Tobbs Learns Algebra: Puzzles and Problem Solving

Teacher's Guide

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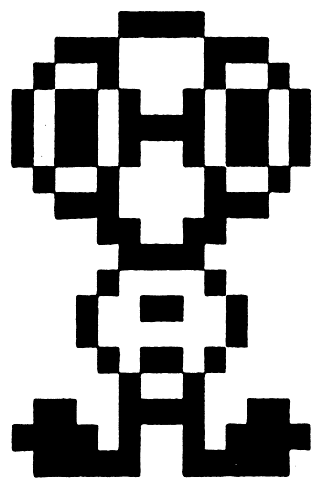

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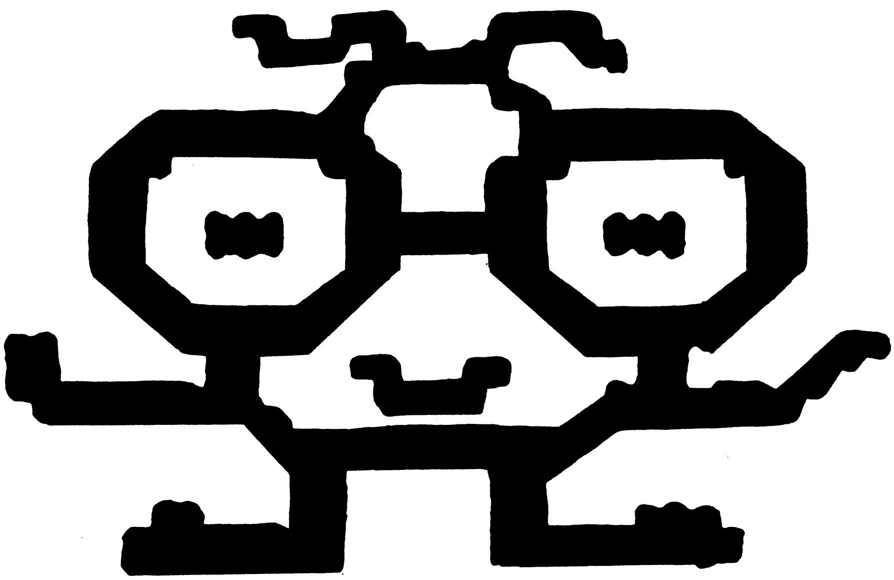
In addition, Dr. O'Brien has published and delivered some 100 papers in children's thinking, mathematics education, intellectual development, and educational change. His papers and presentations have taken place in the USA, Canada, Great Britain, Holland, France, Switzerland, Hungary, and Brazil. Dr. O'Brien was named the North Atlantic Treaty Organization (NATO) Senior Research Fellow-in-Science in 1978. Dr. O'Brien received his bachelor's degree from Iona College, New Rochelle, NY, and his Ph.D. from New York University.



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TOBBS LEARNS ALGEBRA: PUZZLES AND PROBLEM SOLVING

INTRODUCTION

by Thomas C. O'Brien

TOBBS LEARNS ALGEBRA: PUZZLES AND PROBLEM SOLVING is an extension of TEASERS BY TOBBS: PUZZLES AND PROBLEM SOLVING. Again the focus is problem solving in mathematics. Again, there is no teaching but a great deal of learning. Players construct for themselves some of the real basics in mathematical thinking. The benefits are threefold: the development of algebraic thinking, the development of hypothesis making and testing, and, of course, the development of problem-solving tactics.

For many students (and their parents and teachers), mathematics is composed of static rules to be followed without question.

> "Do it this way."
> "Why?"
> "Because that's the way it's done."

No wonder so many children and adults have a fear of mathematics! The truth is that mathematics is a matter of mind, not mere memory. Rather than the passive storing of rules to be followed blindly, mathematics involves the construction, organization, and interweaving of relationships. The mathematics student must be an agent, not a patient.

TOBBS LEARNS ALGEBRA is concerned with five skills essential to success in mathematics: coordinating addition and multiplication; working backwards (algebraic reversability); determining the entry point to a problem; distinguishing between what must be, might be, and can't be; and determining formulas from factors, sums, and products.

SKILL ONE: COORDINATING ADDITION AND MULTIPLICATION

In The Algebra Challenge, players learn to coordinate addition and multiplication. One of the first problems they meet is the following:

2L+1T+1	2	5
3		
4		

The rule is 2L(left) + 1T(top) + 1

What goes in the Tobbs box? "2L" is two 3s. "1T" is one 2.

2L+1T+1	2	5
3	9	
4		

Can you complete the rest of the puzzle using the same formula?

SKILL TWO: WORKING BACKWARDS

Students also learn to construct algebraic reversability (a fancy name for working backwards). For example, suppose the rule for the grid below is 2L + 2T + 1.

2L+2T+1	3	5
	9	
4		

What number does Tobbs want?

A trial and success approach--plugging various numbers into the formula--will eventually work. However, most students soon develop an even more efficient approach to the problem: Two Lefts plus two 3s + 1 is 9. Two Lefts plus 6 + 1 is 9. Subtract 1 from 9. Two Lefts plus 6 is 8. Subtract the 6 from 8. Two Lefts is 2. Aha! The answer is 1.

