

Final Exam – Practice Test
100 min, 100 points

1.

- A. Replace guess by a better name (showing the purpose of the algorithm) _____
- B. The Big O notation is _____
- C. Briefly explain how did you get the answer to 1.B.:

```
template <class T>
bool Guess<T>::guess(T item)
{
    GuessNode *newNode; // Pointer to a new node

    // Allocate a new node and store num there.
    newNode = new GuessNode;
    if (!newNode)
        return false;
    newNode->value = item;

    // Update links and counter
    newNode->next = first;
    first = newNode;
    count++;

    return true;
}
```

2. Give the postfix form of the following expression either using a stack OR an expression tree.

2 * (A + (3 - B) % (4 + C)) - D

3. Given **pDe1**, a pointer to a node in a doubly-linked list, write statements to delete this node. Assume the list has two sentinel nodes.

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4. A binary tree has 9 nodes. The preorder and inorder traversals of this tree are given below. Draw the tree.

Preorder: * + a 5 - b / c 3

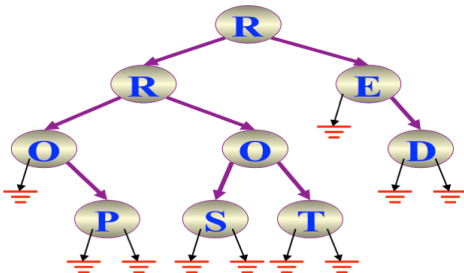
Inorder: a + 5 * b - c / 3

5.

(A) Create a BST using the following data entered as a sequence:

24, 10, 21, 22, 20, 15, 28, 18, 30.

(B). What is the output?



```

Algorithm print( root )
  if (root != NULL)
    print(root->right)
    print(root->left)
    if( root->right == NULL && root->left == NULL)
      display(root->data)
    end if
  end if
end print
  
```

6.

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A. Using the “modulo division” method and linked list collision resolution, store the keys shown below in an array of 5 elements. Each element has two fields: **data** and **link**. What is the load factor?

48, 79, 49, 28, 39, 58

0	<div></div>	<div></div>
1	<div></div>	<div></div>
2	<div></div>	<div></div>
3	<div></div>	<div></div>
4	<div></div>	<div></div>

Load Factor = _____

B. A simple hash function is given below? Is it good? Defend your answer.

Algorithm hash(string key, int size)

```

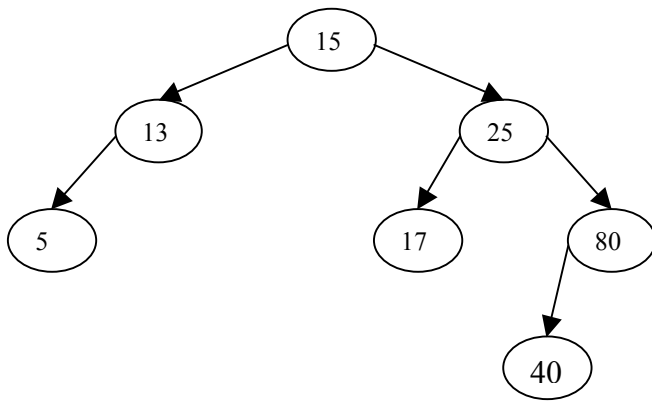
    sum = 0, i = 0;
    loop(not end of key)
        sum += key[i] * key[i] * key[i];
        i++;
    end loop

    return sum % size;
end hash

```

7. Redraw the following AVL tree after 15 has been deleted. Show the balance factors and the rotation(s).

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8. Given the following array of integers, rearrange the data so that the array forms a MAX-HEAP (show all four steps)

Data: **60, 10, 50, 30, 90**

- 1.
- 2.
- 3.
- 4.

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9.

A. Draw the following graph:

	A	B	C	D	E
A		0	6	6	0
B	6		0	4	3
C	6	4		0	3
D	0	3	3		4
E	0	3	0	4	

E

A

B

D

C

B. Find a Minimum Spanning Tree (show the steps)

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10. Show the array after it has gone through a one –increment pass of the Shell Sort with increment factor $k = 5$.

30, 25, 39, 20, 45, 42, 23, 38, 37, 19, 15, 37, 27

11. Many compilers offer the services of a cross-referencing program to aid in debugging. Such a program will list in alphabetical order all the identifiers that appear in a program and the various lines of the program that reference them. Draw a data structure for this application and briefly explain why you choose it. List any assumptions used in the design.

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12. Given the linked representation of an undirected graph, write pseudo-code that will determine if the graph is connected or not.