UNIVERSITY of GUELPH

CIS2520 Data Structures
Sample Final Questions

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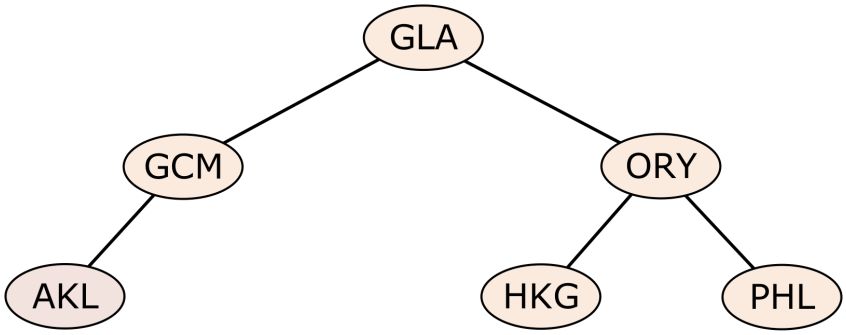
1)
Let I and K be two nonempty sets.
A table of items of type I and keys of type K is a finite subset T of I×K such that:
_____

2)
Consider the AVL tree below. Draw the tree after insertion of FRA.



3)
The worst-case running time for a search in a hash table is O(_____),
where n is the number of _____.

4)
The worst-case running time for a search in a 2-4 tree is O(_____),
where n is the number of _____.

5)
Consider two functions f and g from $\mathbb{Z}_+$ to $\mathbb{R}_+$, where $\mathbb{Z}_+$ is the set of positive integers and $\mathbb{R}_+$ the set of positive real numbers. We say that f is O(g) if and only if:
_____

6)
Consider four functions f_1, f_2, g_1 and g_2 from $\mathbb{Z}_+$ to $\mathbb{R}_+$, where $\mathbb{Z}_+$ is the set of positive integers and $\mathbb{R}_+$ the set of positive real numbers. If f_1 is $O(g_1)$ and f_2 is $O(g_2)$ then

f_1+f_2 is _____

f_1-f_2 is _____

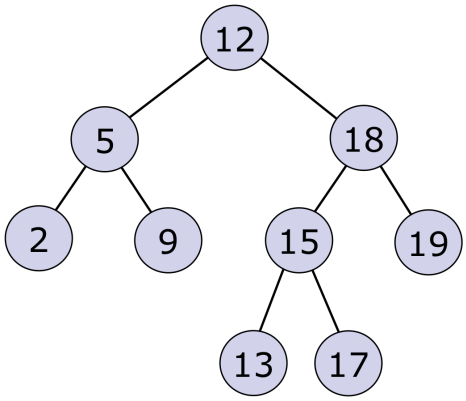
f_1f_2 is _____

f_1/f_2 is _____

7)
Consider the Queue ADT operations below. Write 4 axioms.

Create: ∅ ➔ Queue[T]
Enqueue: TxQueue[T] ➔ Queue[T]
Dequeue: Queue[T] ➔ Queue[T]
Full: Queue[T] ➔ Boolean
Empty: Queue[T] ➔ Boolean
Size: Queue[T] ➔ N
Head: Queue[T] ➔ T
Tail: Queue[T] ➔ T

8)
Consider the binary search tree below. Draw the tree after removal of 12.



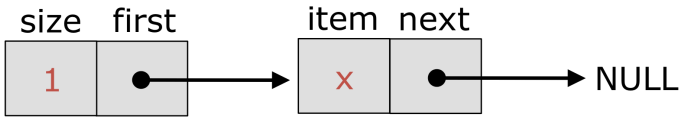
9)
Write a C function that returns the sum of the n first nonnegative integers.

```
int sum (int n) {
     _____________________
     _____________________
     _____________________
}
```

10)
Consider the C function below. The call `foo(7);` outputs _____.

```
void foo (int n) {
     if(n<=10) {
          foo(n+1);
          printf("%d",n);
}
```

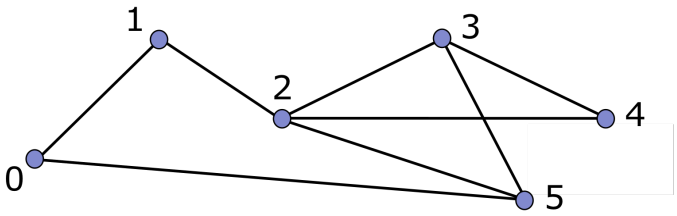
11)
The figure below represents a stack, after initialization and insertion of an item x. Represent the stack after insertion of a second item, y.



