Introduction to the Towers of Hanoi game.

This ancient game can be a brainteaser for beginners but is also enjoyed by experts. For beginners the game can illustrate the complexity of a process that grows in an exponential fashion. This computer simulation of the game can be used in both an Automatic and a Manual mode, so until you master it, you can use this program as a learning tool.

First we will describe the equipment, rules, and object of the game, and then we will explain the particular operations of the program.

The Towers of Hanoi game is usually played with three pegs or spindles, on one of which are stacked a number of round concentric disks of increasing diameter. The other two pegs or spindles are initially empty, but the disks are presumed to have holes in their centers so that they can easily be lifted off one peg and dropped on another peg. In this implementation of the game you can select an initial number of disks between 3 and 9 inclusive. We use the terms peg or spindle interchangeably.

The object of the game is to simply move the disks one at a time from one peg to another until all the disks have been moved onto one pre-selected peg. There are only two rules. You may move only one disk at a time and you are not allowed to place a larger diameter disk on top of a smaller one.

We recommend 5 or fewer disks for beginners. You may discover that the game doubles in complexity for each disk that is added. In general, any number of disks could be used, but since 9 disks will keep you busy for a long time the program doesn't use anymore than 9 disks.

The three pegs can be arranged in any fashion, but the program labels the pegs as 1, 2, and 3. By default, peg #1 is the STARTING peg and peg #3 is the ENDING peg. But the generality of the game is independent of the starting and ending pegs. The goal is to move all the disks off the starting peg and eventually get them all onto the ending peg. In the process you can use the other peg (in fact any of the 3 pegs) for temporary storage.

The game ends if and when you manage to move all the disks to the ending peg. Just remember to move one disk at a time. The program will not let you place a larger diameter disk on top of a smaller one.

The object is also to make as few moves as possible, but beginners should just concentrate on accomplishing the goal and worry about efficiency after they have mastered the goal. The program counts your moves and announces your total when the game ends.

The reason the author decided to write this program was not just to simulate the game. The reason was to solve a complicated programming problem using as few programming steps as possible. In fact, the main logic of the automatic play subroutine basically consists of only three steps! If you are a programmer we encourage you to try to program this game on your own. If you think of a recursive solution you too can solve the Towers of Hanoi game using only three lines of code and in the process you will convince yourself of the real power of recursive programming techniques.

The Pegs Menu

The first main menu is titled Pegs.

Under this menu are the following menu items.

Set the Starting Peg…
This menu item will prompt you to enter the number of the starting peg. This must be a number in the range between 1 and 3. Normally the starting peg number must be different from the ending peg number. However, using this menu item may automatically change the ending peg number so it is different from the number you enter.

Set the Ending Peg…
This menu item will prompt you to enter the number of the ending peg. This must be a number in the range between 1 and 3. Normally the ending peg number must be different from the starting peg number. However, using this menu item may automatically change the starting peg number so it is different from the number you enter.

Set the Number of Disks…
This menu item will prompt you to enter the number of disks that are to be used in the game. This number should be in the range between 3 and 9. After the number of disks has been entered, the program will re-draw the starting peg with that number of disks.

Re-Initialize All The Disks
This menu item is probably not necessary, but it gives you the ability to reset all the disks on the starting peg. This would only be necessary if you quit the game in the middle and leave some disks scattered on the unlabeled peg and/or the ending peg. So all this menu item does is clean everything up by putting all the disks back on the starting peg and initializes the program for the start of a new game.

The Options Menu

The Options menu contains the following items.

Set the Time Delay…
This menu item allows you to change the speed at which disks are moved. This setting applies to both the automatic and manual modes. The number you enter will normally be relatively small. The default value is 10, but you can enter any value up to 100. A value of 0 will cause the program to run the fastest. This number is the number of milliseconds time delay between animation moves of the disks. So a setting of 100 would represent 1/10 of a second between moves. This setting would make for extremely slow moves. In fact, most useful values will be between 0 and 20.

Set the Background Color…
This menu item allows you to set the main color on the form, which is yellow by default. However, you can use the color grid to select any one of 16 colors. This color should be distinct from the colors used for the disks and spindles.

Set the Disks Color…
This menu item allows you to set the color of the disks, which is white by default. However, you can use the color grid to select any one of 16 colors. This color should be distinct from the colors used for the background and spindles.

Set the Spindle Color…
This menu item allows you to set the color of the spindles, which is black by default. However, you can use the color grid to select any one of 16 colors. This color should be distinct from the colors used for the background and disks.

How To Play The Game

Assuming you have read the Introduction section, this section describes how to start playing the game.

If you want to play in the automatic mode, all you do is push the button labeled Start Automatic Play. The program will then re-initialize the disks so they all start on the Starting Peg and then it automatically starts moving the disks. There is nothing for you to do in this case except sit back and relax and enjoy the action. When the game finishes the program will show a message indicating how many moves it took to complete the game. The program is an expert player. If you want to stop automatic play before the game finishes, then you can press the button labeled Stop Automatic Play. In this case the program will complete the current move and then stop. Otherwise you should just study the moves. Before starting automatic play you may want to set the time delay, which is a number that controls the speed of animation. Using the number 0 as the time delay will cause the program to run the fastest.

If you want to play in the Manual Mode, all you do is push the button labeled Start Manual Play. The program will then make sure all the disks are put back on the starting peg. We also use the term spindle to refer to the pegs.

To make each manual move all you do is click two of the buttons that are labeled 1, 2, and 3. The first number you click should represent the peg or spindle that holds the disk you want to move. This spindle is also called the source spindle. When you push the first numbered button, the program doesn't do anything except remember what source spindle you just selected. Then you should click a second numbered button that represents the spindle or peg you want to move the disk to. This spindle is also called the destination spindle. When you click the second numbered button the program will select the top disk on the source spindle and it will move that disk to the destination spindle. So each move is accomplished by pressing two numbered buttons in succession.

Then you continue manual play by again using the numbered buttons to first choose a source spindle and second to choose a destination spindle. Clicking the second numbered button is what causes the program to move the disk for you. If you manage to complete the game by getting all the disks on the ending peg or spindle then the program will show a message that tells how many moves you took.

In the process of selecting the source and destination spindles you may accidentally make an illegal move. In these cases the program will warn you that you can't do such a thing. Examples of illegal moves include selecting an empty source spindle, or trying to move a larger disk on top of a smaller disk. Another illegal move is to select the same destination spindle as your source spindle. In any case, the program will only allow you to make legal moves. If you make an error, just start over and select your source and destination spindles.

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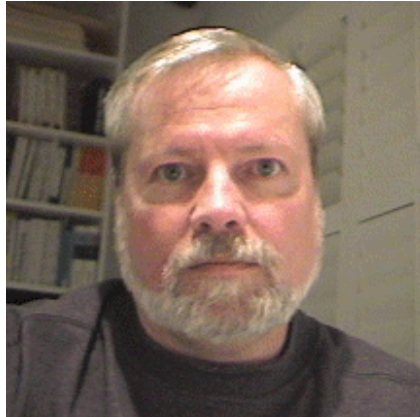
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John writes math software primarily for his students and the students in the Math Lab at Santa Monica College. This version of JKTHanoi is based on an earlier MS-DOS version named THanoi. There is a whole suite of programs related to math and computer science at the author's homepage listed below. Any questions or comments about this program may be referred to:

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