

Program Description I

Program Title *Duel*

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Program Description, Equations, Variables *Duel is a game of timing where the probability of hitting your opponent increases steadily as you approach each other. The duelists start at 150 meters apart with six shots apiece. The probability of a hit at this distance is $\frac{1}{5}$, increasing linearly to certainty at 10 meters. Both duelists have equal accuracies and you are informed of your opponent's firing when it takes place. The HP-67 plays an optimum strategy, firing whenever $P(X) = \frac{m}{m+n}$, unless the 67 has fewer bullets ($m < n$), in which case it will fire when $P(X) > \frac{m}{m+n}$. $P(X)$ is the probability function, m is the number of the 67's bullets, and n is the number of the player's bullets.*

The display is XXX.YY where XXX is the distance and the number of the 67's bullets is YY.

A display with a flashing decimal point indicates game over. Turn the 67 upside down to read the results. It is assumed that when a duelist fires his last bullet, his opponent will obtain a sure hit by waiting until they close.

Operating Limits and Warnings

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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Program Description II

Sketch(es)

Sample Problem(s) Enter the program and initialize it according to the user's instructions. Start the duel. You decide to hold your fire until you are about 60 meters apart where your accuracy is one in six: B(140.06), B(130.06), B(120.05), B(110.05) but the HP-67 scores a hit on its second shot.

So you try again, deciding to shoot at 110 meters and shoot every 20 meters thereafter: A(150.06), B(140.06), B(130.06), B(120.05), B(110.05), C(110.05), B(100.05), B(90.04), C(90.04), B(80.04), B(70.03), C(70.03), B(60.03), B(50.02), C(50.02), B(40.02), B(30.01), C(30.01), B(20.01) and at 20 meters you decide to use your last shot. Good work!

Solution(s)

Reference(s) Drescher, Melvin, Games of Strategy: Theory and Applications
Prentice-Hall, 1961

HP-65 Program Library #01394A

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	/ LBL A	31 25 11	Start Duel		/ LBL O	31 25 00	
	DSP 2	23 02			R CFC	35 61 00	
	1	01			R SFI	35 51 01	
	5	05		060	GTO 6	22 06	
	0	00			/ LBL C	31 25 13	Fire
	STO 3	33 03	Distance $\rightarrow R_3 = 150$ meters		R CFI	35 61 01	
	6	06			RCL 2	34 02	
	STO 1	33 01	$m = 6 \rightarrow R_1$		RCL 3	34 03	
	R STE	35 33	$n = 6 \rightarrow R_I$		\div	81	
010	/ LBL 6	31 25 06			RCL 4	34 04	
	RCL 4	34 04			G X \leq 4	32 71	Player wins
	4	04			GTO 9	22 09	
	1	01	New Random #		/ DSP 3	31 33	Not last shot,
	3	03			GTO 6	22 06	continue
	X	71			GTO 8	22 08	else machine wins
	G FRAC	32 83			/ LBL E	31 25 15	Initialize
	STO 4	33 04			R M	35 73	store seed
	RCL 1	34 01			STO 4	33 04	
	1	01			/ GSB A	31 22 11	Initialize all else
020	0	00			/ GSB B	31 22 12	
	STO 2	33 02	$10 \rightarrow R_2$		R RTN	35 22	
	ENT 1	71			/ LBL D	31 25 14	Display player's
	X	71			R RCI	35 34	shot
	+	81			R RTN	35 22	
	RCL 3	34 03			/ LBL 7	31 25 07	
	+	81	Distance last shot		RCL 2	34 02	$X = X - 10$
	R RTN	35 22			STO - 3	33 51 03	
	/ LBL B	31 25 12	Wait		G RV	35 53	
	RCL 1	34 01			R SFO	35 51 00	
030	R RCI	35 34	Does machine have		R RTN	35 22	Machine wins
	G X \leq 4	32 71	more shots?		/ LBL 8	31 25 08	Display = 0. BLISS
	/ GSB 7	31 22 07			DSP 1	23 01	
	M F 1	35 71 01			5	05	
	GTO 0	22 00	Check if player fires		5	05	
	GTO 1	22 01	first		1	01	
	/ LBL C	31 25 00			7	07	
	+	61			5	05	
	RCL 3	34 03			5	05	
	RCL 2	34 02			7	07	
040	\div	81			5	05	
	G X \geq 4	32 81			7	07	
	GTO 1	22 01	Hold fire		5	05	
	R 1/X	35 62			7	07	
	RCL 4	34 04			5	05	
	G X \leq 4	32 71			7	07	
	GTO 8	22 08	Machine wins		5	05	
	RCL 1	34 01			7	07	
	1	01			5	05	
	G X \leq 4	32 51	Machine's last shot?		7	07	
050	GTO 9	22 09	Player wins,		5	05	
	-	51	$m = m - 1$		7	07	
	STO 1	33 01			5	05	
	/ LBL 1	31 25 01	Hold fire		7	07	
	R F ? 0	35 71 00			5	05	
	GTO 0	22 00			7	07	
	/ GSB 7	31 22 07			5	05	

REGISTERS & Labels

0-Label Generating	1-Label m	2-Label 10	3-Label Distance	4-Label Random #	5-Label Subroutine	6-Label Subroutine	7-Label Subroutine	8-Label Subroutine	9-Label Subroutine
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A-Label Start Duel	B-Label Wait	C-Label Player Fires	D-Label Display m	E-Label Initialize	F-Label m				