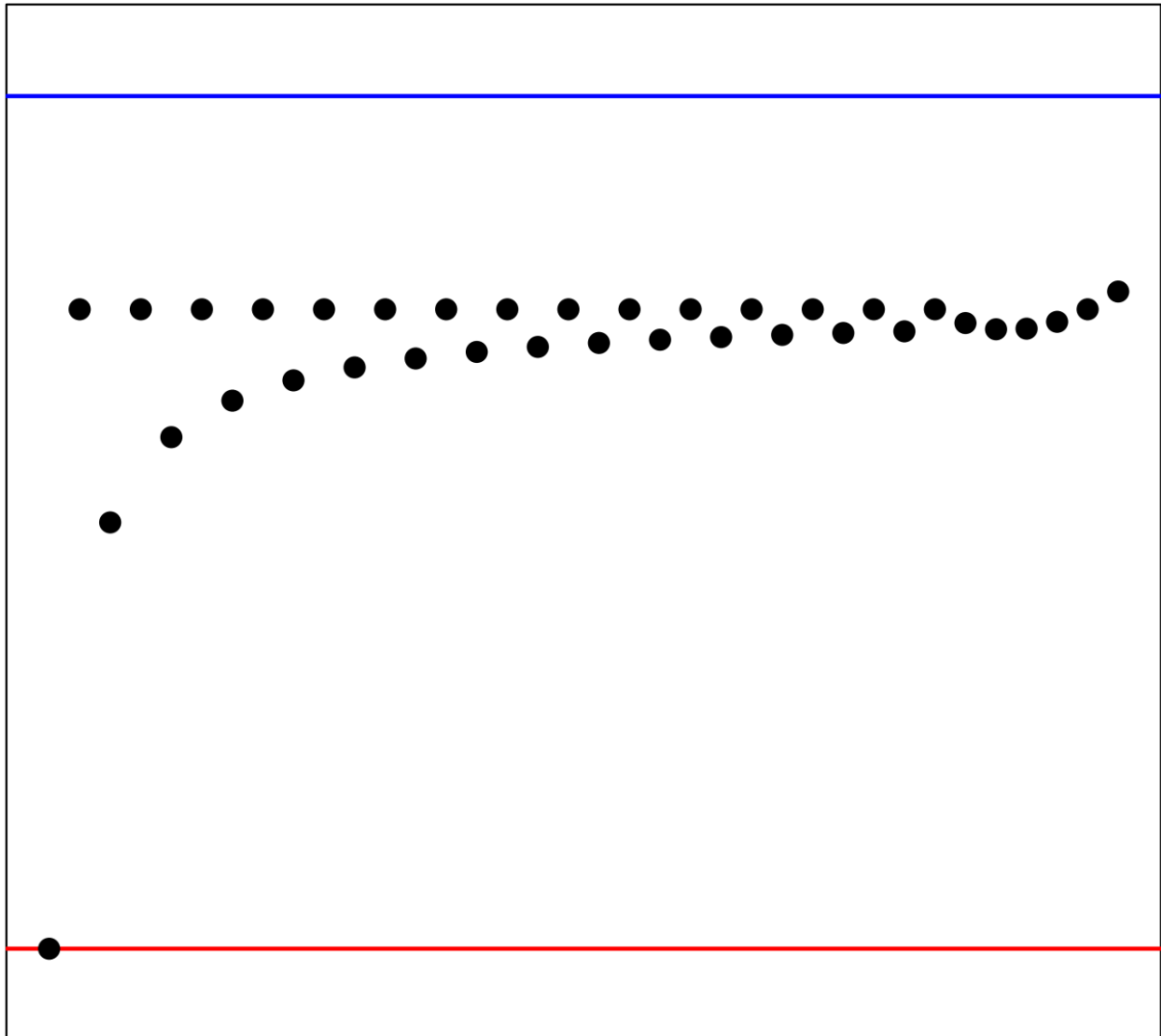
These seven words (BOAT, VOICE, FIRE, LION, BUTTERFLY, BEE, and HERO) can be found together in order within the lyrics of the song “Roar” by Katy Perry (see below, or the video [here](#)) – particularly apt given the ‘Perry’ theme of the puzzle.

