1. In this exercise, assume that we are considering enhancing a machine by adding a vector mode to it. When a computation is run in vector mode it is 5 times faster than the normal mode of execution. We call the percentage of time that could be spent using vector mode the *percentage of vectorization*. You don’t need to know anything about how Vectors work to answer this question!

   a. Draw a graph that plots the speedup as a percentage of the computation performed in vector mode. Label the y axis “Net speedup” and label the x axis “Percent vectorization”.

   b. What percentage of vectorization is needed to achieve a speedup of 1.5?

   c. What percentage of vectorization is needed to achieve one-half the maximum speedup attainable from using vector mode?

   d. Suppose you have measured the percentage vectorization for programs to be 80%. The hardware design group says they can double the speed of the vector rate with a significant additional engineering investment. You wonder whether the compiler crew could increase the use of vector mode as another approach to increasing performance. How much of an increase in the percentage of vectorization (relative to current usage) would you need to obtain the same performance gain? Which investment would you recommend?

2. Devise a program in C that gets the peak MIPS rating for a computer. Run it on two machines to calculate the peak MIPS. Then, choose an application, and run it on both machines and calculate the total execution time of the application on each machine. How well do peak MIPS represent the performance of a machine? What other environmental factors may effect the accuracy of your MIPS calculation?