Java

Conditionals, While loop, For Loop

Conditionals

Java - Conditionals

```java
package week1;

public class PlusMinus {
    public static String letter(int score){
        int tens=score/10;
        if (tens>=9){
            return "A";
        } else if(tens>=8){
            return "B";
        } else if(tens>=7){
            String result = "C";
            return result;
        } else if(tens>=6){
            return "D";
        } else {
            return "F";
        }
    }

    public static void main(String[] args) {
        String result = letter(98);
        System.out.println(result);
        result = letter(75);
        System.out.println(result);
        result = letter(30);
        System.out.println(result);
    }
}
```

- Conditionals (if/else if/else)

- Parentheses around each boolean expression for if and else if

- Braces {} around each code block

Memory Diagram

Stack

Name	Value	

Heap

in/out

```java
package week1;

public class PlusMinus {
    public static String letter(int score){
        int tens=score/10;
        if (tens>=9){
            return "A";
        } else if(tens>=8){
            return "B";
        } else if(tens>=7){
            String result = "C";
            return result;
        } else if(tens>=6){
            return "D";
        } else {
            return "F";
        }
    }

➡️  public static void main(String[] args) {
        String result = letter(98);
        System.out.println(result);
        result = letter(75);
        System.out.println(result);
        result = letter(30);
        System.out.println(result);
    }
}
```

- Setup the memory diagram

- Start the program at the main method

```
package week1;

public class PlusMinus {
    public static String letter(int score){
        int tens=score/10;
        if (tens>=9){
            return "A";
        } else if(tens>=8){
            return "B";
        } else if(tens>=7){
            String result = "C";
            return result;
        } else if(tens>=6){
            return "D";
        } else {
            return "F";
        }
    }

    public static void main(String[] args) {
        String result = letter(98);
        System.out.println(result);
        result = letter(75);
        System.out.println(result);
        result = letter(30);
        System.out.println(result);
    }
}
```

