

CANNIBALS AND MISSIONARIES

This program completely simulates the classical cannibal-missionary river crossing problem in the following form: 3 missionaries and 3 partially-civilized cannibals must cross a river with a boat that can hold no more than 3 passengers. At no time may cannibals outnumber missionaries at either bank or on the boat lest the cannibals regress to an earlier mode of behavior! Further, cannibal(s) left aboard the boat alone will run off with it after launching. Missionaries, cannibals and boat are all initially on the left bank. Press C once for each cannibal you wish to put aboard the boat, press B once for each missionary you wish to put aboard the boat. After each crossing, D, or return, E, the right bank distribution (those already across) is displayed in the form $O.C^M_R$:

For example: 0.00 Noone has crossed initial condition
 0.23 2 cannibals & 3 missionaries on Rt. bank
 0.33 Succesful simulation, everyone across

After a crossing, D or E, improper operations are appropriately punished:

	DISPLAY
A. Impossible crossing, boat on wrong bank	"ERROR"
B. Boat adrift (noone on) or stolen (no missionaries on)	1.00
C. C's outnumber missionaries on boat	2.00
D. Boat sinks, 4 or more aboard	4.00
E. Missionaries outnumbered at either bank	3.00

001 LBL A	31 25 11	031 STO 0	33 00
002 DSP 2	23 02	032 RCL 4	34 04
003 0	00	033 X=0 ?	31 51
004 STO 1	33 01	034 GTO 8	22 08
005 STO 2	33 02	035 ISZ	32 34
006 STO 3	33 03	036 RCL 3	34 03
007 STO 4	33 04	037 X>Y ?	32 81
008 STO 5	33 05	038 GTO 8	22 08
009 STO 6	33 06	039 +	61
010 R/S	84	040 4	04
011 LBL B	31 25 12	041 STO 0	33 00
012 1	01	042 X≤Y ?	32 71
013 STO+4	33 61 04	043 GTO 8	22 08
014 R/S	84	044 RCL 2	34 02
015 LBL C	31 25 13	045 X=0 ?	31 51
016 1	01	046 GTO 7	22 07
017 STO+3	31 61 03	047 3	03
018 R/S	84	048 X=Y ?	32 51
019 LBL D	31 25 14	049 GTO 7	22 07
020 RCL 5	34 05	050 RCL 1	34 01
021 X≠0 ?	31 61	051 RCL 2	34 02
022 GTO 0	22 00	052 DSZ	32 33
023 1	01	053 X≠Y ?	32 61
024 STO 5	33 05	054 GTO 8	22 08
025 RCL 3	34 03	055 LBL 7	31 25 07
026 STO+1	33 61 01	056 0	00
027 RCL 4	34 04	057 STO 3	33 03
028 STO+2	33 61 02	058 STO 4	33 04
029 LBL 9	31 25 09	059 RCL 1	34 01
030 1	01	060 EEX	43

061	1	01
062	+	81
063	RCL 2	34 02
064	EEEX	43
065	2	02
066	÷	81
067	+	61
068	STO 6	33 06
069	RCL 7	34 07
070	X=Y ?	32 51
071	GTO 6	22 06
072	RCL 6	34 06
073	R/S	84
074	LBL 6	31 25 06
075	RCL 9	34 09
076	R/S	84
077	LBL E	31 25 15
078	RCL 5	34 05

Store reg. 9, good
 8, lose
 7, .33

Successful crossing,

A,B,C,D.
 B,E.
 B,B,C,D.
 B,C,E.
 B,B,C,D.
 B,E.
 B,C,D.

079	X=0 ?	31 51
080	GTO 0	22 00
081	0	00
082	STO 5	33 05
083	RCL 3	34 03
084	STO-1	33 51 01
085	RCL 4	34 04
086	STO-2	33 51 02
087	GTO 9	22 09
088	LBL 0	21 25 00
089	0	00
090	÷	81
091	LBL 8	31 25 08
092	RCL 8	34 08
093	PSE	35 72
094	RCL 0	34 00
095	R/S	84

User Instructions

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STEP	INSTRUCTIONS	KEYS EXTENDED	KEYS	OUTPUT DATA/UNITS
1.	Key in the program	KEYS	<input type="text"/> <input type="text"/>	
2.	Initialize: Cannibals, missionaries, and boat at left bank	A	KEYS KEYS	0.00
3.	Load the boat:		<input type="text"/> <input type="text"/>	
3a.	A cannibal boards	C	KEYS KEYS	1.00
3b.	A missionary boards	B	KEYS KEYS	1.00
4.	Repeat 3a/3b until all passengers are loaded		<input type="text"/> <input type="text"/>	
5.	Cross the river (in the proper direction):		<input type="text"/> <input type="text"/>	
5a.	Left to right ----->	D	KEYS KEYS	0.C _R M _R *
5b.	Right to left <-----	E	KEYS KEYS	0.C _R M _R *
	Output = 0.C _R M _R		<input type="text"/> <input type="text"/>	
	e.g. 0.23 means 2 cannibals and 3		<input type="text"/> <input type="text"/>	
	missionaries on right bank		<input type="text"/> <input type="text"/>	
6.	Repeat steps 3-5 until everyone is on right bank.		<input type="text"/> <input type="text"/>	
7.	For a new game or after an improper operation *, go to step 2.		<input type="text"/> <input type="text"/>	
	* Outputs after an improper operation:		<input type="text"/> <input type="text"/>	
	a. Impossible crossing-boat on wrong side		<input type="text"/> <input type="text"/>	Error
	b. Boat adrift (no one on) or stolen (only C's on)		<input type="text"/> <input type="text"/>	1.00
	c. M's outnumbered on boat		<input type="text"/> <input type="text"/>	2.00
	d. Boat overloaded - 4 or more aboard		<input type="text"/> <input type="text"/>	4.00
	e. C's outnumber M's on either bank or too many M's called, e.g., 1 M on bank and 2 M's loaded aboard		<input type="text"/> <input type="text"/>	3.00

If crossing involves multiple errors, the display hierarchy is as above.

CANNIBALS AND MISSIONARIES

GSB1	
GSB2	
GSB3	0.11
GSB2	
GSB4	0.10
GSB1	
GSB2	
GSB2	
GSB3	0.22
GSB1	
GSB2	
GSB4	0.11
GSB1	
GSB2	
GSB2	
GSB3	0.23
GSB2	
GSB4	0.22
GSB1	
GSB2	
GSB3	0.33