Go "Selectalott" — you're mad if you don't

Ever dreamed of winning a million dollars? Who hasn't? Well, you could win it playing Lotto, and our "Selectalott" could help. Without bias, without superstition, it will select random numbers far better than you can yourself. "Go 'Selectalott' — you're mad if you don't!"

by RON DE JONG

Perhaps we should point out that Lotto is played only in NSW, with a similar game called Tatslotto in Victoria. For the benefit of readers in other states, Lotto is a betting game in which one enters coupons containing a number of "games". Each game consists of 40 squares, numbered 1 to 40, and in a standard game the player fills in six squares of their own choice. If those numbers come up in the weekly draw, the player can win a lot of money!

With first prizes ranging up to one million dollars (or more) it is not surprising that Lotto is popular. And, cashing in on this popularity, there have now appeared devices called Lotto selectors; gadgets designed to take the strain and hassle out of deciding which numbers to pick for each game.

They are quite elementary mechanical devices, but have proved extremely popular. One typical version consists of a plastic case in which there are two channels, each numbered non-sequentially with 20 positions. Adjacent to the channels is a clear area in which are parked 40 small ball bearings, 34 silver and six black. The whole assembly is housed under a clear plastic lid.

By tilting the package the ball bearings are allowed to run into the two channels and the numbers opposite the black balls are those selected for the coupon.

What is the motivation to use one of these devices rather than make one's own selection of numbers? In fact, there appear to be several reasons for their popularity. One is the purely psychological reaction whereby the individual feels incapable of making a completely random selection of numbers or a selection which, according to signs, portents, superstition etc, has a better than average chance of success.

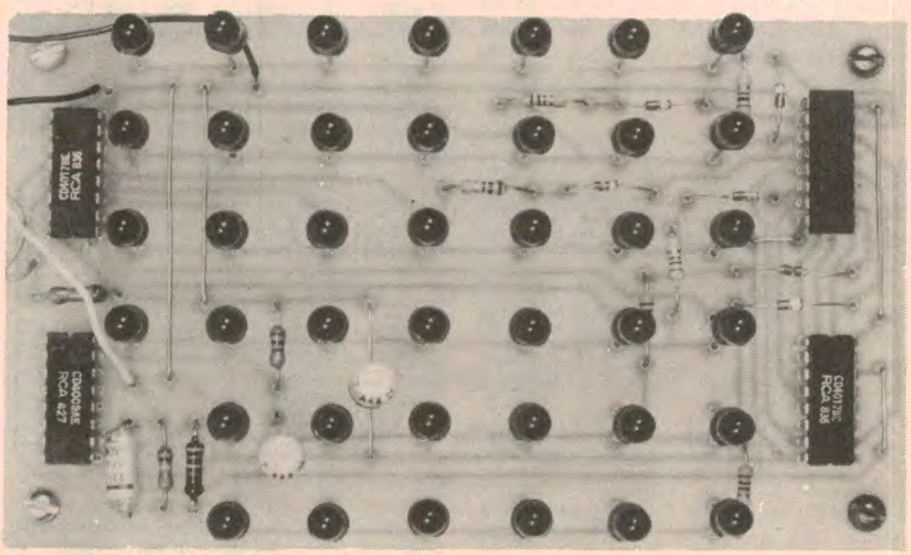
They may also act as a psychological face-saver whereby, when one's selection doesn't win – particularly if it fails by only one number – all the guilt and blame can be laid on the device, rather than one's own ineptitude. It may also help to prevent domestic arguments, when one party has a preference for certain numbers not shared by the other.

At a more serious level it has been suggested that the human brain is, in fact, a very poor random number generator. The mere fact that we stop to think before we select a number means that our choice is being biased in some way. Some people would not select number 13 in any circumstances; others would be biased against consecutive numbers, low value numbers, or numbers which have already won prizes.