Name	Value	
result		
		in/out

- We start with a method call

- Add "result" to the stack with name only
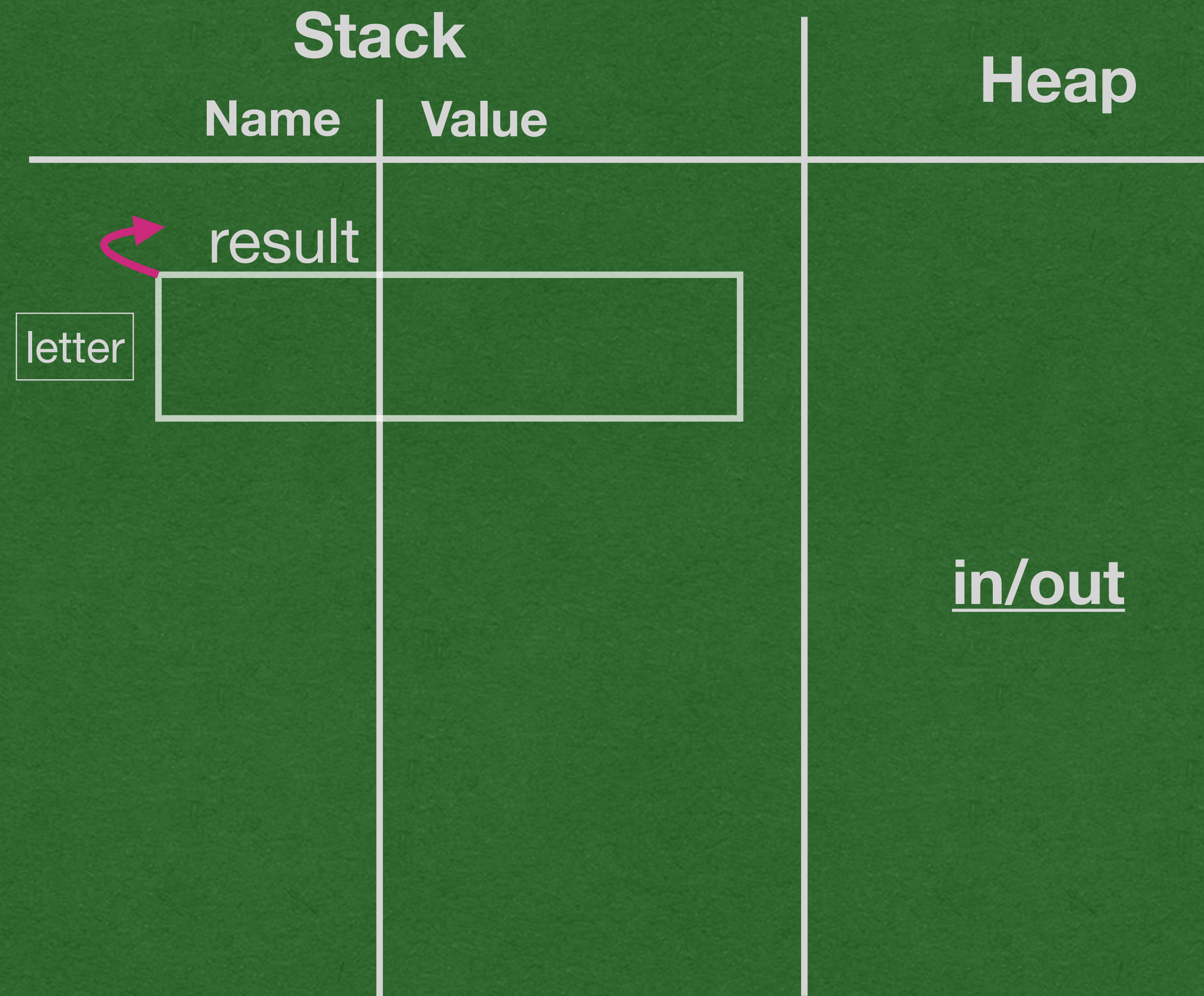
```java
package week1;

public class PlusMinus {
    public static String letter(int score){
        int tens=score/10;
        if (tens>=9){
            return "A";
        } else if(tens>=8){
            return "B";
        } else if(tens>=7){
            String result = "C";
            return result;
        } else if(tens>=6){
            return "D";
        } else {
            return "F";
        }
    }


    public static void main(String[] args) {
        String result = letter(98);
        System.out.println(result);
        result = letter(75);
        System.out.println(result);
        result = letter(30);
        System.out.println(result);
    }
}
```

Stack

Heap

Name	Value
result	

letter

in/out

- Add a stack frame for the method call

- Write the name of the method being called

- Draw a return arrow showing where the return value will go

```java
package week1;

public class PlusMinus {
    public static String letter(int score){
        int tens=score/10;
        if (tens>=9){
            return "A";
        } else if(tens>=8){
            return "B";
        } else if(tens>=7){
            String result = "C";
            return result;
        } else if(tens>=6){
            return "D";
        } else {
            return "F";
        }
    }

    public static void main(String[] args) {
        String result = letter(98);
        System.out.println(result);
        result = letter(75);
        System.out.println(result);
        result = letter(30);
        System.out.println(result);
    }
}
```

Stack

Heap