2L+2T+1	3	5
1	9	
4		

How about this one?

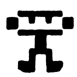
L+2T+4	2	5
	8	
4		

Subtract 4 from the 8. That's 4. Then reduce the 4 by 2 Tops (that is, 4). That's 0. L, therefore, must be 0. The rest of the puzzle is straightforward.

SKILL THREE: DETERMINING THE ENTRY POINT TO A PROBLEM

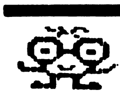
TOBBS LEARNS ALGEBRA also requires students to determine an entry point to the problem--to answer the question "Where do I start?" Such an ability is important in all of problem solving.

Look at this puzzle:

2L+2T+4		
	14	16
1	10	12

"Wow! Where does one start? Two somethings plus two somethings plus 4 is 14. Get me out of here!"

Aha. The 1 and the 10 yield a 2, even though that's not the question originally asked.

2L+2T+4	(2)	
	14	16
1	10	12

2L+2T+4		
3	14	16
1	10	12

Now there's enough information to find the answer for Tobbs. The rule is 2L + 2T + 4. Subtract 4 from 14. That's 10. Then reduce 10 by 2 Top: that's 6. If two Lefts make 6, the answer is 3.

It is clear that these puzzles call upon players to construct complex chains of "If-then" thinking, another vital component of problem-solving ability. (Have you found yourself thinking If...then as you solve these puzzles?)

SKILL FOUR: DISTINGUISHING BETWEEN WHAT MUST BE, MIGHT BE, AND CAN'T BE

One of the most important aspects of mathematics is the distinction between what must be, might be, and can't be. This issue comes to the fore in Level 6 of The Algebra Challenge.

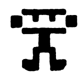
Suppose the rule is 2L + T + 3. In case #1 the Tobbs box must be 1.

In case #2 the Tobbs box can be 1, but it can also be 2 or 3 or even 20.

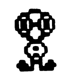
In case #3 the Tobbs box cannot be 1, (13-3-T has to be divisible by 2) but could be 2, 4, or several other possibilities.

2L+T+3	3	4
	8	9
0	6	7

#1

2L+T+3		4
0		7
5		17

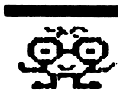
#2

2L+T+3		
	13	15
	11	13

#3

Can you solve each puzzle? Use trial and success if you'd like.

The computer is programmed to deal only with whole numbers from 0 to 99. As you can see from (3) above, one type of "can't be" is a logical "can't be." Another type is caused by the constraints of the 0-99 limit. The answer below can't be 49. If it were, the grid would be pushed beyond 99.

L+T+4	48	15
		
20		

What are the possible entries for the Tobbs box?

SKILL FIVE: DETERMINING FORMULAS FROM PRODUCTS, SUMS, AND FACTORS

The real heights of problem solving are climbed in the Detective Tobbs and Tobbs Gets Tough sections. Their puzzles are of two types. The grids in Detective Tobbs deal with rules such as 3L +2T + 1 or T + 2L + 4. But the rule is not given. It has to be derived, guessed at, or hammered out of a completed grid.

What rule fits this puzzle?

	1	3
0	3	5
2	5	7

The solution is not so hard: T + L + 2. But the problems in Tobbs Gets Tough are significantly more demanding. They represent a total departure from the algebra-based problems of the first two sections. Can you figure these out?

	9	1
4	4	5
7	7	8

	6	2
5	2	7
9	6	2

They appear senseless at first. However you may soon discover that they are addition grids on which the computer reports the sum of the digits of the sums.

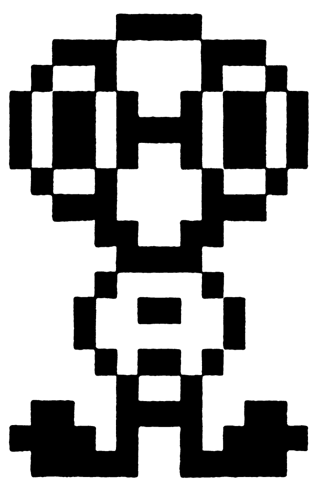
SUMMARY

So what do the puzzles do for students? In brief, the puzzles enable them to construct, organize, and make sense out of basic numerical and algebraic relationships. The puzzles also foster the development of life-long problem-solving skills. A fruitful activity this is. A basic activity!!!

When I was charged with the responsibility of preparing these pages, it was mentioned that readers might be used to behavioral objectives and that I should take care to illuminate the program's benefits for students. I have tried to do so, but have also tried to write so that the reader would be a participant and not a passive storer of a Tobbs laundry list. In his prize-winning Godel, Escher, Bach: An Eternal Golden Braid, Douglas R. Hofstadter addresses the issue with which TOBBS LEARNS ALGEBRA is most intimately concerned: the growth of intelligence.

> "(The) essential abilities for intelligence are certainly:
> to respond to situations very flexibly;
> to take advantage of fortuitious circumstances;
> to make sense out of ambiguous or contradictory messages;
> to recognize the importance of different elements of a situation;
> to find similarities between situations despite differences which may separate them;
> to draw distinctions between situations which may link them;
> to synthesize new concepts by taking old concepts and putting them together in new ways;
> to come up with ideas that are novel."

