THINK a DOT

INSTRUCTIONS



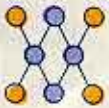
E.S.R.

Start by tilting it on its side . . . then stand it up . . . *Now,* drop a marble in any of the 3 holes on top . . . Try to make all the spots BLUE . . . or YELLOW . . . by dropping the marble in the holes on the TOP over and over . . . That's the FIRST game you can play with THINK-A-DOT. There are lots more . . .

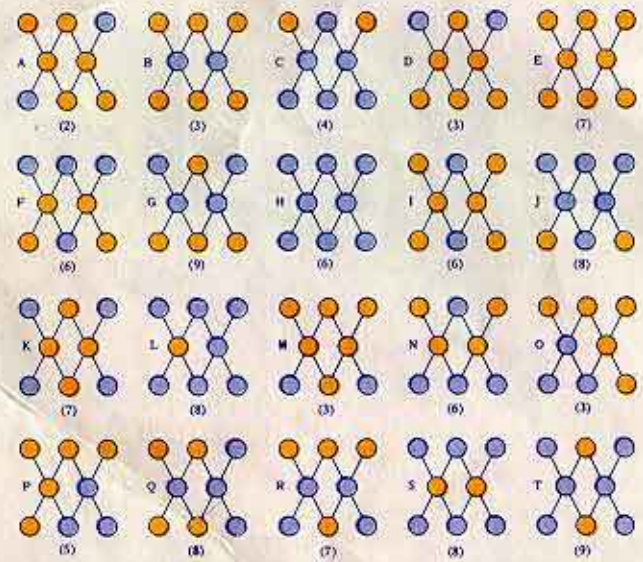
OTHER GAMES YOU CAN PLAY WITH THINK-A-DOT

To Play Alone

Start by tilting THINK-A-DOT to the RIGHT so that the pattern looks like this:



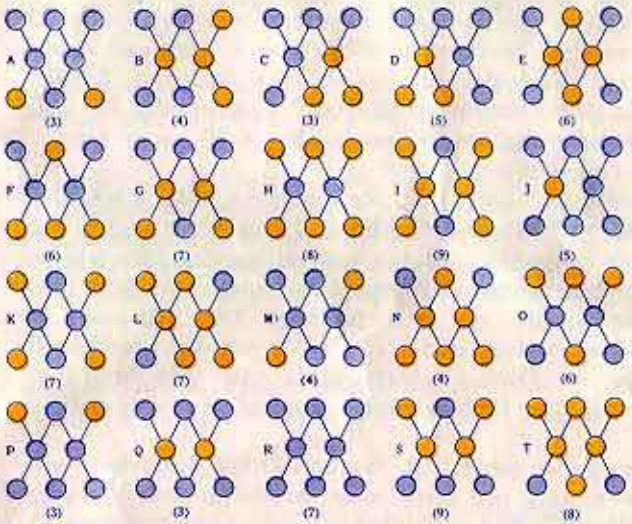
Then try to get any of the patterns below in the number of moves indicated below each pattern.



Next, start by tilting THINK-A-DOT to the LEFT so that the pattern looks like this:



Then try to get any of the patterns below in the number of moves indicated.

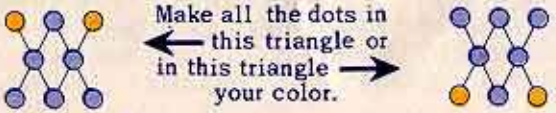


Try to predict the new dot pattern that will occur with each drop of the marble. This will help your play.

To Play Against A Friend

As a game, two players try to outguess THINK-A-DOT and each other.

Each player first chooses one of the two dot colors as his own. Then they choose a dot pattern as the winning pattern. Two of these might be:



Or choose any of the patterns given so far or any others you may want.

Then set THINK-A-DOT to a starting pattern by

either tilting it to one side or the other or shaking it to get a random starting pattern. Choose who goes first. The second player chooses a side (left or right) of THINK-A-DOT.

The first player may continue his turn of dropping the marble as long as the marble comes out his chosen side.

The other player starts as soon as the marble comes out his side. Then he continues as long as the marble comes out his side.

And so on until one of the players gets the chosen winning pattern all in his color.

The following discussions are intended for those interested in the Computer Aspects of THINK-A-DOT.

THINK-A-DOT AND COMPUTERS

A computer is a tool for working with information. Usually the information takes the form of numbers and words. The computer can memorize information given to it by people. It can then perform various calculations on this information. Results of these calculations can also be remembered by the computer. A person can find out what is in the computer's memory when needed.

Electronic computers are used today to predict weather and elections, control space shots, and calculate paychecks. These computers can remember large amounts of information (all the records for thousands of employees). They can also operate at very high speeds (calculate and print each employee's paycheck in a fraction of a second). While these large machines are very complicated, the basic ideas used in them are not. Very simple, slow, mechanical computers can be built using the same ideas. These small computers, while not as useful as their larger cousins, are sometimes more fun. THINK-A-DOT *IS* ONE OF THESE SMALL COMPUTERS. While intended as a game it also

illustrates many of the basic ideas used in larger machines.

