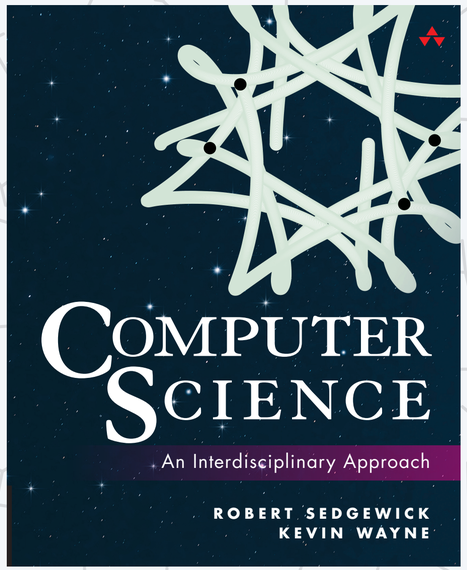

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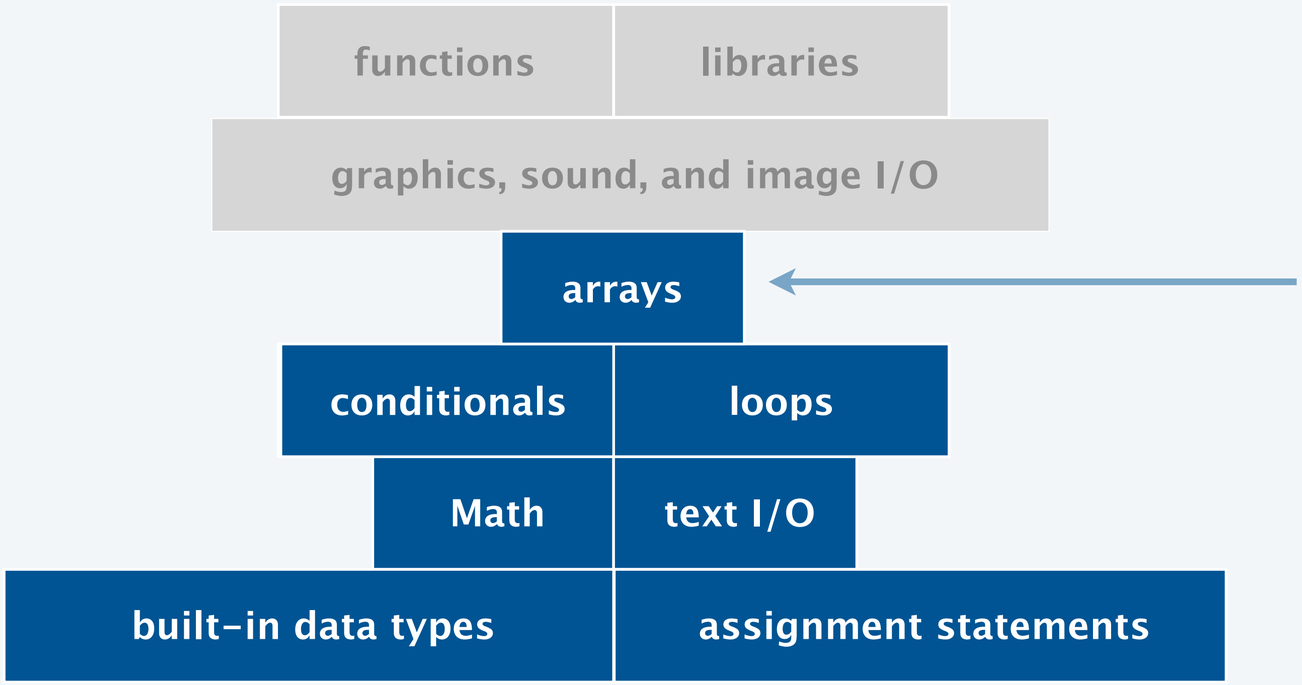
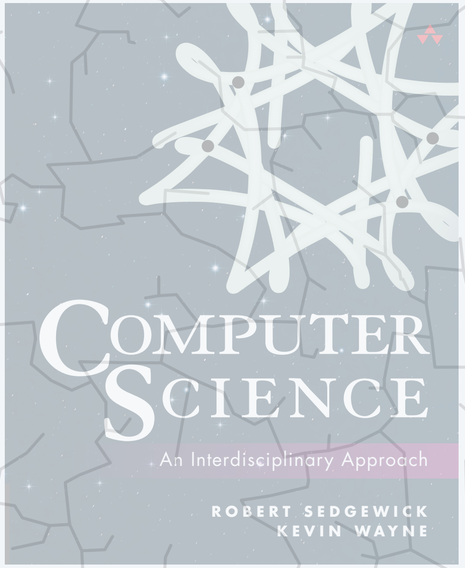
1.4 ARRAYS

- *basic concepts*
- *digital audio*
- *memory representation*
- *two-dimensional arrays*

