# Two Dimensional Arrays in C/C++

C++ Object Oriented Programming

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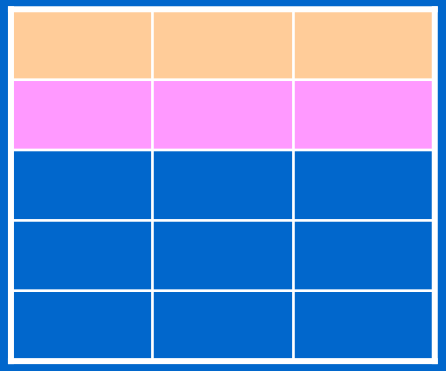
# Version 1. Fixed dimensions 5 by 3

- Both dimensions are fixed
- Allocated either in data segment or in stack
- Example

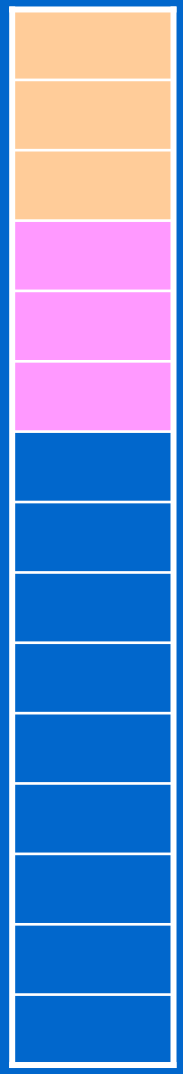
```
int i, j;
int x[5][3];

for (i=0; i<5; i++)
    for (j=0; j<3; j++)
        x[i][j] = 0;
```

Conceptual layout

x



Physical layout

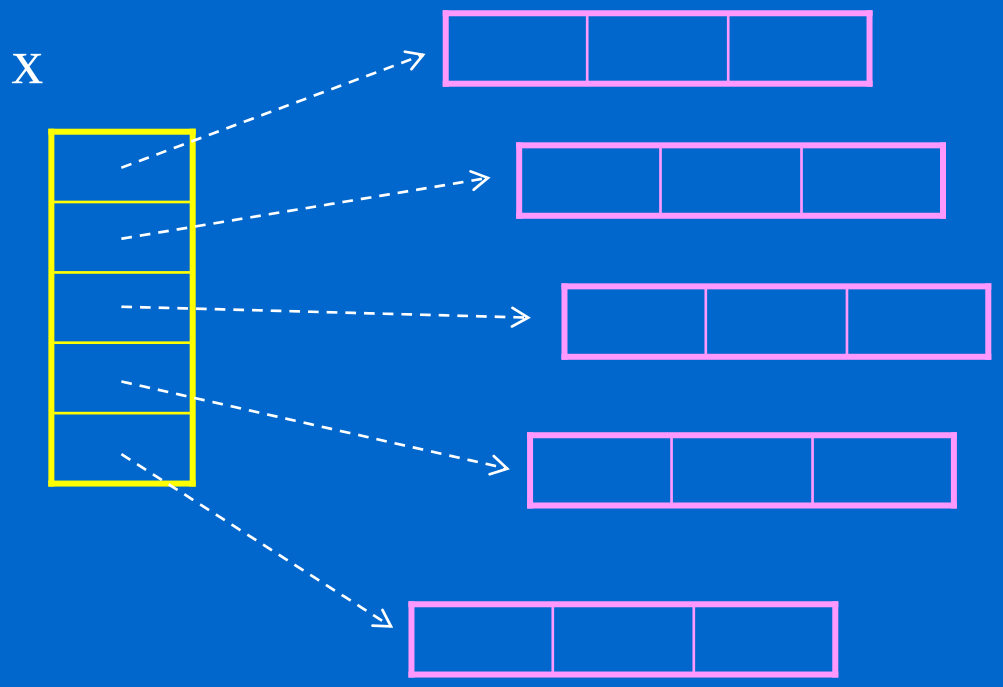


# Version 2a. Dynamic allocated 5 by n

- Size of the first dimension is fixed as 5, size of the second dimension is left variable
- Allocated on the stack (x[]) and the heap (x[i][])
- Example

```
int i, j, n=3;
int *x[5];

for (i=0; i<5; i++)
    x[i] = new int[n];

for (i=0; i<5; i++)
    for (j=0; j<n; j++)
        x[i][j] = 0;

for (i=0; i<5; i++)
    delete[] x[i];
```