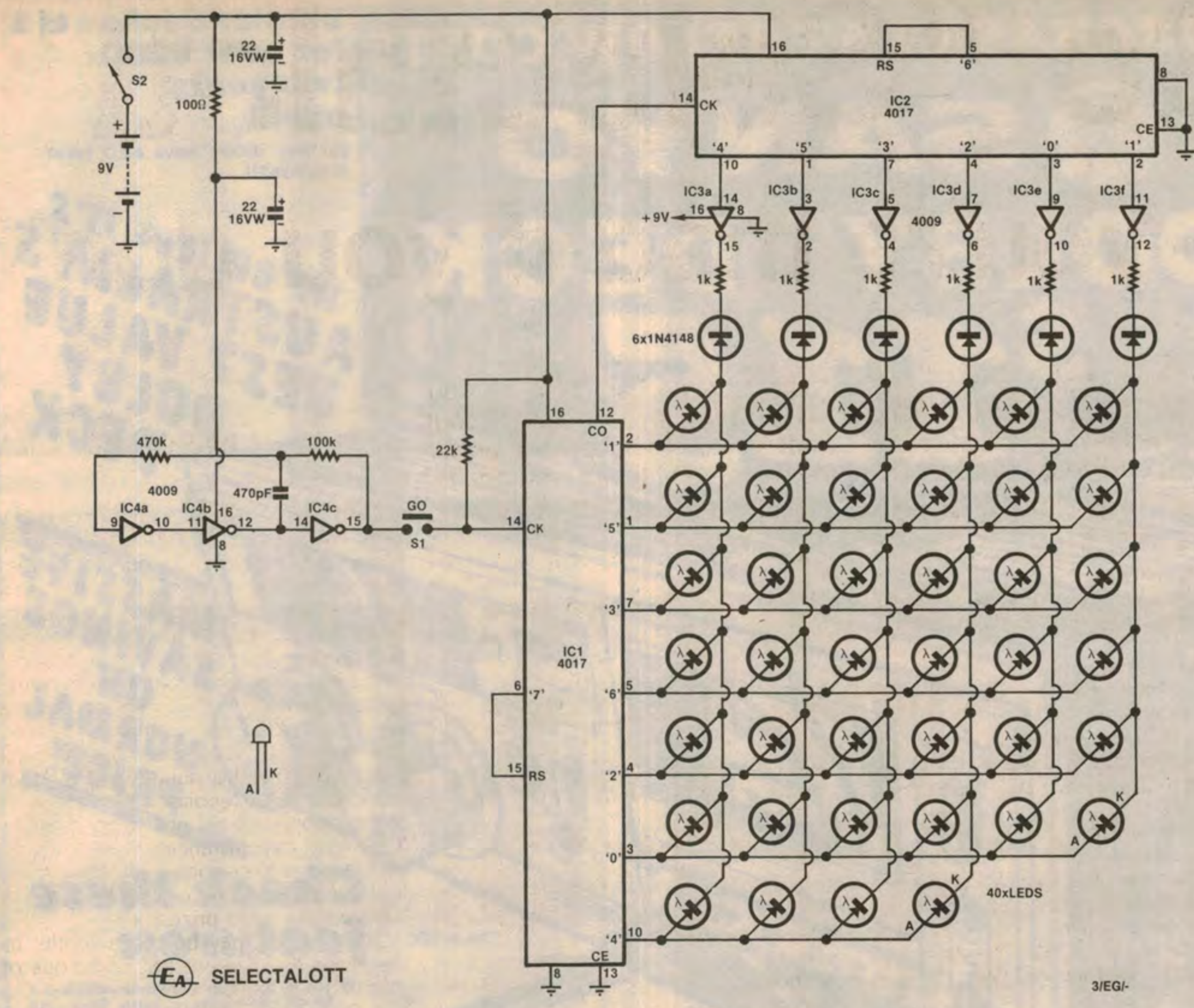
Other biases may be more subtle, to the point that we are not conscious of them, but they exist nevertheless. On this basis an inanimate, non-thinking device becomes a much better random number generator, even though it may still be far from perfect.

In short, there is plenty of justification for a number selector, the only question being what form it should take. While the simple mechanical device we have described will undoubtedly satisfy the

Selecting Lotto numbers is easy – just switch on and press the GO button.



