Foundation of Modern Computer Architectures for HPC

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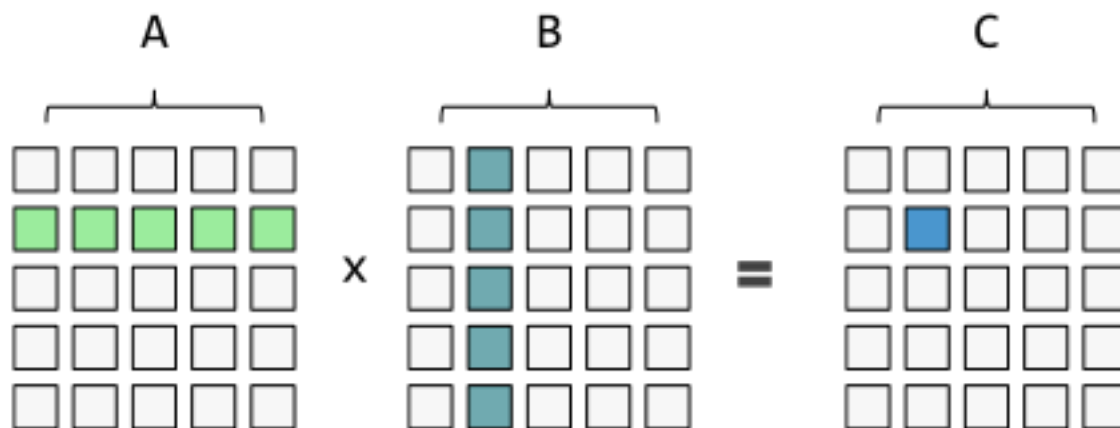
TO DO

```
$cd /scratch/
$mkdir $USER
$cd $USER
$scp hp83-inf-21:/scratch/ca_lab.tar.gz .
```

Exercises

1. Matrix Multiplication

2. Matrix Transpose

MATRIX MULTIPLICATION

A   B   C

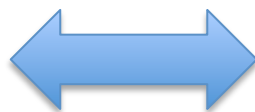$$C[i][j] = sum(A[i][k] * B[k][j]) \text{ for } k = 0 \ldots n$$

```
In our case:
C[1][1] =>
A[1][0]*B[0][1] + A[1][1]*B[1][1] + A[1][2]*B[2][1] + A[1][3]*B[3][1] + A[1][4]*B[4][1]
```

Transpose

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

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1	5	9	13
2	6	10	14
3	7	11	15
4	8	12	16

Fast Transpose - Step 1

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

1	2
5	6

0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0

- Copy the data on the buffer block

Fast Transpose - Step 2

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

1	5
2	6

0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0

- Transpose the block

Fast Transpose - Step 3

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

1	5
2	6

1	5	0	0
2	6	0	0
0	0	0	0
0	0	0	0

- Copy the transposed block from the buffer block to the destination matrix

Fast Transpose - Step 4

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

3	4
7	8

1	5	0	0
2	6	0	0
0	0	0	0
0	0	0	0

- Iterates over blocks

The Abdus Salam
**International Centre
for Theoretical Physics**

UNESCO
United Nations
Educational, Scientific and
Cultural Organization

IAEA
International Atomic Energy Agency

Fast Transpose - Step 5

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

3	7
4	8

1	5	0	0
2	6	0	0
0	0	0	0
0	0	0	0

- Iterates over blocks

Fast Transpose - Step 6

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

3	7
4	8

1	5	0	0
2	6	0	0
3	7	0	0
4	8	0	0

- Iterates over blocks