Name	Value
result	
score	98

letter

in/out

- Start the method call by adding the parameter(s) to the stack inside the new stack frame

- Assign the parameter(s) the value(s) of the argument(s)

```java
package week1;

public class PlusMinus {
    public static String letter(int score){
        int tens=score/10;
        if (tens>=9){
            return "A";
        } else if(tens>=8){
            return "B";
        } else if(tens>=7){
            String result = "C";
            return result;
        } else if(tens>=6){
            return "D";
        } else {
            return "F";
        }
    }

    public static void main(String[] args) {
        String result = letter(98);
        System.out.println(result);
        result = letter(75);
        System.out.println(result);
        result = letter(30);
        System.out.println(result);
    }
}
```

Stack

Heap

Name	Value
result	
score	98
tens	9

letter

in/out

- Variables declared as part of the method call are added inside that method's stack frame

```java
package week1;

public class PlusMinus {
    public static String letter(int score){
        int tens=score/10;
        if (tens>=9){
            return "A";
        } else if(tens>=8){
            return "B";
        } else if(tens>=7){
            String result = "C";
            return result;
        } else if(tens>=6){
            return "D";
        } else {
            return "F";
        }
    }


    public static void main(String[] args) {
        String result = letter(98);
        System.out.println(result);
        result = letter(75);
        System.out.println(result);
        result = letter(30);
        System.out.println(result);
    }
}
```

