CS 173, Fall 18 Examlet 11, Part A

Name:_____

NetID:_____ **Lecture: B**

Discussion: Friday 11 12 1 2 3 4

```
1  Jump(A,bottom,top)   \\ A is an array of integers, bottom and top are positive integers
2        if (top = bottom+1) return bottom
3        middle = floor((bottom+top)/2)
4        if (A[middle] = 0)
5              return Jump(A, bottom, middle)
6        else
7              return Jump(A, middle, top)
```

1. (3 points) Suppose that A is an array of length n ($n \geq 2$) containing a sequence of positive integers followed by zeros, where $A[1] > 0$ and $A[n] = 0$. What does Jump(A,1,n) return?

   Solution: The location of the last positive value in A.

2. (5 points) Let $T(n)$ be the running time of Jump. Give a recursive definition of $T(n)$.

   Solution:

   $T(2) = c$

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

3. (3 points) What is amount of work (aka sum of the values in the nodes) at level k in the recursion tree for $T(n)$?

   Solution: d

4. (4 points) What is the big-Theta running time of Jump?

   Solution: $\Theta(\log n)$

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```
01 Skip(k,n)   \\ inputs are natural numbers
02         if (n = 0) return 1
03         else if (n = 1) return k
04         else if (n is odd)
05                 temp = Skip(k,floor(n/2))
06                 return k*temp*temp
07         else
08                 temp = Skip(k,floor(n/2))
09                 return temp*temp
```

1. (5 points) Suppose $T(n)$ is the running time of Skip. Give a recursive definition of $T(n)$, assuming that n is a power of 2.

   Solution:

   $T(0) = a$

   $T(1) = c$

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

2. (4 points) What is the height of the recursion tree for $T(n)$?

   Solution: $\log_2 n$

3. (3 points) How many leaves are in the recursion tree for $T(n)$?

   Solution: One.

4. (3 points) What is the big-Theta running time of Skip?

   Solution: $\Theta(\log n)$