Basic building blocks for programming



we can start storing and processing larger volumes of data



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1.4 ARRAYS

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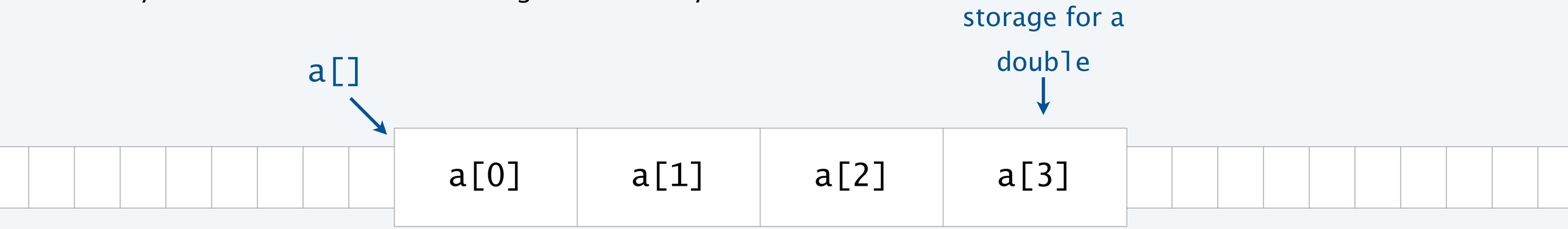
Memory representation of an array

Java array. An array is an indexed sequence of values of the same type.

Computer memory. Computer memory is an indexed sequence of memory locations.

- Each `int`, `double`, boolean occupies a fixed number of memory locations.
- Array elements are stored in contiguous memory locations.



Key properties.

- Given index `i` accessing `a[i]` is extremely efficient.
- Once you create an array, you cannot change its type or length.
- Arrays are reference types, not primitive types.

think of the variables with `a[]` as storing the memory address of the first element

Arrays 2: quiz 1

What does the following code fragment print?

A. 0 1 2 0 1 2

B. 0 1 2 1 2 6

C. 1 2 6 0 1 2

D. 1 2 6 0 1 2

E. 1 2 6 1 2 6

```
int[] a = { 1, 2, 6 };
int[] b = new int[a.length];

b = a;
for (int i = 0; i < b.length; i++) {
    b[i] = i;
}

for (int i = 0; i < a.length; i++) {
    System.out.print(a[i] + " ");
}

for (int i = 0; i < b.length; i++) {
    System.out.print(b[i] + " ");
}
```

Arrays 2: quiz 1

What does the following code fragment print?

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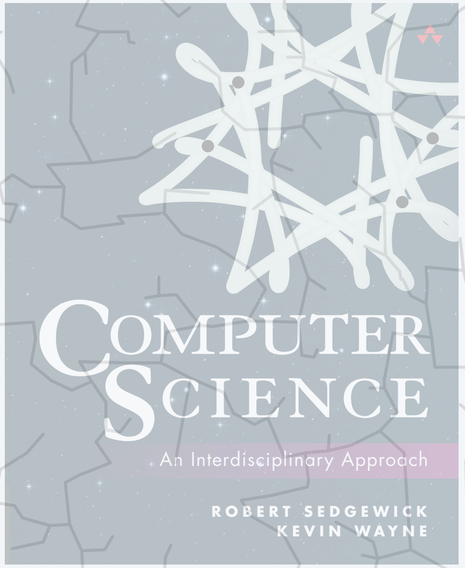
```


F11
Pause



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1.4 ARRAYS

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Your first data structure

A two-dimensional array is a *doubly indexed table* of values of the same type.

Examples.

- Grades of students in an online class
- Customer transactions in a bank
- Entries in a matrix
- Pixels in a digital image
- Cells in a spreadsheet

grade

student	0	1	2
0	A	A	A–
1	B	B–	A
2	B	B+	B
3	C	C–	C–

column

row

Arrays in Java

Create an array. Specify its type and length.

operation	typical code
declare a two-dimensional array	`double[][] a;`
create an m-by-n array	`a = new double[m][n];`
declare, create and initialize	`double[][] a = new double[m][n];`
refer to an array element by index	`a[i][j] = b[i][j] + c[j][k]`
number of rows	`a.length`
number of columns	`a[i].length`

all elements are initialized to the default value (zero for numeric values, false for `boolean`)

can be different for each row ("ragged" array)

	0	1	2	3	4
0	a[0][0]	a[0][1]	a[0][2]	a[0][3]	a[0][4]
1	a[1][0]	a[1][1]	a[1][2]	a[1][3]	a[1][4]
2	a[2][0]	a[2][1]	a[2][2]	a[2][3]	a[2][4]

Examples of two-dimensional arrays

Credits

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Datacenter	Adobe Stock	education license
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Sound wave	Adobe Stock	education license
Ear	Adobe Stock	education license
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