



Full-Stack Software Development

Lecture On: Arrays

Instructor: Arkoprovo Dey

In Last Class, we covered....

- Recursion



Homework Discussion

1. Write a program using recursion to check if the given number is a palindrome or not.
2. Write a program using recursion which checks if the number is divisible by 3 or not.

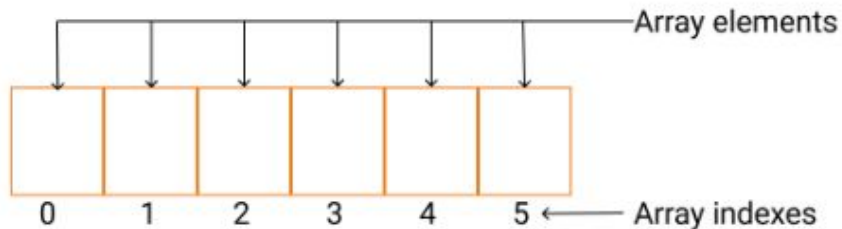
Today's Agenda

- 1 Introduction to arrays
- 2 Solve problems based on arrays



Introduction

Arrays are the simplest form of linear data structures, wherein the data elements are random-access and are stored in contiguous memory locations.



How to declare array?

dataType[] arrayName;

- `dataType` - it can be primitive data types like `int`, `char`, `double`, `byte`, etc. or Java objects
- `arrayName` - it is an identifier

Example:

```
int[] arr;
```

```
arr = new int[5];
```

In Java, we can declare and allocate memory of an array in one single statement. For example,

```
int[] arr = new int[5];
```

How to initialize array?

We can initialize our array during declaration. For example,

```
int[] arr = {1, 4, 3, 22, 21};
```

We can also assign values at specific indexes of array. For example,

```
arr[0] = 12;
```

```
arr[1] = 6;
```

and so on...

Poll 1 (15 sec.)

Which among the following is the right way to declare an array in Java?

1. `int arr[];`
2. `int arr[] = new int(10);`
3. `int() arr = new int(10);`
4. `int arr[] = new int[10];`

Poll 1 (Answer)

Which among the following is the right way to declare an array in Java?

1. `int arr[];`
2. `int arr[] = new int(10);`
3. `int() arr = new int(10);`
4. **`int arr[] = new int[10];`**

Poll 2 (15 sec.)

Which among the following is true in case of a two-dimensional array?
(multiple options can be correct)

1. `int arr [[]];`
2. `int[] arr[];`
3. `int [[]] arr;`
4. `int [][] arr;`

Poll 2 (Answer)

Which among the following is true in case of a multi-dimensional array?
(multiple options can be correct)

1. `int arr[[[]]];`
2. **`int[] arr[][];`**
3. `int[[[]]] arr;`
4. **`int[][][] arr;`**

Poll 3 (30 sec.)

Which of the following statements is true about arrays?

1. It contains objects of similar types
2. It is immutable
3. It shows a hierarchical behaviour
4. None of these

Poll 3 (Answer)

Which of the following statements is true about arrays?

- 1. It contains objects of similar types**
2. It is immutable
3. It shows a hierarchical behaviour
4. None of these

Let us look at how we can perform some basic operations in array:

- Update element at given index of an array.

```
public class Array {  
    public static void main(String[] args) {  
        int[] arr = {2, 4, 6, 8, 10};  
        arr[0]=3;  
        arr[1]=5;  
        arr[2]=7;  
    }  
}
```

Let us look at how we can perform some basic operations in array:

- Traversing an array.

```
public class Array {  
    public static void main(String[] args) {  
        int[] arr = {2, 4, 6, 8, 10};  
        for(int i = 0; i < arr.length; i++)  
            System.out.print(arr[i] + " ");  
    }  
}
```


Let us look at how we can perform some basic operations in array:

- Search for an element in array.

```
public class Array {  
    public static void main(String[] args) {  
        int[] arr = {2, 4, 6, 8, 10};  
        int num = 8;  
        for(int i = 0; i < arr.length; i++)  
            if(arr[i]==num)  
                System.out.print("Number " + num + " found at index " + i);  
    }  
}
```

Time complexity

Let's think about the time complexity (worst case) of performing the following operations on arrays:

- *Fetching an element from a specific position in an array* : $O(\text{Constant})$
- *Traversing an array* : $O(\text{Linear})$
- *Traversing an array within another array* : $O(\text{Quadratic})$

Poll 4 (15 sec.)

What will be the output in this case?

1. 10
2. 2
3. InvalidException
4. ArrayIndexOutOfBoundsException

```
public class Array {  
    public static void main(String[] args) {  
        int[] arr = {2, 4, 6, 8, 10};  
        System.out.print(arr[5]);  
    }  
}
```

Poll 4 (Answer)

What will be the output in this case?

