Department of Computer Science
Graduate Comprehensive Exam
Fall 2023

- **Answer the questions on the paper supplied.**
- **Answer question 1 or 2. You should answer a total of one question. Please Note: If you answer more than one question, only the one with the LOWER score will be counted.**
- **Start each question on a new page. Write on only one side of the paper.**
- **Write your SIX-DIGIT Texas State ID in the top right corner of each page of your answer. Do NOT put your name anywhere on the answers.**
- **Put the number of the question being answered in the top left corner of each answer page. Put the CORRECT question number to avoid missing your answer.**
- **If the answer to a question is written on more than one page, number the pages consecutively.**

1. **CS 5329 Algorithm Design and Analysis**
   { *from Dr. Hwang*}

   Given an array A[ ] of n elements,

   (1) How to make it a binary tree by using diagram and functions? (No need for any English sentences.)

   (2) What is the property of the binary heap? (one sentence only)

   (3) Write functions to build the heap (MAX) for the binary tree A[ ] .

   (4) Mark computation time on the right side to each statement of the functions you coded from item (3).

2. **CS 5329 Algorithm Design and Analysis**
   { *from Dr. Metsis*}

   Question: Hash Functions and Collision Resolution

   a) Define what a hash function is. Explain two different collision resolution schemes and provide examples.

   b) Explain what is meant by linear probing, quadratic probing, and double hashing as methods for collision resolution. Provide an example for each method.

   Note: You may use pseudocode to show or algorithms or a deterministic list of steps in plain English.