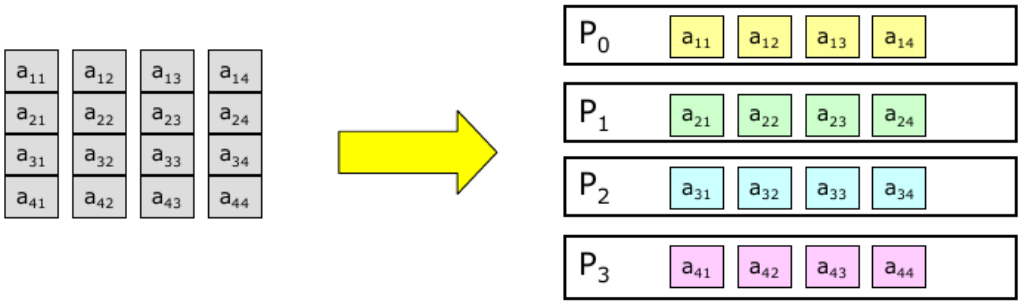
Exercise 15

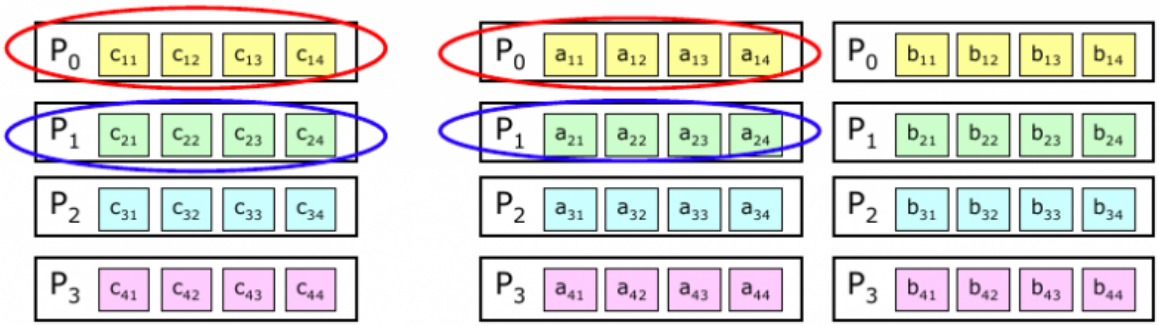
Write a subroutine implementing matrix multiplication and test it.

$$C = A\,B \qquad c_{ij} = \Sigma_k\, a_{ik} b_{kj}$$

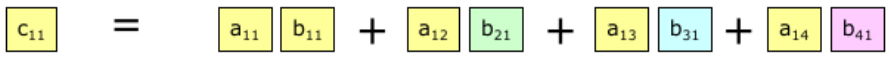
A, B and C being NxN matrices distributed by row among processes (at least 8x8). Inizialize A and B matrices respectively as aij = i*j and bij=1/(i*j). Try to minimize memory allocation and the number of MPI calls.



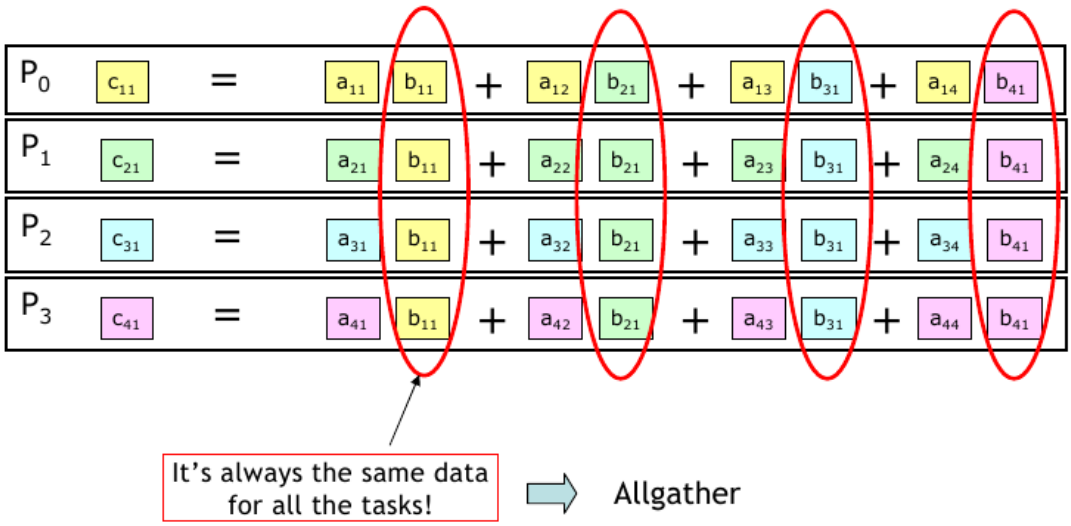
FORTRAN CASE: each process manages a row of elements (or blocks):



