

Program Title The Game of 15

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Program Description, Equations, Variables

The game of 15 is played with nine cards numbered 1 through 9 (displayed digits in the calculator). The nine cards are laid out. The two players alternate turns, taking one card each turn. The first player to have among his cards exactly three cards that total 15 wins the game.

In this version the calculator is the opponent. The calculator makes its selection first. After each turn the calculator will display the cards taken by both players and the cards remaining. To make a selection press the value of the card (1-9) and R/S.

The calculator plays a good game, and has a slight advantage. In fact, it is impossible to beat it. At best you can tie with the calculator.

A winning game is indicated by displaying the three winning cards and their total, 15 (i.e. ABC. 15).

A tied game is indicated by the tie indicator (i.e. 1010101010.). The programmer may choose to change this to his preference.

Operating Limits and Warnings

If a game is interrupted before either indicator, F2 and the primary and secondary registers may not be properly set when starting a new game, resulting in erratic display.

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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02913D Program Description II

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Sketch(es)

Sample Problem(s) For this example enter the seed $S = 0.741852963$

(keystrokes) (display) (comments)

STF 2 .741852963

A

0.6

calculator takes 6

0.123450789

cards remaining

3, R/S

3.65

player takes 3 ; calc. takes 5

0.120400789

cards remaining

4, R/S

43.658

player takes 4; calc. takes 8

0.120000709

cards remaining

2, R/S

681.

15

player takes 2 ; calc. takes

1 and wins the game

A

start new game

0.4

ect.

Solution(s)

Reference(s)

Mathematical Carnival

by Martin Gardner

(Alfred A. Knopf, New York ; © 1975)

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STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	LBL A	31 25 11	Random Flag Set (FO, FI)	057	GSB 2	31 22 02	Calculator's Next Move & Process
002	P4S	31 42		058	GSB 4	31 22 04	
003	F? 2	35 71 02		059	GSB 7	31 22 07	Display
004	STO 0	33 00		060	DSP 2	23 02	
005	FIX	31 23		061	RCL 5	34 05	
006	CF 0	35 61 00		062	-X-	31 84	
007	CF 1	35 61 01		063	DSP 9	23 09	Process Player's Next Move
008	RCL 0	34 00		064	LBL a	32 25 11	
009	ENTER ↑	41		065	RCL C	34 13	
010	X ²	32 54		066	R/S	84	
011	+	61	Reset Card Display	067	STO 6	33 06	Calculator's Next Move & Process
012	STO 0	33 00		068	RCL 0	34 00	
013	EEX	43		069	10 ^x	32 53	
014	5	05		070	X	71	
015	GSB 1	31 22 01		071	STO +5	33 61 05	Decide Winner
016	5	05		072	GSB E	31 22 15	
017	X ≤ Y	32 71		073	GSB 5	31 22 05	
018	SF 0	35 51 00		074	GSB 6	31 22 06	
019	RCL 0	34 00		075	X = Y	32 51	
020	EEX	43		076	GSB 6	31 22 06	
021	6	06		077	GSB 2	31 22 02	
022	GSB 1	31 22 01		078	GSB 4	31 22 04	
023	5	05		079	GSB 7	31 22 07	
024	X ≤ Y	32 71	Process for Display	080	3	03	
025	SF 1	35 51 01		081	RCL 0	34 00	
026	RCL 1	34 01		082	X > Y	32 81	
027	STO C	33 13		083	GTO b	22 31 12	
028	P4S	31 42		084	RCL 1	34 01	
029	1	01		085	1	01	
030	GSB 2	31 22 02		086	5	05	
031	GSB 4	31 22 04		087	-	51	
032	STO 1	33 01		088	STO B	33 12	
033	STO 6	33 06		089	4	04	
034	1	01	Set R ₀ to 0	090	ST I	35 33	
035	0	00		091	RCL 5	34 05	
036	÷	81		092	FRAC	32 83	
037	STO 5	33 05		093	STO 7	33 07	
038	GSB E	31 22 15		094	0	00	
039	0	00		095	STO 4	33 04	
040	STO 0	33 00		096	LBL d	32 25 14	
041	DSP 1	23 01		097	RCL B	34 12	
042	RCL 5	34 05		098	RCL 7	34 07	
043	-X-	31 84		099	1	01	
044	DSP 9	23 09	Display	100	GSB 1	31 22 01	
045	RCL C	34 13		101	LST X	35 82	
046	R/S	84		102	STO 7	33 07	
047	STO 6	33 06		103	R↓	35 53	
048	STO +5	33 61 05		104	X = Y	32 51	
049	GSB E	31 22 15		105	GTO e	22 31 15	
050	GSB 5	31 22 05		106	X = 0	31 51	
051	ST I	35 33		107	GTO 0	22 00	
052	P4S	31 42		108	STO + 4	33 61 04	
053	RCL (i)	34 24		109	1	01	
054	P4S	31 42	Choose Strategy	110	0	00	
055	STO E	33 15		111	STO x 4	33 71 04	
056	GSB 6	31 22 06		112	LBL 8	31 25 08	

