Tri-Alphametic Puzzles

Movie Themes

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Solving Colourmetic Puzzles

Introduction :

The goal is to turn the colours into words, the words into numbers.
Look for a movie title concealed in the 32 cell colour bar. Find the hidden word, and finally decrypt the pictures.

10 colours are used for every puzzle. yellow, blue, green, mint, grey, brown, cerise, orange, pink and sand.

The alphabetical list of letters ABDGIJLNOT in the title bar tells you which letters are used in the puzzle.

Each word has a corresponding column of words showing all the words that are possible for that word.
Any words that do not fit the pattern have been removed from the wordlist. As an example, the word deed could be represented as PINK, GREY, GREY, PINK. So the word STAR won't be in its word list because it does not have a double letter in the middle.
Note, all words used are between 1 and 5 letters long.

On the solver 2 page you will see a link to a difficuty manager. Click the link, then load the Difficulty_Levels.json file. This is my grading of each puzzle, but you can make make your own. This page allows you to display all difficulty 1 puzzles, difficulty 2 etc. The + sign means unfinished.

Part 1: – Turn the colours into letters

Use the word lists and colour grids to identify the 9 words. These words will appear on screen over the coloured blocks. This is an overlay which must be saved when you see all 9 words.

Click on the OVERLAY button to save. It will save a file in your downloads folder called Overlay_Puzzle_001.json

Its a good idea to create a folder somewhere and move these files to it. The grids in the lower part of the page are to help you solve the puzzle. For instance, if you decide J must be brown, you can remove all the other letters in that grid other than J and you can also remove J from the other grids that are not brown. This is my grading of each puzzle, but you can however make your own. This page allows you to display all difficulty 1 puzzles, difficulty 2 etc.

Part 2: – Turn the letters into numbers

Click on the button 'part 2'.

The next thing you must do is load the overlay you saved. The overlay will show you the colours of the 10 letters in the title, the colours of the 32 cell strip and load the 9 words of the puzzle. Again, there are grids below to help you solve this part of the puzzle. Refer to the last 3 pages at the end of this manual for strategies on solving Alphametics.

Part 3: - The movie title

The movie title is concealed in the 32 cell colour strip. Type letters into the strip that correspond to the colours in the title. This will reveal the title of the movie.

Part 4: - The hidden word

Now that you know the title of the movie, you can search for the hidden word. You are looking for 3 key words which have something to do with the title. One word from each block. In the case of puzzle 1 the movie title is revealed from the colour strip to be JAWS.
The 3 key words we are looking for have something to do with this movie. In this puzzle we are looking for the words WATCH THE WATER.
Add these 3 key words together then convert the answer back to letters to reveal the hidden word. A key words grid is provided for you to do the calculation.

18246
269 +
18290

36805 = SHARK

If you can't spot the 3 key words, you have 27 combination to go through in order to find the correct answer.

Part 5: - Compiling the hidden Words

Click the back button to return to solver1.html. Now click the 'PART 3' button.

This will take you to the hidden_words.html page. On this page enter the hidden word you found and then click the save button. It will save to your download folder as puzzle-progress.json. You will need to keep returning to this page in order to add other hidden words. You can now click the return button to continue with another puzzle.

Part 6: - Creating the Key

Once you have filled out the hidden_words.html click the save button.
Now it is time to create the key to the pictures. Click the 'SORT' button and it will put all your hidden words into alphabetical order.
Now click the 'SAVE' button.
Next click the 'MAKE' button and it will take you to the picture_assembler.html page.

Part 7: - Final reward

Step 1 - Load Progress JSON
Step 2 - Select a picture
Step 3 - Start assembly

If your hidden word page is correct the pictures will decrypy.
Press esc (not the browser back button) to return to the assembly page.
You can now select another picture to decrypt.

How many of the 112 celebrities did you manage to inentify.

Part 8: - Footnotes:

The pictures were designed to be impossible to put together without actually solving the puzzles. If you think you could write a program to brute force the answers, note this:
The number of combinations is factorial 730. This number is mind-bogglingly large. 10^1770. The number of atoms in the entire observable universe is estimated to be around 10^80.
730! is vastly, incomprehensibly big. If you had a supercomputer that could check a trillion trillion combinations every second, it would take longer than the age of the universe to even make a dent in the possibilities.
Conclusion: a pure brute-force attack is fundamentally impossible.

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A Shorthand Solution to Puzzle 1

Colours to Numbers: -

To start, lets try to eliminate J

W1 no J IN C2 C4 C5, SAND GREY ORANGE not J
W2 no J IN C2 C3 C4, PINK not J
W3 no J IN C2 C4 C5, GREEN not J

W8 no J IN C2 C4 C5, MINT BLUE not J
W1 C1 C2 C3 SAME AS W7 C1 C2 C3
W1 C4 C5 AND W7 C4 C5 DIFFERENT
W1 is HEJRA, HAJES, RAJES, TAJES
W7 is HEJRA, HAJES, RAJES, TAJES
No WORD IN W1 HAS A MATCH IN W7
YELLOW is not J
BROWN must be J

W6 C1 no CRS
W6 C2 no CST

W2 JACK, JAKE, JARK, JERK.
SAND is AE, GREY is CKR, PINK is KE

W6 C1 is AEHT
W6 C2 is KE

W1 C1 no AES
W1 C3 no EHS
W1 C5 no ACEKRW

W3 C2 is SH
W3 C1 is ACTW
W3 C3 is HKTER

W5 C1 is ACTW
W5 C2 is SH
W5 C3 is HAE

W3 C5 is TRW
W9 C5 is STER
W9 C3 is KRT

W7 C1 TW

W3 C5 is W
W3 C1 is AT
W3 C3 is KR
W3 C4 is EA

W7 is WATER
W5 is THE
W6 is EKE
W9 is CARES
W4 is HER

Letters to Numbers: -

W1 refers to word 1 and C1 refers to column 1
There are 15 columns so i will refer to them as C1, C2 etc.