Stack

Heap

Name	Value
result	
score	98
tens	9

letter

in/out

- The boolean expression "tens>=9" evaluates to true

- Enter the code block

```java
package week1;

public class PlusMinus {
    public static String letter(int score){
        int tens=score/10;
        if (tens>=9){
            return "A";
        } else if(tens>=8){
            return "B";
        } else if(tens>=7){
            String result = "C";
            return result;
        } else if(tens>=6){
            return "D";
        } else {
            return "F";
        }
    }

    public static void main(String[] args) {
        String result = letter(98);
        System.out.println(result);
        result = letter(75);
        System.out.println(result);
        result = letter(30);
        System.out.println(result);
    }
}
```

Stack

Heap

Name	Value
result	
score	98
tens	9

letter

in/out

- We reach a return statement

- Method ends and returns "A"
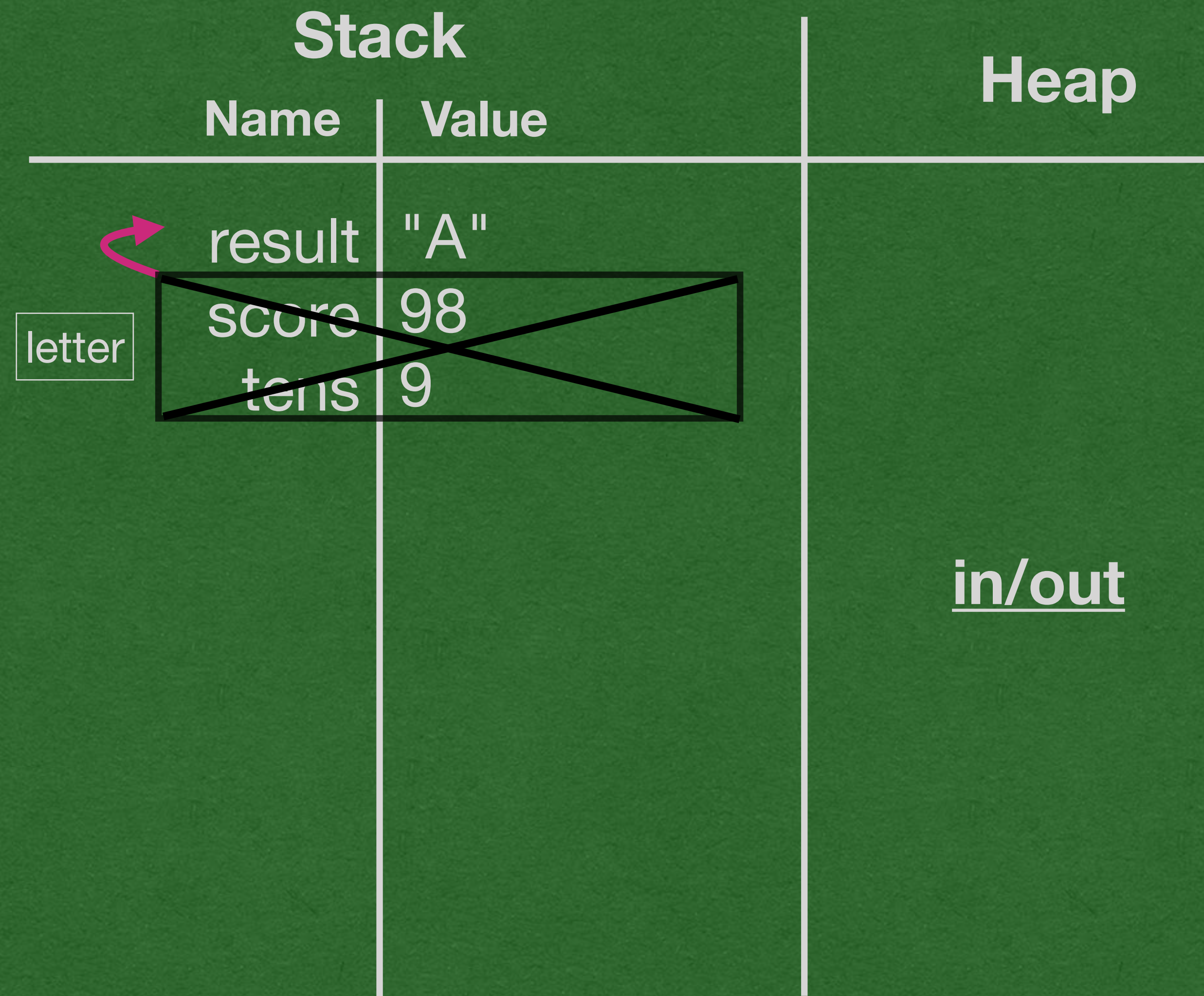
```java
package week1;

public class PlusMinus {
    public static String letter(int score){
        int tens=score/10;
        if (tens>=9){
            return "A";
        } else if(tens>=8){
            return "B";
        } else if(tens>=7){
            String result = "C";
            return result;
        } else if(tens>=6){
            return "D";
        } else {
            return "F";
        }
    }


    public static void main(String[] args) {
        String result = letter(98);
        System.out.println(result);
        result = letter(75);
        System.out.println(result);
        result = letter(30);
        System.out.println(result);
    }
}
```