The growth of intelligence, particularly mathematical intelligence, is what TOBBS LEARNS ALGEBRA: PUZZLES AND PROBLEM SOLVING is all about!



PROGRAM OVERVIEW

TOBBS LEARNS ALGEBRA contains three sections: The Algebra Challenge, Detective Tobbs, and Tobbs Gets Tough. The Algebra Challenge is divided into six levels of difficulty, Detective Tobbs into four, and Tobbs Gets Tough into two. Within each level players attempt to solve problems presented through an intriguing, sometimes tricky number grid format.

The Algebra Challenge puzzles require that students use a given formula to determine missing grid numbers. The Detective Tobbs puzzles present complete grids followed by incomplete grid quizzes. Players are required to determine the formula used to arrive at the given number combination.

Tobbs Gets Tough is a mathematical departure from the first two programs. Although it follows the familiar grid format--and shares inductive thinking skills with Detective Tobbs--it enters an entirely new arena, apart from algebra but nevertheless important. In this section Tobbs displays complete addition and multiplication grids on which the numbers have been systematically altered. Students must determine the rule used in the alteration, then demonstrate their knowledge on incomplete grid quizzes.

In The Algebra Challenge, students are scored after being presented with two to twelve puzzles, depending upon the difficulty level and the number of persons playing. In Detective Tobbs and Tobbs Gets Tough students are scored after completing each quiz.

The program deals only with whole numbers from 0 to 99. Anything that causes it to go beyond these limits will not be accepted as an answer. Decimals (such as 45.3) are not allowed.

BACKGROUND ON PLAYING

Students can play TOBBS LEARNS ALGEBRA individually or in groups. The Algebra Challenge allows the option of up to four students playing competitively. A score is presented as the number of correctly answered Tobbs boxes out of the number given. At the end of each sequence, students playing competitively see their names and scores printed in order from highest to lowest. Students, of course, can play cooperatively under one group name.

Students challenging the Detective Tobbs and Tobbs Gets Tough puzzles may pool their problem-solving skills in a group, but do not play simultaneously against one another. A score is kept as the number of correct quiz answers out of the number of tries.

At the end of each game, students are asked if they would like to try another set of problems at the same difficulty level. If NO, they are asked if they would like to try a set at a new level. If YES, they are involved in another series of problems.

Student Options -- The Algebra Challenge

At any point, players of The Algebra Challenge can press--

P to pass. The player will lose a turn and give the second player and advantage. If playing with a single player, there is no penalty.

N to get a new puzzle. If the puzzle is not a challenge or if it is too difficult, the player can call for a new puzzle. No penalty is assessed.

H to get help. In Levels 1-5, Tobbs will give the answer. In Level 6, where more than one answer will work, Tobbs will give one possible answer but will not complete the box. Students are encouraged to use this number to find a different answer.

Student Options -- Detective Tobbs

Levels 1 and 3 of Detective Tobbs allow students to see any number of complete algebra grids before completing a quiz grid. Levels 2 and 4 allow only one complete grid to be seen before the quiz grid. After giving an incorrect answer on the quiz grid, students may

- ask to try another answer,
- ask to see another grid,
- ask to see the rule.

Student Options -- Tobbs Gets Tough

Level 1 of Tobbs Gets Tough allows students to see any number of complete number grids before attempting to complete a quiz grid. Level 2 allows only one complete grid to be seen before the quiz grid. Students giving incorrect quiz answers may

- ask to try another answer,
- ask to see another grid,
- ask for help. The first time a student selects this option, he or she is told whether the quiz puzzle involves addition or multiplication. He or she is then given another chance to complete the puzzle. If the student again requires help in completing the same box, he or she is told the rule. Boxes completed after a HELP request are not counted in the score.

Ending the Program

A student may end any program at any level by holding the CTRL key and pressing E at any input. On the TRS-80 the program can be ended by holding the SHIFT and down-arrow keys while pressing E. If, after the summary score is printed, a student would like to use a new diskette or start this diskette again, he or she should answer YES to the appropriate question.

THE ROLE OF THE TEACHER

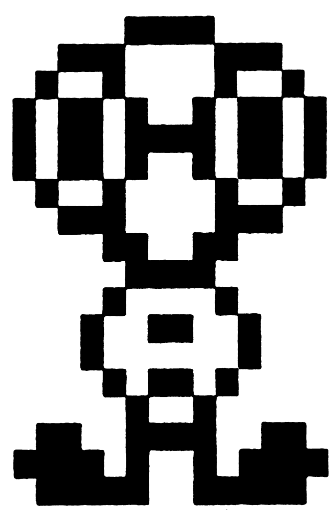
What's the role of the teacher in TOBBS LEARNS ALGEBRA? Commonly, the role of the teacher is to pass information and facts along to the pupils. That's NOT the situation here.

The role of the teacher is to let students experiment, to put the burden of learning in their laps, and to make them thinkers rather than memory bins.

