HABIB UNIVERSITY

Data Structures & Algorithms

CS/CE 102/171 Spring 2023

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Time Complexity of Recursive Functions – Back Substitution Method

Student 1: ____

Q1) For the given recurrence equation, derive its time complexity, by using the Substitution Method. Make sure you show **at least 3** exact equations before you define the generalized statement.

$$T(n) = \begin{cases} T(n-1) + n^2 & , n > 0 \\ 1 & , n = 0 \end{cases}$$

Q2) Short Questions: What is big-O value of the following recurrence equations:

- **T(n) = T(n – 1) + log n** ________________________________
- **T(n) = T(n – 1) +** $\sqrt{n}$ ________________________________

Q3) For the given recurrence equation, derive its time complexity, by using the Substitution Method. Make sure you show **at least 3** exact equations before you define the generalized statement.

$$T(n) = \begin{cases} T(n-4) + n & ,n > 0 \\ 1 & ,n = 0 \end{cases}$$

Q4) Short Questions: What is big-O value of the following recurrence equations:

- **$T(n) = T(n - 20) + \log n$** __________________________________
- **$T(n) = T(n - 100) + n^2$** __________________________________

Q5) For the given recurrence equation, derive its time complexity, by using the Substitution Method. Make sure you show **at least 3** exact equations before you define the generalized statement.

$$T(n) = \begin{cases} 9T(n-1) + 5 & ,n > 0 \\ 1 & ,n = 0 \end{cases}$$

Q6) For the given recurrence equation, derive its time complexity, by using the Substitution Method. Make sure you show **at least 3** exact equations before you define the generalized statement.

$$T(n) = \begin{cases} 5T(n-4) + 1 & ,n > 0 \\ 1 & ,n = 0 \end{cases}$$

Q7) Short Questions: What is big-O value of the following recurrence equations:

- **T(n) = 2 T(n – 4) + n** ______________________________
- **T(n) = 100 T(n – 50) + log n** ______________________________
- **T(n) = 99 T(n – 1) + 99** ______________________________
- **T(n) = 3T (n – 3) + n!** ______________________________

Q8) For the given recurrence equation, derive its time complexity, by using the Substitution Method. Make sure you show **<u>at least 3</u>** exact equations before you define the generalized statement.

$$T(n) = \begin{cases} T(n/3) + 5 & ,n > 1 \\ 1 & ,n = 1 \end{cases}$$

Q9) For the given recurrence equation, derive its time complexity, by using the Substitution Method. Make sure you show **<u>at least 3</u>** exact equations before you define the generalized statement.

$$T(n) = \begin{cases} T(n/2) + n^2 & ,n > 1 \\ 1 & ,n = 1 \end{cases}$$

Q10) For the given recurrence equation, derive its time complexity, by using the Substitution Method. Make sure you show **at least 3** exact equations before you define the generalized statement.

$$T(n) = \begin{cases} 4T(n/2) + 1 & ,n > 1 \\ 1 & ,n = 1 \end{cases}$$

Q11) Short Questions: What is big-O value of the following recurrence equations:

- **T(n) = 5 T(n/2) + 10** ________________________________
- **T(n) = 1024 T(n/2) + 1** ________________________________

Q12) For the given recurrence equation, derive its time complexity, by using the Substitution Method. Make sure you show **<u>at least 3</u>** exact equations before you define the generalized statement.

$$T(n) = \begin{cases} 2T(n/2) + n^2 & , n > 1 \\ 1 & , n = 1 \end{cases}$$