Conceptual layout

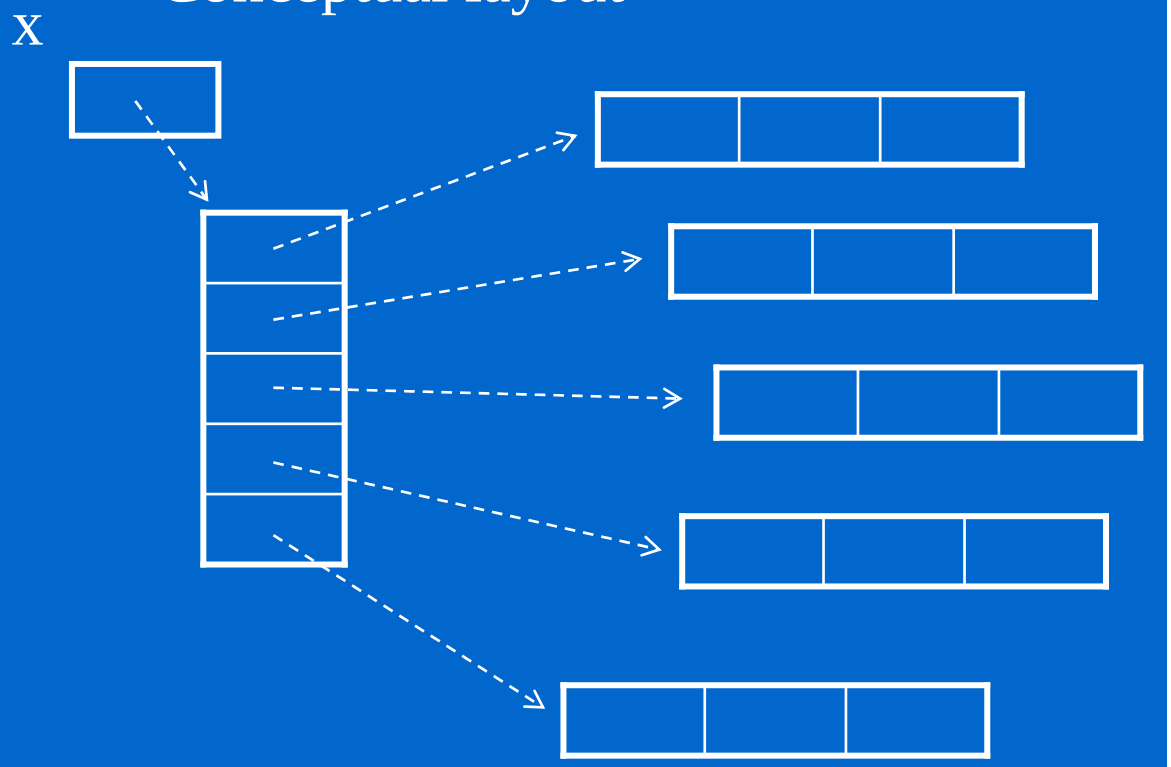


# Version 2b. Dynamic allocated m by n

- Size of both dimensions are variable
- Both allocated on the heap
- Example

```
int i, j, m=5, n=3;
int **x;

x = new int*[m];
for (i=0; i<m; i++)
    x[i] = new int[n];

for (i=0; i<m; i++)
    for (j=0; j<n; j++)
        x[i][j] = 0;

for (i=0; i<m; i++)
    delete[] x[i];
delete[] x;
```

