

## POLYWHATSITS

Have you ever investigated the shapes called POLYOMINOES? If so, then don't skip this article altogether; jump to the part below the figures. If not, here is a brief description.

Everyone knows the shape of a domino—it is made in the shape of two squares placed edge to edge (Fig. 1). Suppose we extend this idea to three squares, and call this shape a *triomino*. We keep the edge to edge rule, so that shapes like Fig. 2 and Fig. 3 are NOT allowed. There are two possible shapes for such a triomino; a rectangle and an L shape.

It is an interesting, and quite challenging, exercise to try to find all the possible *tetrominoes* and *pentominoes*, or even all the *hexominoes*. Many people find that they mistakenly include duplicates (for we do not count two *polyominoes* as different if one can be turned round or turned over to fit on to the other).

Although there is general agreement as to the number of each type of polyomino for those made up of a small number of squares, you will realise that the problem becomes complicated and tiresome for larger polyominoes. So far, no one has been able to find a formula connecting the number of distinct "n"-ominoes with the number n of squares used to make each one.

Fig. 1



Fig. 2

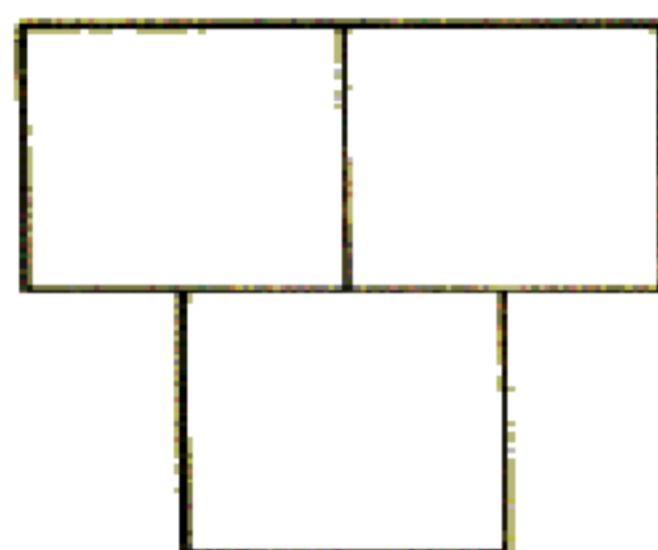
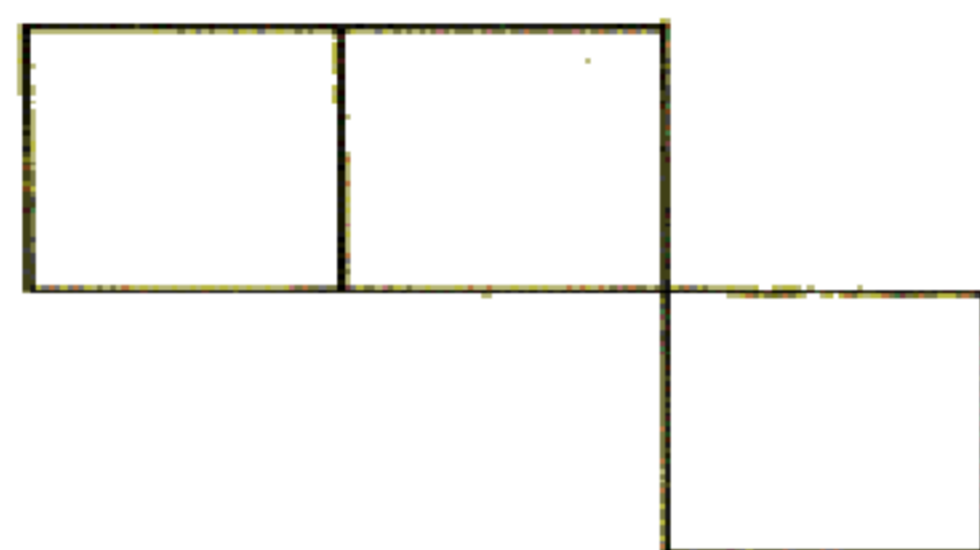


Fig. 3



Now that we all know what a polyomino is, here is a slightly different idea. Suppose that the shapes are made from equilateral triangles instead of squares. How many different shapes can be made with 2, 3, 4 or 5 triangles? Perhaps we should not call these *polyominoes*. Do readers have any suggestions for a name? Remember that the ending you choose must fit well after poly-, do- (or duo-, or bi-, or di-), tri-, tetra- (or quad-), etc. If this investigation has caught your interest, you might like to try a similar one based on a "unit" of a rhombus with its angles  $60^\circ$  and  $120^\circ$ .