where each element of the matrix c is given by

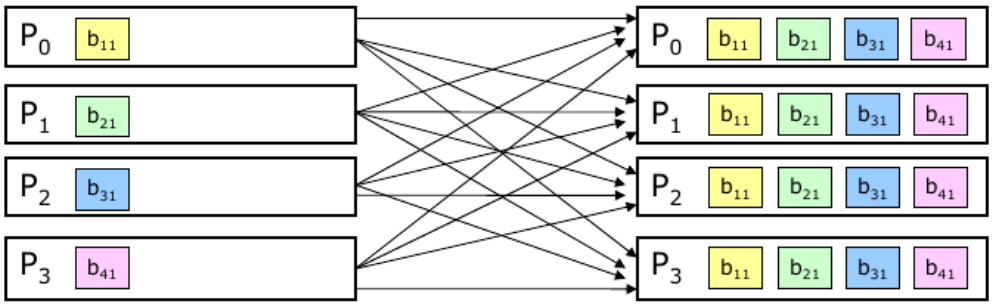


each process computes the first element (block) of its own row

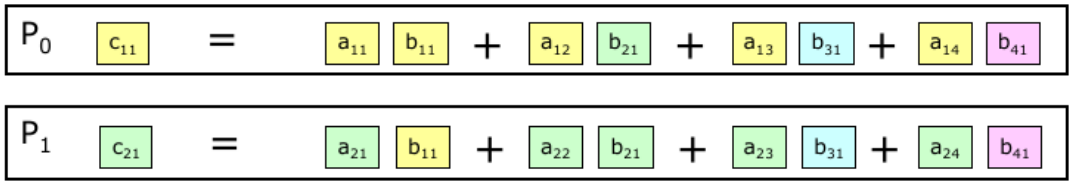


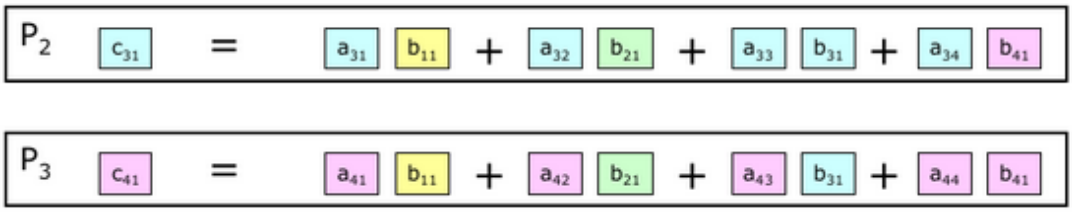
Therefore, for each column element (or block) of the matrix C you need to:

1- perform an All gather on the colum



2- calculate the column of the matrix C





The output should resemble the following one:

```
A:
 1.0000  2.0000  3.0000  4.0000  5.0000  6.0000  7.0000  8.0000
 2.0000  4.0000  6.0000  8.0000 10.0000 12.0000 14.0000 16.0000
 3.0000  6.0000  9.0000 12.0000 15.0000 18.0000 21.0000 24.0000
 4.0000  8.0000 12.0000 16.0000 20.0000 24.0000 28.0000 32.0000
 5.0000 10.0000 15.0000 20.0000 25.0000 30.0000 35.0000 40.0000
 6.0000 12.0000 18.0000 24.0000 30.0000 36.0000 42.0000 48.0000
 7.0000 14.0000 21.0000 28.0000 35.0000 42.0000 49.0000 56.0000
 8.0000 16.0000 24.0000 32.0000 40.0000 48.0000 56.0000 64.0000
B:
 1.0000  0.5000  0.3333  0.2500  0.2000  0.1667  0.1429  0.1250
 0.5000  0.2500  0.1667  0.1250  0.1000  0.0833  0.0714  0.0625
 0.3333  0.1667  0.1111  0.0833  0.0667  0.0556  0.0476  0.0417
 0.2500  0.1250  0.0833  0.0625  0.0500  0.0417  0.0357  0.0312
 0.2000  0.1000  0.0667  0.0500  0.0400  0.0333  0.0286  0.0250
 0.1667  0.0833  0.0556  0.0417  0.0333  0.0278  0.0238  0.0208
 0.1429  0.0714  0.0476  0.0357  0.0286  0.0238  0.0204  0.0179
 0.1250  0.0625  0.0417  0.0312  0.0250  0.0208  0.0179  0.0156
C:
 8.0000  4.0000  2.6667  2.0000  1.6000  1.3333  1.1429  1.0000
16.0000  8.0000  5.3333  4.0000  3.2000  2.6667  2.2857  2.0000
24.0000 12.0000  8.0000  6.0000  4.8000  4.0000  3.4286  3.0000
32.0000 16.0000 10.6667  8.0000  6.4000  5.3333  4.5714  4.0000
40.0000 20.0000 13.3333 10.0000  8.0000  6.6667  5.7143  5.0000
48.0000 24.0000 16.0000 12.0000  9.6000  8.0000  6.8571  6.0000
56.0000 28.0000 18.6667 14.0000 11.2000  9.3333  8.0000  7.0000
64.0000 32.0000 21.3333 16.0000 12.8000 10.6667  9.1429  8.0000
```

HINTS:

C

MPI_ALLGATHER

```
int MPI_Allgather(void* sendbuf, int sendcount, MPI_Datatype sendtype, void* recvbuf, int recvcount, MPI_Datatype recvtype, MPI_Comm comm)
```

‹ Q/A Exercise 14 up Solution 15 ›