

SC/MP 'Mastermind' TM programme

Pit your wits against the computer with the aid of the following 'Mastermind' TM 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.

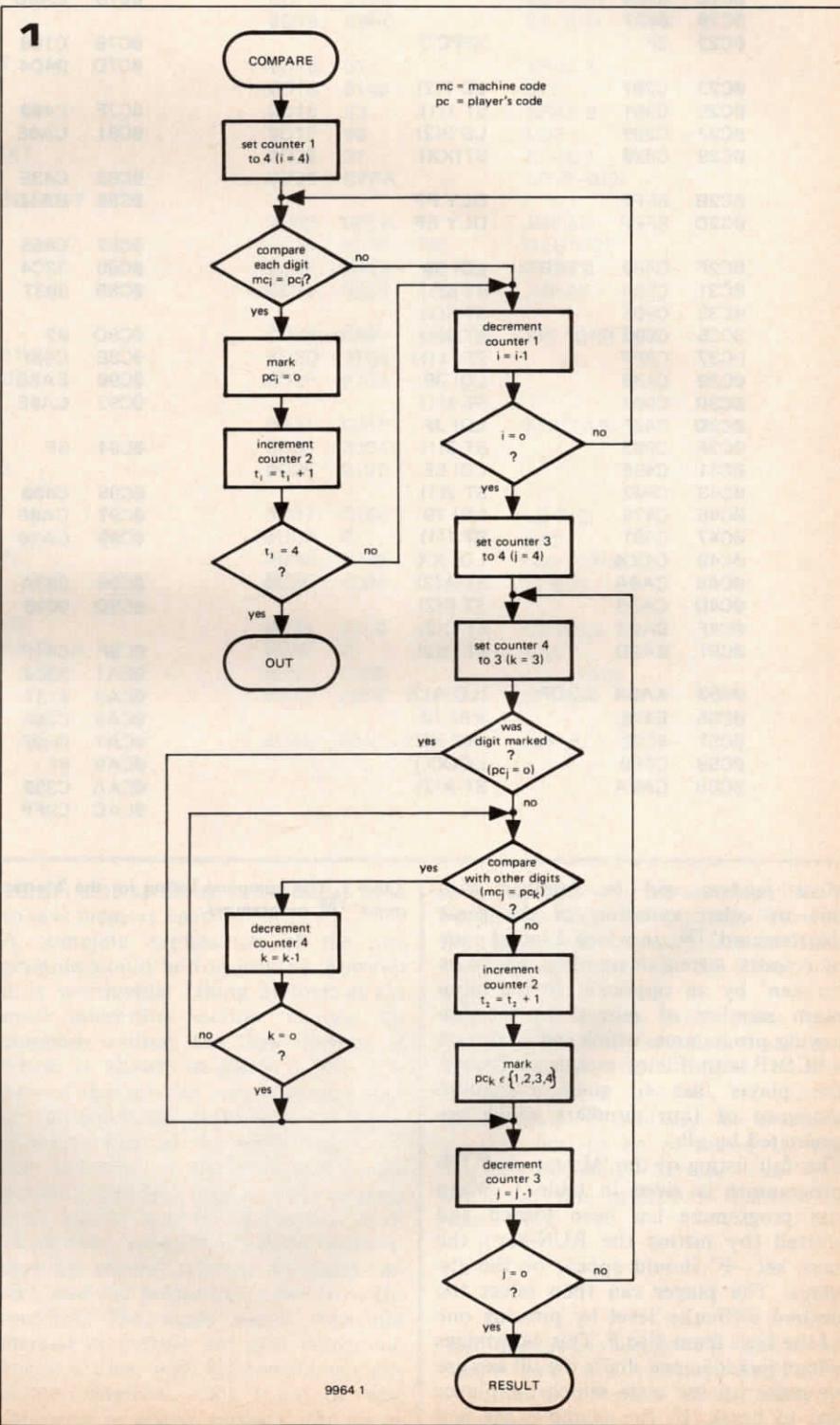
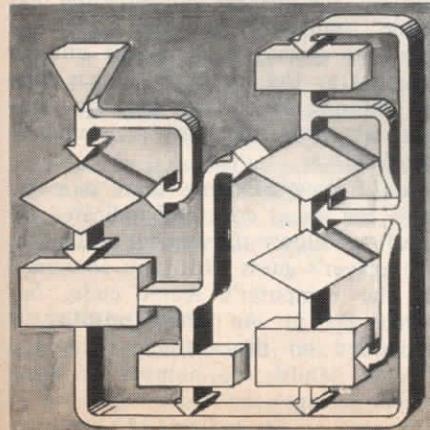