Make sure that all polarised components are inserted the right way round.



The circuit consists of two 4017 decoded decade counter ICs driving a 40-led matrix arrangement.

average player we cannot visualise any full blooded electronics enthusiast – in short, anyone reading this article – being satisfied with anything so elementary.

Not when, for a mere $20 or so, and a couple of pleasant hours on the bench, he can have a genuine electronic version using the latest space age technology!

In terms of behaviour, our selector may be best described as a 40 sided die, or perhaps more accurately, a 42 sided die with two blanks. The reasons for this qualification will become more evident as the circuit is examined, but it means that there will be odd times when no number comes up and the "throw" is simply ignored.

Another die-like characteristic is that it can produce the same number consecutively, or during the six throws needed to complete a game. Naturally, such a throw is simply ignored.

And while considering the die analogy, it is worth pointing out that it could be used as a simple gambling game in its own right, such as a simplified version of roulette.

The photograph gives a good idea of the physical form of the selector. It has a large easy to read display consisting of 40 LEDs arranged exactly as on a Lotto coupon. Apart from the on/off switch the only control is the "GO" button. When this is pressed and released one of the LEDs will turn on and this number is crossed off the corresponding square on the coupon.

While it would have been nice to have all six numbers come up on the display simultaneously, this would have made the circuit excessively complex. As it is the circuit is quite simple, as is evident from the diagram. It uses just four standard CMOS ICs; two 4009, and two 4017.

The two 4017 ICs form the heart of the circuit. These devices are decoded decade counters which have 10 outputs labelled "0" to "9". Only one of these outputs is high at a time and they turn on in sequence as the counter is clocked; from "0" to "9" then back to "0" and so on. They also have a reset input which can be used to set the counter back to zero at any point in the sequence.

We have used these counters to scan the display leds, which are arranged in a matrix of six columns, and seven rows (or six and two third rows, to be exact!). The rows are connected to IC1, and the columns are connected to IC2 via a 4009 hex inverter.

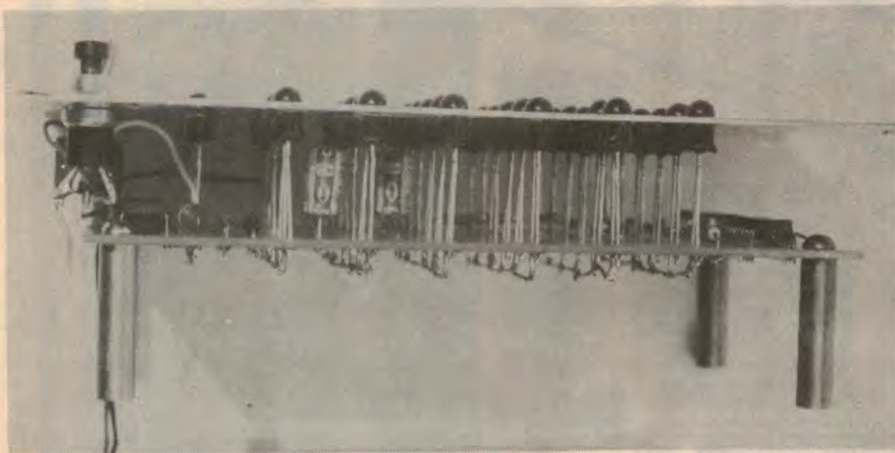
Thus the rows are scanned by IC1, making each row high in turn. At the same time IC2, via the inverter, makes each column low in turn. Since each LED is connected between a row and a column, it will light when its particular row goes high and its column goes low.