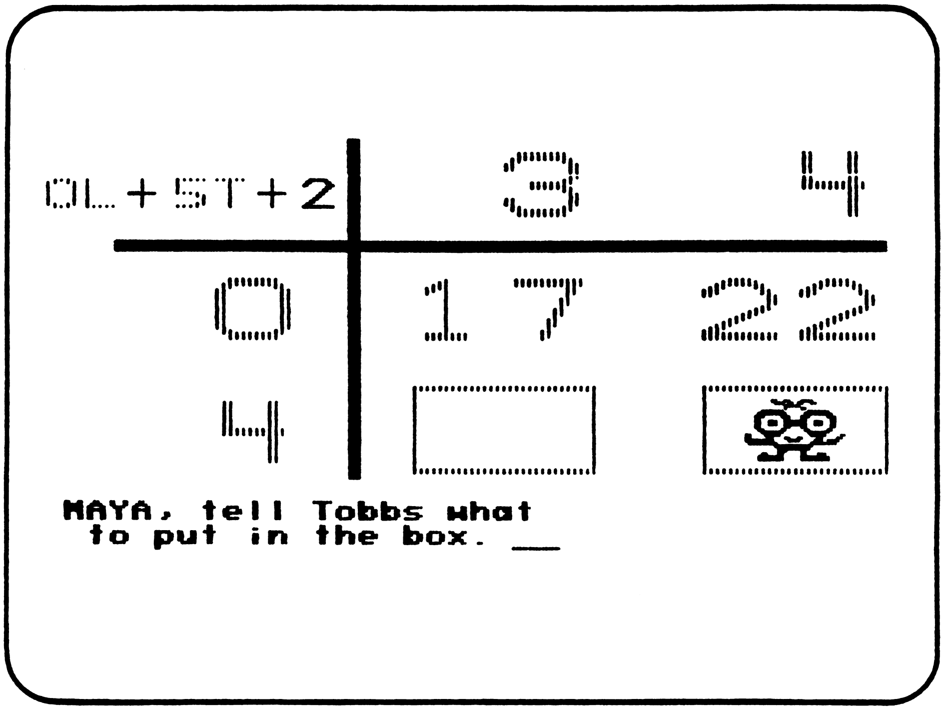
Teachers, of course, should become familiar with the puzzles by playing with them--two or three games at each level. Beyond that, the major role of the teacher is to act as a midwife in the birth of ideas. That is, if a student comes up with a question, throw the question back with a bit of encouragement, a statement of trust in the student's ability, and a suggestion that the student try a hunch or guess and follow through on its consequences. In this manner, trial and error very often turns into trial and success.

A second approach to students' questions is to team the questioner with a partner (or encourage him/her to choose a partner) and let them work together to figure things out. Whatever happens, try not to give answers to students. Let them have the fun and challenge of discovering their own solutions.

Finally, make sure students understand the format and functions of the puzzle grids, especially the ways in which the left and top numbers relate to given rules and to the inside numbers. Check to see that they also know how to operate the machine and the program's student options (see page 8).



THE ALGEBRA CHALLENGE



Skills	Algebraic thinking Coordinating addition and multiplication Working backwards (algebraic reversability) Determining the entry point to a problem Distinguishing between what must be, might be, and can't be Problem solving
Student Work With:	Addition Subtraction Multiplication Logic
Grade Level:	8 - adult
Reading Level:	3rd grade (Fry)
Time Required:	5 - 10 minutes for each puzzle

Background on The Algebra Challenge

The Algebra Challenge has six progressive levels of difficulty, based upon the problems and the logic involved. The program can be played by one to four students. A player can press P to pass, N for a new grid, H for help, or Control E to end the program. In each puzzle, the Tobbs character responds to each student answer. Players get one point for each correct solution, and are presented with a score at the end of each series of puzzles.

Levels 1 - 3 present the outside numbers (i.e. the Lefts and the Tops), and require students to compute the inside numbers:

3L+1T+2	4	1
2		9
0	6	3

The Tobbs box is three 2s plus one 4 plus 2. The Tobbs box is 12.

The puzzle grids in the first two levels use expressions of the type aL + bT + c, with a, b, and c always representing positive whole numbers from 0 to 4:

0L + 0T + 4	3L + 2T + 4
2L + 4T + 3	2L + 0T + 0

The following expression will never appear:

7L + 2T + 10	2L + 3T + 10
4L - 2T + 1	10L - 7T - 1
$\frac{1}{2}$L + T + 3	L + 3T + $\frac{1}{2}$

* * * * *

Players get an easy start in Level 1. Only one inside box is blank, and outside numbers range only from 0 to 5. Further, the coefficients are often specially chosen to make the expression easier. (That is, 2L + 2T + 2 is easier to deal with than 2L + 4T + 3). Here are some Level 1 puzzles:

1L+0T+1	2	0
4	5	5
1		2

2L+2T+2	1	2
1	6	8
0		6

0L+1T+2	3	1
4	5	
1	5	3

Level 2 is the same as Level 1, except that up to four inside boxes are blank. Here are a few examples:

1L+1T+3	0	4
1		
3		

2L+1T+4	4	0
1		6
3		10

0L+1T+0	4	3
1	4	
2		3

Tobbs moves on to a randomly chosen box after each answer attempt, whether it is correct or not. Tobbs eventually returns to boxes previously answered incorrectly. By that time, a more complete grid has made them easier to solve.