Stack

Heap

Name	Value
result	"A"
score	98
tens	9

letter

in/out

When a method returns:

• Follow the return arrow and assign the returned value

• Cross out the stack frame - it is deleted from memory

```java
package week1;

public class PlusMinus {
    public static String letter(int score){
        int tens=score/10;
        if (tens>=9){
            return "A";
        } else if(tens>=8){
            return "B";
        } else if(tens>=7){
            String result = "C";
            return result;
        } else if(tens>=6){
            return "D";
        } else {
            return "F";
        }
    }


    public static void main(String[] args) {
        String result = letter(98);
        System.out.println(result);
        result = letter(75);
        System.out.println(result);
        result = letter(30);
        System.out.println(result);
    }
}
```

Stack

Name	Value
result	"A"
score	98
tens	9

letter

Heap

in/out

A

- Print the value stored in result
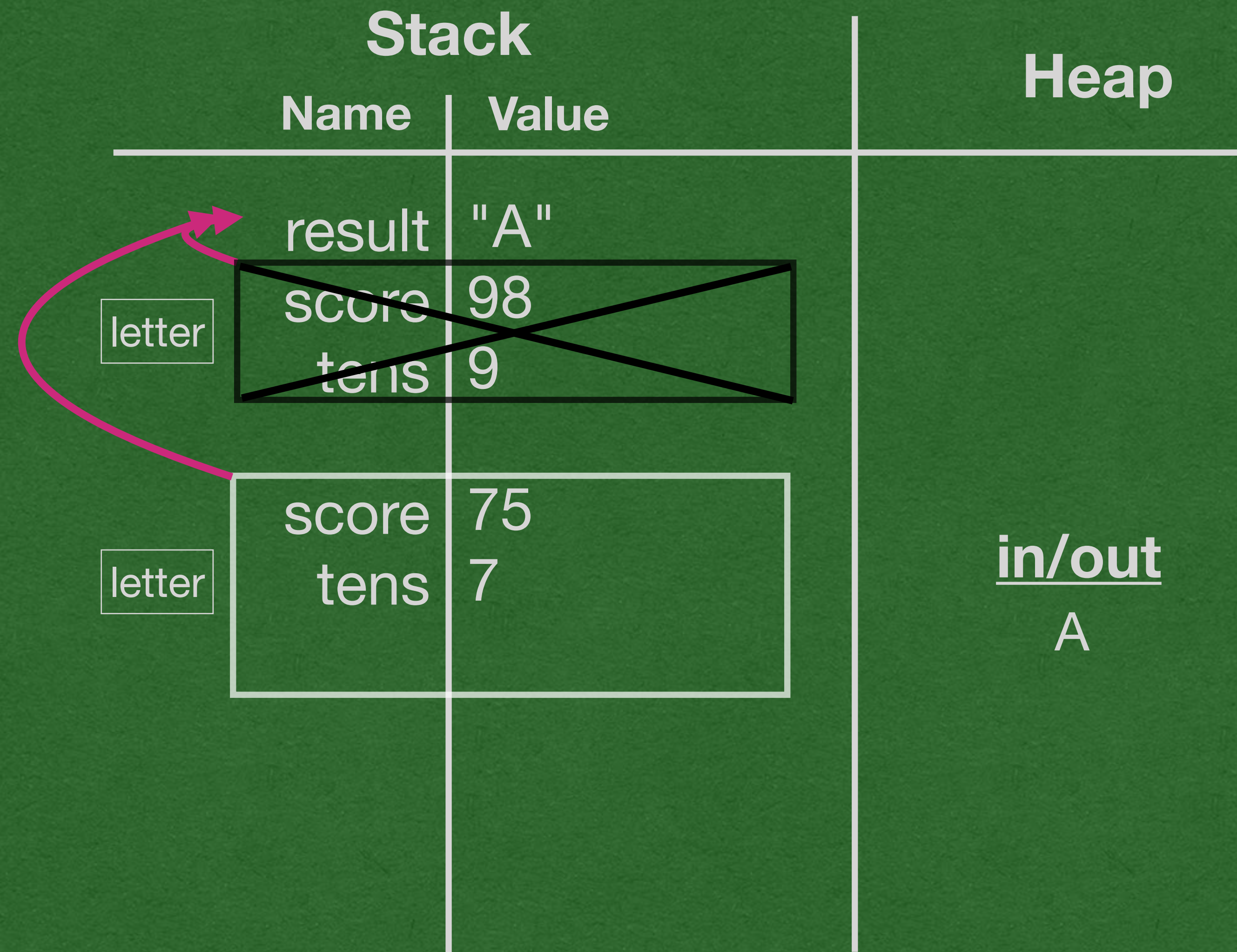
```java
package week1;

public class PlusMinus {
    public static String letter(int score){
        int tens=score/10;
        if (tens>=9){
            return "A";
        } else if(tens>=8){
            return "B";
        } else if(tens>=7){
            String result = "C";
            return result;
        } else if(tens>=6){
            return "D";
        } else {
            return "F";
        }
    }

    public static void main(String[] args) {
        String result = letter(98);
        System.out.println(result);
        result = letter(75);
        System.out.println(result);
        result = letter(30);
        System.out.println(result);
    }
}
```

Stack

Heap

Name	Value

result   "A"

