Games and Computation Homework #6:
Binary Numbers and Computational Complexity

Answer these questions within the HW #6 Moodle quiz:

Pig Play Data Collection

Please enter the date that you emailed me your Pig play data file PigPlay.dat with at least 20 games of play data. This was due the class before this homework is due.

_____

Binary to Decimal Translation

1) Please enter the decimal representation (with no leading zeros) of the binary number 101100: _____
2) Please enter the decimal representation (with no leading zeros) of the binary number 100011: _____
3) Please enter the decimal representation (with no leading zeros) of the binary number 111100: _____

Decimal to Binary Translation

1) Please enter the binary representation (with no leading zeros) of the decimal number 34: _____
2) Please enter the binary representation (with no leading zeros) of the decimal number 31: _____
3) Please enter the binary representation (with no leading zeros) of the decimal number 25: _____

Decimal to Hexadecimal Translation

1) Please enter the hexadecimal representation (with no leading zeros) of the decimal number 27: _____
2) Please enter the hexadecimal representation (with no leading zeros) of the decimal number 37: _____
3) Please enter the hexadecimal representation (with no leading zeros) of the decimal number 20: _____

Hexadecimal to Decimal Translation

1) Please enter the decimal representation (with no leading zeros) of the hexadecimal number 2f: _____
2) Please enter the decimal representation (with no leading zeros) of the hexadecimal number 10: _____
3) Please enter the decimal representation (with no leading zeros) of the hexadecimal number 22: _____

Card Red/Black Sequence Translation to Hexadecimal

One can take a sequence of playing cards and memorize the red-black sequence of the suits by treating black and red as binary digits 0 and 1, respectively, and chunking the memory task by translating successive 4-card sequences as hexadecimal digits. For the following card sequence, the two character representation consists of a rank character (irrelevant) followed by the first character of the suit name ("c" for "clubs", "D" for "diamonds", "H" for "hearts", and "s" for "spades"). Note that upper- and lower-case characters are used for red and black suits, respectively. Translate the following sequences of cards to a sequence of hexadecimal digits with no separating spaces and including leading 0's if appropriate:

1) 8H As Kc Qc Ks 6c Tc JH TH 8c AD 6H 7H 6s 2c 5D 3s 5c Jc 2H AH 7c 6D 5s 4s 7D 2D 9s _____
2) 8H 8D 9H Jc 7D 2H 7H AH 6H 8c QH 3c KD 3D 9D JD QD 3s 7s 4D 5c As Js 4c 5D 4s 2c 7c _____
3) JH 3H 5s KH 5c 7D 4D Qc 8D Kc Qs AD 6H Jc 6s 5H AH 3c JD Ac TD TH As 8s Ts 7c Js KD _____

Towers of Hanoi T(n)

For the Towers of Hanoi puzzle, we wish to move *n* disks from peg *f* to peg *t* using a third peg *u*. Let T(*n*) be the number of single disk movement steps in the solution, where *n* is the number of disks. When *n* = 1, there is one solution step: Move a single disk from peg *f* to peg *t*. When *n* > 1, there are three steps: (1) move *n*-1 disks from peg *f* to peg *u* using peg *t*, (2) move a single disk from peg *f* to peg *t*, and (3) move *n*-1 disks from peg *u* to peg *t* using peg *f*. Note that the first and third steps involve moving *n*-1 disks. First, write the values of T(*n*) for *n* = 1, 2, 3, and 4. Then, for n > 1, express T(*n*) in terms of T(*n*-1).

Towers of Hanoi Big-O Complexity

What is the tightest Big-O upper bound complexity of T(n) for the Towers of Hanoi puzzle where T(*n*) is the number of single disk movement steps in the solution?

Name Game Complexity

One awkward orientation rite of passage consists in forming small groups that sit in circles and play games to learn names. One such name game, Picnic, has students think of an introduction where they say their first name and a food name they would bring on a picnic that starts with the same letter as their first name (e.g. “I’m Todd, and I’m bringing tacos.”). Starting with one student in the circle and proceeding clockwise, each student recalls and says the name and food of each student who has gone before and then adds their own name and food to the sequence. The one leading the group generally goes last, repeating all student names and foods. Let n be the number of students in the circle, and let T(n) be the total number of name-and-food pairs that will be recited. What is the tightest Big-O asymptotic upper-bound on T(n)?