*I used to bite my tongue and hold my breath
 Scared to rock the BOAT and make a mess
 So I sat quietly, agreed politely
 I guess that I forgot I had a choice
 I let you push me past the breaking point
 I stood for nothing, so I fell for everything
 You held me down, but I got up (hey)
 Already brushing off the dust
 You hear my VOICE, you hear that sound
 Like thunder, gonna shake the ground
 You held me down, but I got up (hey)
 Get ready 'cause I've had enough
 I see it all, I see it now
 I got the eye of the tiger, a fighter
 Dancing through the FIRE
 'Cause I am a champion, and you're gonna hear me roar
 Louder, louder than a LION
 'Cause I am a champion, and you're gonna hear me roar
 Oh-oh-oh-oh-oh
 Oh-oh-oh-oh-oh
 Oh-oh-oh-oh-oh
 You're gonna hear me roar
 Now I'm floatin' like a BUTTERFLY
 Stinging like a BEE, I earned my stripes
 I went from zero, to my own HERO
 (...)*

Finally, in terms of inter-puzzle connections, the song “Roar” is the lead single from Katy Perry’s album “Prism”, which links back to the “colours of the rainbow” theme of Puzzle 2 (and, as we shall see shortly, to the colours in Puzzle 8) – indeed, track 12 on the “Prism” album is entitled “Double Rainbow”. In addition, the Katy Perry single “Birthday” – which is track 3 on “Prism” – provides a link back to Puzzle 1, in which the word BIRTHDAY was spelled out by the incorrect symbols.

Puzzle 8: BAYES OPTIMIZATION [9 points]

Explain the figure shown below:



Continuing the theme, what ten-letter word is revealed by the instances below – and how is this word relevant to an even greater achievement recorded in August 2021?

03/14, 04/19, 11/18, 03/89, 05/13, 08/16, 11/08, 11/13, 11/92, 09/20

PUZZLE 8 SOLUTION

This puzzle concerns maximum breaks in the game of snooker (with the title being a pun on “baize optimization” – congratulations to those solvers who realised this!)

The figure shows the evolution of the statistic “average points scored per shot” over the 36 shots of a 147 break in snooker, with the red and blue horizontal lines indicating the position of “1 point” and “5 points” on the y-axis (in keeping with the value of the red ball and blue ball in snooker).

As a reminder, the first 30 shots of a 147 break involve fifteen consecutive repeats of potting a red (1 point) followed by the black (7 points), to reach a total of 120 points after 30 shots; the remaining six shots then involve potting the colours in sequence – yellow (2), green (3), brown (4), blue (5), pink (6), and black (7) – to reach a final total of 147 (see [here](#)).

Observe that during the first 30 shots of such a break, the average points scored per shot will always be equal to 4 after an even number of shots (as an equal number of reds and blacks will have been potted), while after an odd number of shots, the average points per shot will be less than 4 (as the number of reds potted will be one more than the number of blacks potted). In the latter case, the value of the average points per shot after the $(2K+1)$ th shot (for $K = 0, 1, 2, 3, \dots, 14$) can be shown to be $(8K+1)/(2K+1)$, which can be rearranged to give $4 - (3/(2K+1))$; this sequence takes the values 1, 3, 3.4, 3.571429, and so on, as shown by the steadily rising curve of points in the ‘lower-left’ portion of the figure.

