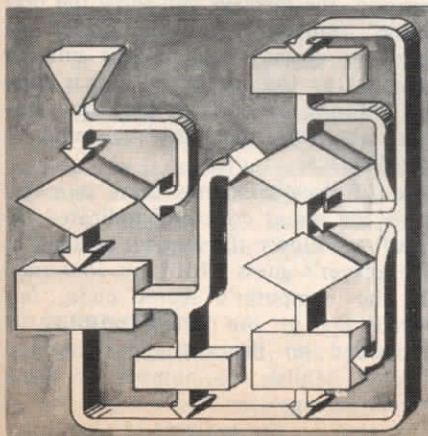


# SC/MP 'Mastermind'™ programme

Pit your wits against the computer with the aid of the following 'Mastermind'™ programme, which is designed to run on the Elektor SC/MP system.

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Figure 1. This flow-diagram should help to clarify the operation of the 'compare' routine.



1

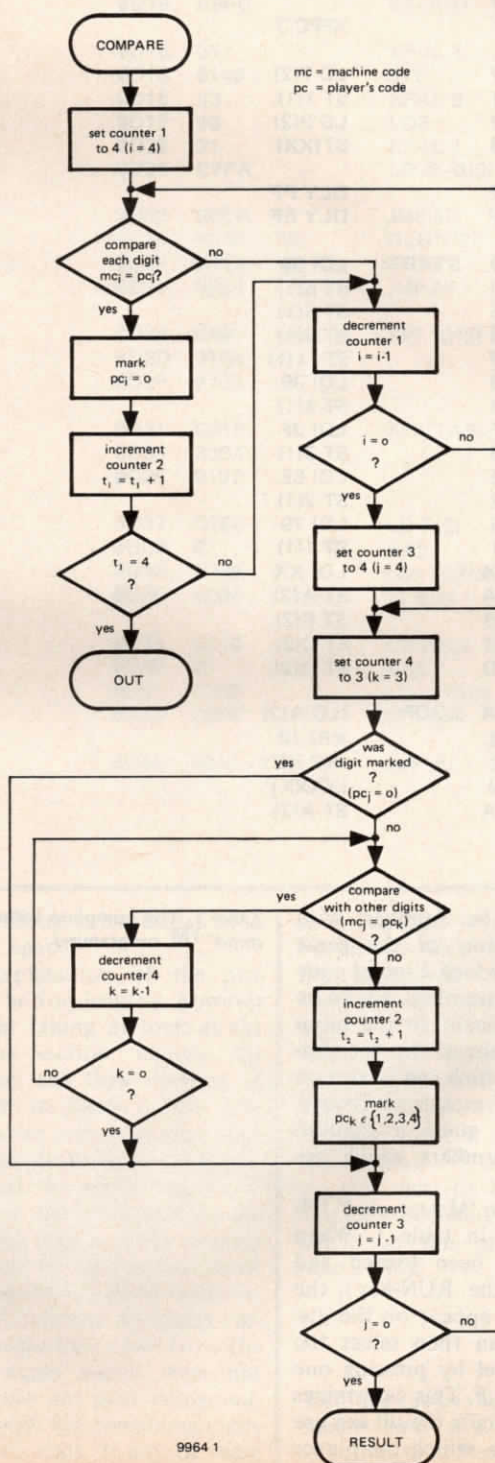




Table 1

0C00	C46D	ENTER:	LDI 6D	0C5D	AA0B	ILD B(2)
0C02	C906		ST 6(1)	0C5F	E410	XRI 10
0C04	C479		LDI 79	0C61	9C18	JNZ KEY
0C06	C905		ST 5(1)	0C63	C0E6	LD(XX)
0C08	C478		LDI 78	0C65	CA0B	ST B(2)
0C0A	C904		ST 4(1)			
0C0C	C400		LDI 00	0C67	AA0C	ILD C(2)
0C0E	C903		ST 3(1)	0C69	E410	XRI 10
0C10	C902		ST 2(1)	0C6B	9C0E	JNZ KEY
0C12	C901		ST 1(1)	0C6D	C0DC	LD(XX)
0C14	C440		LDI 40	0C6F	CA0C	ST C(2)
0C16	C900		ST 0(1)			
0C18	C471		LDI 71	0C71	AA0D	ILD D(2)
0C1A	C9FF		ST-1(1)	0C73	E410	XRI 10
				0C75	9C04	JNZ KEY
0C1C	C455	XP3 (PUSH) - 1		0C77	C0D2	LD(XX)
0C1E	33C4			0C79	CA0D	ST D(2)
0C20	0037					
0C22	3F	XPPC 3		0C7B	C108	KEY: LD 8(1)
				0C7D	94D4	JP LOOP
0C23	C207	LD 7(2)				
0C25	C901	ST 1(1)		0C7F	C400	LDI 00
0C27	C209	LD 9(2)		0C81	CA0E	ST E(2)
0C29	C820	ST(XX)				
				0C83	C43E	NEXT: LDI L(GETHEX)-1
0C2B	8FFF	DLY FF		0C85	CA1D	ST 1D(2)
0C2D	8FFF	DLY FF				
				0C87	C455	XP3(PUSH)-1
0C2F	C480	START: LDI 80		0C89	33C4	
0C31	C906	ST 6(1)		0C8B	0037	
0C33	C905	ST 5(1)				
0C35	C900	ST 0(1)		0C8D	02	CCL
0C37	C9FF	ST-1(1)		0C8E	C401	LDI 01
0C39	C439	LDI 39		0C90	EA0E	DAD E(2)
0C3B	C904	ST 4(1)		0C92	CA0E	ST E(2)
0C3D	C43F	LDI 3F				
0C3F	C903	ST 3(1)		0C94	3F	XPPC 3
0C41	C45E	LDI 5E				
0C43	C902	ST 2(1)		0C95	C400	LDI 00
0C45	C479	LDI 79		0C97	CA0F	ST F(2)
0C47	C901	ST 1(1)		0C99	CA10	ST 10(2)
0C49	C4XX	LDI XX				
0C4B	CA0A	ST A(2)		0C9B	903A	JMP COMP
0C4D	CA0B	ST B(2)		0C9D	9090	JS: JMP START
0C4F	CA0C	ST C(2)				
0C51	CA0D	ST D(2)		0C9F	C41F	OUT: XP3(TAB)-1