In Level 3, up to four blank boxes can occur in each grid. The outside numbers can be any number from 0 to 9 and the coefficients are chosen at random by the computer from the range 0 - 5. Here are some Level 3 puzzles:

3L+1T+4	1	6
2	11	
4	17	

2L+3T+2	4	8
4		
5		

4L+3T+1	1	2
1		11
2		

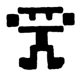
Level 4 puzzles use the same outside numbers (0 - 9) and coefficients as Level 3, but here for the first time, students have to work backwards because one of the outside numbers is missing. Here are some grids from Level 4:

3L+2T+2	4	2
	16	18
0	10	6

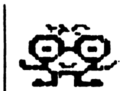
3L+3T+0	0	4
	12	21
2	6	18

4L+2T+2		1
0	10	4
1	14	8

Level 5's range of outside numbers is 0 to 9. The coefficients range from 0 to 5, and students often have to work backwards:

1L+4T+4		4
6		
1	29	

1L+2T+0		7
	8	14
7		

4L+4T+0	1	
	8	
	12	16

In Level 6, students meet situations where there may be many possible answers for each Tobbs box. For example, if the rule is 3L + 2T + 1,

3L+2T+1	1	
(0)	3	
(2)	9	

the left outside numbers are straightforward.

But that says nothing so far as the Tobbs box is concerned. The solution is that the Tobbs box can be any odd number from 1 to 93. Let's try 93.

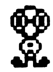
3L+2T+1	1	(46)
(0)	3	93
(2)	9	(99)

Why not 95? Here's what happens:

3L+2T+1	1	(47)
(0)	3	95
(2)	9	(101)

Oops. This answer is beyond the 0-99 limits.

And why must it be an odd number? Here's the original puzzle.

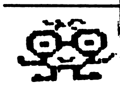
3L+2T+1	1	
	3	
	9	

Try 2 and see what happens.

3L+2T+1	1	(½)
(0)	3	2
(2)	9	

Oops. Only whole numbers are allowed.

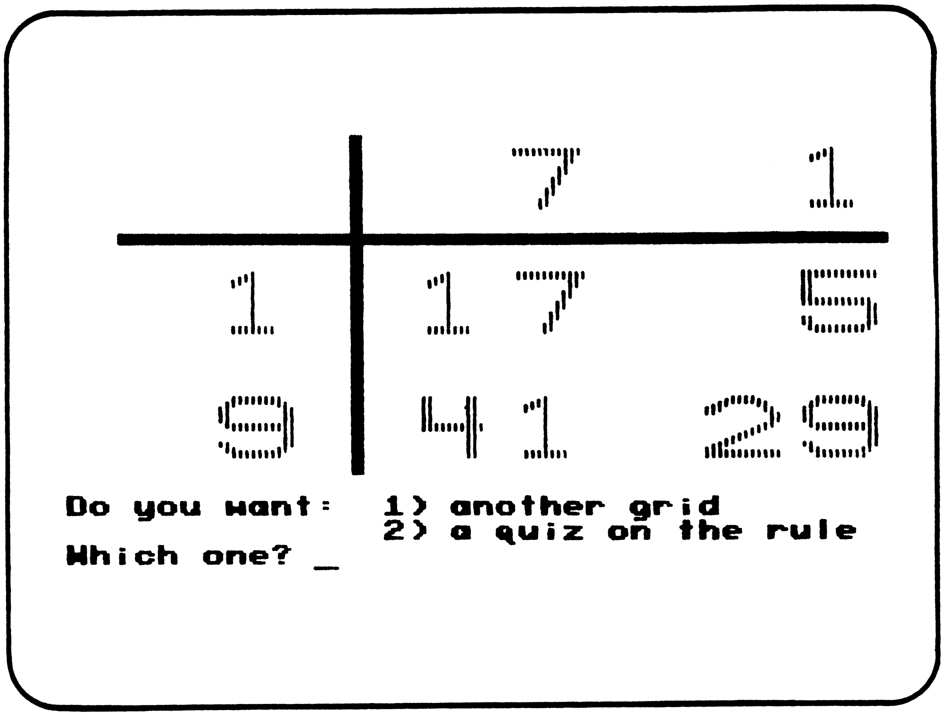
As you can see, Level 6 calls for some good thinking. Here are some Level 6 puzzles. Try them. Don't be afraid of a trial-and-success approach. And don't be afraid of asking colleagues to help out. Mathematics has long been thought of as "drill and practice" or as "What's the formula?" It's NOT. It's a construction of the mind. It's the creation of relationships. Knowledge is NOT a spectator sport!!!