REGISTERS

⁰ Move #	¹ Calc. Sum	²	³ Const.	⁴ Winning Cards	⁵ Cards Taken	⁶ Player's Move	⁷ —	⁸ Com II	⁹ Anti-Com II
S ₀ Random #	S ₁ Card Reset	S ₂ { — }	S ₃ —	S ₄ Game	S ₅ Strategy	S ₆ —	S ₇ —	S ₈ —	S ₉ }
A	B	C Cards Remaining		D Tied Game Indicator		E Chosen Strategy		I —	

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
113	DSZ	31 33		169	CHS	42	
114	GTO d	22 31 14		170	I	01	
115	RCL 4	34 04		171	0	00	
116	F? 2	35 71 02		172	+	61	
117	GTO 9	22 09		173	RTN	35 22	
118	LBL 0	31 25 00		174	LBL 4	31 25 04	
119	CF 2	35 61 02		175	10 ^x	32 53	Conversion II
120	RCL 0	34 00		176	RCL 8	34 08	
121	ST I	35 33		177	GSB 1	31 22 01	
122	ISZ	31 34	Display	178	RTN	35 22	
123	DSP (i)	23 24		179	LBL 5	31 25 05	
124	RCL 5	34 05		180	RCL 6	34 06	
125	-X-	31 84		181	10 ^x	32 53	
126	DSP 9	23 09		182	RCL 9	34 09	
127	GTO a	22 31 11		183	GSB 1	31 22 01	Anti-Conversion
128	LBL e	32 25 15		184	GSB 2	31 22 02	for I & II
129	SF 2	35 51 02		185	F? 0	35 71 00	
130	GTO 8	22 08		186	RTN	35 22	
131	LBL b	32 25 12		187	CHS	42	
132	RCL D	34 14	Tied Game	188	I	01	
133	RTN	35 22		189	0	00	
134	LBL 9	31 25 09		190	+	61	
135	DSP 2	23 02	Calculator	191	RTN	35 22	
136	RCL 3	34 03	Wins	192	LBL 6	31 25 06	
137	X	71		193	RCL E	34 15	Calculator's
138	ENG	35 23		194	FRAC	32 83	Next Move
139	RTN	35 22		195	I	01	
140	LBL 1	31 25 01		196	0	00	
141	X	71	Digit "Split-off"	197	X	71	
142	FRAC	32 83		198	STO E	33 15	
143	I	01		199	INT	31 83	
144	0	00		200	RTN	35 22	
145	X	71		201	LBL 7	31 25 07	
146	INT	31 83		202	STO 6	33 06	
147	RTN	35 22		203	I	01	
148	LBL 2	31 25 02		204	STO + 0	33 61 00	
149	F? 0	35 71 00		205	RCL 0	34 00	
150	GTO 3	22 03		206	I	01	
151	STO B	33 12		207	+	61	Process Digit
152	2	02		208	CHS	42	for Display
153	X	71		209	10 ^x	32 53	
154	7	07		210	RCL 6	34 06	
155	÷	81		211	STO + 1	33 61 01	
156	I	01	Conversion I	212	X	71	
157	+	61		213	STO + 5	33 61 05	
158	INT	31 83		214	LBL E	31 25 15	
159	I	01		215	RCL C	34 13	
160	0	00		216	RCL 6	34 06	
161	X	71		217	ENTER ↑	41	
162	RCL B	34 12		218	CHS	42	
163	3	03		219	10 ^x	32 53	
164	X	71		220	X	71	
165	-	51		221	-	51	
166	LBL 3	31 25 03		222	STO C	33 13	
167	F? 1	35 71 01		223	RTN	35 22	
168	RTN	35 22					

LABELS					FLAGS		SET STATUS		
A Start	B	C	D	E Process	0 Conv.	1 Conv.	FLAGS	TRIG	DISP
a —	b Tied Game	c	d —	e SF 2	1 Conv.	2 —	ON OFF		
0 Display	1 "Split-off"	2 Conv. I	3 —	4 Conv. II	2 —	3 —	0 ☐ ☒	DEG ☐	FIX ☒
5 Anti-Conv.	6 Calc. Move	7 Process	8 —	9 Calc Wins	3 —		1 ☐ ☒	GRAD ☐	SCI ☐
							2 ☒ ☐	RAD ☐	ENG ☐
							3 ☐ ☒		n 9

02913D Data Card Listing

Game of 15 (Data)

Register	Contents	Comments
R ₀	0.	
R ₁	0.	
R ₂	0.	
R ₃	1. E 14	constant for winning game display
R ₄	0.	
R ₅	0.	
R ₆	0.	
R ₇	0.	
R ₈	0.0618753294	conversion II
R ₉	0.0276951438	anti - conversion II
R _{S0}	0.9164372853	random number
R _{S1}	0.123456789	card reset
R _{S2}	0.594678310	strategy
R _{S3}	0.749584210	"
R _{S4}	0.593728610	"
R _{S5}	0.237469810	"
R _{S6}	0.593728410	"
R _{S7}	0.329568410	"
R _{S8}	0.745392610	"
R _{S9}	0.327456810	"
R _A	0.	
R _B	0.	
R _C	0.123456789	cards remaining
R _D	1010101010.	tied game indicator for display
R _E	0.	
R _I	0.	