1. 10
2. 2
3. InvalidException
4. **ArrayIndexOutOfBoundsException**

```
public class Array {  
    public static void main(String[] args) {  
        int[] arr = {2, 4, 6, 8, 10};  
        System.out.print(arr[5]);  
    }  
}
```

Poll 5 (15 sec.)

Can the size of an array be declared at runtime?

1. Yes
2. No

Poll 5 (Answer)

Can the size of an array be declared at runtime?

1. **Yes**

2. No

Poll 6 (15 sec.)

An element can be inserted in an array

1. Only at the front
2. Only at the end
3. Only in the middle
4. Anywhere

Poll 6 (Answer)

An element can be inserted in an array

1. Only at the front
2. Only at the end
3. Only in the middle
4. **Anywhere**

Poll 7 (15 sec.)

How does an array retrieve the elements in it?

1. Sequentially
2. Randomly

Poll 7 (Answer)

How does an array retrieve the elements in it?

1. Sequentially
2. **Randomly**

Poll 8 (30 sec.)

What will be the time complexity here?

1. $O(1)$
2. $O(\log n)$
3. $O(n)$
4. None of these

```
45%  
public void traverse(int[] arr){  
    for(int i=0;i<arr.length;i++){  
        System.out.println(arr[i]);  
    }  
}
```

Poll 8 (Answer)

What will be the time complexity here?

1. $O(1)$
2. $O(\log n)$
3. **$O(n)$**
4. None of these

45%

```
public void traverse(int[] arr){  
    for(int i=0;i<arr.length;i++){  
        System.out.println(arr[i]);  
    }  
}
```

Hands-on Coding

- Write a program to delete an element at a given index from the array.

Sample Input:

5

1 2 7 4 16

2

Sample output: 1 2 4 16

Explanation:

Deleted the 2nd element i.e. 7

- Write a program to find the maximum number in an array.

Sample Input:

4

3 1 8 2

Sample Output:

8

Hands-on Coding

- Write a program to find the top two maximum numbers in an array which is sorted and repetition is not allowed.

Sample Input:

5

2 5 7 3 19

Sample Output:

19 7

- Find the first repeating number in an array.

Sample Input:

7

2 3 4 9 4 2 6

Sample Output:

2

Hands-on Coding

- Find the odd and even numbers of an array in two separate arrays.

Sample Input:

5

2 5 3 16 8

Sample Output:

2 16 8

5 3

- Reverse an array.

Sample Input:

5

2 5 3 16 8

Sample Output:

8 16 3 5 2

Hands-on Coding

- Rotate an array by k positions.

Sample Input:

6

2 4 3 6 17 5

2

Sample Output:

17 5 2 4 3 6

Explanation:

Rotated the array to 2 positions right

Hands-on Coding

- Find common elements in two arrays (repetition is not allowed here).

Sample Input:

5

2 4 3 6 17

6

13 4 6 2 24

Sample Output:

2 4 6

Explanation:

The common elements are printed and the order of the output is corresponding to the order of first input array.

Hands-on Coding

Let us discuss some more problems on arrays and think of an optimal approach to solve them which you can code later on.

- Print the pair of numbers whose sum is equal to a given integer k.

Sample Input:

6

2 4 3 6 17 5

7

Sample Output:

2 5

4 3

Explanation:

Here, the sum that we are looking for is: 7

Therefore, we need to find the pairs in the input array whose sum is equal to 7.

Poll 9 (30 sec.)

Which among the following options is(are) the advantage(s) of arrays?
(Multiple options can be correct.)

1. Elements of same data type can be stored.
2. Elements of mixed data type can be stored.
3. The size can be changed at run-time.
4. Data is stored in contiguous memory.

Poll 9 (Answer)

Which among the following options is(are) the advantage(s) of arrays?
(Multiple options can be correct)

- 1. Same data type elements can be stored**
2. Mixed data type elements can be stored
- 3. The size can be changed at run-time**
- 4. Data is stored in contiguous memory**

Poll 10 (30 sec.)

Which among the following options is(are) the disadvantage(s) of arrays?
(Multiple options can be correct)

1. Mixed data elements cannot be stored
2. It is a non-static data structure
3. Data is not stored in contiguous memory location
4. Wastage of allocated memory may take place

Poll 10 (Answer)

Which among the following options is(are) the disadvantage(s) of arrays?
(Multiple options can be correct)

- 1. Mixed data elements cannot be stored**
2. It is a non-static data structure
3. Data is not stored in contiguous memory location
- 4. Wastage of allocated memory may take place**

Homework

1. Find the maximum product of two elements in an array.

Sample Input:

5

2 4 3 14 6

Sample Output:

84

Explanation:

14*6 is the largest product possible.

Tasks to complete after the session

Homework Questions
MCQs
Coding Questions

In the next class...

- Searching algorithms and their applications.





Thank You!