# CSN-103: Fundamentals of Object Oriented Programming

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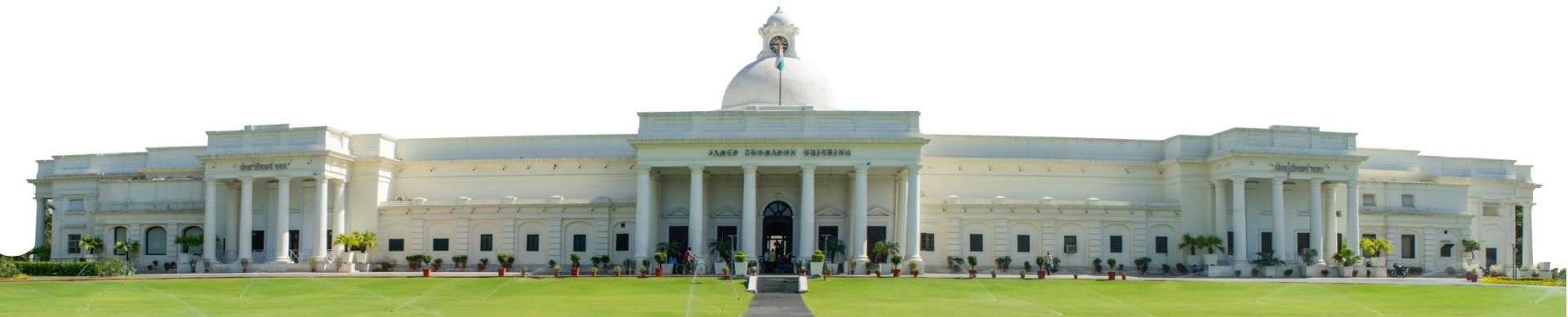

# Introducing final

- If a variable is declared as **final**
  - Its content can't be modified
  - Must initialize a **final** variable (Assignment done only **once**)
- Example:

```
final int FILE_NEW = 1;
or
final int FILE_NEW;
FILE_NEW=1;

FILE_NEW=2;
```

Convention to use all UPPERCASE identifiers for **final** variables

***Error: error: variable FILE_NEW might already have been assigned***

# Introducing final

- Final variables are essentially **constants**
- Keyword **final** can also be applied to:
  - **Methods:** Different meaning
    - Related to inheritance
  - **Classes and objects:**
    - A class that is declared final cannot be subclassed
    - A final object's instance variables **can be** modified, but the reference can't

# Variable-Length Arguments

- Example:
  - Marks of a number of students
  - Wants to calculate the average marks
- You need to know the marks of individual student
- You need to know the **number** of students
- **Methods** that need to take a variable number of arguments
  - This feature is called *variable-length arguments (varargs)*
  - A method that takes a variable number of arguments is called *varargs method*

# Variable-Length Arguments

```
class CalculateAvg {
   public static void main(String args[]) {
   calculateAverage(2,3);
   calculateAverage(2,3,4);
   }

   static void calculateAverage(int a, int b){
           System.out.println("Average: "+ ((double)(a+b)/2));
   }

   static void calculateAverage(int a, int b, int c){
    System.out.println("Average: "+ ((double)(a+b+c)/3));
   }
}
```

Overloaded Parameterized Methods

Good enough approach: If max number of arguments are is small

# Variable-Length Arguments

```
class CalculateAvg2 {
   public static void main(String args[]) {
   int m1[] = {2,3};
   int m2[] = {2,3,4,5,6};
   calculateAverage(m1);
   calculateAverage(m2);
   }

   static void calculateAverage(int a[]){
         int sum=0;
         for(int i=0;i<a.length;i++)
               sum+=a[i];
         System.out.println("Average: "+ (double)sum/a.length));
   }
}
```

Arguments are put into an Array
Array is passed to the method

Drawback: Declare and initialize array with arguments

# Variable-Length Arguments

- In Java, you can specify variable length argument by **three periods** (…)
- Example:

```
static void calculateAverage (int … argt)
```

*calculateAverage()* can be called with **zero or more arguments**

- ***argt*** *is implicitly declared* ***as an array*** *of type int[]*
  - ***argt*** *is accessed using the* ***normal array syntax***

# Variable-Length Arguments

```
class CalculateAvg3 {
   public static void main(String args[]) {
   calculateAverage(2,3);
   calculateAverage(2,3,4,5,6);
   }

   static void calculateAverage(int ... a){
         int sum=0;
         for(int i=0;i<a.length;i++)
               sum+=a[i];
         System.out.println("Average: "+ ((double)sum/a.length));
   }
}
```

No array required

No overloaded methods needed

# Variable-Length Arguments

- Normal parameters can also be specified with a variable-length parameter
- Restrictions
  - Variable-length parameter **must be the last** parameter
  - There can be **only one** variable-length parameter

- Examples:
  - VALID:

```
void calculateAverage (int a, char b, double c, int ... vals){
```

  - INVALID:

```
void calculateAverage(int a, char b, int ... vals, double c){
void calculateAverage(int a, char b, int ... vals, float … fls){
```

# Overloading Vararg Method

- Vararg method can be overloaded in two ways
  - ***Type*** of its vararg parameter can differ
    - Java uses the ***type*** of vararg parameter for overload resolution
  - Add a normal parameter with the vararg parameter
    - Java uses the ***number and type*** of parameters for overload resolution

# Vararg and Ambiguity

- It is possible to create an ambiguous call to an overloaded vararg method because of:
  - Empty vararg parameter
  - A normal parameter along with vararg parameter of the same type