The reason for the two blank positions on the die should now be evident. The matrix of six columns of seven rows commits the system to 42 combinations. Since we require only 40, the last two are simply not provided for in the display. But it will sometimes select one

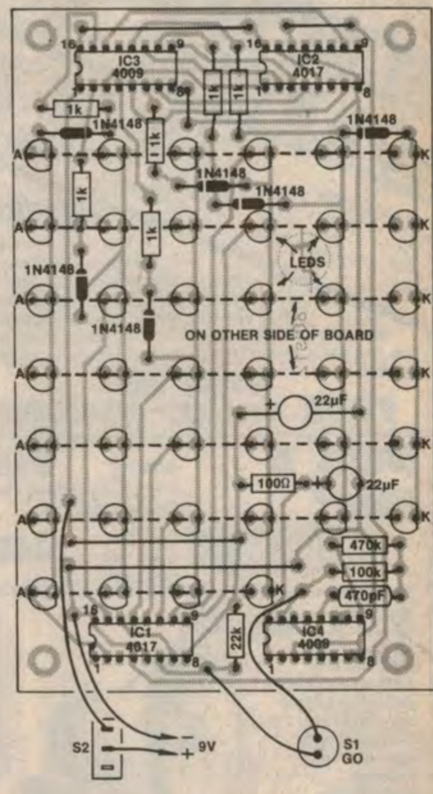
We estimate that the current cost of parts for this project is about

$20

including sales tax.



This side-on view shows the completed board and front panel assembly. Note the wire links connecting the led anode rows on the underside of the PC board.



The wiring diagram for the PC board. Take the usual precautions when soldering the CMOS ICs and don't forget the small wire link near IC3.

of these two positions, and give no readout.

The clock pulses for IC1 come from a simple oscillator circuit via the "GO" button and the clock pulses for IC2 come from the output of IC1. When the "GO" button is pressed, IC1 begins counting and its outputs turn on in sequence, causing the LEDs in that column to turn on sequentially. After one column has been scanned the carry output (pin 12) goes high, clocking IC2 so the next column is scanned, and so on until the entire array has been scanned. This occurs much too quickly to be seen but, when the button is released, a random LED will remain on; voila!

As already explained, both these counters count from "0" to "9", which is more than we need. We want IC1 to count from "0" to "6" (rows "1" to "7") and IC2 to count from "0" to "5" (columns "1" to "6"). This is arranged by connecting the next decoded output of each counter to its reset (pin 15) so that, for example, when output "7" of IC1 is reached the counter restarts at "0",

Note that this is usually a bad method of resetting a counter because shortly after the reset signal goes high the counter resets and the reset signal disappears which means that the length of the reset pulse is only as long as the internal reset propagation delay of the counter. In this non-critical application however it is acceptable, but we have taken one precaution. Because IC1 is used to clock IC2 we connected the IC2 clock to the IC1 "carry-out," rather than the reset. The reset pulse may be too short to reliably clock IC2 but the carry-out signal is quite well defined.

Some other features of this matrixing arrangement are the diodes and 1kΩ resistors in series with each column output from the inverters, IC3. The resistors provide current limiting while the diodes have been incorporated so that, when an inverter output is high, none of the LEDs will be reverse biased. If they were they would conduct because the reverse breakdown voltage of a LED is a low 3V. The diodes would not be damaged because of the current limiting resistors, but the increased current drain is undesirable.

The CMOS oscillator circuit is a standard three gate design. The 100kΩ and 470pF capacitor determine the operating frequency which, in our case, is about 5kHz. The 470kΩ resistor provides feedback and isolates the charging waveform from the input protection diodes of IC4a. To reduce the chances of biasing the otherwise random nature of the circuit the power supply to the oscillator is decoupled by a 100Ω resistor and 22µF capacitor.

The unit is powered from a single 9V battery such as the Eveready No. 216. Current drain is about 10ma, which should give a life of about 30 hours — a lot of Lotto games.

Construction of the unit is straight forward. All the components except the front panel switches are mounted on a single printed board coded 80ls12 and measuring 79 × 131mm. The actual size artwork is shown elsewhere in this article for those who wish to make their own boards, but finished boards should be available from the usual retailers.

Mount the components on the board according to the component overlay shown in this article. Take care to see that the electrolytics and diodes are correctly orientated and, when installing the CMOS ICs, take the usual precautions against static electricity, viz avoid handling the pins, use an earthed soldering iron and solder the two supply pins first (pins 8 and 16) so as to enable the input protection diodes.

