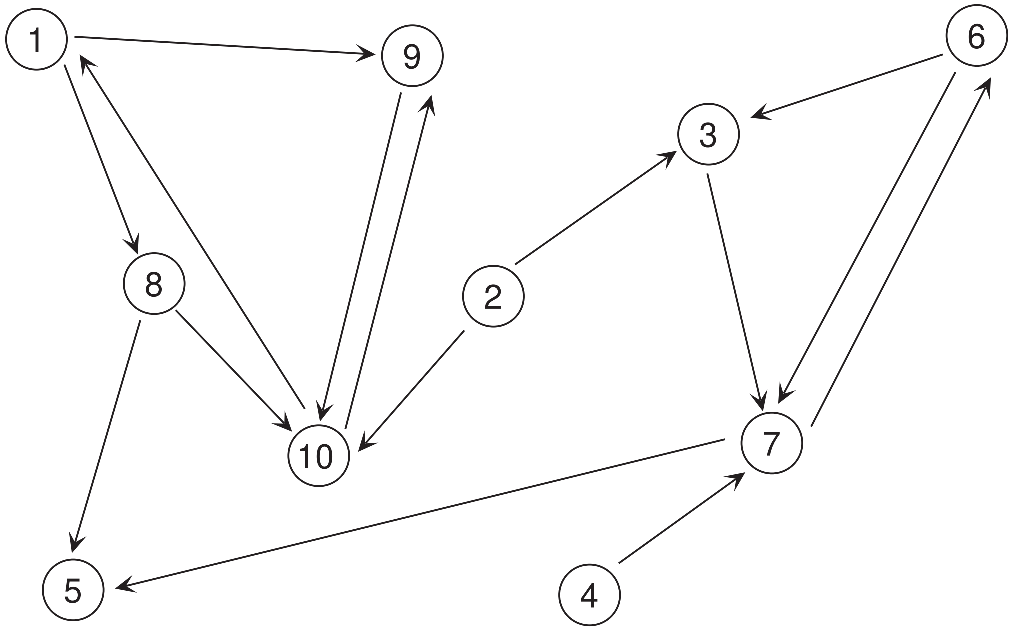
Problem Set 7—Due 21 September 1999

Problem 19 Do DFS on the following graph, labelling each vertext with its start time and finish times (s/f). Then label tree edges (T), forward edges (F), back edges (B), and cross edges (C). Assume that vertices are numerically ordered within the adjacency list.



Problem 20 Let $n \geq 1$ be a number and consider the digraph $G = (V, E)$ having n verticies and a directed edge (v, w) for each distinct $v, w \in V$.

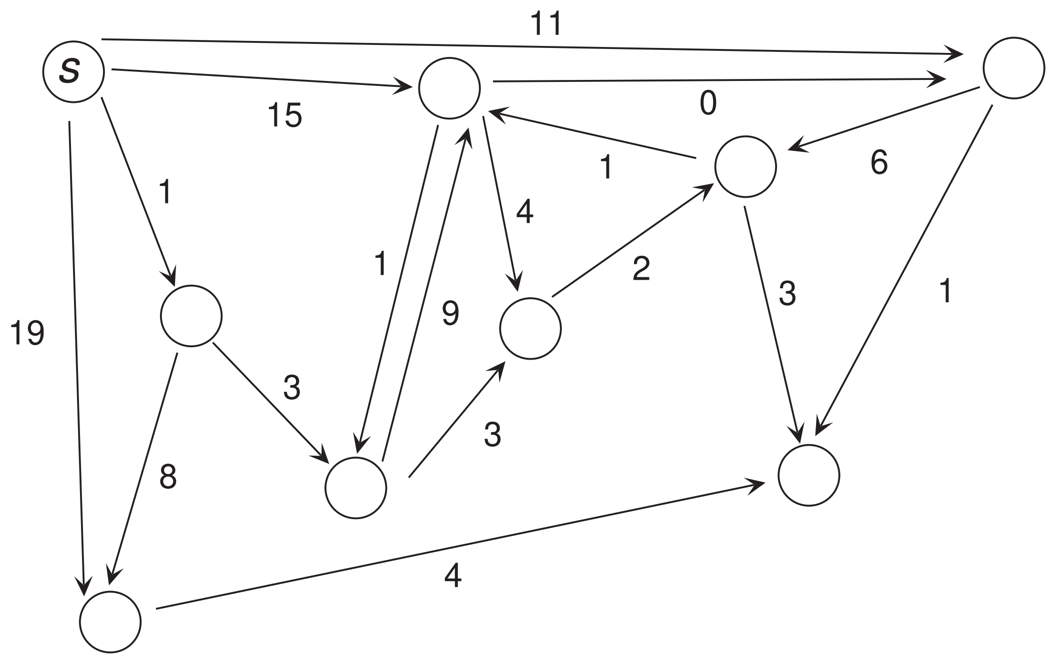
(a) How many edges does G have?

Now suppose you do a DFS on G.

(b) How many tree edges will you get?
(c) How many forward edges?
(d) How many back edges?
(e) And how many cross edges?

Problem 21 Modify our DFS algorithm to get an algorithm which decides if a directed graph $G = (V, E)$ has a (directed) cycle.

Problem 22 Run Dijkstra's algorithm on the following graph, showing all intermediate $d[]$-labels. The start vertex is s.



Problem 23 Suppose you are given a subroutine that **decides** SAT. You are given a satisfiable Boolean formula ϕ having variables $X_1, \ldots, X_n$. Show how to use your subroutine to find a satisfying assignment to ϕ. How many calls to the subrotine do you make?