electronic maze

The problem in most mazes is simply to find the way out, with no account being taken of the number of false steps made. Part of the novelty of this electronic labryrinth is that it counts the number of incorrect steps made. The maximum number of errors permitted can be preset to 10, 20, 40 or even 80. If the hapless victim has failed to find his way out of the maze before reaching the preset limit, an audio tone sounds to indicate that he has lost. The number of steps taken to escape from the labyrinth is indicated on a digital display so that successful contenders can compare their scores, the one with the lowest score obviously winning.

The maze itself consists of a matrix of drawing pins or furniture tacks on the playing board. All pins that lie along the correct path are linked and connected to positive supply, whilst other pins are grounded. The path through the maze is traced using a probe wired to the input of the error counter. So long as the correct path is followed the counter input will remain high, but whenever a false step is taken the counter input will receive a low-going pulse and will advance.

Whether they are formed by garden hedges or walls, galleries of mirrors or simply lines on paper, mazes have always proven a popular pastime for all ages. The 'electronic maze' described in this article provides an extra 'twist' to the problem of finding the correct path through the maze.

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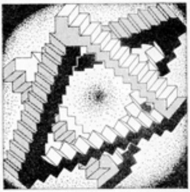
Complete circuit

The major part of the maze circuit consists of a two decade counter, which is shown in figure 1. The probe, which can be a 'banana' plug or may be made from an old ballpoint pen, is connected to the input of Schmitt trigger N2. So long as the probe input is high or floating (not grounded) the input of N2 will remain high. If the probe is grounded the input of N2 will be pulled low. The output of N1 will then go low, clocking the counter IC4. The filter network R4/C2 connected at the input of N2 helps suppress noise generated by 'contact bounce' between the probe and the drawing pins. This bounce could cause the counter to advance several counts for only one wrong step.

When the counter reaches a predetermined number, selected by S1, the appropriate output of the second decade counter (IC3) will go high. The oscillator constructed around N4 will then produce an audio tone to indicate that the contestant has lost. This tone is amplified to loudspeaker level by T1 and T2. The volume can be adjusted by changing the value of resistor R3. The counter is reset to zero at the start of the game by a pushbutton switch, S2.

Two 7447 BCD-to-seven-segment decoders (IC1 and IC2) drive the seven-segment displays which indicate the number of errors made.



Multiple exits

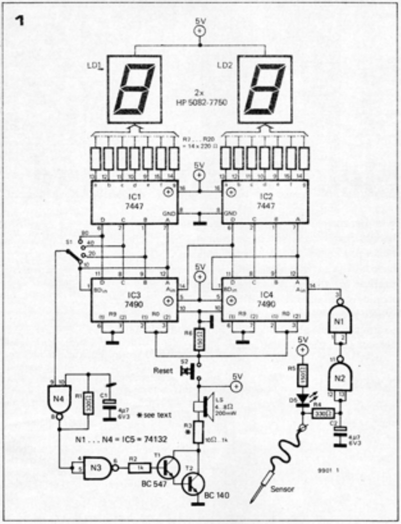
A maze with only a single path would quickly lose its entertainment value. This can be avoided by providing multiple exits from the maze. To achieve this, several paths are provided to exit points around the periphery of the maze. However, these are not permanently wired to positive supply, but each path is linked to positive supply only when it is in use, and all other paths are grounded. Light-emitting diodes mounted around the edge of the playing board indicate which exit is being aimed for.

The switching circuit used to select the paths of a four-exit maze is shown in figure 2. When exit D1 is selected, for example, then output D1 of the switching circuit is high. All points in the path leading to exit D1 only are linked to output D1. Provision is also made for connecting points that are common to two paths. For example, output A is high when output D1 is high and when output D4 is high (see table 1). Any points common to both these paths should be linked to output A. Output B performs a similar function for outputs D2 and D3. It is important that any points common to two paths should be linked to A or B and not back to any of the D outputs, as this would mean that one of the outputs would be trying to pull these points low while the other was trying to pull them high.