E.G.

## THE CLOSED SEASON

Charleot Manor is closed from the last day of October until the first possible day that it can open in April subject to the conditions that it is closed on Mondays and Good Friday but open on other Bank Holidays.

A man arrives on 2nd November, 1971, to find the Manor closed. How many days will pass before he can visit the Manor house?

What complications could arise in other years?

R.H.C.



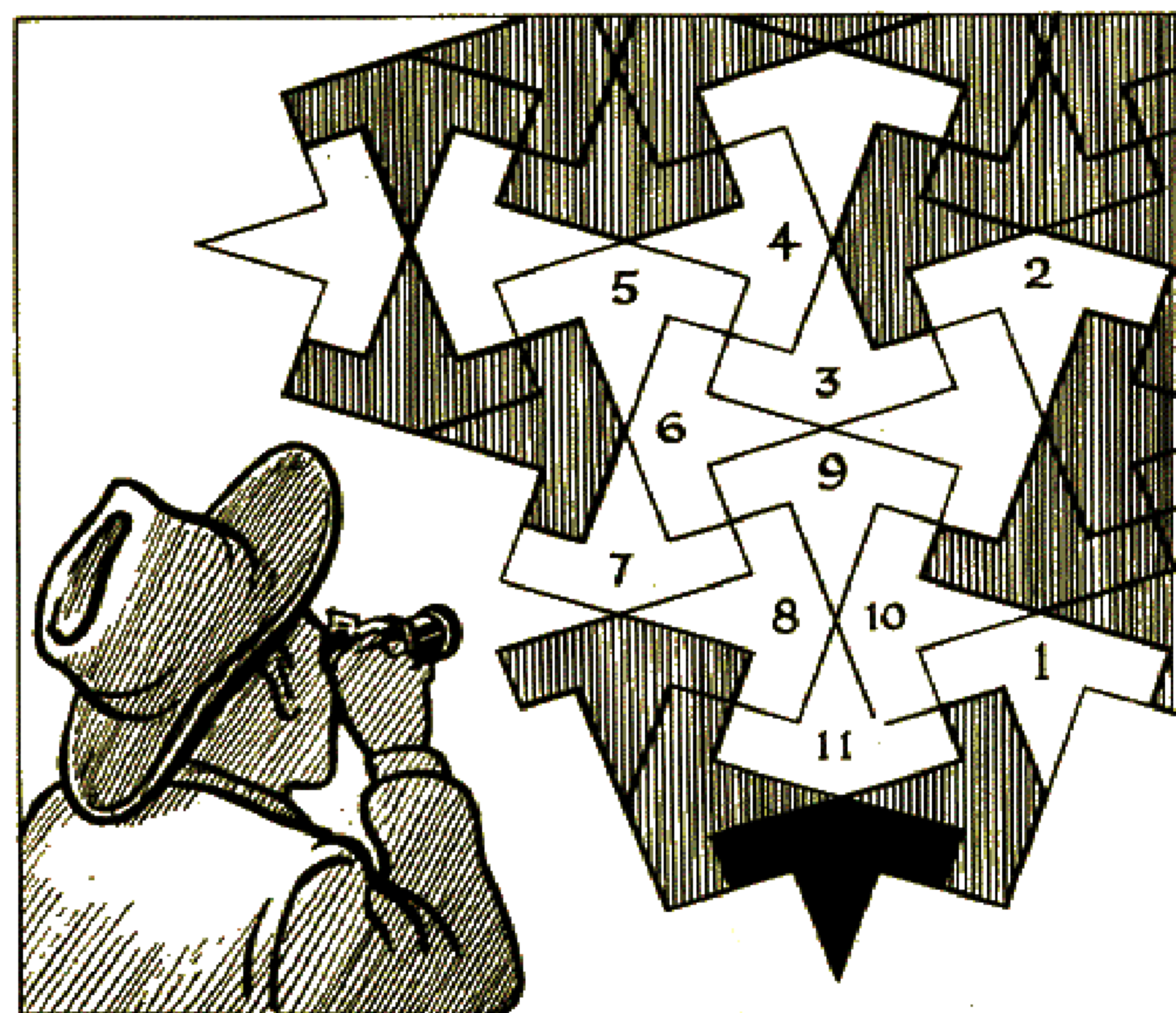
No. 62

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SPRING, 1971

## A NIGHT ON THE TILES

Imagine my surprise, on holiday in Spain, when I bumped into my old American pal, Al Gebra! I was wandering through the Alhambra in Granada when I saw him studying a tiled wall like the diagram below.





