CS 5114
Homework Exercise 5

Given: March 1, 2000 **Due:** March 10, 2000

The point value of each problem is shown in [ ]. Each solution must include all calculations and an explanation of why the given solution is correct. In particular, write complete sentences. A correct answer without an explanation is worth no credit. The assignment must be *submitted* to the instructor by 12:00 noon on March 10, 2000. See syllabus for late policy.

Electronic preparation of your solutions in LaTeX is mandatory. Here is the suggested procedure.

> Retrieve this LaTeX source file `homework5.tex` from the 5114 Web pages and rename it `solvehw5.tex`. Delete these instructions. Enter your solutions in the locations explained by LaTeX comments (`%`). Also enter your name in the `\student` command and uncomment the line near the beginning of the file that uses the `\student` command. When you are satisfied with your solutions, print a copy and turn it in during class or no later than noon on March 10, 2000.

Electronic submission is optional. If you use electronic submission, send an email to `cs5114@courses.cs.vt.edu` with subject `Solutions to Homework Assignment 5` and with two attachments: `solvehw5.tex` and `solvehw5.ps`. Your email must be *received* by 12:00 noon on March 10, 2000.

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[15] 1. Consider a directed graph $G = (V, E)$ with node set $V = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$ and with edge-weights given by the following matrix:

$$W = \begin{Bmatrix} 0 & 8 & 13 & \infty & 5 & \infty & \infty & 30 & \infty \\ \infty & 0 & 6 & \infty & \infty & \infty & \infty & \infty & \infty \\ \infty & \infty & 0 & 9 & 17 & \infty & \infty & \infty & \infty \\ \infty & 7 & \infty & 0 & 14 & \infty & \infty & \infty & \infty \\ \infty & \infty & \infty & \infty & 0 & 19 & 22 & \infty & \infty \\ \infty & \infty & \infty & 4 & \infty & 0 & 21 & \infty & \infty \\ \infty & \infty & 12 & \infty & \infty & \infty & 0 & 11 & 23 \\ \infty & \infty & \infty & \infty & \infty & 28 & \infty & 0 & 4 \\ 15 & \infty & \infty & \infty & \infty & \infty & \infty & \infty & 0 \end{Bmatrix}.$$

Use the method of repeated squaring (algorithm FASTER-ALL-PAIRS-SHORTEST-PATHS) to compute the all-pairs/shortest-paths distance matrix D. How many squarings are necessary for a graph with nine nodes? Show the intermediate matrixes in the computation.

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[15] 2. Use the same graph as in problem 1. Use the Floyd-Warshall algorithm to compute the all-pairs/shortest-paths distance matrix D. Show the intermediate matrixes in the computation.

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[5] 3. CLR Exercise 27.2-1.

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[15] 4. CLR Exercise 27.2-2.