It is also easy to see that the highest value of the “average points scored per shot” occurs after the 36th and final shot of the 147 break, when the average exceeds 4 for the first time, becoming equal to $147/36 = 4.08333\dots$

Continuing this theme, the ten items listed at the end of the puzzle refer to 147 breaks that occurred in specific calendar months (recorded in the format ‘month / year’), which were achieved by the following players (see [here](#)):

03/14: Ronnie O’SULLIVAN
04/19: Stuart BINGHAM
11/18: Mark SELBY
03/89: Cliff THORBURN
05/13: Neil ROBERTSON
08/16: Thepchaiya UN-NOOH
11/08: Marcus CAMPBELL
11/13: Judd TRUMP
11/92: Peter EBDON
09/20: Ryan DAY

These surnames reveal the 10-letter word “OBSTRUCTED” – a word which is particularly relevant to Thepchaiya Un-Nooh’s 155 break in August 2021 (in a practice match against Hossein Vafaei), which was recorded – as per the puzzle text

– by a security camera (see [here](#), under “Breaks exceeding 147”). After a foul shot by Vafaei early in the frame, Un-Nooh found himself obstructed (snookered) on all 15 reds, which permitted him to nominate a colour as “free ball” (effectively treating it as an “additional red”). After successfully potting this additional red, followed by the black, Un-Nooh then chained together a standard 147 break (as described earlier) to achieve the maximum possible snooker break of 155 – an “even greater achievement” (as per the puzzle text) than a 147 break.

As several solvers noted, the appearance of “Bayes” in the puzzle title is also appropriate given that the Reverend Thomas Bayes – after whom Bayesian statistics is named (see [here](#)) – famously described a thought-experiment involving a white ball and red balls on a billiard table, in “An Essay Towards Solving A Problem In The Doctrine Of Chances” (for details, see [here](#)).

One further technical observation, especially in light of the ‘Bayesian’ title, is that the formula $(8K+1)/(2K+1)$ noted earlier (which defines the average points scored per shot after each odd-numbered shot of the ‘red/black phase’) can be seen to have a similar structural form to the Bayesian posterior formula $(y+1)/(n+2)$ given at the previous link above (and to other similar formulae from Bayesian statistics). Indeed, imagine that we glance at the average points scored per shot only after each odd numbered shot of the red/black phase (i.e., after shot 1, 3, 5, ..., 29), so as to track the upwards curve forming the lower-left portion of the figure. We can view this numerical process as initially taking a ‘prior’ value of 1 (representing the single red potted on the first shot), with the value then gradually shifting towards 4 as we see an ever-increasing number of black/red pairs, each of which adds further ‘evidence’ that the average value should in fact be 4 – gradually outweighing our original ‘prior’. Of course, this part of the figure provides a particularly strong visual impression of a converging process, since the missing (even-numbered) points effectively trace out the horizontal line at 4 to which the average is converging.

Lastly, many solvers noted (usually at this point in their solutions) that many of this year’s puzzles are connected through their references to colours. In addition to the rainbow / “Prism” connections (as noted previously within the solution to Puzzle 7), several solvers drew a direct link from Puzzle 8 back to Puzzle 2 (ICSAR), noting that the “snooker ordering” of colours (Red, Yellow, Green, Brown, Blue, Pink, Black) was another seven-colour sequence that offered almost as good an approximation to the visible light spectrum as the “I Can Sing A Rainbow” song, with an associated Mastermind score of two black pegs (for Red and Blue) and two white pegs (for Yellow and Green). Other solvers remarked that the appearance of “BlackPink” in Puzzle 6 (clued via their numerical colour codes) foreshadowed the theme of Puzzle 8, with black and pink arising together at the conclusion of the 147 break. Finally, a few solvers also drew a neat connection between Puzzle 8 and Puzzle 5, noting that both are sporting scenarios in which the ‘White’ plays a significant role in the proceedings!

Puzzle 9: CHRISTMAS RESTUFFING [12 points]

The list of items below has become all mixed up – can you fix it?

For full credit, you should identify each of the three hidden items along with its associated number – one point will be awarded for each. One of the hidden items features somewhere in an earlier puzzle, one has a particular form that projects a festive message, and one will provide plenty of entertainment on Christmas Day.

