Math 2280-1
Earthquake project answer template
Due March 10 2006

You may work in groups of up to three people. Download this file from our lectures or homework page, or directly open the URL http://www.math.utah.edu/~korevaar/2280spring06/quaketemplate.mws

```
> restart:
  with(DEtools):with(plots):with(linalg):
```

1) Enter the names of the people in your group!

2) You will be using your student number to construct your building. As the book instructs on page 327, let the weight in tons of each story be given by the largest digit of your I.D. number(s), and let the spring constant k (tons/foot) be the smallest digit in the I.D. number of the person in your group who has the largest digit!? Deduce the mass of each floor (in slugs), and then define the mass and spring constant values for your building.

3) Define the mass matrix M for this system, the spring constant matrix K, and find the matrix "A" as in equation (1), page 326. Notice that the last row should look a little different than you may expect.

4) Find the natural angular frequencies (the omegas) for your seven story building, as well as the corresponding periods. Hint: MAKE SURE THAT AT LEAST ONE ENTRY IN "A" IS IN DECIMAL (RATHER THAN FRACTION OR WHOLE NUMBER) FORM. OTHERWISE MAPLE TRIES FINDING EIGENVALUES AND EIGENVECTORS ALGEBRAICALLY INSTEAD OF NUMERICALLY, AND CAN FAIL.
Exhibit this data in a table like figure 5.3.17 on page 327. (I would make the table in a text field and copy and paste the Maple output into the text table. But leave in the Maple commands which give you the various values!)

5) Study approximate resonance by studying the (undetermined coefficients) particular solution to (2), page 327, for your building. The method is outlined on page 323 of the text, and in the class notes from Monday March 6. Choose the vector **b** appropriately in (2) so that it corresponds to a ground shaking amplitude of 3 inches (as suggested by the warmup problem #4). Find the vector **c** (depending on w) so that **c***cos(wt) solves (2):

6) Create an approximate resonance picture like Figure 5.3.18, for your building. Note that in this graph you are to compute the norm of the **c**-vector as a function of period, not of angular frequency.

7) Is your particular building susceptible to likely damage from an earthquake having its period in the 2 to 3 second range? Explain.