

Program Description I

Program Title DOWN THE MIDDLE

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Program Description, Equations, Variables

The object of this mathematical game is to guess a secret number that is EXACTLY OR APPROXIMATELY halfway between the two given numbers.

See how many times you can guess the secret number on the very first try!

$$\text{LOW NUMBER } (R_1) = N_1 \quad (\text{if } N_1 > 25, \text{ divide by } 5)$$

$$\text{HIGH NUMBER } (R_2) = [N_1 + N_2 + N_3] \quad (R_2 \text{ must be } \leq 999)$$

$$\text{SECRET NUMBER } (R_3) = [N_1 + N_2 + \frac{N_3}{3}] \pm \begin{matrix} \text{AMOUNT NEEDED TO} \\ \text{ADJUST NUMBER} \end{matrix}$$

$$R_3 = \text{INT} \left[\frac{R_1 + R_2}{2} \right] \pm 4$$

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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Sketch(es)

Sample Problem(s)

INITIALIZE .123456 **E** → 0.START **A** → (48.0)*, 1.89**GUESS 49 **B** → 7.89GUESS 50 **B** → 50.0, 2 (GUESSES)GO **A** → (57.0), 24.90GUESS 55 **B** → 24.90GUESS 53 **B** → 24.90GUESS 57 **B** → 24.90GUESS 58 **B** → 24.90GUESS 59 **B** → 24.90GUESS 60 **B** → 24.90GUESS 61 **B** → 61.0, 7 (GUESSES)GO **A** → (39.5), 12.67GUESS 39 **B** → 12.67GUESS 38 **B** → 12.67GUESS 40 **B** → 40.0, 3 (GUESSES)

CHANGE MAXIMUM NUMBER TO 500.

500 **C** → 500.0GO **A** → (384.5), 72.697GUESS 382 **B** → 72.697GUESS 383 **B** → 72.697GUESS 384 **B** → 384.0, 3 (GUESSES)GO **A** → (414.5), 92.737GUESS 414 **B** → 92.737GUESS 416 **B** → 92.737GUESS 417 **B** → 92.737GUESS 418 **B** → 418.0, 4 (GUESSES)GO **A** → (359.0), 71.647GUESS 361 **B** → 361.0, 1.***RECALL SCORES **D** →

1. BEST SCORE

7. HIGH (WORST) SCORE

3.33 AVERAGE SCORE

Reference(s)

* The Calc. PAUSES to display some "HELP."

** The 1st number is between 7 and 89. (48 is exactly halfway between)

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS		OUTPUT DATA/UNITS
1	Load sides 1 and 2 of PROGRAM CARD.		<input type="text"/>	<input type="text"/>	
2	INITIALIZE (Input a seed: $0 < s \leq 1$)	seed	E	<input type="text"/>	O.
3	OPTIONAL: CHANGE THE MAXIMUM NUMBER used as a multiplier ($50 \leq N \leq 999$)*	N	C	<input type="text"/>	N.O
4	OPTIONAL: To get some "HELP" Program will PAUSE to display $\frac{1}{2}$ of $(R_1 + R_2)$		f	E	I. **
5	GO (DISPLAY TWO NUMBERS)		A	<input type="text"/>	X.Y
6	MAKE YOUR GUESS (6A) If your GUESS is WRONG: (6B) If your GUESS is CORRECT:	GUESS	B	<input type="text"/>	<div style="background-color: #cccccc;">X.Y AGAIN</div>
7	FOR A NEW PROBLEM, [GTO] STEP 5			<input type="text"/>	GUESS.O # of GUESSES.
8	OPTIONAL: TO RECALL YOUR LOW (BEST), HIGH (WORST), AND AVERAGE SCORES:		D	<input type="text"/>	LOW SCORE HIGH SCORE AVG. SCORE
	* 50, if default.			<input type="text"/>	
	** If OUTPUT is 0 (NO HELP), press f E again.			<input type="text"/>	