"Hi, man!" he cried, "don't need no interpreter to *translate* this!" for he had noticed the repetitions such as 1 to 2 which when regarded as movements would be called translations. (Al is very keen on the latest word-plays; he calls them "current puns".)

I was determined not to be outdone, "Are you sure you have the *right angle* on it?" I asked, pointing out the movements 3,4,5,6 and 6,7,8,9.

"O.K. You have had a *turn*, now here's mine" he replied, showing me the rotations 8 to 10 and 9 to 11. (We couldn't think of these as "reflections" because only one side of a tile can be used—the other side of a tile is rough for fixing to the wall.)

I was reminded of Alice's teacake (issue No. 58), so we decided to call the movements after the letters in the name of my hero ASTLE.

A means translate nosewards, e.g., 1 to 2.

S means rotate 90° anti-clockwise around the right wing, e.g., 3 to 4.

T means rotate 90° anti-clockwise around the left wing, e.g., 7 to 8.

L means rotate 180° around the nose, e.g., 8 to 10.

E means rotate 180° around the tail, e.g., 9 to 11.

"Let's tessellate, Al", I said, and using the movements we tried to find what my sentence would do to a tile, by doing L, then E, then T, and so on. Can you help us? Start on the black tile.

Many of you did very well with the "teacake": can you find rules for this game? For instance, what are the results of the following (i) LL, (ii) SSSS, (iii) TS, (iv) ST, (v) TSST?

Are the results always the same, no matter where you start? How can you tell that I am a better mathematician than Al? Can you find any other interesting sentences?

NOTE.—"tessellate" has been deliberately spelled incorrectly. Why do you think this was necessary?

E.G.

### A GALAXY OF TALENT

submitted by J. Cameron, Esq., Hastings

The Anglo-Saxon race, in its colonisation of the Galaxy, has carried the pleasures of civilisation to the furthest star: cricket is played throughout the Milky Way.

I was a little late arriving for the match between the Algoliwogs and the Bellatrixters, two leading teams whose performances compare well with English county standards; and as I took my seat the Algoliwog spectators rustled their tentacles in appreciation. "That puts the 200 up" one of them said; but alas, only one run more was scored before the wicket fell.

"All out for 100", said a Bellatrixter, applauding by twinkling the band of eyes which encircled his head.