Provision is not made for connecting points that are common to three or more paths. Such points should be avoided when drawing the maze, but if any such points are unavoidable they should be treated as 'dead' points and left floating.

Constructing the maze

The construction of a 14 x 14 point maze is illustrated in figure 3. To con-



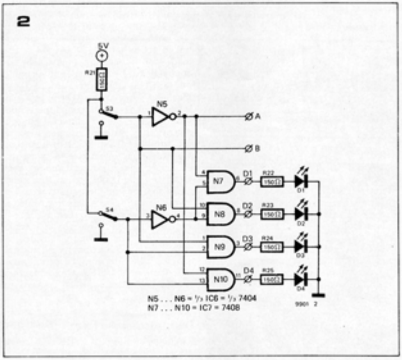


Figure 1. Circuit of the counter and audible warning oscillator, which forms the major part of the maze electronics.

Figure 2. This gating circuit provides four different exits from the maze by taking the required path high and all other paths low.

Figure 3. A typical layout for a 14 x 14 maze, with the four exits at the corners.

Figure 4. Mains power supply for the maze circuit.

Table 1. This table illustrates the four possible combinations of S3 and S4, and the state of the outputs that define which path through the maze is active.

struct the maze a sheet of squared (e.g. graph) paper is glued to a playing board made of suitable material such as strong card (Bristol board) or thin plywood. Drawing pins or furniture tacks are then pushed through the paper and the baseboard to form a matrix. It is important that the spacing between the heads of the tacks should be such that it is not possible to move the probe from one to the next without breaking contact.
On the underside of the board all tacks which form part of a path through the maze should be linked together and connected to the appropriate points (D1 to

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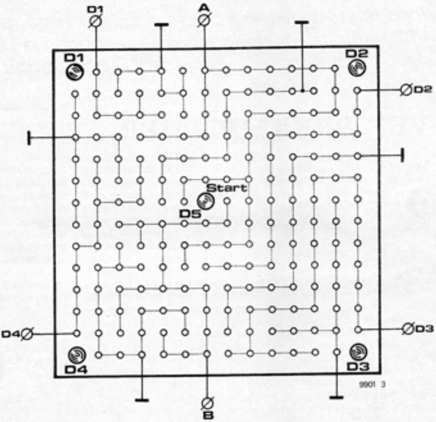

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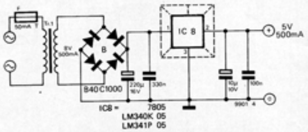

Table 1.

S3	S4	D1	D2	D3	D4	A	B
0	0	1	0	0	0	1	0
1	0	0	1	0	0	0	1
1	1	0	0	1	0	0	1
0	1	0	0	0	1	1	0

D4, A or B). Points not forming part of any path are permanent blind alleys and should be connected to ground.

How to play the game

A maze usually is nothing more than a complicated pattern of lines drawn on paper, and there is normally only one correct way through the maze with a large number of blind alleys leading off from the main path.
However, if 'walls' are drawn for this electronic maze it becomes a fairly simple task to find the proper way out. The game becomes much more interesting (or frustrating) if no lines are drawn, so that the path must be found in true ' hit or miss ' fashion by the player. LED D5 indicates each false step, and the player must remember each step taken – otherwise the ' wrong step counter ' will quickly reach the maximum permitted setting!
An alternative possibility is to construct a truly complicated maze, including lengthy and involved blind alleys, and draw in the walls alongside the rows and columns of the matrix. In this case the ' wrong step indicator ' D5 and displays LD1 and LD2 should obviously not be visible to the player, as he would then be aware that he was wandering off the correct path.

Power supply

A suitable power supply circuit for the maze is given in figure 4. Care should be taken to ensure the electrical safety of the circuit, especially if it is to be used by children. All mains wiring should be extremely well insulated from the low-voltage circuits. ◾