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001 E	f LBL E	31 25 15	INITIALIZE		—	51	ADJUST SECRET NUMBER
	h F?3	35 71 03	check for seed input		g x > y	32 81	SO THAT:
	h F?3	35 71 03			GTO 2	22 02	$R_3 = \text{INT} \left[\frac{R_1 + R_2}{2} \right] + 4$
	GTO 9	22 09		060	9	09	
	h F?0	35 71 00	FLAG 0 is SET if you		+	61	
	GTO 9	22 09	have <u>already</u> INITIALIZED.		g x < y	32 71	
	h T	35 73			GTO 3	22 03	
	+	61			RCL 3	34 03	
	f SIN	31 62			f INT	31 83	
010	f CL REG	31 43			STO 3	33 03	
	STO 0	33 00		6	f LBL 6	31 25 06	DISPLAY GIVEN NUMBERS
	5	05			RCL 1	34 01	
	0	00			RCL 2	34 02	
	STO D	33 14		070	EEX	43	
	0	00			2	02	
	ENT ↑	41			DSP 2	23 02	
	ENT ↑	41			g x < y	32 71	
	ENT ↑	41			f GSB 8	31 22 08	
	h SFO	35 51 00			÷	81	
020	DSP 0	23 00			+	61	
	h RTN	35 22			h RTN	35 22	
A	f LBL A	31 25 11	GO		GTO B	22 12	
	f GSB 1	31 22 01		8	f LBL 8	31 25 08	ADJUST DISPLAY
	STO 1	33 01		080	1	01	
	STO 2	33 02	$N_1 = R_1$		0	00	
	STO 3	33 03			X	71	
	f GSB 0	31 22 00	(N_2)		DSP 3	23 03	
	STO + 2	33 61 02			h RTN	35 22	
	STO + 3	33 61 03		0	f LBL 0	31 25 00	RANDOM # GENERATOR
	GSB 0	31 22 00	$N_1 + N_2 + N_3 = R_2$		RCL 0	34 00	
	STO + 2	33 61 02	$N_1 + N_2 + \frac{N_3}{3} = R_3$		9	09	
	3	03			9	09	
	÷	81			7	07	
	f INT	31 83		090	X	71	
	STO + 3	33 61 03	check that $R_2 \leq 999$		g FRAC	32 83	
	9	09			STO 0	33 00	
	9	09			RCL D	34 14	
	9	09			X	71	
	RCL 2	34 02			f INT	31 83	
040	g x < y	32 71			f x ≠ 0	31 61	
	GTO 5	22 05			h RTN	35 22	
	—	51			2	02	
	STO + 2	33 61 02			+	61	
5	f LBL 5	31 25 05	SECRET NUMBER LOOP	100	h RTN	35 22	
	RCL 3	34 03		1	f LBL 1	31 25 01	N_1 GENERATOR
	RCL 1	34 01			0	00	
	RCL 2	34 02			h STO I	35 33	
	+	61			2	02	
	2	02			5	05	
050	÷	81			f GSB 0	31 22 00	R_1 must be ≤ 25
	STO 4	33 04			g x < y	32 71	If $R_1 > 25$, ÷ 5.
	DSP 1	23 01	Did you ask for HELP?		h RTN	35 22	
	h F?2	35 71 02	If so, PAUSE		5	05	
	h PAUSE	35 72		110	÷	81	
	f INT	31 83			f INT	31 83	
	4	04			h RTN	35 22	

REGISTERS

0 Seed	1 GIVEN NUMBER ₁	2 GIVEN NUMBER ₂	3 SECRET NUMBER	4 $\frac{R_1 + R_2}{2}$	5	6 # of GAMES	7 TOTAL # of GUESSES	8 LOW SCORE	9 HIGH SCORE
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B GUESS	C TEMPORARY	D RND. # MULTIPLIER	E	I COUNT GUESSES				