letter

~~score   98~~

~~tens   9~~

letter

in/out

A

- Do it all again with an argument of 75

- Set up the stack frame
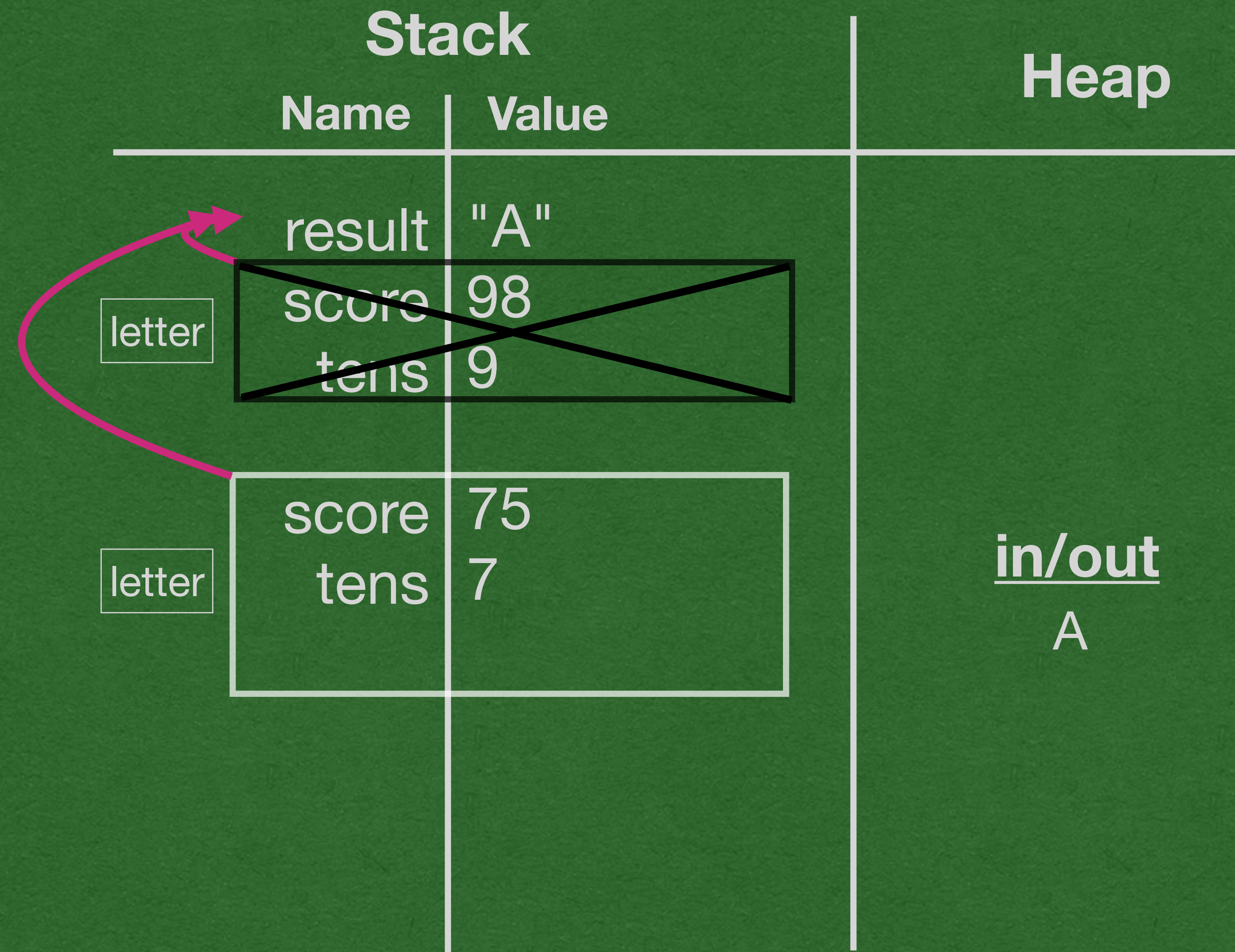
```java
package week1;

public class PlusMinus {
    public static String letter(int score){
→       int tens=score/10;
        if (tens>=9){
            return "A";
        } else if(tens>=8){
            return "B";
        } else if(tens>=7){
            String result = "C";
            return result;
        } else if(tens>=6){
            return "D";
        } else {
            return "F";
        }
    }


    public static void main(String[] args) {
        String result = letter(98);
        System.out.println(result);
→       result = letter(75);
        System.out.println(result);
        result = letter(30);
        System.out.println(result);
    }
}
```