3L+3T+3		
	24	39
	24	39

0L+2T+1		
7		
1	3	7

1L+3T+1	0	
	5	26
4		

DETECTIVE TOBBS



Skills:	Algebraic thinking Coordinating addition and multiplication Working backwards (algebraic reversability) Determining the entry point to a problem Determining algebraic products from data Problem solving Looking for relevant data Generating and testing hypotheses
Students Work With:	Addition Subtraction Multiplication Logic
Grade Level:	8 - adult
Reading Level:	4th grade (Fry)
Time Required:	5 - 10 minutes per puzzle

Background on Detective Tobbs

Players have just finished working with algebra puzzles such as

2L+T+3		2
0	4	
	6	

Now they work with precisely the same sort of puzzle, except that they're given the grid and they have to determine the rule used. Detective Tobbs is designed for individual or small team play, and has four levels of difficulty. In Levels 1 and 3, students can call for any number of grids before asking for a quiz on the applicable rule. (The quiz presents outside numbers; the player must apply the rule to determine the inside numbers.) In Levels 2 and 4, they will be given one fully-completed grid and then the quiz.

Here is a typical puzzle given in the latter situation:

	4	2
3	9	5
1	9	5

"Aha! The rule is 0L + 2T + 1.

	1	4
1		
3		

Can you complete the quiz?

Players who complete any box incorrectly can do one of three things:

- They can ask to try another blank box.
- They can ask to see another grid based upon the same rule.
- They can ask to see the rule.

In Level 1, students can ask for as many grids as they want. Rules of the following type are used:

$0L + 2T + 3$	$2L + T + 3$
$4L + 4T + 1$	$2L + 4T + 0$
$1L + 1T + 0$	$3L + 0T + 4$

In every case the coefficients range from 0 to 4 and in every case there is a term for L, for T, and for the constant. That is, rules of the following type could not occur:

$2L + 4L + T$	$3L + 4L + 4$

Level 2 is exactly the same as Level 1 except that students can only see one grid before being given the quiz.

In Level 3 there is still a term for L, one for T, and one for the constant, but the term for L could be L^2 and the term for T could be T^2. Thus, here are some possible rules for Level 3.

$2L + 3T + 4$	$4L + 4T + 1$
$L^2 + 3T + 4$	$4L + T^2 + 1$
$L^2 + T^2 + 4$	$L^2 + T^2 + 1$

Rules of the following type do not occur:

$L^2 + L^2 + 4$	$2L^2 + 3T + 1$
$2L^2 + 2T^2 + 0$	$L^2 + 2T^2 + 4$
$4L + T^2 + L'$	$T^2 + T^2 + 0$

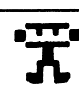
Suppose a student decides to challenge Detective Tobbs in Level 3. He or she is first presented with the following grid:

	4	2
0	18	10
4	34	26

The student calls for another grid and gets this:

	6	6
1	27	27
3	35	35

Through trial and error, or through more systematic thinking, the student decides that the rule may be $L^2 + 4T + 2$. He or she then requests a quiz:

	6	5
4		
3		

The student enters "32" in the Tobbs box. Tobbs shakes its head to the message, "Sorry, that is not correct. What would you like to do: 1) try another answer 2) see another grid 3) see the rule?"

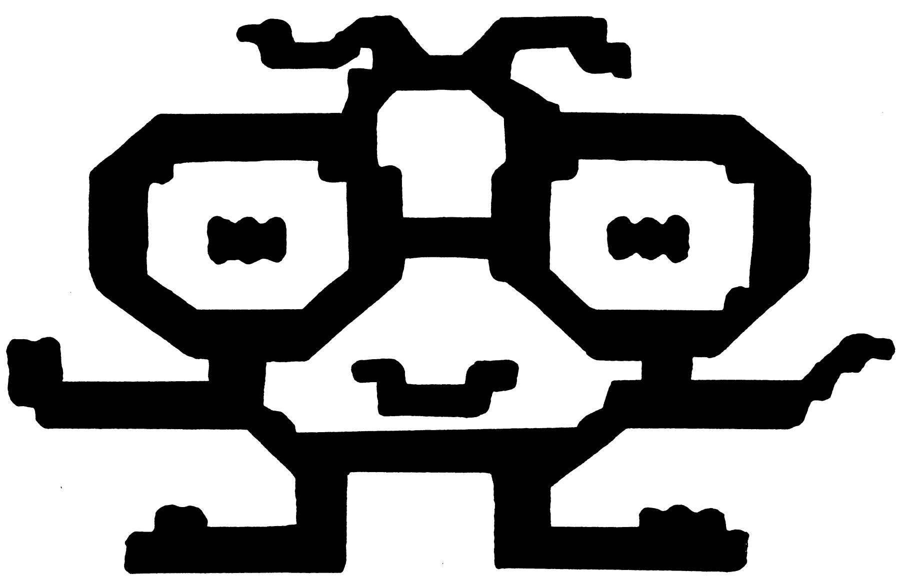
The student double-checks the arithmetic and realizes that he or she has doubled, rather than squared, the L value. The student requests another box:

