

Problem

Problem 1

Harry and Sam, and their sons Micah and Todd, wish to cross a river. Their small boat can carry only the mass of one man, or of one or two boys. What is the minimum number of one-way trips the boat must make across the river in either direction in order to get all four people to the opposite shore?



Hints

Hint 1 - Who should go first?

Hint 2 - Who will bring the boat back for the second trip?

Hint 3 - Could either dad cross the river with his son?

Hint 4 - Who must make the last trip?

Suggestion: Have students act out the problem in groups of 4, with one student playing the role of each character.

Solution

The key idea is that the boat has to return to the near shore after each trip except the last one. So after the first trip, there always needs to be at least one person on the far shore, so they can bring the boat back.

Below is a table outlining a sequence of nine trips across the river. The boys and their fathers are represented by their initials, H for Harry, S for Sam, M for Micah, and T for Todd. Their positions on either side of the river are shown AFTER the current trip. (Interchanging H and S, or M and T, or both, gives other solutions.)

Trip	Crossing Over to Far Shore	Crossing Back to Near Shore	On Near Shore	On Far Shore
1	M, T		H, S	M, T
2		M	H, S, M	T
3	S		H, M	T, S
4		T	H, M, T	S
5	M, T		H	S, M, T
6		M	H, M	S, T
7	H		M	S, T, H
8		T	M, T	S, H
9	M, T			S, H, M, T

Suggestion: Ask how we know this is the least possible number of trips...an interesting discussion will ensue.