ARTHUR MELVILLE [-68]

BEN RIPLEY [-46/-30]

CHRIS ABBOTT [-66]

EDITH SELIG [-26]

GLYPHOPSYCHE [-23]

HAO GE [-54]

HOCH [-13]

LOONEY TUNES CARTOONS [-47]

MELVIN RADER [-60]

MOHAMMAD WAHEED [-18]

██

MURDER BAY [-28]

OKAY YOKUSLU [-38]

POLJOT [-4]

████████████████

ROBERT PAPE [-35]

████████████████

SHOTTON SNOWFIELD [-20]

SMILETS DYNASTY [-31]

TOBICO MARSH [-24]

PUZZLE 9 SOLUTION

The twenty items in the puzzle have been created by taking the names of twenty historical UK Christmas number-one singles (see [here](#)), and 'restuffing' the words – i.e., retaining the same first and last letters in each word, but modifying the interiors using letters borrowed from the other items.

The bracketed numbers given in the puzzle indicate how many years ago the associated song was the Christmas number-one – for instance, ARTHUR MELVILLE is followed by [-68] because its corresponding song, ANSWER ME, was the UK Christmas number-one 68 years ago, in 1953.

This theme is hinted at by the phrasing "can you fix it?" (a nod to the dazzling 2000 Christmas number-one, "Can We Fix It?" by Bob the Builder), and the fact that the words "associated number – one" appear in the text of the puzzle, just before the word "point". (The puzzle title is also, of course, a play on the traditional "Christmas stuffing" served with Christmas dinner.)

The complete collection of restuffed items and their associated Christmas number-one songs are displayed below (including those for the three hidden items, which appear in bold). For ease of reference, the relevant years have also been added to the right-hand list, in square brackets.

ARTHUR MELVILLE [-68]
BEN RIPLEY [-46 / -30]
CHRIS ABBOTT [-66]
EDITH SELIG [-26]
GLYPHOPSYCHE [-23]
HAO GE [-54]
HOCH [-13]
LOONEY TUNES CARTOONS [-47]
MELVIN RADER [-60]
MOHAMMAD WAHEED [-18]
MORECAMBE AND WISE [-33]
MURDER BAY [-28]
OKAY YOKUSLU [-38]
POLJOT [-4]
RIBOSE [-5]
ROBERT PAPE [-35]
SATYR [-8]
SHOTTON SNOWFIELD [-20]
SMILETS DYNASTY [-31]
TOBICO MARSH [-24]

ANSWER ME [1953]
BOHEMIAN RHAPSODY [1975 / 1991]
CHRISTMAS ALPHABET [1955]
EARTH SONG [1995]
GOODBYE [1998]
HELLO, GOODBYE [1967]
HALLELUJAH [2008]
LONELY THIS CHRISTMAS [1974]
MOON RIVER [1961]
MAD WORLD [2003]
MISTLETOE AND WINE [1988]
MR BLOBBY [1993]
ONLY YOU [1983]
PERFECT [2017]
ROCKABYE [2016]
REET PETITE [1986]
SKYSCRAPER [2013]
SOMETHIN' STUPID [2001]
SAVIOUR'S DAY [1990]
TOO MUCH [1997]

For full credit, solvers needed to remark (one way or another) that the twenty items in the left-hand list have been created as one huge anagram of the twenty Christmas number-ones in the right-hand list (as hinted at by the phrasing “all mixed up” in the puzzle text) – in other words, the left-hand list and right-hand list above have exactly the same constituent letters, as shown in the table below:

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	R	S	T	U	V	W	Y
16	8	6	8	23	1	3	12	11	1	2	12	10	9	21	6	15	15	14	5	2	3	10

It is this property, of course, that makes it feasible to pin down the three missing items uniquely (when combined with the size of the black boxes, and the clues provided). As shown in the lists on the previous page, these missing items are MORECAMBE AND WISE (who certainly “provide plenty of entertainment on Christmas Day” – particularly Christmas Day 2021, when a ‘lost’ episode from 1970 was aired – see [here](#)), RIBOSE (whose ‘L-’ form has a Fischer projection containing the festive message “HO HO HO” – see [here](#) and [here](#)), and SATYR (which played a key role in Puzzle 7, via “The Satyr and the Traveller”). The associated numbers for these items are [-33], [-5], and [-8], as they correspond respectively to MISTLETOE AND WINE [1988], ROCKABYE [2016], and SKYSCRAPER [2013].

