Student ID: **Name:**

Data Structures
Fall 2018 Quiz 4

1. (1 pt) Given N nodes, what is the maximum height and minimum height of a binary tree? Explain your answer.
2. (1 pt) Given the height H, what is the maximum and minimum numbers of nodes in a binary tree? Explain your answer.
3. (2 pts) Draw the expression tree for the following expression and write the result of performing the **preorder** traversal.

   A * B – C + D / E – F * G
4. Use the type definition and function prototypes below and complete these three functions in C:
   i. (2 pts) initQ () which prepares the queue head by initialize Count to 0 and Front and Rear to NULL
   ii. (2 pts) enqueue () which enqueues (inserts) a data to the queue and updates the count and pointers
   iii. (2 pts) dequeuer () which dequeues (removes) the front data as the return value and updates the count and pointers.

```
typedef struct list {
    int data;
    struct list * link;
    } listType;

typedef struct head {
    int count;
    listType * front;
    listType * rear;
    } qHead;

qHead * initQ (void);
void enqueue (qHead *, int);
int dequeue (qHead *);

int main(void)
{
    qHead * Q;

    Q = initQ ();
    enqueue (Q, 123);
    enqueue (Q, 98765);
    enqueue (Q, 2468);
    while (Q->count > 0) {
        printf("Content of Queue is:\n");
        printf("%d\n", dequeue (Q));
    }
}
```

Student ID: **Name:**

Data Structures
Fall 2018 Quiz 5

1. (2 pts) Define the AVL tree. How is a binary search tree (BST) updated to the AVL tree?
2. (1 pt) Define the data structure to the node in a BST using C.
3. (3 pts) Using C and the data structure above, write the code to the insert function of a BST.
4. (1 pt) Explain how the delete function of a BST works.
5. (3 pts) Write the search algorithm of a BST. Analyze its complexity and give the result in the Big-O notation. Show detail calculation with your explanation.

Student ID: **Name:**

Data Structures
Fall 2018 Quiz 6

1. (1 pt) Explain the property of a heap (max heap) and how this can be implemented in an array.
2. (1 pt) Consider a heap in an array X[0..N]. Where is the parent located for the node X[i]? Where are the children?
3. (2pts) Consider an array of size 6 below. Complete the content of array in each phase of heap construction. The shaded area is the unprocessed data, and the white area is the heap in each phase.

	A[0]	A[1]	A[2]	A[3]	A[4]	A[5]
Phase 0	10	101	50	33	85	120
Phase 1	10	101	50	33	85	120
Phase 2	101	10	50	33	85	120
Phase 3						
Phase 4						
Phase 5						
Phase 6						

4. (1 pt) Draw the above heap according to the content of the array in Phase 6.
5. (3 pts) Using C to write the code for constructing a heap using the process defined in Question 3.
6. (1 pt) Assume you have N numbers. How can you use a heap to find the k largest numbers? Explain and use pseudo code to write your algorithm.

Student ID: **Name:**

Data Structures
Fall 2018 Quiz 7

1. (2pts) Consider an array of size 6 below to perform **Insertion Sort**. Complete the content of array after completing a process in each phase of sorting. The shaded area is the unprocessed data, and the white area is the sorted sublist.

Phase 0

101	10	50	33	85	100
A[0]	A[1]	A[2]	A[3]	A[4]	A[5]

Phase 1

10	101	50	33	85	100
A[0]	A[1]	A[2]	A[3]	A[4]	A[5]

Phase 2

10	50	101	33	85	100
A[0]	A[1]	A[2]	A[3]	A[4]	A[5]

Phase 3

A[0]	A[1]	A[2]	A[3]	A[4]	A[5]

Phase 4

A[0]	A[1]	A[2]	A[3]	A[4]	A[5]

Phase 5

A[0]	A[1]	A[2]	A[3]	A[4]	A[5]

Phase 6

A[0]	A[1]	A[2]	A[3]	A[4]	A[5]

2. (3 pts) Using C to write the code for performing **Insertion Sort** using the process defined in Question 1.

3. (2pts) Consider an array of size 6 below to perform **Selection Sort**. Complete the content of array after completing a process in each phase of sorting. The shaded area is the unprocessed data, and the white area is the sorted sublist.

Phase 0

101	10	50	33	85	100
A[0]	A[1]	A[2]	A[3]	A[4]	A[5]

Phase 1

10	101	50	33	85	100
A[0]	A[1]	A[2]	A[3]	A[4]	A[5]

Phase 2

10	33	50	101	85	100
A[0]	A[1]	A[2]	A[3]	A[4]	A[5]

Phase 3

A[0]	A[1]	A[2]	A[3]	A[4]	A[5]

Phase 4

A[0]	A[1]	A[2]	A[3]	A[4]	A[5]

Phase 5

A[0]	A[1]	A[2]	A[3]	A[4]	A[5]

Phase 6

A[0]	A[1]	A[2]	A[3]	A[4]	A[5]

4. (3 pts) Using C to write the code for performing **Selection Sort** using the process defined in Question 3.