				0CA1	33C4	
0C53	AA0A	LOOP: ILD A(2)		0CA3	0137	
0C55	E410	XRI 10		0CA5	C20E	LD E(2)
0C57	9C22	JNZ KEY		0CA7	D40F	ANI 0F
0C59	C0F0	LD(XX)		0CA9	01	XAE
0C5B	CA0A	ST A(2)		0CAA	C380	LD-128(3)
				0CAC	C9FF	ST-1(1)

Most readers will be familiar with one or other variation of the game 'Mastermind'™, in which a secret code of colours, letters or numbers has to be 'broken' by an opponent in the minimum number of moves. In the following programme, which can be run on a SC/MP with 'Elbug' monitor software, the player has to guess a random sequence of four numbers which are generated by  $\mu$ P.

The full listing of the 'Mastermind'™ programme is given in table 1. When the programme has been loaded and started (by hitting the RUN-key), the text 'set -F' should appear on the displays. The player can then select the desired difficulty level by pressing one of the keys from 4 to F. This determines which hexadecimal digits the  $\mu$ P can use to make up the code which the player has to break. If, for example, the key

Table 1. The complete listing for the 'Mastermind'™ programme.

'9' is pressed, then the code 'word' may consist of a combination of any four digits between 9 and F (i.e. 9, A, B, C, D, E, or F).

Once the desired data key has been pressed, the displays will show the text 'code', indicating that the player can begin to guess the four-digit number selected by the computer. This is done by entering four (legal) numbers from the data keys, these are registered on the displays.

The  $\mu$ P now compares these numbers with the secret code and indicates the result as follows: the number of digits in the player's guess which are contained in the computer's secret code, *but which are in the wrong position*, is registered on the extreme right-hand display, whilst the number of digits which occupy the correct position is indicated on the extreme left-hand dis-



Table 1, cont.