Table 1

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
0C1C	C455		XP3 (PUSH) – 1	0C75	9C04	JNZ KEY
0C1E	33C4			0C77	C0D2	LD(XX)
0C20	0037			0C79	CA0D	ST D(2)
0C22	3F		XPPC 3	0C7B	C108	KEY:
0C23	C207		LD 7(2)	0C7D	94D4	LD 8(1) JP LOOP
0C25	C901		ST 1(1)	0C7F	C400	LDI 00
0C27	C209		LD 9(2)	0C81	CA0E	ST E(2)
0C29	C820		ST(XX)			
0C2B	8FFF		DLY FF	0C83	C43E	NEXT:
0C2D	8FFF		DLY FF	0C85	CA1D	LDI L(GETHEX) – 1 ST 1D(2)
0C2F	C480	START:	LDI 80	0C87	C455	XP3(PUSH) – 1
0C31	C906		ST 6(1)	0C89	33C4	
0C33	C905		ST 5(1)	0C8B	0037	
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
0C53	AA0A	LOOP:	ILD A(2)	0CA1	33C4	
0C55	E410		XRI 10	0CA3	0137	
0C57	9C22		JNZ KEY	0CA5	C20E	LD E(2)
0C59	C0F0		LD(XX)	0CA7	D40F	ANI 0F
0C5B	CA0A		ST A(2)	0CA9	01	XAE
				0CAA	C380	LD-128(3)
				0CAC	C9FF	ST-1(1)

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

Most readers will be familiar with one or other variation of the game 'Mastermind' TM, 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 μ P.

The full listing of the 'Mastermind' TM 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 μ P can use to make up the code which the player has to break. If, for example, the key

'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 μ 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 \$5	
0CB7	C900	ST 0(1)				
			0D0A	40	\$4: LDE	
0CB9	C479	LDI 79	0D0B	E701	XOR @+1(3)	
0CBB	C906	ST 6(1)	0D0D	9C16	JNZ \$6	
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	\$5: DLD 0(2)	
0CC7	C901	ST 1(1)	0D15	9814	JZ RESLT	
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)			
0CCF	94FC	JP WAIT	0D1B	31	XPAL 1	
0CD1	8FFF	DLY FF	0D1C	0140	STE	
0CD3	90C8	JMP JS	0D1E	33	XPAL 3	
			0D1F	40	LDE	
0CD5	90AC	JN:	JMP NEXT	0D20	31	
				0D21	C7FA	
0CD7	C4E7	COMP:	XP3(STKBSE)+7			
0CD9	33C4			0D23	90DA	
0CDB	0F37			0D25	BA01	\$6: DLD 1(2)
				0D27	98EA	JZ \$5
0CDD	C404	LDI 04		0D29	90DF	JMP \$4
0CDF	CA00	ST 0(2)				
			0D2B	C401	RESLT: XP1 (DISPL)+1	
0CE1	C7FF	\$1:	LD @-1(3)	0D2D	31C4	
0CE3	E307		XOR 7(3)	0D2F	0735	
0CE5	9C08		JNZ \$2			
				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	\$2:	DLD 0(2)	0D3A	C380	LD-128(3)
0CF1	9CEE		JNZ \$1	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	\$3:	LDI 03			
0D01	CA01		ST 1(2)			

play. On the basis of this information, the player then enters a second number, whereupon the μ 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 prove 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).