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High Performance Computing
Homework 4 - Question 1

My program passes an integer variable from process to processes (increasing in rank), printing and incrementing each time up to 64. Next, the last process decrements the variable by 2 and sends it back to the first process. After this, the variable is again sent from process to process (increasing in rank), printing and decrementing by 2 each time down to 0. I ran my program using a batch script requesting 4 nodes on the Explorer Cluster with 16 processes each. Finally, I noticed that the variable value was always correct for a given process, but sometimes the print statements would appear out of order. I suspect this is because cout works as a queue and each process has an independent print queue. I was able to obtain a more consistent print order by moving from rank 0 to rank 64 compared to moving down from rank 64 to rank 0. Also, I added flush statements to the end of prints to increase the odds that a print queue would complete before the message passing began. Results are shown below:

```
mpiCC -o Q1 Q1.cpp    Process 35: 35    Decrementing ...
Incrementing ...      Process 36: 36    Process 1: 62
Process 1: 1          Process 37: 37    Process 2: 60
Process 2: 2          Process 38: 38    Process 3: 58
Process 3: 3          Process 39: 39    Process 4: 56
Process 4: 4          Process 40: 40    Process 5: 54
Process 5: 5          Process 41: 41    Process 6: 52
Process 6: 6          Process 42: 42    Process 7: 50
Process 7: 7          Process 43: 43    Process 8: 48
Process 8: 8          Process 44: 44    Process 9: 46
Process 9: 9          Process 45: 45    Process 10: 44
Process 10: 10        Process 46: 46    Process 11: 42
Process 11: 11        Process 47: 47    Process 12: 40
Process 12: 12        Process 48: 48    Process 13: 38
Process 13: 13        Process 49: 49    Process 14: 36
Process 14: 14        Process 50: 50    Process 15: 34
Process 15: 15        Process 51: 51    Process 16: 32
Process 16: 16        Process 52: 52    Process 17: 30
Process 17: 17        Process 53: 53    Process 18: 28
Process 18: 18        Process 54: 54    Process 19: 26
Process 19: 19        Process 55: 55    Process 20: 24
Process 20: 20        Process 56: 56    Process 21: 22
Process 21: 21        Process 57: 57    Process 22: 20
Process 22: 22        Process 58: 58    Process 23: 18
Process 23: 23        Process 59: 59    Process 24: 16
Process 24: 24        Process 60: 60    Process 25: 14
Process 25: 25        Process 61: 61    Process 26: 12
Process 26: 26        Process 62: 62    Process 27: 10
Process 27: 27        Process 63: 63    Process 28: 8
Process 28: 28        Process 64: 64    Process 29: 6
Process 29: 29                          Process 30: 4
Process 30: 30                          Process 31: 2
Process 31: 31                          Process 32: 0
Process 32: 32                          rm Q1
Process 33: 33
Process 34: 34
```
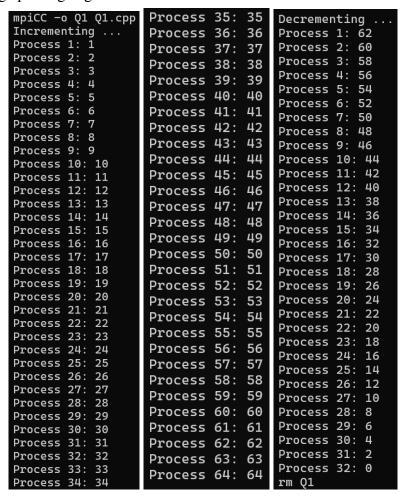
Figure 1. MPI Integer Incrementing Results