0CAE	C20E		LD E(2)	0D03	C501		LD @+1(1)
0CB0	1C1C		SR	0D05	01		XAE
0CB2	1C1C		SR				
0CB4	01		XAE	0D06	C1F8		LD-8(1)
0CB5	C380		LD-128(3)	0D08	9809		JZ 55
0CB7	C900		ST 0(1)				
				0D0A	40	S4:	LDE
0CB9	C479		LDI 79	0D0B	E701		XOR @+1(3)
0CBB	C906		ST 6(1)	0D0D	9C16		JNZ 56
0CBD	C437		LDI 37				
0CBF	C905		ST 5(1)	0D0F	AA10		ILD 10(2)
0CC1	C45E		LDI 5E	0D11	CBFF		ST-1(3)
0CC3	C904		ST 4(1)				
0CC5	C400		LDI 00	0D13	BA00	S5:	DLD 0(2)
0CC7	C901		ST 1(1)	0D15	9814		JZ RESULT
0CC9	C902		ST 2(1)				
0CCB	C903		ST 3(1)	0D17	C1F8		LD-8(1)
				0D19	C9FC		ST-4(1)
0CCD	C108	WAIT:	LD 8(1)	0D1B	31		XPAL 1
0CCF	94FC		JP WAIT	0D1C	0140		STE
0CD1	8FFF		DLY FF	0D1E	33		XPAL 3
0CD3	90C8		JMP JS	0D1F	40		LDE
				0D20	31		XPAL 1
0CD5	90AC	JN:	JMP NEXT	0D21	C7FA		LD @-6(3)
0CD7	C4E7	COMP:	XP3(STKBSE)+7	0D23	90DA		JMP 53
0CD9	33C4			0D25	BA01	S6:	DLD 1(2)
0CDB	0F37			0D27	98EA		JZ 55
				0D29	90DF		JMP 54
0CDD	C404		LDI 04			RESULT:	XP1 (DISPL)+1
0CDF	CA00		ST 0(2)	0D2B	C401		
				0D2D	31C4		
0CE1	C7FF	S1:	LD @-1(3)	0D2F	0735		
0CE3	E307		XOR 7(3)				
0CE5	9C08		JNZ 52				
				0D31	C41F		XP3(TAB)-1
0CE7	CB00		ST 0(3)	0D33	33C4		
0CE9	AA0F		ILD F(2)	0D35	0137		
0CEB	E404		XRI 04				
0CED	98B0		JZ OUT	0D37	C20F		LD F(2)
				0D39	01		XAE
0CEF	BA00	S2:	DLD 0(2)	0D3A	C380		LD-128(3)
0CF1	9CEE		JNZ 51	0D3C	C906		ST 6(1)
0CF3	C701		LD @+1(3)	0D3E	C210		LD 10(2)
0CF5	C4EA		XP1(STKBSE)+A	0D40	01		XAE
0CF7	31C4			0D41	C380		LD-128(3)
0CF9	0F35			0D43	C9FF		ST-1(1)
0CFB	C404		LDI 04	0D45	908E		JMP JN
0CFD	CA00		ST 0(2)				
0CFF	C403	S3:	LDI 03				
0D01	CA01		ST 1(2)				

play. On the basis of this information, the player then enters a second number, whereupon the  $\mu P$  will respond in a similar fashion, indicating how many digits are correct and how many are in the right place etc. This continues until the player finally guesses the secret code, at which point the text 'End XX' will appear on the displays, the number XX indicating how many attempts the player took to guess correctly. The game can be restarted by pressing one of the data keys. If the difficulty level is to be modified, the game must be restarted with the 'Run' key.

### Compare routine

As already mentioned, the 'Mastermind' TM programme can only be run on a system with 'Elbug' monitor software. This is because the programme

utilises several Elbug sub-routines so as to save memory space.

A complete explanation of the programme would be too lengthy, however it is worthwhile taking a look at the most interesting section, namely the compare routine, the flow diagram of which is shown in figure 1. The first part of this routine compares each digit of the computer code with the corresponding digit of the player's guess. If one or more of the comparisons are positive, then that digit is noted as being both correct and in the right position (if all four comparisons prove positive, then the player's guess is obviously correct, and the programme exits from the routine). The digits which were not marked as correct are next compared, one at a time, with the remaining digits of the computer's code. If any of these comparisons proves positive, the corre-

sponding digit is noted as being correct, but not in the proper position. When all the comparisons are complete, the final result is displayed via the Elbug routines.

Along with those programmes previously published ('reaction timer' and 'digital clock'), and a number of programmes which are still to appear, 'Mastermind' TM will also be available on the disc to be produced by the Elektor Software Service (see the article on this subject in Elektor 38, June 1978).

TM We acknowledge the fact that 'Mastermind' is a registered trade mark of Invicta Plastics Ltd., Oadby, Leicester.