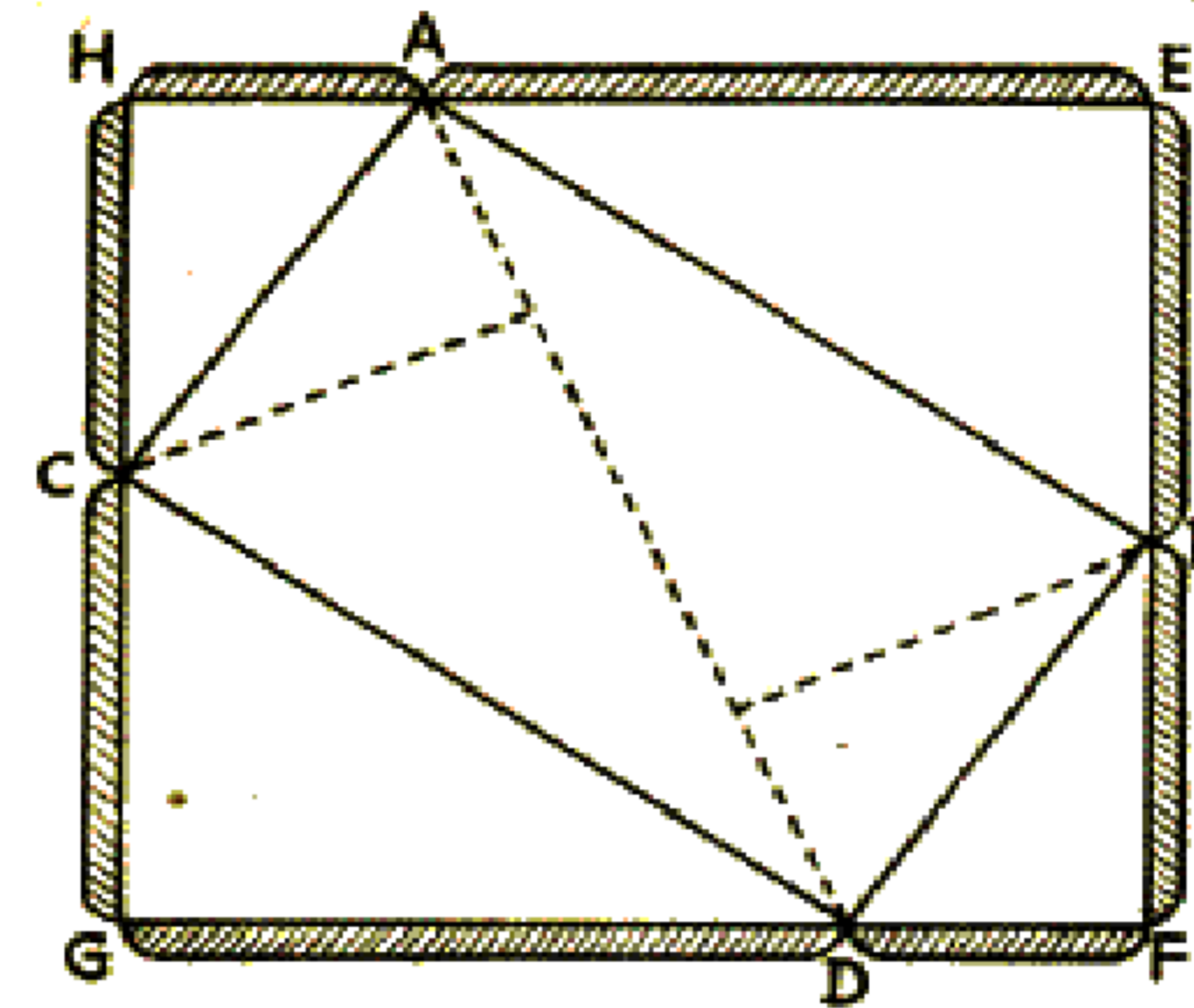
I know that, just as I base my reckoning on my ten fingers, the Algoliwogs base theirs upon the number of their tentacles; and the Bellatrixters upon the number of their eyes: so if both my informants were correct in their own reckonings, what was the score for the winnings in mine?

### ADDITIVE POWER

Which positive whole number is actually more when increased by 1,000 than when it is multiplied by 1,000?

R.H.C.

### HOW TO MAKE AN ENVELOPE



A point A is fixed on the side EH of a square EFGH. Explain how to complete the figure.

When the figure is complete, the corners of the square EFGH are folded over as shown by the dotted lines. How many cyclic quadrilaterals appear in the figure?

R.H.C.

### JUNIOR CROSS FIGURE No. 54

1	2		3	4	
5					
			6		7
8		9			
10	11		12		
13					

Ignore decimal points.

#### CLUES ACROSS

- One new penny in old pence.
- (Digit sum of 5 across) × (Digit sum of 13 across).

#### CLUES DOWN

- Square number plus 1.
- Product of two consecutive integers.
- 48% of £3.25 in new pence.
- Sum of the remaining angles in the triangle in Fig. 2 when A is 19.
- Next two terms in the sequence 2, 5, 10, 17,
- Total surface area of cylinder diameter 7 cm. height 10 cm.
- 11/10 of 1 right angle in degrees.

P.J.G



FIG. 1



FIG. 2

### SOLUTIONS TO PROBLEMS IN ISSUE No. 61

CHARLIE COOK AGAIN—He had 3 questions correct out of 7 in part 1 and 4 correct out of 5 in part 2 making 7 correct out of 12 on the whole paper.

A BASE QUESTION No. 2—The relation can be extended to the case when a=8 and c=9. The bases will be 18 and 17.

HIGH FINANCE—The smallest sum of money is £345,678 12s. 9d.

#### SENIOR CROSS FIGURE No. 57

Clues Across: 2. 768; 5. 4576; 7. 62; 8. 766; 10. 667; 12. 981; 13. 452; 15. 48; 16. 3646; 19. 132.