By tilting THINK-A-DOT to the left or right you can put one of two different information (or color) patterns into its memory. Note that when you return THINK-A-DOT to its upright position it retains or "remembers" the pattern you set into it when you tilted it. You can then cause THINK-A-DOT to perform calculations on the memorized information by dropping a marble in at the top. The newly calculated color pattern then replaces the original pattern in THINK-A-DOT's memory. You can observe the information (color pattern) in THINK-A-DOT's memory by means of the eight windows provided.

The memory of a large computer might comprise millions of individual memory cells. Each cell however, could remember only one of two things. For this reason, they are called binary cells. THINK-A-DOT contains eight binary memory cells, each of which remembers either of its two colors. Another name for these cells is Flip-Flop.

Much of the ability of a large computer comes from using parts which perform "logical" operations. You can easily demonstrate "logical" operations with THINK-A-DOT. Drop the marble into the middle hole. The bottom right-hand dot will change color only when the top-middle AND the middle-right hand dots are both yellow. This is called a "logical" operation. See if you can discover others in THINK-A-DOT.

THINK-A-DOT can also count in a manner similar to large computers. Remember the colors of the top-right, middle-right, and bottom-middle dots. Now drop the marble into the right-hand hole eight times. The eighth time all three dots will return to their original colors! This shows that THINK-A-DOT can count and remember that you dropped the marble through the same hole eight times in a row.

THINK-A-DOT OPERATION

For those interested in learning how to program THINK-A-DOT the following discussion may be helpful.

1. Each time a marble hits a flip-flop it changes its color (State). Hence, these are complementary flip-flops.

2. Since the middle and lower flip-flops change color no matter which direction the marble comes from, we can say that they are connected by "OR" gates. That is to say, a marble coming in from the right OR the left hand path will change (complement) the flip-flop.

3. The direction the marble goes upon leaving a flip-flop depends upon its previous color state. For example, when the center top flip-flop is YELLOW the marble will take the right hand path and move to complement the right hand flip-flop of the center pair. On the other hand, if the top center flip-flop is the BLUE state the marble will move to the left hand path and complement the left hand flip-flop of the center pair. And so on.

   NOTE: Not all flip-flops have this same direction routing, of the marble. You will have to experiment with each flip-flop to discover all of the conditions.

4. Finally, the side on which the marble comes out depends on the color (state) of the flip-flop it complements in the bottom row of three flip-flops. For example, if the center bottom flip-flop is yellow the marble will come out of the right hand side, if it hits that center flip-flop. And so on . . . You will have to experiment to find the complete set of conditions.

Now, if you have written down all of the above conditions, you can draw a FLOW CHART or diagram for your THINK-A-DOT from which you can program or predict each move. Each flip-flop acts as an information storage element, as well as a logical control element. The marble acts just as an electric current flowing between these elements through OR gates, just as it might in a real electronic computer!

Answers to the THINK-A-DOT problems on Page 2. (Don't look at these unless you really have to.)

Answers to Page 2 – R-Right, L-Left, M-Middle:

A (RM), B (MLL), C (MMM), D (LMR),
E (MMMMRR), F (MMRRRL), G (MMRRRRLMR),
H (MMRLLL), I (MLLLLM), J J (RRRLLLLL),
K (MMMMRL), L (MLLLLRML), M (RRM),
N (MMRRRR), O (MMM), P (MMMMM), Q (MMMRLLLL),
R (MLLMMMM), S (RRRRRLLL), T (MMMRLLLLL).

Answers on Page 3:

A (LLM), B (MRRR), C (MMM), D (MMMMM),
E (RMRLML), F (MMLLLL), G (MRRMMMM),
H (LLLLLRRR), I (MMMLRRRRR), J (MRRRR),
K (MMMMMLR), L (LLLRRRR), M (LLMR),
N (MMMM), O (MMLLLR), P (LMR), Q (MRR),
R (MMMMMLL), S (MMLLLLRML), T (LLLRRRRR).

If you have further interest in computers, may we suggest that you purchase a DIGI-COMP I with its new, updated Instruction Manual. DIGI-COMP I is a complete mechanical equivalent of a binary digital computer, designed to allow you to view and understand the logical operations of a computer. E.S.R., Inc. has designed DIGI-COMP I especially for you, whether you are 10 years old or 80 years young.

Another E.S.R., Inc. computer is THE AMAZING DR. NIM. Whether you be 5, 15, or 50, it will afford you many hours of fun and relaxation. DR. NIM is another mechanical binary computer. DR. NIM is a wizard; DR. NIM is a challenge; DR. NIM plays an almost perfect game . . . BUT you can beat him if you try. There are ways. Made with only three flip-flops, DR. NIM is almost magical in its operation.

Watch for the E.S.R. trademark!!! E.S.R., Inc. will be turning out many more wonderful toys for your future pleasure.

Sincerely yours,
E.S.R., Inc.
34 Label Street
Montclair, New Jersey 07042