Assignment 4

Due: Monday, November 21st, 11:59pm
Send a zip file to Ben Crysup (brc13c@my.fsu.edu) that contains a copy of your program. Put the code into a folder that has your name and the assignment number, for example the folder beerli3 contains main.cpp. Then compress the file (using zip) and attach (for example it would be beerli3.zip). Most importantly, use ISC-3313 in the subject line of the email to Ben. Alternatively, you can copy the file to our dropbox directory on pamd.sc.fsu.edu (or your classroom machine) using this [you need to be on one of the Scientific omcputing machines to do this (or then use the appropriate scp command):

```
cp yourfile.zip /research/pbeerli/isc3313dropbox
```

Write a function using the Rungekutta midpoint method to approximate the predator-prey equation:

$$\frac{dr}{dt} = \alpha r - \beta r f$$
$$\frac{df}{dt} = \delta r f - \gamma f$$

- Use the *euler.cpp* program (from the **Program snippet section** on the course website `http://www.peterbeerli.com/classdata/ISC3313/codes/`) and add the function

```
void rungekutta(double & r0, double & f0,
                double start, double end, double deltat,
                vector<double> parameters)
```

- add the call to `rungekutta()` to the `main()` and calculate the difference in the results ('error') between the Euler and the Rungekutta midpoint method for a delta of $h = 0.1$. Pick the rabbits (r) for reporting the 'error'. For each cycle in the `for loop` print i, r_{Euler}, $r_{\text{Rungekutta}}$ to a file (another one than the `outfile` stream and then plot a graph in gnuplot (or any other plotting software (e.g. excel, matplot, octave) that shows on the X-axis the time (i) and the y-axis r_{Euler}, $r_{\text{Rungekutta}}$.