

## Department of Computer Science

### Final exam for data structures and algorithms

**Course Code: SENG2032**

**Academic Year: 2020**

**Exam Date: \_\_\_\_\_**

**Maximum Score: 50%**

**Time Allowed: 01:45**

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Name: \_\_\_\_\_ ID No: \_\_\_\_\_

Department: \_\_\_\_\_ Section: \_\_\_\_\_ Year: \_\_\_\_\_

Program: \_\_\_\_\_ Admission: Regular ☐ Extension: ☐ Semester: \_\_\_\_\_

#### General Instructions

- ☞ Write your name Id, Department and section both on the cover page and on the answer sheet.
- ☞ Please make sure the exam has 4 parts and 8 pages including the cover page and the answer sheet.
- ☞ Provide your answer only on the separate answer sheet.
- ☞ Any material shall not be taken to the exam room unless permitted by the course instructor.
- ☞ Cheating is strictly forbidden and it will lead you academic dismissal.
- ☞ Please switch off your mobile until the end of the exam.

***PLEASE DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO!!***

## Part I: True/False Items (8 points)

**Instruction: Write TRUE if the statement is true and FALSE if the statement is false. (1 point each)**

1. Hash tables use the array data structure as a data storage medium.
2. Hashing cannot be used for applications where multiple records with the same key value are permitted.
3. Data searching can be optimized to a very high level if the data is sorted.
4. Bubble sort is a better sorting algorithm than the selection sort algorithm because it makes the minimum amount of swapping values.
5. A balanced binary tree is a binary tree in which each node has either 0 or 2 children.
6. The depth first traversal/search graph traversal algorithm uses the queue data structure to maintain visited nodes and continue searching.
7. Big-O notation is used to measure the lower bound growth rate of an algorithm.
8. For binary search to work properly the dataset should be stored in a sorted format.

## Part II: Multiple choice Items (8 points)

**Instruction: Choose the correct answer among the given alternatives and write the letter of your choice on the space provided on the separate answer sheet. (1 point each.)**

1. Which of the following algorithms is guaranteed to run in  $O(N\log N)$  time?  
A. Selection Sort  
B. Bubble Sort  
C. Merge Sort  
D. Quick Sort
2. Which of the following tree traversing algorithms traverse a binary search tree in a sorted format?  
A. Pre Order Traversal  
B. In Order Traversal  
C. Post Order Traversal.  
D. Breadth first Traversal
3. Which of the following statements is false about the binary tree data structure?  
A. A binary tree is a tree data structure in which the maximum number of children for a node is 2.  
B. A binary tree is called a balanced binary tree if each node in a tree has exactly either 0 or 2 number of children.  
C. A binary tree is called complete binary tree if the length from the root node to any leaf node is either  $h$  or  $h-1$ .  
D. In a binary search tree all nodes which are smaller than the root node are stored to the left of the root node.
4. Which of the following statements is false about the graph data structure?  
A. Graphs without cycles are called acyclic graphs.  
B. Two nodes are adjacent if there is a path between them.  
C. Directed graphs with cycles are called DAG's.  
D. None.
5. Which of the following algorithms has the worst case running time of  $O(\log N)$ ?  
A. Binary Search  
B. Linear Search  
C. Accessing an array element at some index.  
D. Inserting a node at the end of a linked list.

6. Which one of the following asymptotic notations are used to express both lower bound and upper bound growth rates of an algorithm?
  - A. Big-O Notation
  - B. Theta Notation
  - C. Omega Notation
  - D. None of them can describe both lower and upper bounds
7. Which one of the following statements is false about recursive and iterative solutions?
  - A. Recursive functions terminate when the base case is reached.
  - B. Iterative statements terminates when a condition is proven to be false.
  - C. Recursive functions are generally more efficient compared to iterative statements.
  - D. Solutions to some problems are easier to formulate recursively.
8. Which one of the following statements is false about the hash table data structure?
  - A. Hash tables can be used for applications where multiple records with the same key value are permitted.
  - B. Collisions are generally unavoidable in hash tables.
  - C. Hash tables has an efficient searching and inserting capabilities.
  - D. The records in a hash table are not ordered by value or frequency.

### **Part III: Explanation (8 points)**

**Instruction: Explain the following questions neatly and write the answer on the answer sheet.**

1. Discuss both hash table collision resolution strategies. (2pts)
2. Discuss the 2 properties of recursive functions, and define the common mistakes that can occur in recursive functions. (1pt)
3. List at least 3 applications of the graph data structure. (2pts)
4. Discuss the two graph data structure representation techniques and what their advantages and disadvantages are. (2pts)
5. Define the divide and conquer algorithm design technique and give some examples of algorithms that use the divide and conquer technique. (1pt)