Finally, as more than one solver remarked in passing, both “Morecambe and Wise” and “Mistletoe and Wine” could be said to provide plenty of entertainment on Christmas Day!

Puzzle 10: PUZZLE OF THE CENTURY? [6 points]

Identify the century-old puzzle that was personified using a 5-letter adjective and 4-letter female name, and later found to have over 370,000 solutions – rather more than the two known to the inventor.

How are the numbers {72, 106, 132, 146, 166, 168, 192, 194} connected to the puzzle, and in what sense are the numbers {26, 7, 1, 14, 8, 19, 5, 35, 31, 26, 4, 10} irrelevant?

PUZZLE 10 SOLUTION

The “Mystic Eight” puzzle was extremely popular in England during the final months of 1921. It was designed and publicised by the “John Bull” newspaper in

the form of a national competition, with entries being due in at the end of December 1921 – making the puzzle exactly one century old at the time the 2021 RSS Christmas Quiz came out (as per the third word of the puzzle text).

The PuzzleMuseum.com website has various images of the Mystic Eight puzzle, accessible via the links below – these images are also reproduced below for ease of reference. As shown in the images, the front of the Mystic Eight box describes it as “The Greatest Puzzle of the Century”, as alluded to by the title of Puzzle 10.

<https://www.puzzlemuseum.com/catalogue/index.html> (search for “Mystic Eight” – catalogue number J044)

<https://www.puzzlemuseum.com/sales/dups/PAT/store-PAT.htm> (scroll down to “Mystic Eight”)



As described on the above webpages, the Mystic Eight puzzle requires the solver to assemble the eight cardboard cubes (whose faces bear the numbers 1 to 48, with no repeats) into a larger 2x2x2 cube such that the six outer 2x2 faces all have the same total.

How does the cryptic description in the text of Puzzle 10 ("personified using a 5-letter adjective and 4-letter female name") apply to the puzzle? As many solvers noted, search engines such as Google are of extremely limited use in identifying the Mystic Eight from this description (and deliberately so!) – but searching for the title text "Puzzle of the Century" within the British Newspaper Archive (see [here](#)) brings up numerous helpful results from 1921, including the puzzle name "Mystic Eight". A few more well-chosen searches of the Archive will then gradually reveal that the puzzle was thought to have two solutions, and "Misty Kate" (a homophone of "Mystic Eight") was the alternative name often given to the puzzle (see, for instance, the clipping below from the Saturday 12 November 1921 issue of John Bull – particularly the sections labelled "Two Known Solutions" and "Misty Kate"):

6
JOHN BULL.
NOVEMBER 12TH, 1921.

THE GREAT "MYSTIC EIGHT" PUZZLE.

THE MOST REMARKABLE ENIGMA OF THE CENTURY—£500 IN PRIZES—ON SALE ON FRIDAY.

THE average mind turns with much pleasure to the unravelling of problems created for purely recreative purposes. That is why we prophesy the enormous success of our great new puzzle, THE MYSTIC EIGHT, which will be released for sale simultaneously throughout the Kingdom on Friday next, the 11th. THE MYSTIC EIGHT possesses features of extraordinary fascination, and is so named because it consists of eight small cubes, the sides of which are numbered from 1 to 48.

THE PROBLEM TO BE SOLVED.

The problem before the would-be solutionist is to arrange the small cubes into one larger cube (as in the diagram below) so that the additions of the four numbers on each of the six sides of the made-up cube make six totals of the same amount. That is to say, the four figures on each of the six sides of the built-up cube, when totalled, should yield the same result. For example: if one decides that the winning number is 48—which it is not—the four numbers shown on

each of the six sides of the constructed cube should give, when added up, six totals amounting each to 48. To make the reading of the numbers on the cubes as clear and definite as possible, the numbers "six" and "nine" are

shown in clearly printed words, so that to mistake 6 upside down for 9, or vice versa, will be impossible.

THE PRIZES TO BE WON.

