# FA18 CSC 130 Lesson 3 Quiz Questions

## Goal

* Investigate the running time of a recursive algorithm by counting the number of moves with a series of different inputs and attempt to find the formula for the number of moves based on the input.

## Submission

Download this document and supply the answers in the space provided after the **Answer:** prompt. Submit this file with your answers to Blackboard.

## Questions

1. (70 pts) Using your **TowerOfHanoi** program, fill in the following table with the number of moves for each number of disks.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **N: NumDisks** | **NumberOfMoves** | **N2** | **N3** | **2n** |
| 3 | 7 | 9 | 27 | 8 |
| 4 | 15 | 16 | 64 | 16 |
| 5 | 31 | 25 | 125 | 32 |
| 6 | 63 | 36 | 216 | 64 |
| 7 | 127 | 49 | 343 | 128 |
| 8 | 255 | 64 | 512 | 256 |
| 10 | 1023 | 100 | 1000 | 1024 |
| 12 | 4095 | 144 | 1728 | 4096 |
| 14 | 16383 | 196 | 2744 | 16384 |
| 16 | 65535 | 256 | 4096 | 65536 |
| 20 | 1048575 | 400 | 8000 | 1048576 |
| 24 | 16777215 | 576 | 13824 | 16777216 |

1. (15 pts) Using the table above, does doubling the number of disks lead to a doubling of the number of moves? Explain your answer.

Look at the number of moves for 4 disks and compare that the number of moves for 8 disks and compare the number of moves for 8 disks and compare that to the number of moves for 16 disks. You could also look at the differences between 3, 6, 12 and 24.

Answer:

No, the number of moves does not double as the number of disks doubles. The number of moves increases in powers of 2 or 2n - 1 with n being the number of disks.

1. (15 pts) Look for a pattern between the number of disks and the number of moves and place the answer below. I am looking for a formula that describes the number of moves in terms of the number of disks.

(Hint: See extra columns in the table for help)

Answer:

2n - 1 with n being the number of disks.