CSC705 - Design & Analysis of Algorithms

Exam II – Final Exam

This is a take-home exam, which means you are free to use any notes and lecture videos from the course as you take it. That said, you are expected to work on it by yourself. Any sharing of work could potentially lead to no credit for the exam. If you have any questions, please feel free to contact me. Please be sure to include all work necessary to solve the problems. Simple answers may only yield partial credit.

# Problem 1:

State the asymptotic relationship between the functions and , as in , where may be , , . You must justify your answer by showing your work using the

## 

# Problem 2:

Using the master theorem for solving recurrences, state the Big-O value for the following recurrences. If it is inappropriate to use the master method, then state this fact instead.

# Problem 3:

Consider the following algorithm:

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | void sort(int A[], int n) { | | | | | | | | |
| *1* |  | |  | int i **=** 0**,** j**,** s**;** | | | | | | |
| *2* |  | |  | **while(**i **<** n**-**1**){** | | | | | | |
| *3* |  | |  | |  | s = i**;** | | | | |
| *4* |  | |  | |  | j = i+1**;** | | | | |
| *5* |  | |  | |  | **while(**j **<** n**){** | | | | |
| *6* |  | |  | |  | |  | **if(**A**[**j**]** **<** A**[**s**]){** | | |
| *7* |  | |  | |  | |  | |  | s = j**;** |
|  |  | |  | |  | |  | } | | |
| *8* |  | |  | |  | |  | j **+=** 1**;** | | |
|  |  | |  | |  | } | | | | |
| *9* |  | |  | |  | A**[**i**]** **=** A**[**s**];** | | | | |
| *10* |  | |  | |  | i **+=** 1**;** | | | | |
|  |  | |  | } | | | | | | |
|  |  | } | | | | | | | | |

## Give a precise line count for every numbered line of code in terms of . Use indicator functions if/when needed.

## What is the efficiency of the algorithm in terms of Big-O?

# Problem 4:

Identify all subgraphs that are Cliques or Independent Sets given the Graph Below. You can identify a subgraph by listing their vertices (e.g. could be a potential clique or independent set).

A diagram of a network

Description automatically generated