	6	5
4		
3		

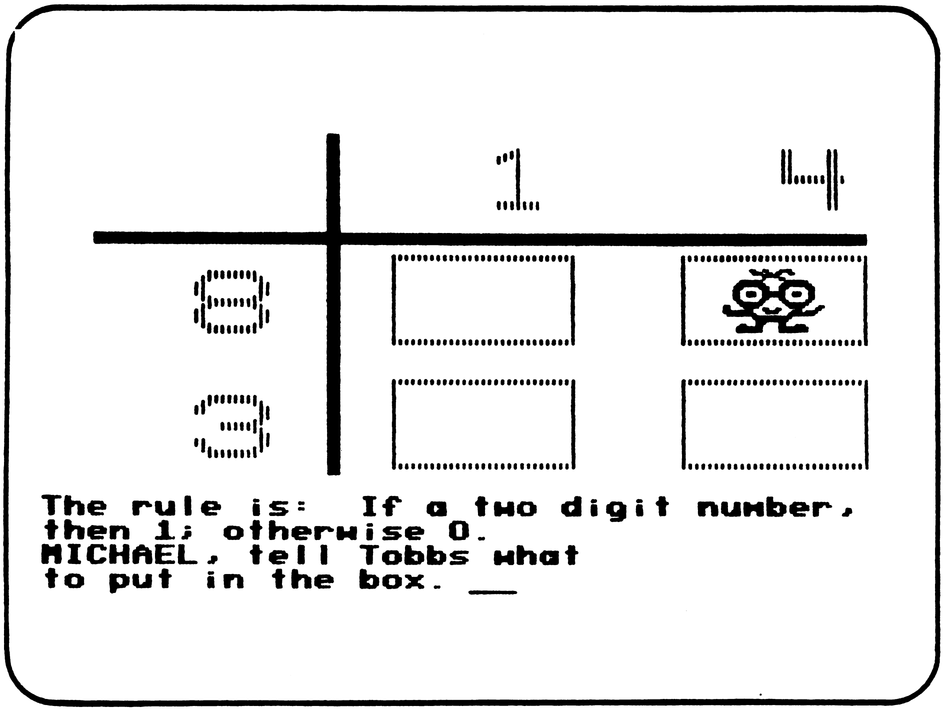
He or she then completes the grid:

	6	5
4	42	38
3	35	31

Level 4 presents the same types of rules, but with only one grid given before the quiz.



TOBBS GETS TOUGH



Skills:	Addition Multiplication Squares and square roots Determining place values Logic Problem solving Looking for relevant data Generating and testing hypotheses Divergent thinking
Student Work With:	Addition Multiplication Logic
Grade Level:	8 - adult
Reading Level:	5th grade (Fry)
Time Required:	10 - 15 minutes per puzzle

Background on Tobbs Gets Tough

In Tobbs Gets Tough, the wicket gets much more sticky. Tobbs presents a series of addition and multiplication grids, but with the inside numbers systematically altered according to rules that are completely different from those used in the program thus far. The rules used are not algebraic formulas as before, but are arbitrary arithmetic anomalies such as "Add the digits of the sum" or "Give the tens' digit minus the ones' digit." Students must determine the unusual rules, and then demonstrate their knowledge on subsequent grid quizzes.

Suppose a student requests a puzzle and gets this:

	4	3
7	2	1
1	5	4

What's going on? Suppose the student requests more grids and get these:

	3	4
1	4	5
5	8	9

	3	7
2	5	9
5	8	3

	4	6
7	2	4
8	3	5

"Aha," you might say, "It's addition and it's sum-of-the-digits." (Instead reporting 11 for 7 + 4 and 14 for 8 + 6, etc., 11 is reported as 2 (i.e. 1 + 1) and 14 as 5 (i.e. 1 + 4). You're right! Here's a new puzzle:

	3	4
1	30	40
5	51	2

	4	6
3	21	81
5	2	3

	1	8
4	40	23
7	70	65

This time it's multiplication, but the tens and ones digits in the products (the "answers") are switched around.

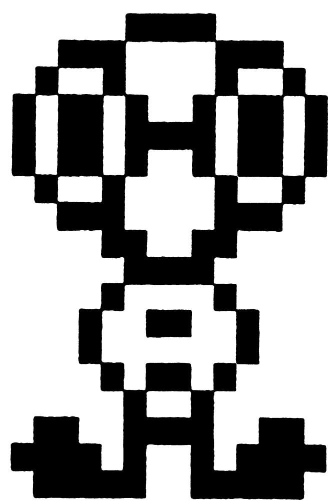
In Level 1 of Tobbs Gets Tough, a player may call for any number of grids before taking the quiz on the applicable rule. In Level 2, players are given only one fully completed grid prior to the quiz. Players who incorrectly complete a box on either level may

- o ask to try another answer,
- o ask to see another grid based upon the same rule
- o ask for help (gives the operation--if used twice on same box, gives the rule).

For teachers' and parents' use--and NOT to be passed along to the players-- here are the rules used in Tobbs Gets Tough:

Take the sum or product and

1) show only the one's digit.
2) show only the ten's digit.
3) show the sum of the digits.
4) show the product of the digits.
5) show the difference between the two digits, negatives ignored.
6) find the square root, throw away the decimal, square the results.
7) reverse the digits.
8) add a common random number.
9) halve the number, throw away any fractions.
10) find the square root, throw away decimals.
11) if even, then 0; if odd then 1.
12) divide by 5, throw away the fraction.
13) multiply the one's digit by 10.
14) show as is.
15) if a two-digit number, then 1; otherwise 0.
16) square the one's digit.
17) if the one's digit is greater then ten's digit, then 0; otherwise 1.
18) if a two-digit number, subtract the one's value from the number.



