

Problem 1. Consider the following code fragment. (line numbers are provided for reference purposes and are not part of the code.)

```

1  while I < N loop
2      Q := S;
3      S := S + P;
4      P := Q;
5      I := I + 1;
6  end loop;

```

Use the variable ordering: 0) I 1) N 2) P 3) Q 4) S

Use the expression ordering:

```

0) "I < N"            (in line 1)
1) "S"                (in line 2)
2) "S + P"            (in line 3)
3) "Q"                (in line 4)
4) "I + 1"            (in line 5)

```

Calculate the matrices L_{body} , M_{body} and R_{body} for the body of the while statement (lines 2-5). (You do not need to show the calculation of these matrices.)

Calculate:

```

I + Rbody
I + Rbody + (Rbody)2
I + Rbody + (Rbody)2 + (Rbody)3
...

```

Keep going until you reach a fixed point, when you will have calculated the transitive closure, $(R_{\text{body}})^*$. (See example on pages 260 & 261 for clarification.)

Now use the equations for the while statement to calculate the R matrix for the while statement (lines 1-6). Show the instantiated equation (see equation for R on page 259 or, equivalently, for R_S on slide 29 in the lecture notes 08_spark_into_flow, which you can find at <http://www.cse.msu.edu/~cse814/Lectures>).

Problem 2:

Give an argument to justify the equation at the top of slide 24 in the lecture notes 08_spark_info_flow (at <http://www.cse.msu.edu/~cse814/Lectures>) or, equivalently, for the equation defining M on page 251 of the Spark textbook. The two equations are the same, but use slightly different notational conventions. Your argument should be along the same lines as that given in the text to justify the equation for the L matrix on the same page.

Problem 3: Download and unpack the file <http://www.cse.msu.edu/~cse814/Public/F09/Homeworks/travell1hw.tar.gz>. Follow the directions in the README.TXT file.

Note: Problem 3 should be "handed in" by mailing me an archive of the directory containing all the files I will need to build and analyze your project and containing the file "proof_notes.txt".

Problems 1 and 2 may be hand written, if you prefer not to spend time type setting matrices. In that case, you should hand them in to me in class on Monday. Also, you should make and keep a copy in case my dog chews your homework or I get drenched biking home (both have been known to happen!).