

Numbers puzzles courtesy of Mike Mudge.

The area of investigation this month has been suggested by Neil Duncan of Ealing, west London.

Consider a set of tableware in brightly-coloured plastic, consisting of S distinct pieces — eg S = 5, cup, saucer, plate, bowl and egg-cup. Suppose further that this is available in R distinct colours — eg R = 5, red, orange, yellow, green and blue. This tableware is to be used, in complete sets, to lay the table for T people, where T is less than or equal to R and only one set of a given colour is permitted.

In the special case S = R = T = 5 it is possible to avoid giving anybody any matching pieces at all. One way is:

	Annie	Billie	Charlie	Daisy	Ernie
Cup	Red	Orange	Yellow	Green	Blue
Saucer	Orange	Yellow	Green	Blue	Red
Plate	Yellow	Green	Blue	Red	Orange
Bowl	Green	Blue	Red	Orange	Yellow
Egg-Cup	Blue	Red	Orange	Yellow	Green

Some readers may recognise this as a fifth order Latin Square, and thus know that the total number of different such arrangements is 161280. Moreover, the total number of different arrangements of the 25 pieces — giving each person one of each piece regardless of whether they match — is $(5P_5)^5 = 24883200000$.

So, the chances of getting a 'no matches' setting if the table is laid at random is less than 1 in 150000.

Reduction in the values of S, R and hence T lead, naturally, to problems which are easier to analyse.

Problem 1 If four people sit down for tea with only three pieces each (cup, saucer and plate, say) but all five colours are available, show that the probability that a random table setting will give no matching pieces to anyone is exactly 0.07.

The general situation shows that the total number of different arrangements, regardless of matches but taking account of order, is $(R P_T)^S$. Thus Table A:

R	S	T=2	T=3	T=4
2	2	4		
3	2	36	36	
3	3	216	216	
4	2	144	576	576

Problem 2 Verify and extend Table A.

Now to the problem of 'no match' arrangements and the associated prob-

abilities of these arising from random selection. Consider Table B:

R	S	T=2	T=3	T=4
2	2	2		
3	2	18	12	
3	3	12	12	
4	2	84	264	216
4	3	264	1056	576

Problem 3 Verify and extend Table B by direct generation of the 'no match' arrangements.

Problem 4 Approximate to Table B and its extension via the estimated probabilities resulting from the use of a random number generator (or other equivalent device) to generate a large enough number of distributions of tableware.

Now, the £64,000 Question: Are there recurrence relations underlying the entries in Table B?

Answers to some or all of the above problems may be sent to Mike Mudge, 22 Gors Fach, Pwll-Trap, St Clears, Carmarthen, Dyfed SA33 4AQ, tel (0994) 231121, to arrive by 1 March 1992.

Brainteasers courtesy of JJ Clessa.

Here is a Quickie to test your powers of logic. No answers, no prizes. In the following encoded message, each letter of the original has been replaced by a different letter. Spaces and punctuation are unchanged. All the words may be found in any standard dictionary. Can you decipher the message?

Etd td ttpbjtpw stwg t fqpr tkpqqztaqstiq oyp t ktdbqp y p t bptwg

Note: all answers are whole numbers

28 across = the answer to 28 across
19 down = the answer to 19 down

When you have solved the puzzle, photocopy it and stick it on a postcard, or the back of a sealed envelope (no

Answers

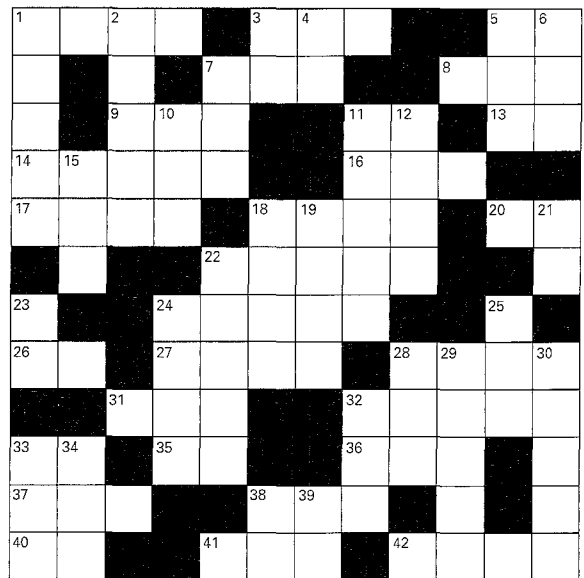
Here's a nice, easy number crossword for you to do on the train.

Clues Across

- 1 40a squared
- 3 Reverse of 6d
- 5 See 17a
- 7 200 more than 40a
- 8 Same digits as 7a
- 9 3d plus 4d plus 26a
- 11 2 less than 20a
- 13 One quarter of 26a
- 14 1 less than 7a squared
- 16 21 times 4d
- 17 5a squared plus 1
- 18 Its digits total 18
- 20 23d minus 13a
- 22 17a times 10
- 24 8a times 70
- 26 40a minus 13a
- 27 20a squared
- 28 Same as 1a
- 31 33a times 10
- 32 1a times 10
- 33 One third of 23d
- 35 First two digits of 1d
- 36 34d minus 5
- 37 33 d plus 5a
- 38 Same as 7a
- 40 26a plus 13a
- 41 7d plus 4d
- 42 37a times 5

Clue Down

- 1 7d squared
- 2 9a squared
- 3 40a reversed
- 4 13a plus 10
- 5 1 more than 40a times 10
- 6 34d plus 700
- 7 10d reversed
- 10 40a plus 33d
- 11 14a minus 4
- 12 6d times 10
- 15 Same as 3a
- 18 Its digits total 15
- 19 11a squared plus 200
- 21 40a minus 26a
- 22 25d times 1000
- 23 33a times 3
- 24 Same as 1a
- 25 4d squared
- 28 First three digits of 32a
- 29 41 a squared
- 30 34d squared less 5
- 32 15d minus 4
- 33 37a minus 5a
- 34 13a squared
- 38 1 less than 4d
- 39 Same as 5a



letters please) and send it to: December Prize Puzzle, Personal Computer World Editorial, VNU House, 32-34 Broadwick Street, London W1A 2HG, to arrive before 1992.

