1. A clear and concise explanation in words of how you achieve a circular shift one place to the left;

I simply took 1 away from the rank number of the task to find the left task’s rank to find the rank number to send to. For rank 0, I hard-coded an if statement to change rank -1 to max_rank -1 to get the rank number to “wrap around” to the last task’s rank number.

To get the right task’s rank number, I just found the modulo of the current task’s rank number plus 1.

From there it was just a matter of issuing a send and receive message from each task. Each task uses its own “m_value” variable to store the value and then send from each time.

2. A clear and concise explanation in words of your strategy for achieving ordered output;

I chose task 0 to be the “master”, i.e. the task responsible for outputting all the final values of each task. I made each task other than task 0 send a message containing their final value, then got task 0 to receive and print out each value in order.

Since I specified the task in the MPI_Recv() call to get the value from, and the for loop goes in order of task 1 to the final task, so the values are printed in order regardless of the order the tasks were first executed.

For task 0 itself, I just printed its own value before the loop receiving each of the other task’s values.

3. An extract from the printed record of communication, showing only the interactions between tasks 0 and 3;

```
Initial value of task 3 is 27

Task 3: sending value 27 to task 2

Task 3: received value 20 from task 0

Task 3: sending value 20 to task 2

Task 3: received value 16 from task 0

Task 3: sending value 16 to task 2

Task 3: received value 18 from task 0

Initial value of task 0 is 20

Task 0: sending value 20 to task 3

Task 0: received value 16 from task 1

Task 0: sending value 16 to task 3

Task 0: received value 18 from task 1

Task 0: sending value 18 to task 3

Task 0: received value 27 from task 1
```

4. A copy of the ordered output of m-values.

```
The final value of task 0 is 27!

The final value of task 1 is 20!

The final value of task 2 is 16!

The final value of task 3 is 18!
```