We are offering the following prizes for correct solutions of THE MYSTIC EIGHT problem. The sum of £500 has been set aside for this purpose, and will be divided as follows: 1st Prize, £300; 2nd Prize, £100; 3rd Prize, £50; 4th Prize, £15; 5th Prize, £10; 6th, 7th, 8th, 9th, and 10th Prizes, £5 each. These prizes will be awarded to competitors posting the first ten correct solutions received, and will be allotted in the order in which the solutions are posted. The postmark showing the time of collection, and a "certificate of posting"—which must be obtained by all competitors from their local post office, at the cost of a halfpenny, will be accepted as evidence of the time of posting. The certificates of the probable winning solutionists will be applied for in due course. Solutions must be sent by ordinary post, with the actual date and time of posting clearly written on the back of the envelope. Special arrangements have been made to assure the Puzzle being on sale on November 11th in all parts of the country simultaneously, so that competitors in Scotland, the North of England, Wales, or the West, will stand an equal chance with competitors living in Central London, as the date and time of posting are the governing conditions under which the selection of the first ten correct solutions will be made.

TWO KNOWN SOLUTIONS.

There are two known solutions of the Puzzle, and in the event of more than one correct solution being posted at the same time, the solver with the lowest number will receive preference. In the event of a tie, the Prize will be divided. No solution

posted prior to the date and time mentioned in the conditions accompanying the puzzle will be eligible. The closing date of the Competition is December 30th, 1921, on which day all attempts will be opened. Prizewinners will be notified on January 7th, 1922, and their names and addresses will be published in JOHN BULL dated January 14th, 1922. Proof of posting will not necessarily be accepted as proof of receipt. While the competition lasts, interesting and useful hints will be published.

"MISTY KATE."

There is no doubt that on the day of its release there will be a tremendous rush for the Puzzle, which already is known and asked for as "Misty Kate." A unique feature of the Puzzle, as compared with those recently on the market, is that it may be preserved intact after the solution has been sent in, and used for entertaining friends during the winter. Competitors are advised to take heed of the behest printed in each box: "Keep this box intact. See JOHN BULL." It may be worth something to you! Competitors are advised to use moderately-wide rubber bands or a bent hairpin to hold the cubes together while the additions are being made. The solutions, which may only be sent in on the form provided in each box, should be clearly addressed to "Mystic Eight" Puzzle Dept., 92, Long Acre, London, W.C.2, and posted in the ordinary way. Remember the date for THE MYSTIC EIGHT—November 11th, 1921.



Reduced facsimile of Lid of Puzzle Box.



Diagram showing larger cube, built up from the eight small cubes. The numbers shown provide no guide to the solution.

The "Misty Kate" personification of the Mystic Eight (as per the first line of the puzzle text) was sometimes taken a step further, with John Bull using a cartoon-like

figure-eight character in their advertising, as illustrated by the following clipping from the 22 October 1921 issue:

The Mystery of Miss "Misty Kate"!

THAT is what everyone will soon be talking about, and to stimulate enterprise "John Bull" is offering **£500** in Cash Prizes for correct solutions. Everybody, no matter where they live, will stand an equal chance of winning one of these handsome prizes.

"The Mystic Eight" (or, if you prefer it, "Misty Kate") puzzle is "John Bull's" latest and best. It puzzled the ancient Egyptians. It will puzzle you.

On Sale Friday, Nov. 11.
1/-
 Of all Newsagents and Stationers.

THE MYSTIC EIGHT PUZZLE OF PUZZLES

Issued by the Proprietors of "John Bull."

£500 Cash Prizes

(Note: The British Newspaper Archive allows a limited number of free searches for non-members – please drop an email to the quizmaster if you are interested in seeing a PDF of the above pages.)

In terms of the number of solutions to the Mystic Eight, there is a brief note online (see [here](#)) indicating that the puzzle has over 300,000 solutions, but at the time of writing, there seems to be no online reference giving the exact number of solutions. However, the answer can be found on page 34 of "The Book of Ingenious and Diabolical Puzzles" by Jerry Slocum and Jack Botermans – according to a computer analysis by Dick Hess, the total number of solutions to the Mystic Eight is 375,179. (Further information from this book is available on request – again, please drop an email to the quizmaster.)