C15 R+S=S R=0

C12 A+E=A E=9

C4 C+C=9 C=4

C1 W+1=T T>W

C11 W+T=4 W=1, T=2

C3 2+A=0 A=8

C8 H+2=9 H=6

C9 9+6=K K=5

C2 8+J=6 J=7

By elimination S=3

Tri-Alphametics

The Tri-Alphametics presented in this book enhance the traditional alphametic to form puzzles that are both challenging and fun. Each puzzle can be solved using pure logic, so there is never any guesswork required. Due to the mathematical nature of these puzzles they are suitable for all ages that can add two numbers together.

A *cryptarithm* or *alphametic* is a mathematical equation in which the digits have been replaced by letters. The first known form of the puzzle originated in China and was known as letter arithmetic. During the Middle Ages a form of cryptarithm known as *mathematical restorations* or *skeletons* appeared in India. The term *crypt-arithmetic* was introduced by M. Vatriquant in May 1931 and the term *alphametic* was introduced by J. A. H. Hunter in 1955 to describe a cryptarithm whose letters form sensible words. The word cryptarithm is used by the American Cryptogram Association, and alphametic by the Journal of Recreational Mathematics.

The conventions of alphametics are that each different letter represents only one digit without repetition and that words do not begin with zero. All alphametics in this book are addition equations.

In this book we present a new style which we call *Tri-Alphametics* as they use a set of three Alphametics that are linked to form a puzzle. Each different letter from the three alphametics share the same decoded number. There are two challenges for each puzzle. The first is to decrypt the string of numbers at the bottom of each page by exchanging the numbers for letters from the Tri-Alphametic. This will reveal a movie title. The second is to use your movie trivia knowledge to reveal another hidden word buried within the Tri-Alphametic. This can be found by forming a sum of three words (one from each alphametic) that relate to the deciphered movie title. The hidden word is revealed by adding these words together and decrypting.

How to Solve

Each Alphametic puzzle is constructed from up to 10 letters. Each letter represents a number between 0 and 9. Two letters can not represent the same letter. The objective is to determine the number used to exchange for each letter. The only obvious clue is that a word can not start with a zero.

The following is an example to illustrate how to solve a simple Alphametic using logic.

```
1 2 3 4   (Column)
    A N
+ C A N
-------
N E E D
```

A good first step is to look for the number 0. Since the conventions outline that no word may start with 0, we know that neither A, C or N are 0.

Next we attempt to establish whether any columns add up to more than 10 (e.g. 4 + 7 = 11), which indicates this column carries over to the next column. From the example, column 1 contains only the letter N. For this to happen, the addition from the preceding column must have generated a carry, therefore N = 1. From column 4, if N + N = D, this means that D = 2.

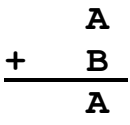
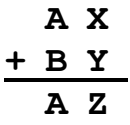
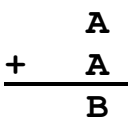
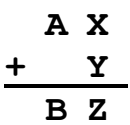
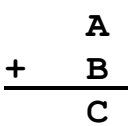
From column 2, C = 9 as any number less than 9 would not have produced a carry to column 1. By the same reasoning, column 3 must also produce a carry. Using this we can determine that E = 0 from column 2.

Finally, in column 3, A + A = 0. This means that A = 5 as we have already determined that column 4 had no carry.

We have now replaced all the letters with numbers, providing the solution: A=5, C=9, D=2, E=0, N=1.

Tips and Tricks

The following is a selection of tips and tricks to help in solving Alphametics using logic. There are many more tips and tricks that you will discover as you progress through this book.

	If this occurs in the right end column, then B is clearly the number 0 as any number plus 0 leaves that number unchanged.
	If the previous situation occurs but not in the right end column, B must be either 0 or 9 depending on whether the preceding column has a carry.
	If this occurs in the right end column, then B is an even number and A is not 0.
	This arrangement tells you that B is 1 more than A.
	If it can be shown that this column has no carry, the smallest A or B can be is 1 and the smallest C can be is 3. In addition neither A or B can be 9.

Using Solving Aids

Each puzzle in this book has two pages; the first page contains the puzzle and the second contains several aids to help in solving the puzzle. These solving aids can reduce the complexity of the problem by working through the logic of the problem visually, rather than in your head. When you start out it is a good idea to use these as it will help you to understand the process for solving the puzzles.

A	D	E	G	M	N	P	R	S	T
0					*1*				
0	0	0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9	9

You use the first solving aid to help record what each letter could be and what it is not. As you solve the puzzle you will discover the certain letters can not logically be certain numbers, cross these out on the table *(shown here in grey)*.

Eventually there will be only one number associated with each letter. You will have solved the puzzle.

The second solving aid is also used to eliminate numbers, by associating letters in a sum. It helps in applying your logic while solving a puzzle. When you discover a range of values for a letter, use the table to see the effect on other letters.

For example, the third tip (A + A = B) is shown in the first table. If later we determine that A is less than 5, the second table shows you that B must be 2, 4, 6, or 8 and has no carry.

	(0 , 1) *carry*									
A	0	1	2	3	4	5	6	7	8	9
A	0	1	2	3	4	5	6	7	8	9
B	0	1	2	3	4	5	6	7	8	9
	10	11	12	13	14	15	16	17	18	19

	(0 , 1) *carry*									
A	0	1	2	3	4	5	6	7	8	9
A	0	1	2	3	4	5	6	7	8	9
B	0	1	2	3	4	5	6	7	8	9
	10	11	12	13	14	15	16	17	18	19