The Open University of Sri Lanka
B.Sc. (IT) Degree Programme - 2023/2024
Department of Computer Science
Level 3
COU3306 – Data Structures and Algorithms
No Book Test – 1 (NBT – 1)
Duration: One hour only (1 hour)

Registration Number:.....

Date: 14.09.2024 Time: 2.30 p.m. – 3.30 p.m.

ANSWER ALL QUESTIONS

(1). What does it mean by an algorithm?

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(2). What are the two main factors that should be considered when analyzing an algorithm?

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(3). There are many different methods to design algorithms. Mention **three (03)** methods used to design an algorithm.

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(4). Evaluating the runtime of a program beforehand is essential. List **three (03)** factors affecting running time of a program?

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(5). Asymptotic Analysis evaluates the performance of an algorithm in terms of input size. It commonly uses three notations. Name those **three (03)** notations with names used to measure the running time.

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(6). What is a Data Structure?

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(7). List **three (03)** basic operations that can be performed on a data structure.

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(8). When selecting a data structure to solve a problem, what are the steps you should follow?

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(9). What is an Abstract Data Type (ADT)?

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(10). Using Big O notation, determine the running time of the following Java code segment. State any assumptions you made.

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for(int i = 0; i < n; i++){
        x = x + 1;
}
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(11). Consider the steps of running times O(f(n)) and O(g(n)) where,

$f(n) = \begin{cases} n^8 \text{ if n is even} \\ n^4 \text{ if n is odd} \end{cases}$

$g(n) = \begin{cases} n^2 \text{ if n is even} \\ n^6 \text{ if n is odd} \end{cases}$

Consider also that f(n) and g(n) are placed sequentially.
Calculate the time complexity of both odd n and even n separately.

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(12). State whether the following statements are **True** or **False**.

(i). There is typically only one correct algorithm for a given problem.

(.....)

(ii). The worst-case analysis of an algorithm is used to determine the minimum time required for completion.

(.....)

(iii). Growth rates help in comparing the efficiency of algorithms by ignoring lower order terms.

(.....)

(iv). Operation counts are used to measure the number of instructions executed by an algorithm.

(.....)

(v). The Product Rule can be used to analyze nested loops in an algorithm.

(.....)

(13). Fill in the blanks in each of the following statements. Use the words given inside brackets underneath.

(Dynamic programming, infinite, time, $O(n^2)$, divide and conquer, finite, space, $O(3n^2)$)

(i). _____ and _____ methods are both used to solve complex problems by breaking them into smaller parts.

(ii). An algorithm must consist of a _____ number of steps to ensure it terminates.

(iii). The efficiency of an algorithm can be measured in terms of _____ complexity or _____ complexity.

(iv). The running time of an algorithm with $T(n) = 3n^2 + 5n + 4$ is _____ in Big-Oh notation.