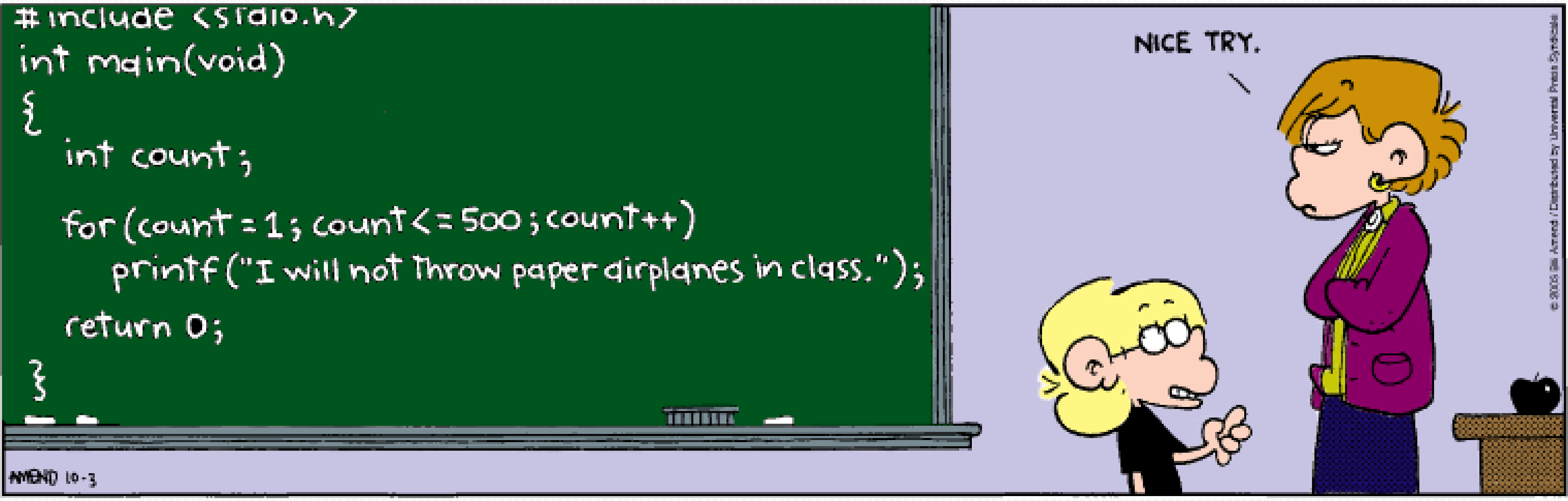
CSE 142, Spring 2013

Chapter 2
Lecture 2-3: Loop Figures and Constants

reading: 2.4 - 2.5



```
#include <stdio.h>
int main(void)
{
   int count;

   for(count = 1; count <= 500; count++)
      printf("I will not throw paper airplanes in class.");
   return 0;
}
```

Drawing complex figures

- Use nested `for` loops to produce the following output.

- Why draw ASCII art?
  - Real graphics require a lot of finesse
  - ASCII art has complex patterns
  - Can focus on the algorithms

```
#================#
|      <><>      |
|    <>....<>    |
|  <>........<>  |
|<>............<>|
|<>............<>|
|  <>........<>  |
|    <>....<>    |
|      <><>      |
#================#
```

Development strategy

- Recommendations for managing complexity:
  1. Design the program (think about steps or methods needed).
     - write an English description of steps required
     - use this description to decide the methods

  2. Create a table of patterns of characters
     - use table to write your `for` loops

```
#================#
|      <><>      |
|    <>....<>    |
|  <>........<>  |
|<>............<>|
|<>............<>|
|  <>........<>  |
|    <>....<>    |
|      <><>      |
#================#
```

1. Pseudo-code

- **pseudo-code**: An English description of an algorithm.

- Example: Drawing a 12 wide by 7 tall box of stars

```
print 12 stars.
for (each of 5 lines) {
    print a star.
    print 10 spaces.
    print a star.
}
print 12 stars.
```

```
************
*          *
*          *
*          *
*          *
*          *
************
```

2. Tables

- A table for the top half:
  - Compute spaces and dots expressions from line number

line	spaces	line * -2 + 8	dots	4 * line - 4
1	6	6	0	0
2	4	4	4	4
3	2	2	8	8
4	0	0	12	12

```
#================#
|      <><>      |
|    <>....<>    |
|  <>........<>  |
|<>............<>|
|<>............<>|
|  <>........<>  |
|    <>....<>    |
|      <><>      |
#================#
```

Scaling the mirror

- Let's modify our Mirror program so that it can scale.
  - The current mirror (left) is at size 4; the right is at size 3.
- We'd like to structure the code so we can scale the figure by changing the code in just one place.

```
#================#                #============#
|      <><>      |                |    <><>    |
|    <>....<>    |                |  <>....<>  |
|  <>........<>  |                |<>........<>|
|<>............<>|                |<>........<>|
|<>............<>|                |  <>....<>  |
|  <>........<>  |                |    <><>    |
|    <>....<>    |                #============#
|      <><>      |
#================#
```

Limitations of variables

- Idea: Make a variable to represent the size.
  - Use the variable's value in the methods.

- Problem: A variable in one method can't be seen in others.

```
public static void main(String[] args) {
    int size = 4;
    topHalf();
    printBottom();
}

public static void topHalf() {
    for (int i = 1; i <= size; i++) {     // ERROR: size not found
        ...
    }
}

public static void bottomHalf() {
    for (int i = size; i >= 1; i--) {     // ERROR: size not found
        ...
    }
}
```

Class constants

- **class constant**: A fixed value visible to the whole program.
  - value can be set only at declaration; cannot be reassigned

- Syntax:

  `public static final` **type name** `=` **value**`;`

  - name is usually in ALL_UPPER_CASE

  - Examples:

```
public static final int DAYS_IN_WEEK = 7;
public static final double INTEREST_RATE = 3.5;
public static final int SSN = 658234569;
```

Observations about constant

- The constant can change the "intercept" in an expression.
    - Usually the "slope" is unchanged.

```
public static final int SIZE = 4;

for (int space = 1; space <= (line * -2 + (2 * SIZE)); space++) {
    System.out.print(" ");
}
```

- It doesn't replace *every* occurrence of the original value.

```
for (int dot = 1; dot <= (line * 4 - 4); dot++) {
    System.out.print(".");
}
```