Textbook Exercises

For the first part of the lab, you need to complete the following exercises from chapter 2 of the textbook:

2.1, 2.2, 2.3, 2.4, 2.29, 2.32, 2.31, 2.33, and 2.34

Exercises in red should be completed during the lab period. Make sure to work on these exercises first!

Programming Assignments

For the second part of the lab, you need to write the following two programs:

1) Write a program to print all permutations of the first n positive integers.

    INPUT: A positive integer, n, from standard input.

    OUTPUT: All permutations of the numbers 1,...,n, one per line with spaces between the numbers, on standard output.

    Here is an example run (user input in **bold**):

        mulan% **./lab2.1**
        3
        1 2 3
        1 3 2
        2 1 3
        2 3 1
        3 1 2
        3 2 1

2) Write a program for a **modified** version of the Hanoi Towers Problem. As in the original version of the Hanoi towers problem, there are three poles (1, 2, and 3), and the goal is to get all of the rings onto pole 3, with the only restriction being that you cannot move a larger ring on top of a smaller ring.

    Unlike the original Hanoi Towers problem, in this version of the problem there are initially N rings of size 1, ..., N on pole 1 AND N rings of size N+1, …, 2N on pole 2, for a total of 2N rings.

    INPUT: A positive integer, n, from standard input

OUTPUT: All the moves required to move the 2N rings from poles 1 and 2 all to pole 3, with one move per line, where a move is printed as two numbers, the starting pole and ending pole of the move.

Here is an example run (user input in **bold**):

mulan% **./lab2.2**
2
1 2
1 3
2 3
2 1
3 2
3 1
2 1
2 3
1 3
1 2
3 2
1 3
2 1
2 3
1 3

Here is a more detailed illustration of these 15 moves, where we show the state of the rings and poles after each move.

The input was N = 2, so there are a total of 4 rings, arranged as follows:

Pole 1	Pole 2	Pole 3
X	XXX	
XX	XXXX	

MOVE(1, 2)

	X	
	XXX	
XX	XXXX	

MOVE(1, 3)

	X	
	XXX	
	XXXX	XX

MOVE(2, 3)

	XXX XXXX	X XX

MOVE(2, 1)

		X
XXX	XXXX	XX

MOVE(3, 2)

	X	
XXX	XXXX	XX

MOVE(3, 1)

XX	X	
XXX	XXXX	

MOVE(2, 1)

X XX XXX	XXXX	

MOVE(2, 3)

X XX XXX		XXXX

MOVE(1, 3)

XX XXX		X XXXX

MOVE(1, 2)

		X
XXX	XX	XXXX

MOVE(3, 2)

	X XX	XXXX
XXX		

MOVE(1, 3)

	X XX	XXX XXXX

MOVE(2, 1)

X	XX	XXX XXXX

MOVE(2, 3)

X		XX XXX XXXX

MOVE(1, 3)

		X XX XXX XXXX