Clues Down: 1. 24; 2. 77; 3. 667; 4. 32; 6. 55648; 7. 66834; 9. 69; 11. 75; 14. 233; 15. 48; 17. 62; 18. 60.

WRAP UP—The first parcel is a 1½ ft. cube. The second parcel with a square section is 0.6 ft. square by 3 ft. The volume is 27/25 cubic feet.

#### JUNIOR CROSS FIGURE No. 53

Clues Across: 1. 24; 3. 100; 5. 5279; 6. 827; 8. 144; 10. 7387; 12. 525; 13. 15.

Clues Down: 1. 25; 2. 4224; 3. 198; 4. 007; 7. 2381; 8. 125; 9. 475; 11. 75.

SHORT PUZZLES—(i) 99 1/8 (ii) 4.

B.A.







# Index of Retail Prices

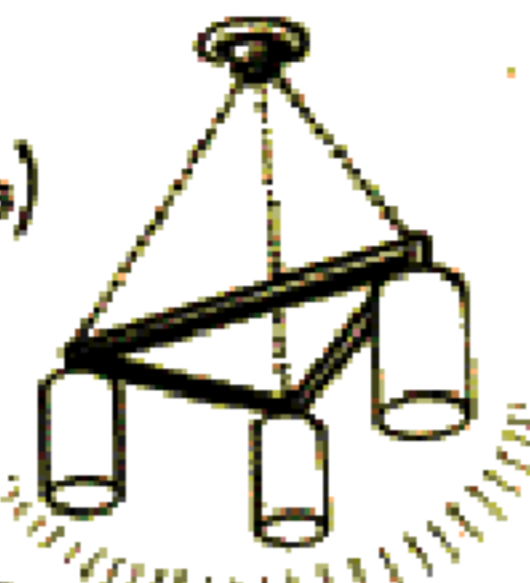
(Group weightings for 1970 are shown in brackets)



FOOD (225)



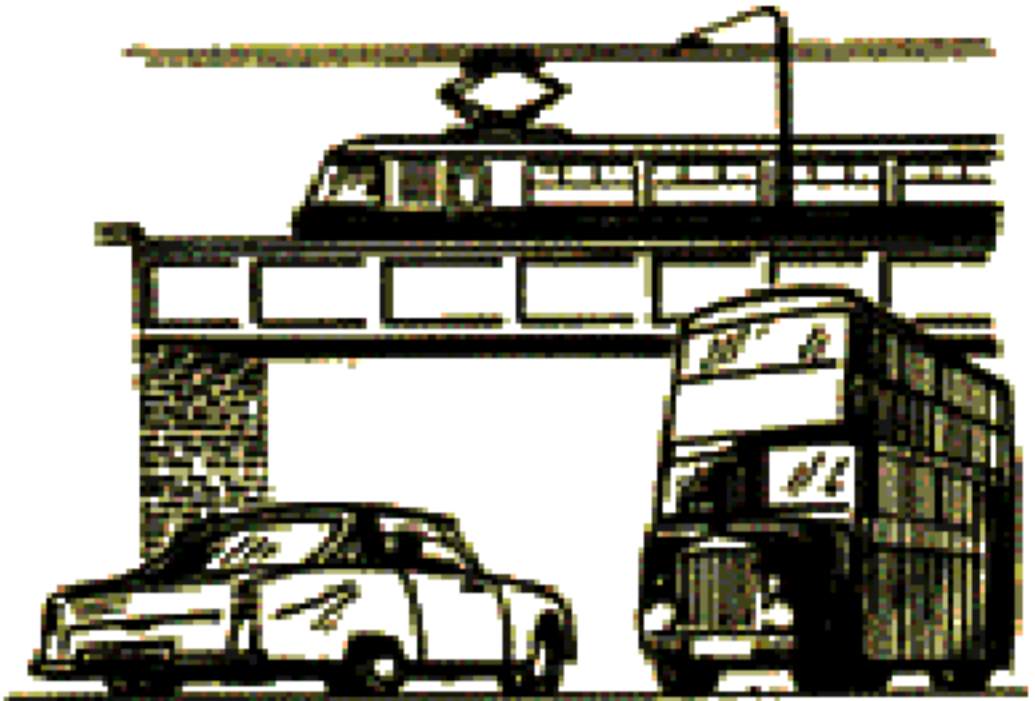
FUEL and LIGHT (61)



