Homework 5

CIS 501, Spring 1998
Due on February 25, 1998

1. Consider a pipeline where the total work to be done would take 40ns. If the overhead for each pipeline stage is 1 ns, plot the speedup of the pipelined machine vs the number of stages, upto 20 stages. If the overhead is fixed, what could be the highest speedup achievable?

2. Suppose that 20% of all instrucitnos are conditional branches, while 5% are unconditional (jumps and calls). Also assume that 60% of the conditional branches are taken. Consider a four stage pipeline. All unconditional branches get resolved by the end of the second stage, while conditional branches take one more cycle. Assume that the first stage can be done independent of branch resolution. Ignoring all other stalls, how much faster would the machine be without branch hazards?

3. The table in figure 3.19 is not complete - in particular, it ignores the following case :

   ```
   ADD     R1, R3, R4
   SW      R1, 0(R2)
   ```

   The result of the `ADD` needs to be forwarded to the LMD register. Add entries to the table to take care of this case.