Stack

Heap

Name	Value

letter

result "A"
~~score 98~~
~~tens 9~~

letter

score 75
tens 7

in/out

A

- Add the parameter to the stack frame

- Declare "tens" inside the stack frame
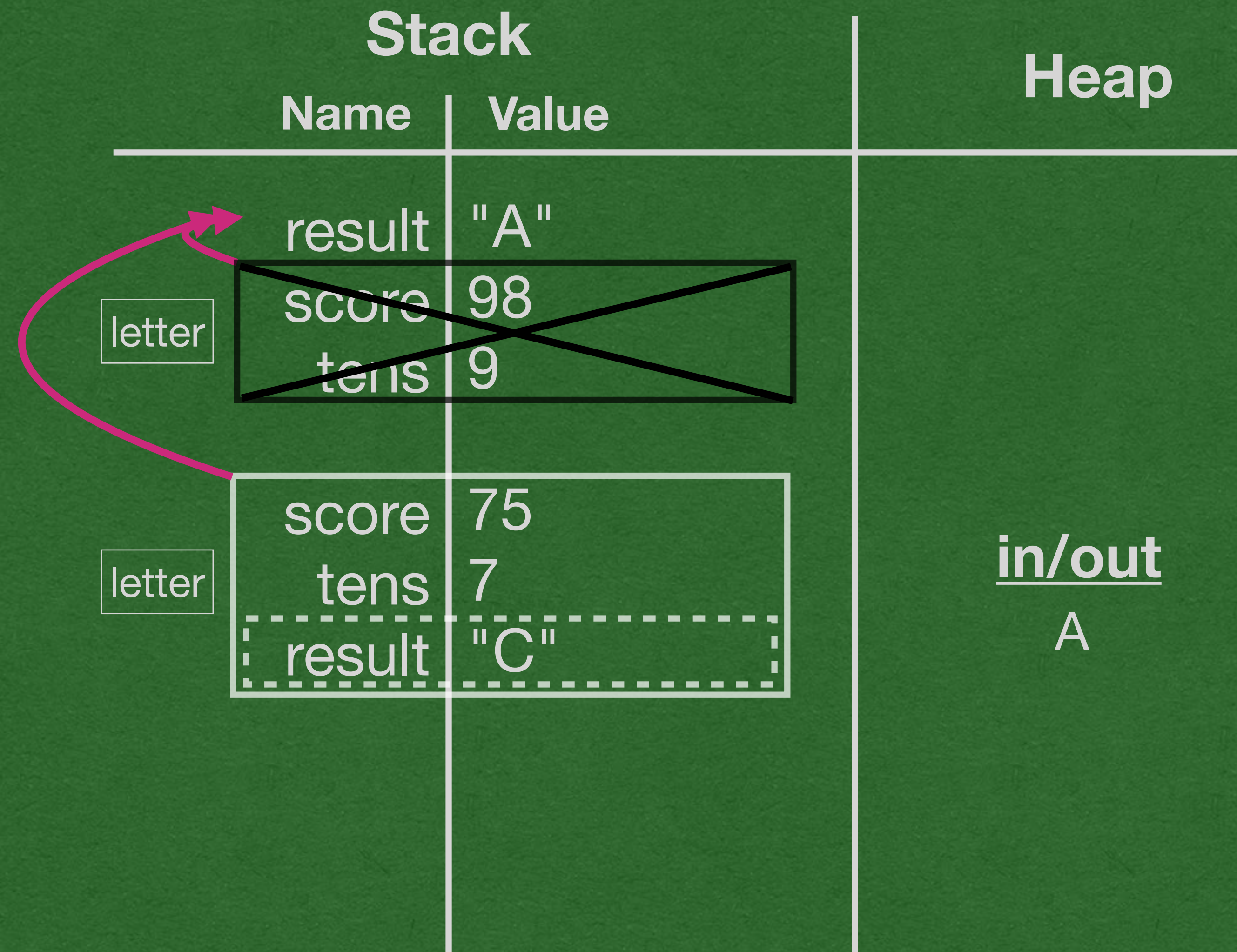
```java
package week1;

public class PlusMinus {
    public static String letter(int score){
        int tens=score/10;
        if (tens>=9){
            return "A";
        } else if(tens>=8){
            return "B";
        } else if(tens>=7){
            String result = "C";
            return result;
        } else if(tens>=6){
            return "D";
        } else {
            return "F";
        }
    }

    public static void main(String[] args) {
        String result = letter(98);
        System.out.println(result);
        result = letter(75);
        System.out.println(result);
        result = letter(30);
        System.out.println(result);
    }
}
```

Stack

Heap

Name	Value

result "A"