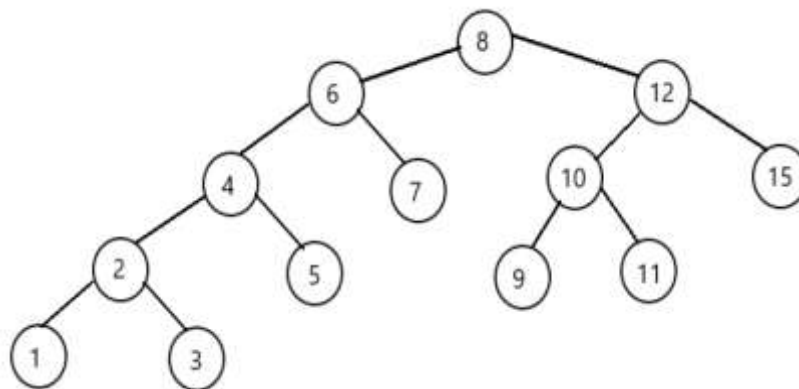
#### Part IV: Workouts (26 points)

**Instruction: Read the following questions carefully and solve the following questions, write your answer on the space provided.**

1. Sort the following array using the selection sort algorithm, [8, 4, 3, 1, 6, 2]. (3pts)

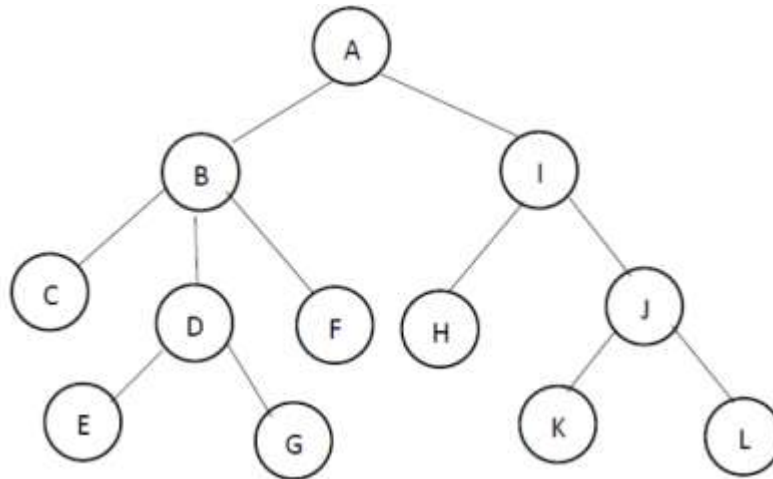
2. Create a binary search tree using the following values, [8, 3, 6, 5, 4, 13, 9, 10, 15, 1]. (4pts)

3. Traverse the following binary search tree using all the tree traversing algorithms. (4pts)

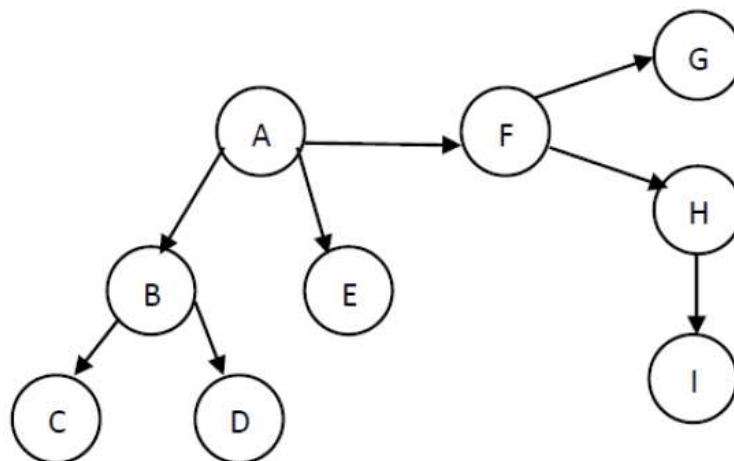


4. Determine the following terms for the following tree: (4pts)

- Find the root node (vertex) of the tree:
- Determine the descendants of D:
- Determine the ancestors of J:
- Determine the degree of the tree:
- Determine the height of the tree:
- Determine the path length of the tree:



5. Traverse the following graph using both Breadth first and Depth first search algorithms: (4pts)



6. Draw the graph using the following adjacency list of a graph. (2pts)

A	C,D,E
B	A,E
C	A,B
D	F,E,C
E	A,B
F	D,E

7. What is the worst case running time complexity of the following code snippet? (2pts)

```
for(int i=1; i<=n; i++){  
    for(int j=1; j<=n; j*=2){  
        cout<<j<<endl;  
    }  
}
```

8. Write an algorithm and its implementation to find the largest element in a given array. (3pts)

**Microlink Information Technology and Business Collage**

**Department of computer science**

**Mid exam for data structures and algorithms**

**2020/ Academic Year**

**Answer sheet**

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Name: \_\_\_\_\_ Department: \_\_\_\_\_

ID No: \_\_\_\_\_ Section: \_\_\_\_\_ Year: \_\_\_\_\_ Program: \_\_\_\_\_

Enrolment: \_\_\_\_\_ Semester: \_\_\_\_\_

Add  Drop  DD/MM/YYYY \_\_\_\_\_

<b>Part I: True/False Questions (1 points each)</b>	<b>Part II: Multiple Choice Questions (1 point each)</b>
1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____ 7. _____ 8. _____	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____ 7. _____ 8. _____

**Part III: Explanation (8 points)**

1.

2.

3.

4.

5.