Turning to the final paragraph of the puzzle text, the numbers {72, 106, 132, 146, 166, 168, 192, 194} are connected to the Mystic Eight puzzle in that they are the totals of the numbers on each of the eight dice. This fact can be confirmed directly from the nets for the eight dice given on page 143 of the Slocum and Botermans book cited above – but even without access to these nets, a few solvers managed to deduce this property by observing that the eight given numbers add up to 1176, which is precisely the sum of the numbers from 1 to 48 (and thus, the sum of all of the numbers on the eight dice).


Lastly, the numbers {26, 7, 1, 14, 8, 19, 5, 35, 31, 26, 4, 10} are “irrelevant” in the sense that they are the (entirely incorrect) numbers making up the “sample solution” on the puzzle’s instructions / answer submission sheet (which can be seen underneath the dice in the third photo given above, or in the lower-right corner of the first John Bull clipping). Not only do the three visible 2x2 faces shown in this “sample solution” not have the same totals (respectively adding up to 48, 67, and 71), but the number 26 appears twice, which is of course impossible.

In terms of inter-puzzle connections, the “Mystic” element of the puzzle’s name links back to Evelyn Underhill (the final Evelyn in Puzzle 1) – a mystical poet and key figure in mystical theology (see [here](#)) whose works included “Mysticism” (1911) and “The Mystic Way” (1913). In Puzzle 1, Evelyn Underhill received the number eight, meaning that both Puzzle 1 and Puzzle 10 could be said to feature a “Mystic Eight”.

The quizmaster was also intrigued and entertained by one solver’s note that the book “The Chambers Crossword Completer” (which might help one crack the puzzles of celebrated crossword-setter Araucaria, born a century ago in 1921) was famed for having “over 370,000 solutions” (like the Mystic Eight) – and further, that Evelyn Paulden (from Puzzle 1) might find the book particularly interesting, given that ‘Chambers’ is the surname of her mother!

Finally, as noted by a handful of solvers, it is also pleasing that the £500 of prizes distributed among the Mystic Eight solvers in early 1922 coincides with the £500 of charity donations being distributed now, in early 2022, to successful solvers of the RSS Christmas Quiz.

Puzzle 11: CLOSE ENCOUNTERS [7 points]

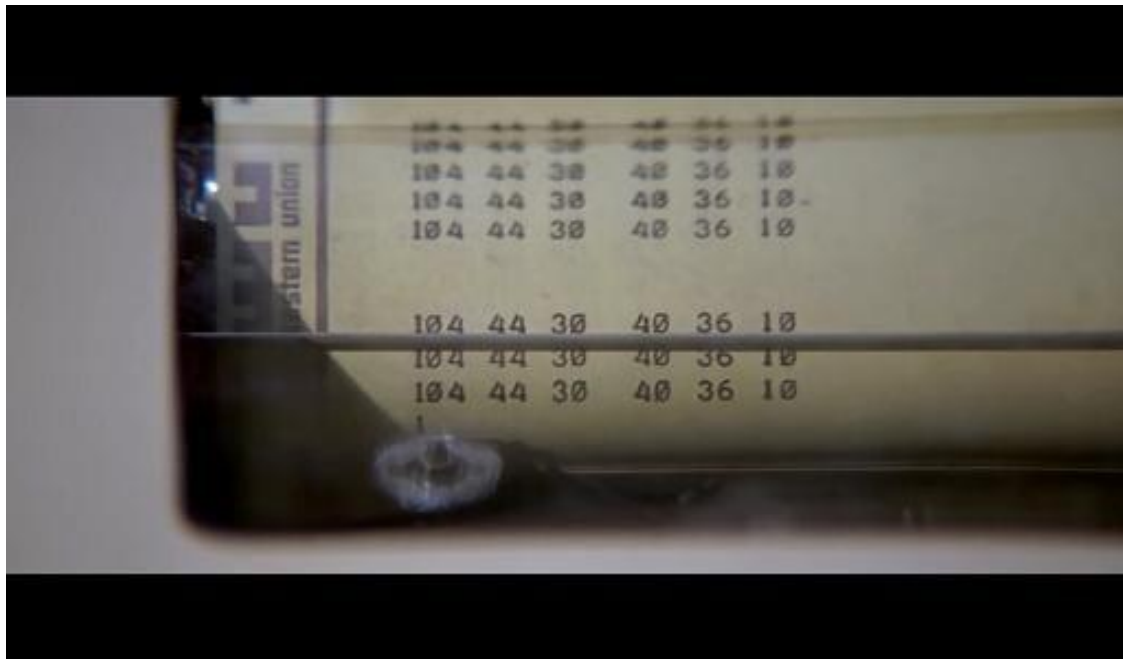
190	730	762	366	513	665
221	303	704	322	373	440
115	656	771	236	337	880
091	551	583	028	623	

