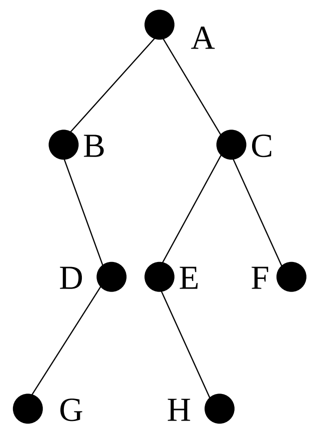
MAD 3104 Discrete Math 1 **Test 3** 29 Nov 1995

Show **ALL** work for credit; be neat; and use only **ONE** side of each page of paper.

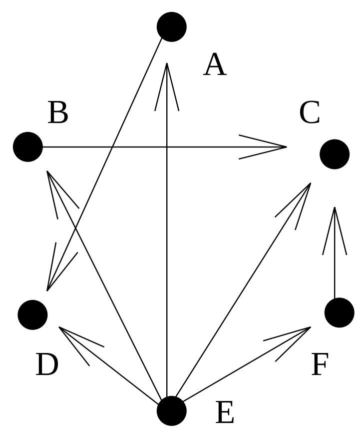
1. For the binary tree to the right, list the vertices in:
 A. Preorder.
 B. Inorder.
 C. Postorder.



2. Draw the binary tree.
 A. BST for the data 60, 10, 80, 20, 50, 70, 40.
 B. For the expression $((a + b) * (r - s) + 7)/(u * v - x/y)$.

3. Draw the binary tree.
 A. With level-order vertices 1, 2, 3, 5, 6, 10, 13, 27, 54, 55.
 B. The vertices in postorder are $BAFGDCE$ and the vertices in inorder are $BEFACGD$.

4. For the digraph to the right.
 A. Give the in-degree and out-degree of each vertex.
 B. Write the adjacency matrix for the digraph.



5. Construct the binary tree. (Smaller weights to the left.)
 A. The Optimal binary tree for the weights 10, 12, 13, 16, 17 and 18.
 B. Give the resulting code word for each weight.

6. What is the chromatic number of the following graphs?
 A. K_5 – the complete graph on 5 vertices.
 B. The empty graph (empty of edges) with 3 isolated vertices.
 C. $K_{3,3}$ – the utility graph.
 D. Any non-trivial tree.

7. Give counterexamples. (In C and D be sure to label the edge e.)
 A. Every tree has a vertex of degree 1.
 B. A graph with $|E| = |V| - 1$ is a tree.
 C. In a graph G with $|E| = |V|$ any edge e in G will make $G - e$ a tree.
 D. In a graph G with $|E| = |V| - 2$ any edge e not in G will make $G + e$ a tree.

8. Prove: If e is an edge not in G so that $G + e$ is a tree, then G is acyclic and $|V(G)| - 2 = |E(G)|$

9. Prove: G is connected and $|E| = |V|$ then G has an edge e so that $G - e$ is a tree.

10. Prove by (stong) induction on the number of **CYCLES:** Every connected graph satisfies $|E| \geq |V| - 1$.