APPLE: WORKING WITH THE COMPUTER

1. Turn on the television or monitor.

2. Insert the diskette into the disk drive with the label facing up and on the right.

3. Close the door to the disk drive.

4. Turn on the Apple. (The on-off switch is on the back left side of the computer.)

5. You will see a red light on the disk drive turn on. If the disk drive light does not turn off in about 10 seconds, turn the Apple off and make sure your diskette is placed correctly in the disk drive.

6. SUNBURST will appear on the screen, followed by a menu. Select the program you want and press the RETURN key.

7. Follow directions given in the program.

8. If at any time during the program you want to stop, hold the Control button and press the E key.

TURNING OFF THE COMPUTER:

1. Remove the diskette from the disk drive and return it to its place of storage.

2. Turn off the Apple.

3. Turn off the television or monitor.

ATARI: WORKING WITH THE COMPUTER

1. Turn on the television or monitor.

2. The disk drive must be turned on before the computer. Turn on the disk drive using the switch on the front. Two lights will come on, the "PWR ON" light and the disk "BUSY" light. After about 10 seconds, the BUSY light should go. off.

3. Press the rectangular release button below the disk drive door and the door will open. Insert a diskette with the exposed oval "window" inserted first and the label side up.

4. Close the door on the disk drive.

5. Turn on the computer.

6. SUNBURST will appear on the screen, followed by a menu of program. Select the program you want and press the RETURN key.

7. Follow the instructions in the program.

8. If, at any time during the program, you want to stop, hold the Control button and press the E key.

TURNING OFF THE COMPUTER:

1. Remove the diskette.

2. Turn off the disk drive, television, and the Atari.

TRS-80: WORKING WITH THE COMPUTER (diskette)

1. Insert the diskette into the disk drive with the label facing up and on the right.

2. Close the door to the drive.

3. Turn on the computer.

4. You will see a red light on the disk drive light up. If the disk drive does not turn off in about 25 seconds, turn off the TRS-80 and make sure the diskette is placed correctly in the disk drive.

5. SUNBURST will appear on the screen, followed by a menu of program.

6. Select the program you want from the menu.

7. If, at any time during the program, you want to stop, hold the SHIFT key and the down-arrow key and press the E key.

TURNING OFF THE COMPUTER:

1. Remove the diskette from the disk drive and return it to its place of storage.

2. Turn off the TRS-80.

TRS-80: WORKING WITH THE COMPUTER (cassette)

1. Turn on the video display if it is separate from the computer.

2. Turn on the computer. If your TRS-80 has a disk drive, hold the BREAK key down while you turn on the computer. If you have a Model III TRS-80, type L and press ENTER when the computer asks "CASS?".

3. Choose the tape you wish to use.

4. Insert the tape in the tape recorder (the label of the program you want should be facing up).

5. Make sure the tape is rewound.

6. Press the PLAY button on the tape recorder.

7. Type CLOAD and press the ENTER key. (This starts the tape recorder.)

8. Two stars (**) will appear and blink on the top line of the screen. This indicates the program is loading.

   If you don't see two stars (one star should be blinking) in the upper right-hand corner in about 30 seconds--

   - reset the computer (see How to Reset the Computer);
   - check the volume control (it should be set between 6 and 8);
   - make sure all the plugs are in place, and
   - try again, starting at Step 4.

9. When READY appears on the screen, press REWIND. Return the tape to its box. The program is now loaded into the computer's memory.

10. Type RUN and press ENTER.

11. Follow instructions that appear on the screen.

RESETTING THE COMPUTER:

When you press the RESET button, it resets the computer without erasing the memory. With the Model I (separate keyboard and monitor), the RESET button is located at the left rear of the keyboard (inside of a small door).

The Model III is reset by the BREAK key (on the keyboard). When you reset the computer, the word READY will appear on the screen. You are now back in control and can run the program again. Type RUN and press ENTER, or load a new program from tape.

TURNING OFF THE COMPUTER:

1. Turn off the video display if it is separate from the computer.

2. Turn off the computer.

"WHAT HAPPENS IF...?" -- SUNBURST COURSEWARE AND WARRANTY

1. What happens if a program will not load or run?
   Call us on our toll-free number and we will send you a new tape or diskette.

2. What if I find an error in the program?
   We have thoroughly tested the programs that SUNBURST carries so we hope this does not happen. But if you find an error, please note what you did before the error occurred. Also, if a message appears on the screen, please write the message down. Then fill out the evaluation form or call us with the information. We will correct the error and send you a new tape or diskette.

3. What happens if the courseware is accidentally destroyed?
   SUNBURST has a lifetime guarantee on its courseware. Send us the product that was damaged and we will send you a new one.

4. How do I stop the program in the middle to go on to something new?
   These programs can be ended at any time by holding the Control button and pressing the E key. (On the TRS-80, hold the SHIFT key and the down-arrow key and press the E key.) To change diskettes, select the End option on the menu and insert a new diskette.

5. Can I copy this diskette?
   The material on the diskette or cassette is copyrighted. You should not copy the courseware.