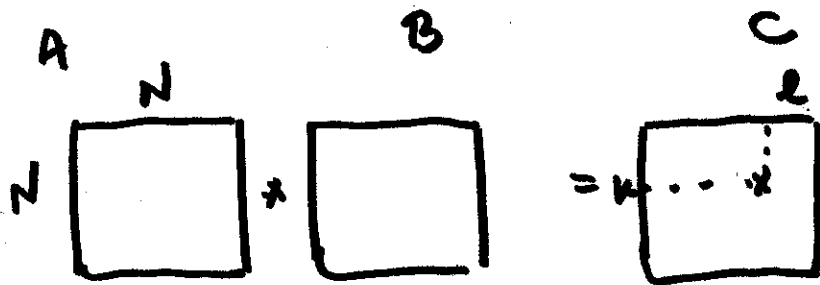


D



LS  
ECE668

1. Sequential Algorithm

$$C(k, l) = \sum_{j=0}^{L-1} A(k, j) * B(j, l)$$

```
int **A, **B, **C;  
main() {  
  initialize(A, B, C);  
  for (k=0, ... )
```

9

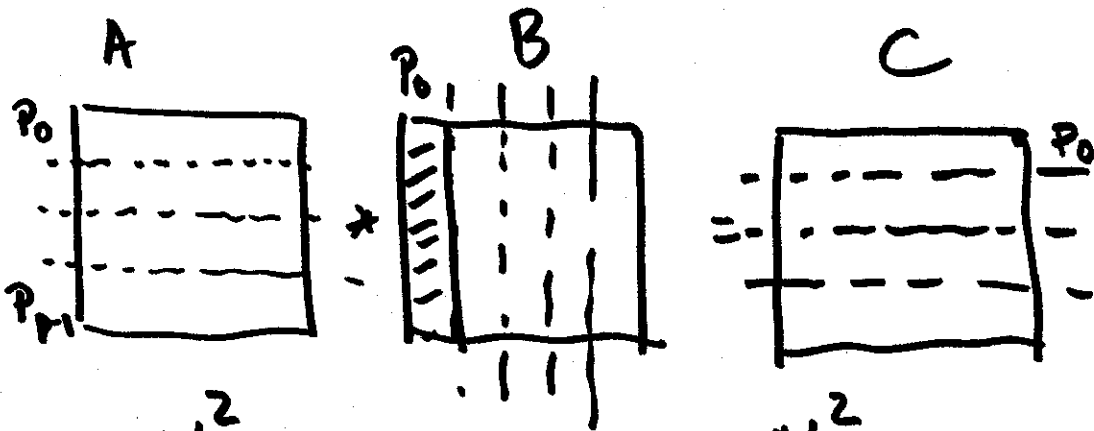
for (k=0; k < N; k++)

for (l=0; l < N; l++)

for (j=0; j < N; j++)

C(k, l) += A(k, j) \* B(j, l);

(5)



$N \times N$   
 $P$

$$R_p = \frac{N^2}{P} (NC_* + (N-x)) \approx \frac{N^2}{P} (2N-1) \approx \frac{2N^3}{P} = O\left(\frac{N^3}{P}\right)$$

$$R_m = \frac{N^2}{P} + \frac{N^2}{P} + \frac{N^2}{P} + \frac{P-1}{P} \cdot \frac{N^2}{2} = O(N^2)$$

5)

$$R_c = \underbrace{\frac{N^2}{P}}_{\text{send}} + \underbrace{\frac{P-1}{P} \cdot N^2}_{\text{receive}} \approx O(N^2)$$

$$\frac{R_p}{R_c} = O\left(\frac{N}{P}\right)$$

ratio computation to  
communication

### 3) 1. Message - Passing

```
int ** A, **B, **C;
```

```
main () {
```


```
    initialize (A, B, C);
```

```
    CREATE (nprocs, solve)
```

```
    WAIT-FOR-END (nprocs);
```

```
}
```

create  
explicitly!



⑥

```
if (proc != mypid) {  
    send (PB[ ], N2/nprocs, proc, );  
}  
receive (PB[mypid], );  
  
for (k = N/nprocs (mypid));  
    for ( )  
        for ( )  
            C(k, l) += . . . ;
```

Communication

Compute

## ⑦ Data Parallel

Solve ( )

DECOMP A (BLOCK, \*, nprocs);

DECOMP B (\*, BLOCK, nprocs);

DECOMP C (BLOCK, \*, nprocs);

~~for~~

for-all

for-all

end-all

(Computation)

	Message-Passing	Shared-Memory	Data Parallel
--	-----------------	---------------	---------------

<u>Communication</u>	explicit	implicit	—
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<u>Signal</u>	implicit P-to-P	explicit	—
---------------	-----------------	----------	---

<u>Processes Started</u>	explicit	explicit	—
--------------------------	----------	----------	---

<u>Note.</u>			<u>Decomposition</u>
--------------	--	--	----------------------

# Shared-memory

```
main ( ) {  
    CREATE C , solve;  
    WAIT_FOR_END C };
```

```
solve ( ) {
```

```
    for ( k = myrank(pid); ... )
```

```
        for ( e  
            for ( j )
```

$$C(k, e) += A(k, j) * B(j, e)$$