We have used an unusual connection method for the LEDs. Because they are

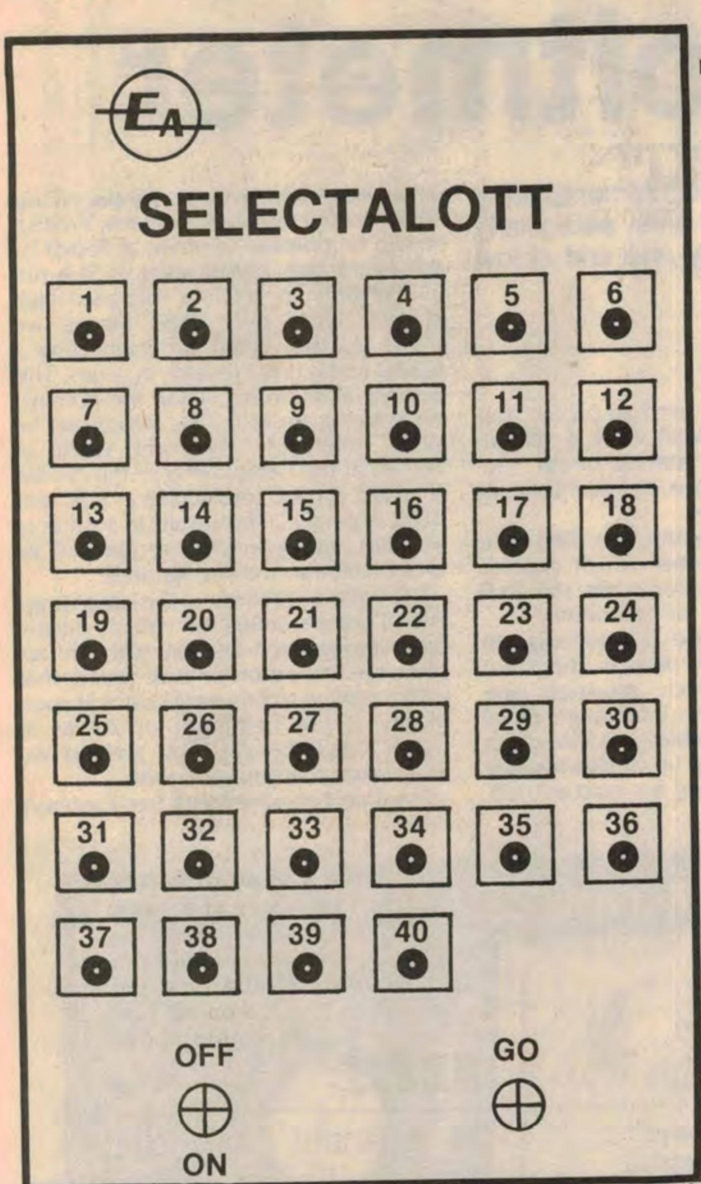
PARTS LIST

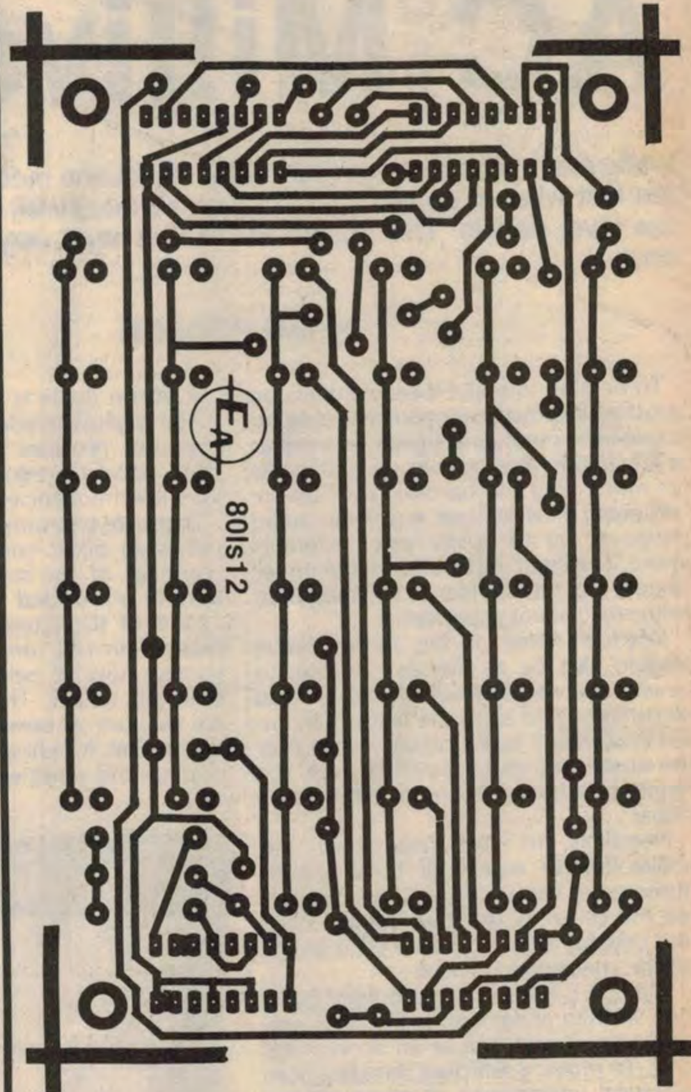
1 zippy box, 159 × 95 × 50mm (D × H × W)
1 PC board, 79 × 131mm, coded 80ls12
1 SPST miniature toggle switch
1 momentary contact push switch
1 9V battery, Eveready No. 216 or similar
1 battery clip to suit above
4 25mm tapped spacers
1 Scotchcal front panel

SEMICONDUCTORS
2 4017B CMOS decoded decade counters
2 4009 CMOS hex inverting buffers
6 1N4148 small signal diodes
40 large red LEDs

CAPACITORS
2 22µF/16VW PC electrolytics
1 470pF ceramic or polystyrene

RESISTORS (all ¼W 5%):
1 × 470kΩ, 1 × 100kΩ, 1 × 22kΩ, 6 × 1kΩ, 1 × 100Ω





At left is an actual size artwork for the Selectalott front panel while above is the printed circuit board pattern.

matrixed it would normally require a large number of links or a double sided board to connect them. We have compromised by providing the column connections on the board and making the row connections to runs of tinned copper wire beneath the board. This proved to be a safe and rapid way of doing things.

The method of mounting the LEDs is worthy of some comment. The anode lead is identified by being slightly longer than the cathode and this difference fits in well with the wiring arrangement already mentioned. When the cathode lead is soldered directly to the copper pattern, without trimming, the bottom of the LED should be about 15mm above the board. At the same time, the longer anode lead should protrude about 5mm beyond the copper side of the board, giving sufficient clearance for the runs of tinned copper wire used to connect them.

We recommend that only a few LEDs be soldered in place initially, the board, front panel, and case then being assembled to check that the dimensions are right and that everything fits. If not, make the necessary adjustments before fitting the remaining LEDs.

Drill holes for LEDs and switches on the front panel next. The actual size artwork for the front panel can be used as a guide for drill centres. A Scotchal front panel can be prepared from this artwork if photographic equipment is available. Alternatively finished front panels can be obtained from Rod Irving Electronics, PO Box 135 Northcote, Vic 3070 or Radio Despatch Service, 869 George St, Sydney 2000.

If you do use the Scotchcal front panel then drilling holes for the front panel LEDs is quite a delicate procedure so we recommend the following tips; drill the holes using a small drill then ream them to the desired size, being sure to ream from the front rather than the back of the panel, to avoid lifting the Scotchcal.

You should now be in a position to fire the unit up. One point to check is that when the "GO" button is pressed all of the LEDs appear to glow weakly but all at about the same level. This is due to the multiplexing effect as all the LEDs are scanned, and it provides a quick indication that the LEDs and associated connections are working.

And that is about as far as we can go towards helping you win that million dollars. But who knows, it might just happen. Naturally, if it does, we would appreciate any small token of appreciation you may care to offer.

Good luck!