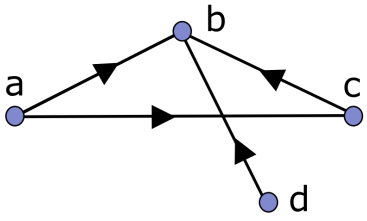
12)
Let the symbol A be the base 26 expansion of 0, let B be the base 26 expansion of 1, etc. According to the division method, the hash address of GLA in a hash table with 11 slots is _____

13)
We say that a problem is tractable if _____

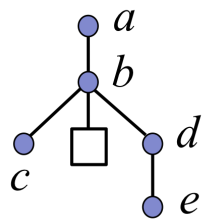
14)
Consider the graph below. What is its adjacency matrix?



15)
The graph below is not connected because _____



16)
As seen in class, a tree can be defined as follows:
(a) The empty tuple () is a tree.
(b) Any tuple $(N,T_1,T_2,\ldots,T_n)$ where $n \geq 0$ and $T_1, T_2, \ldots, T_n$ are trees is a tree.
The tree represented below is the tuple _____

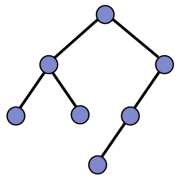


17)

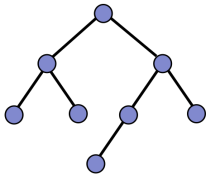
Draw the expression tree that represents the polynomial fraction $\frac{1+5x}{2-x}$.

18)
Which ones of these trees, if any, are AVL trees?

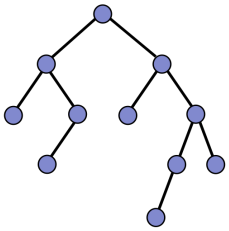
(a)



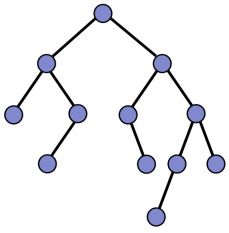
(b)



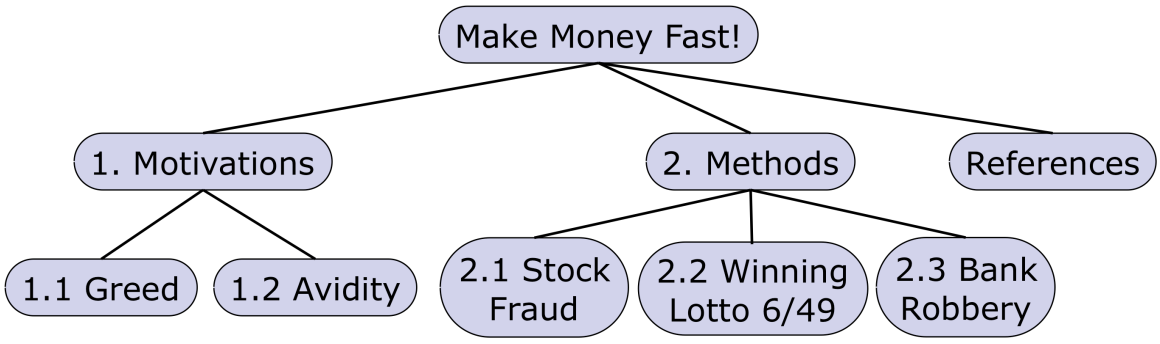
(c)



(d)



19)
To print the structured document represented by the tree below, use _____ traversal.



20)
A queue is implemented using a circular array of size 5.
Assume the queue is empty, and then the following operations are performed:
enqueue 4, then 8, then 3; dequeue; enqueue 7; dequeue; enqueue 6, then 1.
Draw the resulting array with its elements.