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
2	f LBL 2	31 25 02	SECRET NUMBER TOO LOW		GTO A	22 11	
	RCL 4	34 04		170 e	g LBLE	32 25 15	HELP WANTED!
	RCL 3	34 03			DSP 0	23 00	
	—	51			hF? 1	35 71 01	
	2	02	$(\frac{R_4 - R_3}{2.1}) + 4 \rightarrow \text{STO} + 3$		GTO 4	22 04	
	.	83			hSF 1	35 51 01	Set F1, F2 for HELP
	1	01			hSF 2	35 51 02	
120	÷	81			1	01	
	4	04			hRTN	35 22	
	+	61		4	f LBL 4	31 25 04	NO HELP!
	STO + 3	33 61 03			hCF 1	35 61 01	
	GTO 5	22 05		180	hCF 2	35 61 02	CLEAR F1, F2 for NO HELP
3	f LBL 3	31 25 03	SECRET NUMBER TOO HIGH		0	00	
	RCL 3	34 03			hRTN	35 22	
	RCL 4	34 04		C	f LBL C	31 25 13	CHANGE MAX. #
	—	51			hF? 3	35 71 03	
	2	02	$(\frac{R_3 - R_4}{2.1}) + 4 \rightarrow \text{STO} - 3$		hF? 3	35 71 03	
130	.	83			GTO 9	22 09	
	1	01			STO C	33 13	
	÷	81			5	05	
	4	04			0	00	
	+	61		190	g x > y	32 81	Check that N ≤ 50 and ≤ 999
	STO - 3	33 51 03			GTO 9	22 09	
	GTO 5	22 05			9	09	
B	f LBL B	31 25 12	GUESS		5	05	
	hF? 3	35 71 03			0	00	
	hF? 3	35 71 03			+	61	
140	GTO 9	22 09			g x ≤ y	32 71	
	STO B	33 12			GTO 9	22 09	
	f ISZ	31 34	INCREMENT GUESS COUNTER		RCL C	34 13	
	RCL 3	34 03			STO D	33 14	
	g x ≠ y	32 61		200	DSP 1	23 01	
	GTO 6	22 06	GTO 6 if <u>WRONG</u> GUESS		hRTN	35 22	
	DSP 1	23 01			GTO A	22 11	
	h PAUSE	35 72		D	f LBL D	31 25 14	DSP SCORE
	h PAUSE	35 72	DSP CORRECT GUESS		DSP 0	23 00	
	DSP 0	23 00			RCL 8	34 08	LOW SCORE
150	RCL 8	34 08			h PAUSE	35 72	
	f x = 0	31 51			RCL 9	34 09	HIGH SCORE
	h RCL I	35 34	STORE BEST SCORE in R8		h PAUSE	35 72	
	h RCL I	35 34			RCL 7	34 07	
	g x ≤ y	32 71		210	RCL 6	34 06	
	STO 8	33 08			÷	81	
	hF? 1	35 71 01	If you asked for HELP, then RE-SET FLAG 2.		DSP 2	23 02	AVG. SCORE
	hSF 2	35 51 02			hRTN	35 22	
	RCL 9	34 09			GTO A	22 11	
	h RCL I	35 34		9	f LBL 9	31 25 09	Error
160	g x > y	32 81	STORE WORST SCORE in R9		0	00	
	STO 9	33 09			÷	81	
	STO + 7	33 61 07			R/S	84	
	1	01					
	STO + 6	33 61 06		220			
	h RCL I	35 34					
	g x = y	32 51					
	f - x -	31 84	PRINT X if X = 1 (YOU GUESSED SECRET NUMBER IN ONE TRY)				
	hRTN	35 22					

LABELS				FLAGS		SET STATUS		
A GO	B GUESS	C CHANGE MAX. NUMBER	D DISPLAY SCORE	E INITIALIZE	0 INITIALIZED?	FLAGS	TRIG	DISP
a —	b —	c —	d —	e HELP?	1 HELP WANTED?	ON OFF		
0 RANDOM # GENERATOR	1 N1 GENERATOR	2 SECRET # TOO LOW	3 SECRET # TOO HIGH	4 NO HELP	2 PAUSE (HELP)	0 <input type="checkbox"/> <input type="checkbox"/>	DEG <input type="checkbox"/>	FIX <input type="checkbox"/>
5 SECRET # LOOP	6 DISPLAY GIVEN NUMBERS	7	8 ADJUST DISPLAY	9 Error	3 KEYBOARD ENTRY?	1 <input type="checkbox"/> <input type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
						2 <input type="checkbox"/> <input type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
						3 <input type="checkbox"/> <input type="checkbox"/>		n <u>2</u>