Conceptual layout

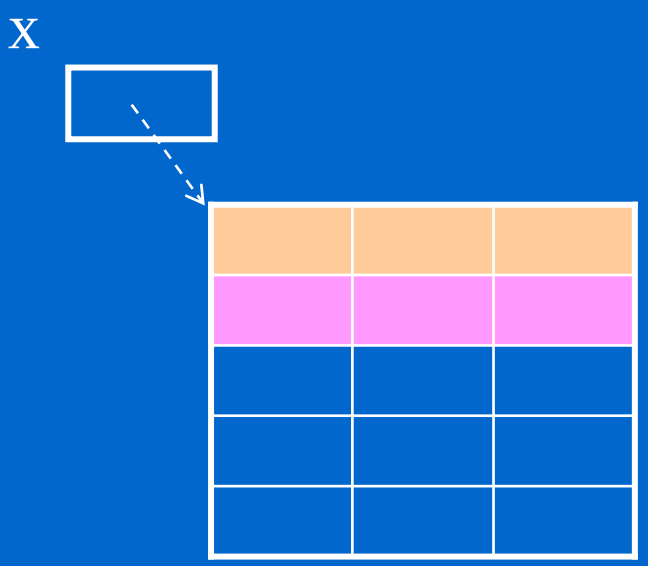


# Version 3. Dynamic allocated m by 3

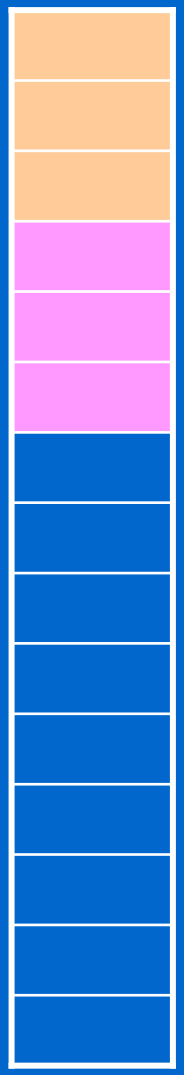
- Size of the first dimension is variable, size of the second dimension is fixed as 3
- Allocated on the heap
- Example

```
int i, j, m=5;
int (*x)[3];

x = new int[m][3];

for (i=0; i<m; i++)
    for (j=0; j<3; j++)
        x[i][j] = 0;

delete[] x;
```

Conceptual layout




Physical layout

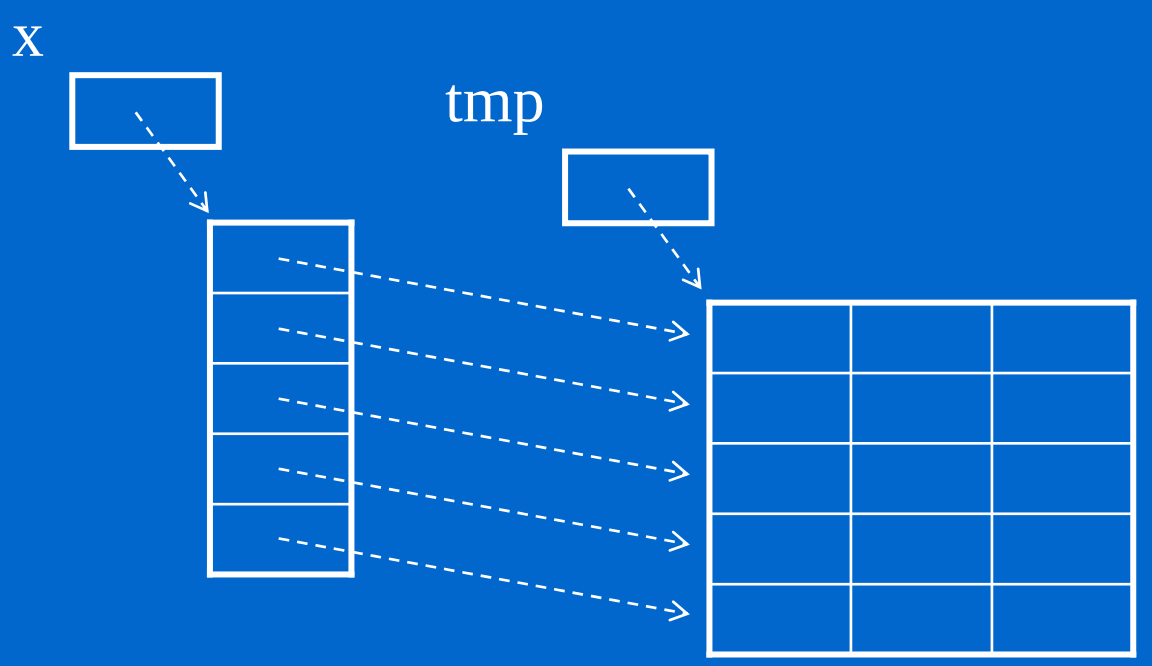


# Version 4. Dynamic allocated m by n

- Sizes of both dimensions are variable
- Allocated on the heap
- Example

```
int i, j, m=5, n=3;
int **x, *tmp;

x = new int*[m];
tmp = new int[m*n];
for (i=0; i<m; i++)
    x[i] = &tmp[i*n];

for (i=0; i<m; i++)
    for (j=0; j<n; j++)
        x[i][j] = 0;

delete[] x[0];
delete[] x;
```

Conceptual layout



# Version 5. Dynamic allocated m by n

- Sizes of both dimensions are variable, emulate with 1-D array syntax
- Allocated on the heap
- Example

```
int i, j, m=5, n=3;
int *x;

x = new int[m*n];

for (i=0; i<m; i++)
    for (j=0; j<n; j++)
        x[i*n+j] = 0; // x[i][j] does not work
                      // (&x[i*n])[j] is OK
delete[] x;
```