MISCELLANEOUS GOODS (65)



HOUSING (119)



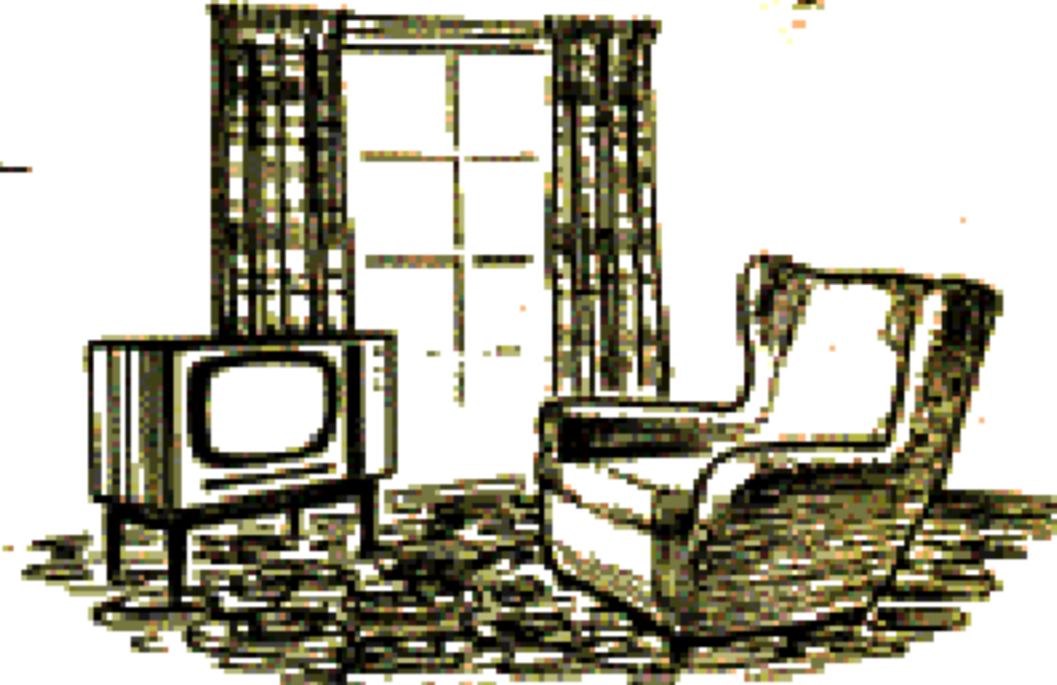
TRANSPORT & VEHICLES (126)



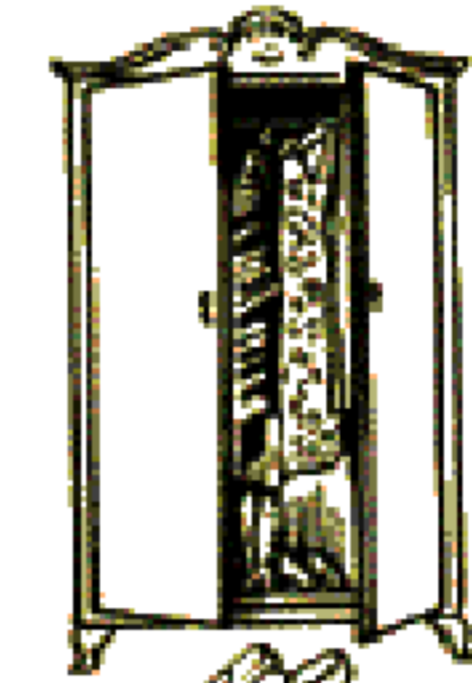
ALCOHOLIC DRINK (66)



