CS 173, Summer 19 Examlet 11

Name:_____

NetID:_____ **Lecture: A**

Discussion: Monday & Wednesday 1:30 2:30

```
00 Flang(a_1, ..., a_n) : list of n positive integers, n ≥ 2)
01      if (n = 2) return |a_1 − a_2|
02      else
03          bestval = 0
04          for k = 1 to n
05              newval = Flang(a_1, a_2, ..., a_{k−1}, a_{k+1}, ... a_n)   \\ constant time to remove a_k
06              if (newval > bestval) bestval = newval
07          return bestval
```

1. (3 points) Describe (in English) what Flang computes.

2. (5 points) Suppose that $T(n)$ is the running time of Flang on an input list of length n. Give a recursive definition of $T(n)$.

3. (3 points) What is the height of the recursion tree for $T(n)$?

4. (4 points) How many leaf nodes are there in the recursion tree for $T(n)$?

CS 173, Summer 19 Examlet 11

Name:_____

NetID:_____ **Lecture: A**

Discussion: Monday & Wednesday 1:30 2:30

(15 points) Check the (single) box that best characterizes each item.

$T(1) = d$
$T(n) = 2T(n/4) + c$

$\Theta(\log n)$ ☐ $\Theta(\sqrt{n})$ ☐ $\Theta(n)$ ☐ $\Theta(n \log n)$ ☐
$\Theta(n^2)$ ☐ $\Theta(n^3)$ ☐ $\Theta(2^n)$ ☐ $\Theta(3^n)$ ☐

Dividing a list in half

$\Theta(1)$ ☐ $\Theta(\log n)$ ☐ $\Theta(n)$ ☐ $\Theta(n \log n)$ ☐
$\Theta(n^2)$ ☐ $\Theta(n^3)$ ☐ $\Theta(2^n)$ ☐ $\Theta(3^n)$ ☐

$T(1) = d$
$T(n) = T(n/2) + d$

$\Theta(\log n)$ ☐ $\Theta(\sqrt{n})$ ☐ $\Theta(n)$ ☐ $\Theta(n \log n)$ ☐
$\Theta(n^2)$ ☐ $\Theta(n^3)$ ☐ $\Theta(2^n)$ ☐ $\Theta(3^n)$ ☐

Finding the chromatic number of a graph with n nodes requires $\Theta(2^n)$ time.

true ☐ false ☐ not known ☐

Problems in class P (as in P vs. NP) can be solved in exponential time

true ☐ false ☐ not known ☐