PUZZLE 11 SOLUTION

Puzzle 11 – the final one of this year’s collection – was quite a toughie!

The formatting of the triples of numbers in the puzzle is designed to mimic the computer output in the film “Close Encounters of the Third Kind” (see [here](#)), as per

the image shown below – but unlike the numbers in the film, it's fairly clear that these numbers are not in the correct range to represent co-ordinates.



Instead, this puzzle involves some mathematical “*close encounters of the third kind*” – each left triple and its corresponding right triple, when raised to the power of a third, have the same sum to an extremely high degree of precision.

On the first row, for instance, we have the following equivalence to 14 decimal places (16 significant figures):

$$190^{1/3} + 730^{1/3} + 762^{1/3} = \underline{23.8868137763925443961...}$$

$$366^{1/3} + 513^{1/3} + 665^{1/3} = \underline{23.8868137763925449342...}$$

The latter sum is only around 5.38×10^{-16} larger than the former – definitely a ‘close encounter’!

(Note: If you do not have access to a computer algebra system, or similar software, the above values can be calculated to high precision using the Wolfram Alpha website – see [here](#).)

It is easy to check that this pattern also holds true for the triples on the second row:

$$221^{1/3} + 303^{1/3} + 704^{1/3} = \underline{21.6584339198373738438...}$$

$$322^{1/3} + 373^{1/3} + 440^{1/3} = \underline{21.6584339198373743326...}$$

(In this case, the latter sum is around 4.89×10^{-16} larger than the former.)

And similarly, for the triples on the third row:

$$115^{1/3} + 656^{1/3} + 771^{1/3} = \underline{22.7215296571773064492...}$$

$$236^{1/3} + 337^{1/3} + 880^{1/3} = \underline{22.7215296571773068452...}$$

(In this case, the latter sum is around 3.96×10^{-16} larger than the former.)

It follows that the missing value on the bottom row must be 850, in order to set up the following 'close encounter' between the left triple and right triple:

$$91^{1/3} + 551^{1/3} + 583^{1/3} = \underline{21.05002146020851119026...}$$

$$28^{1/3} + 623^{1/3} + 850^{1/3} = \underline{21.05002146020851141986...}$$

(In this case, the latter sum is around 2.30×10^{-16} larger than the former – making it the 'closest encounter' of the four examples.)

As some solvers noted, the fact that each triple given in the puzzle appears in ascending left-to-right order (e.g. 190, 730, 762) offers a strong hint that the three values should somehow be considered together as a group – if it were instead the case that each number in the grid could vary independently (to spell out a code message, say), it would be extremely unlikely that such a regular pattern would manifest itself simply by chance.

Finally, as a technical side-note, the evaluation and comparison of sums of this nature is a surprisingly relevant (and deep) topic in computer science, particularly in the more common scenario where powers of one half (square roots) appear instead of powers of one third (cube roots). For instance, see Example 1 on page 137 of Ron Graham's paper [here](#) – or for further exploration, see [here](#) and [here](#).

The RSS Christmas Quiz 2021 was devised and created by Dr Tim Paulden. Many thanks to all those who participated in this year's competition.