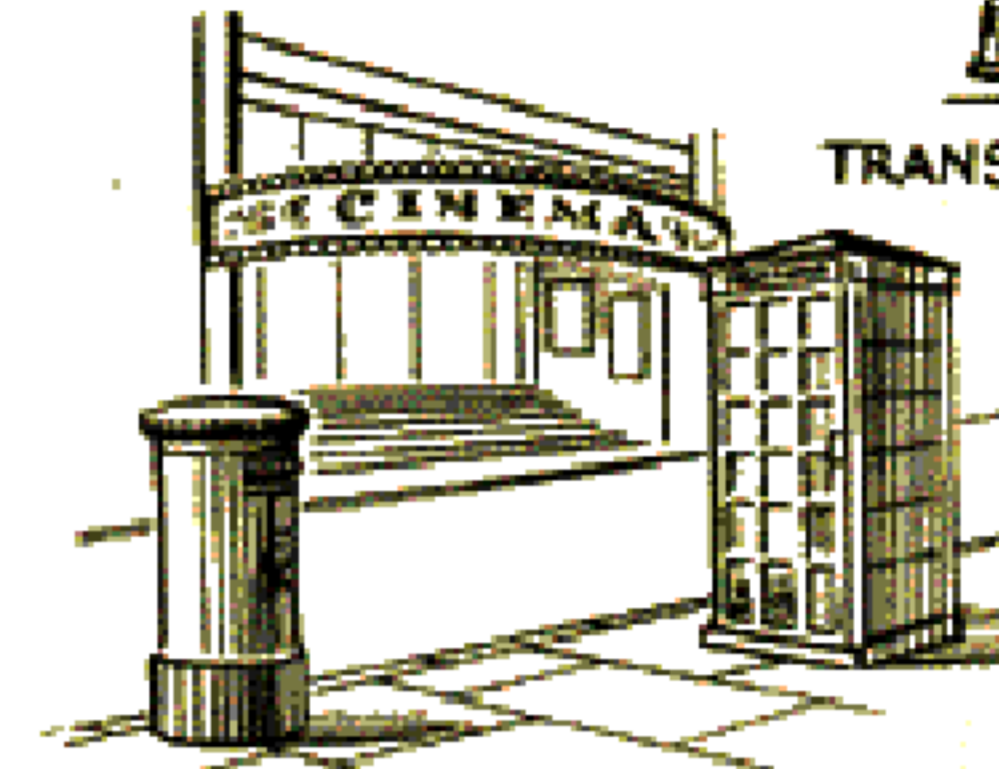
TOBACCO (64)



DURABLE HOUSEHOLD GOODS (60)



CLOTHING and FOOTWEAR (86)



SERVICES (55)



MEALS bought & consumed outside the home (43)

The Index of Retail Prices (often incorrectly called the Cost of Living Index) covers the eleven groups shown above, which in turn are divided into a total of ninety-three sections. Most sections are further sub-divided into items: e.g., in the Food group, the Bread section comprises white 1 3/4 lb. and 14 oz. loaves and the brown 14 oz. loaf. Consideration must be given to the importance of each section. After all, most households would be expected to spend much more on bread than on cooking-fat. To allow for these relative differences, "weightings" are given annually to each section. In the same way, each group has an annual "weighting" (the sum of the weightings for each section in that group) which ensures that the all-items Index finally evaluated is accurate. Although the group weightings for 1970 are shown, space is too limited here to give the weightings for each section.

Table (i)

Section	Rise in Price %	Section Weighting	Rise in Price % × Section Weighting
Bread	$\frac{12-10}{10} \times \frac{100}{1} = 20$	16	320
Cornflakes	$\frac{10-8}{8} \times \frac{100}{1} = 25$	4	100
		20	420

Percentage increase =  $\frac{420}{20} = 21$

Therefore, Group Index =  $100 + 21 = 121$  (With previous January as 100).

As the index measures only price changes, prices of the same goods and services must be collected. The percentage increase or decrease is calculated on the base value of 100 representing the index for the previous January. The procedure for calculating the index is probably best explained by simple examples.

Supposing that the Food group consists of only two sections, a white 1 3/4 lb. loaf and a 12 oz. packet of cornflakes, table (i) shows the calculation if the January prices of bread and cereal rise from 10p to 12p and 8p to 10p, respectively.

Instead of the eleven groups, a further simplification will be made by supposing that there are only two groups, Food (which, covering a large number of important items, actually has a total weighting of 255 and not 20 as indicated) and Durable Household Goods (which has a total weighting of 60).

Table (ii)

Group	Rise in Price %	Group Weighting	Rise in Price % × Group Weighting
Food	21	20	420
Durable Household Goods	5	60	300
		80	720

Retail Price Index =  $\frac{720}{80} + 100 = 109$  (With previous January as 100).

The Retail Price Index, issued monthly by the Department of Productivity, is based on an index of 100 in January, 1962.