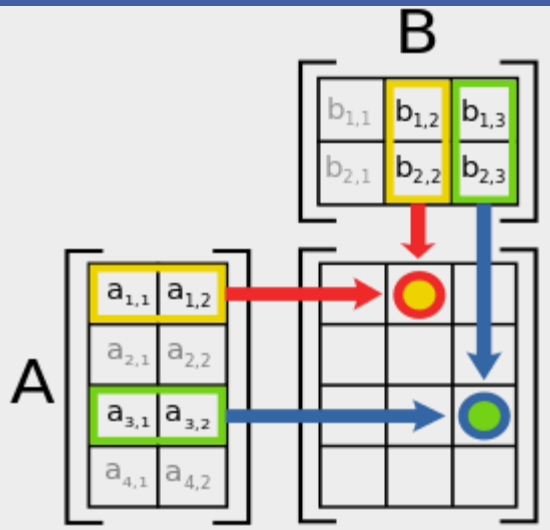
ITMO UNIVERSITY

5th Programming Task

Matrix multuplication

The Matrix Multiplication Problem

- Matrix multiplication is a binary operation that takes a pair of matrices, and produces another matrix.
- Computing matrix products is both a central operation in many numerical algorithms and potentially time consuming, making it one of the most well-studied problems in numerical computing. Various algorithms have been devised for computing C = AB, especially for large matrices.

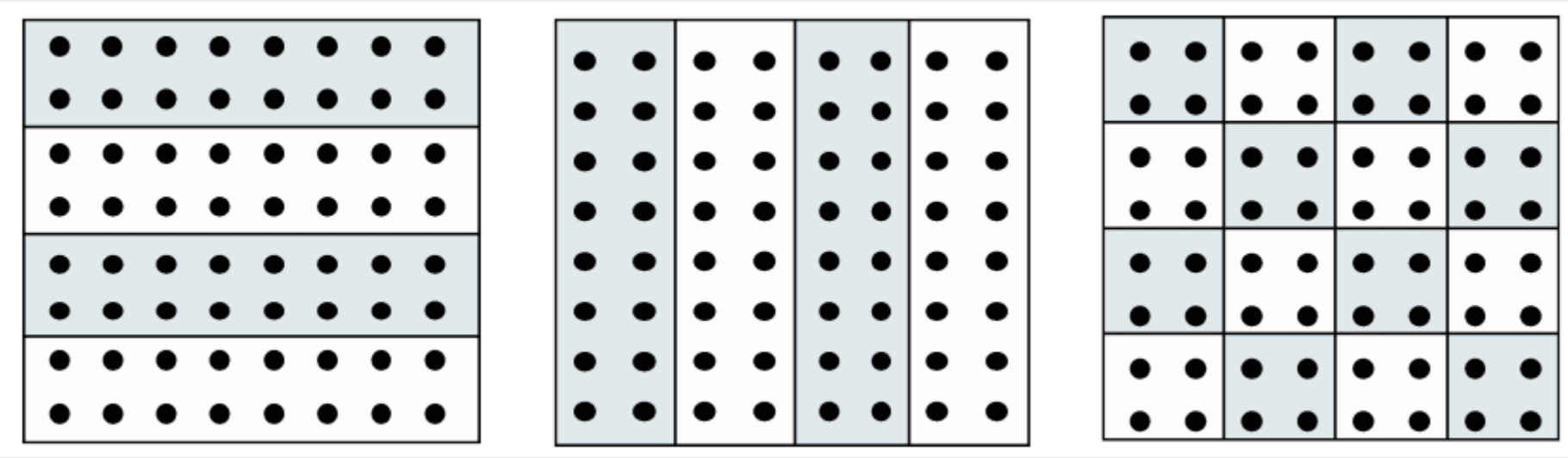


$$c_{ij} = \sum_{k=0}^{n-1} a_{ik} \cdot b_{kj}, \ 0 \le i < m, \ 0 \le j < l$$

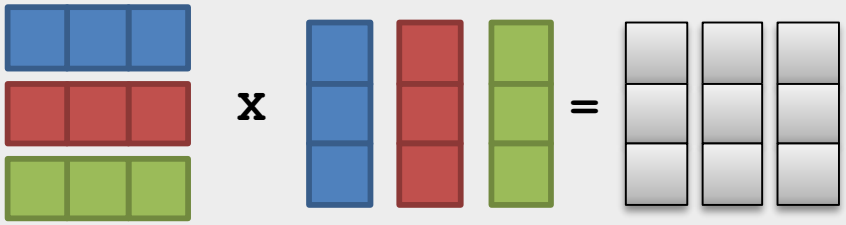
```
//Serial algorithm of Matrix Multiplication
double A[Size][Size],   B[Size][Size]   C[Size][Size];
int i,j,k;
...
for (i=0; i<Size; i++) {
      for (j=0; j<Size; j++){
            C[i][j] = 0;
            for (k=0; k<Size; k++){
                  C[i][j] += A[i][k]*B[k][j];
            }
      }
}
```

The Problem Decomposition

There are 3 ways of problem decomposition depending on dividing matrix:



You should use the dividing matrices A by rows and B - by columns.



The Task

1. Implement the serial version of the Matrix Multiplication
2. Chose (actually use) the problem decomposition
3. Define sub-problems and size of each sub-problem
4. Define information dependencies between sub-problems
5. Implement the parallel algorithm of matrix multiplication
6. Determine the speedup