

Northern Michigan University (Marquette Co, MI)

CS 426-01-26F: Operating Systems

Program 4

Due: Monday 26 October 2026 3:00 P.M. EDT

All-To-All Broadcast

Create a directory called “PG4” in the root of your CS426-01-26F folder. When you are ready for your program to be graded, put a (possibly empty) file in the root of your PG4 folder called “DONE”.

I have n processes and they each wish to send a message to the other $n-1$. All of these messages are different. But they all need to be sent, and I need to handle this efficiently, so I make sure every processor is busy exchanging messages in a series of rounds.

For example, 2 processors:

0,1 (Well, that was easy. Processors 0 and 1 exchange messages.)

4 processors:

1,2	0,3	First round:	1&2 exchange; 0&3 exchange
2,0	1,3	Second round:	2&0 exchange 1&3 exchange
0,1	2,3	Third round:	0&1 exchange; 2&3 exchange

6 processors:

1,4	2,3	0,5
2,0	3,4	1,5
3,1	4,0	2,5
4,2	0,1	3,5
0,3	1,2	4,5

8 processors:

1,6	2,5	3,4	0,7
2,0	3,6	4,5	1,7
3,1	4,0	5,6	2,7
4,2	5,1	6,0	3,7
5,3	6,2	0,1	4,7
6,4	0,3	1,2	5,7
0,5	1,4	2,3	6,7

If there are an odd number of processors, then the last column is unused. For example, if there are 7 processes that need to exchange messages, use the schedule for 8 processors, but don't

process the last column involving the non-existent process 7, so that, in the odd number case, each processor gets a break in one of the rounds.

Write a program in C that asks the user to enter the number of processors, and then to enter a specific processor from 0 to $n-1$. Your program should then print the processes in sequence with which that process exchanges messages. You must use the above protocol. Your code should be pretty short because there's actually a reasonably short formula for it.

For example, if the user enters 6 processors and processor 3, your program should print 2,4,1,5,0, which is the sequence of processors that 3 exchanges messages with.

If the user enters 5 processors and processor 3, your program should print 2,4,1,NIL,0 to indicate that in the fourth round processor 3 doesn't exchange messages with anybody.