CS 365, Spring 2013 — Feb 28th — Exam 1 Name: _____

Question 1. [10 points] *Twin primes* are pairs of integers m, $m+2$ such that both m and $m+2$ are prime.

Assume that you have a function called `is_prime` available that takes an integer and returns true or false depending on whether or not that integer is prime. For example, `is_prime(11)` would return a true value, while `is_prime(25)` would return false.

Using pseudo-code, sketch a *sequential* algorithm which, given a range of integers in the range from *min* to *max*, will find the *largest* pair of twin primes within that range. For example, if $min = 1$ and $max = 20$, the algorithm should find the pair $17, 19$. If there are no prime pairs in the range, then the algorithm should indicate that the search failed.

Question 2. [40 points] Using pseudo-code, sketch a message-passing parallel algorithm which uses P communicating processes to find the largest pair of twin primes in the range from *min* to *max*. You may use your sequential algorithm from Question 1 as a subroutine.

You can assume that each process will know *min*, *max*, P, and its own rank.

Be sure to indicate

- How the problem is divided up between processes
- How the processes will communicate to combine their local solutions into a global solution (hint: the pseudo-code equivalent of `MPI_Allreduce` and the `MPI_MAX` operator might be useful)

Note: you should design the algorithm so that all processes will terminate relatively soon (but not necessarily immediately) after the global solution is discovered.

Hint: the algorithm should start searching the highest part of the input range first, since you are looking for the largest pair of twin primes.

Question 3. [50 points] Implement your parallel algorithm from Question 2 using MPI.

Using your VNC session on the cluster head node, start a web browser and open the following page:

`http://faculty.ycp.edu/~dhovemey/spring2013/cs365/assign/exam1.html`