

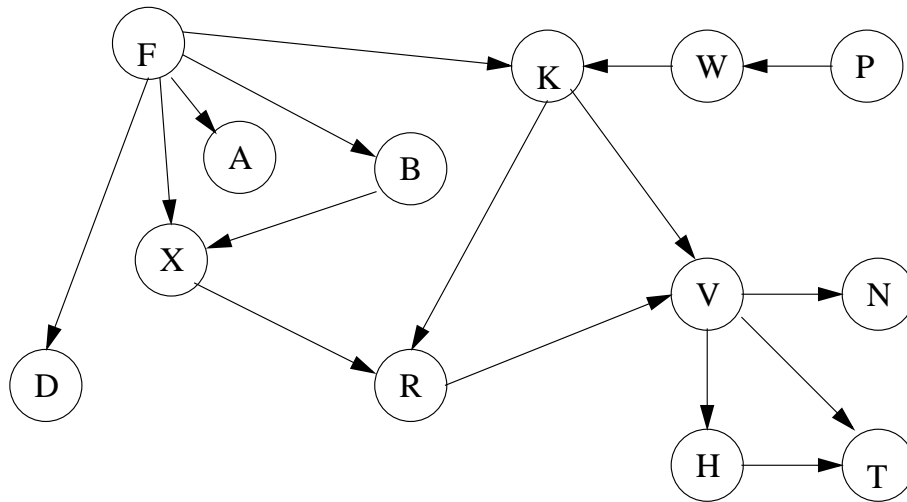
**FLORIDA TECH
DEPARTMENT OF COMPUTER SCIENCES
DATA STRUCTURES AND ALGORITHMS
COMPREHENSIVE EXAM
SPRING 2003
(Total of 115 points)**

**IN ALL PROGRAMMING QUESTIONS YOU MAY USE ADA,
PASCAL, C, C++, JAVA OR PSEUDO-CODE WITH ENOUGH
DETAILS.**

1. (25 points) Give a simple data structure for *singly* linked list of integers. Write a function to reverse a list. You should assume the argument of your function is a reference to the first node of the linked list and that it returns a reference to the first node of the reversed linked list.

2. (25 points) Give a simple data structure for an AVL-Tree of integers. Write a function to search for an element in a tree. Your function should return a reference to the node where the element was found.

3. (25 points) Given the graph below.



- a) Perform a topological sort of the graph and give the output.
- b) Describe a real-world problem in which a topological sort can be used to find a solution.

4. (20 points) Describe two different ways in which a graph can be implemented as a data structure. Compare and contrast the advantages and disadvantages of each.

5. (20 points) Answer the following questions about Quicksort

- a) Describe a way in which the partitioning part of the algorithm can be implemented so that the algorithm will more likely perform in $O(n \log n)$
- b) Write a Quicksort function using the partitioning you have described above. You should also provide the implementation of the partition function.