

Game Project

The project is to implement the DFS program for games for the game below and to analyze the data.

Sequence: There are n moves, alternating between Paul (first) and Carole. At each move the player selects a bit, zero or one. The starting node, denoted e , is the empty string. After u moves the intermediate node will be a binary string of length u . At the end of the game, the leaves are the 2^n strings of length n . The values $VALUE(x)$ for the leaves x are set in advance. The algorithm should then compute $VALUE(e)$, the value of the game to Paul.

Analyze, through simulation, what happens when the 2^n values $VALUE(x)$ are chosen as random real numbers in the interval $[-1, +1]$. What is $VALUE(e)$? Of course, it will depend on the random numbers. For each n do some number of simulations and get data on the different $VALUE(s)$. (The number of nodes is $2^{n+1} - 1$ so that even for $n = 20$ the algorithm should be pretty quick.)

Now – put on your Data Scientist hat! Display this data in some meaningful way and come up with a reasoned conjecture (from the data) about what $VALUE(s)$ will usually be as a function of n . Your instructor does *not* know what will happen! Here are some things to think about.

1. Is there an advantage to playing last? If so the parity of n would affect the data.
2. Is there an advantage to playing first? By putting values for leaves random in $[-1, +1]$ if there was no advantage the value would be zero.
3. Is there much variance in the results. (Take some n and do many runs.)
4. Is there a distribution to the results? (Again, take some n and do many runs.)
5. What does the limiting behavior as $n \rightarrow \infty$ appear to be?
6. Surprise your instructor! Come up with some other analysis.

Most of all, have fun – explore – take to heart the words of the founder of Theoretical Computer Science, Don Knuth:

...pleasure has probably been the main goal all along. But I hesitate to admit it, because computer scientists want to maintain their image as hard-working individuals who deserve high

salaries. Sooner or later society will realise that certain kinds of hard work are in fact admirable even though they are more fun than just about anything else.