

Cmpe 300 - Analysis of Algorithms
Fall 2010
Assignment 1

Due Date: 03/11/2010 17:00

Question 1 (60 Points)

Consider the following function which takes X (a stream of 0's and 1's, whose length is n) as input.

$$\begin{aligned} X &= [x_0 \ x_1 \ x_2 \ \dots \ x_{n-1}] \\ X[i] &= x_i \in \{0, 1\}, \quad i = 0, \dots, n-1 \end{aligned}$$

```
function Q1(X)
Input : X[0:n-1] (a list of size n)
Output : y
  y ← 0
  for i ← 0 to n-1 do
    if X[i] = 0 then
      for j ← i to n-1 do
        for k ← n to 1 by k ← ⌊k/2⌋ do
          y ← y+1
        endfor
      endfor
    else
      for l ← i to n-1 do
        y ← y+1
      endfor
    endif
  endfor
  return(y)
end Q1
```

Find the best case ($B(n)$), worst case ($W(n)$), and average ($A(n)$) complexities exactly and also express them in asymptotic notation. You can assume a suitable probability distribution for calculating ($A(n)$).

Question 2 (40 Points)

Consider the given function $f(n)$ and determine whether the following case are true or false. Justify your answers formally. (*Hint: Use Stirling's Approximation*)

$$f(n) = n^2 \log(2n!) + 3n^3 + \sqrt{n}$$

- a) $f(n) \in O(n^3)$
- b) $f(n) \in o(n^3 \log(n))$
- c) $f(n) \in \Theta(n^3 \log(n))$
- d) $f(n) \in \Omega(n^3)$