letter
~~score 98~~
~~tens 9~~

letter
score 75
tens 7

in/out
A

- First two boolean expressions resolve to false

- Third expression resolves to true

- Enter the third code block
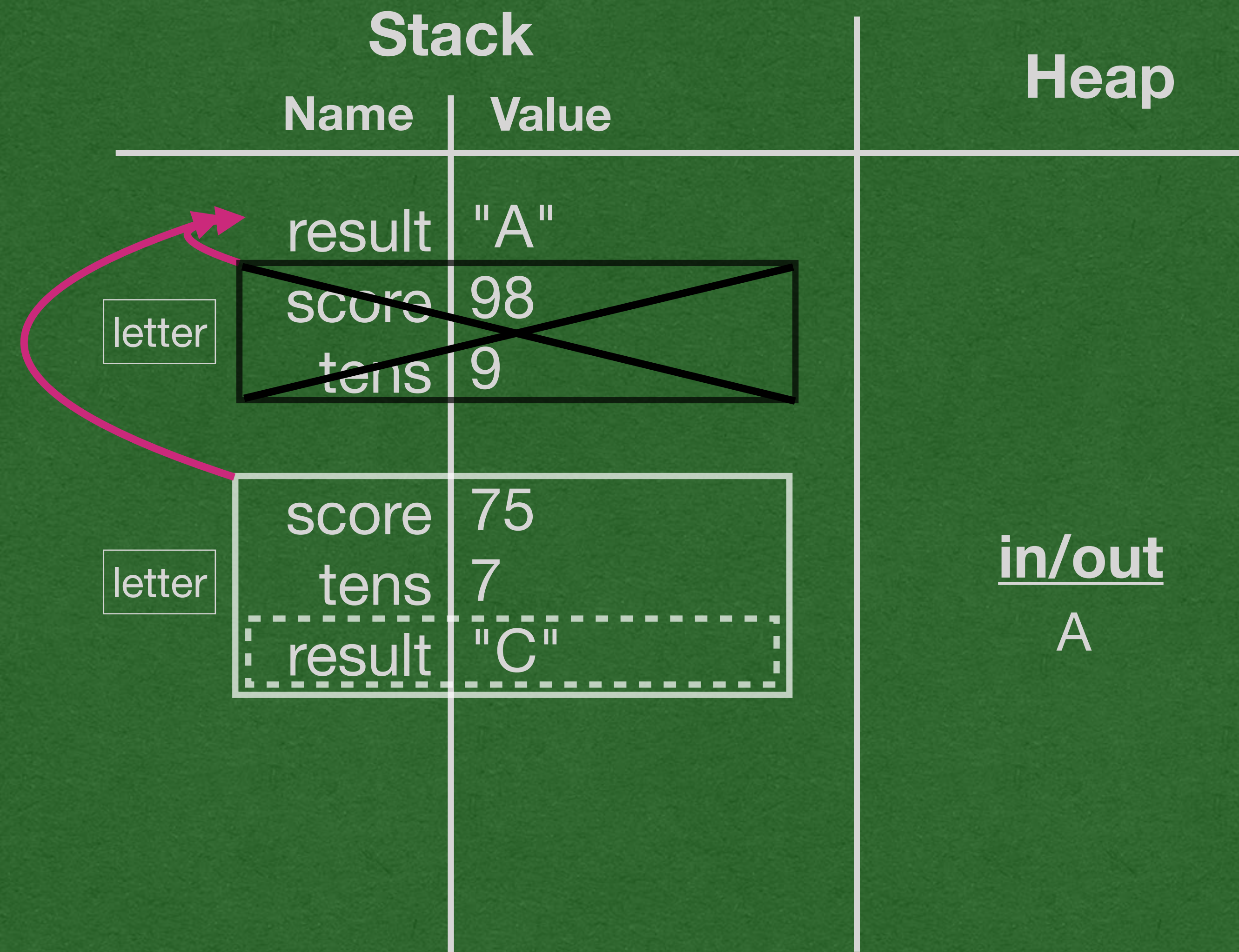
```java
package week1;

public class PlusMinus {
    public static String letter(int score){
        int tens=score/10;
        if (tens>=9){
            return "A";
        } else if(tens>=8){
            return "B";
        } else if(tens>=7){
            String result = "C";
            return result;
        } else if(tens>=6){
            return "D";
        } else {
            return "F";
        }
    }

    public static void main(String[] args) {
        String result = letter(98);
        System.out.println(result);
        result = letter(75);
        System.out.println(result);
        result = letter(30);
        System.out.println(result);
    }
}
```

Stack

Heap

Name	Value
result	"A"
letter — score	98
tens	9
letter — score	75
tens	7
result	"C"

in/out

A

- When a variable is declared inside a code block:

  - Add the code block to the stack

  - Add the variable inside the code block
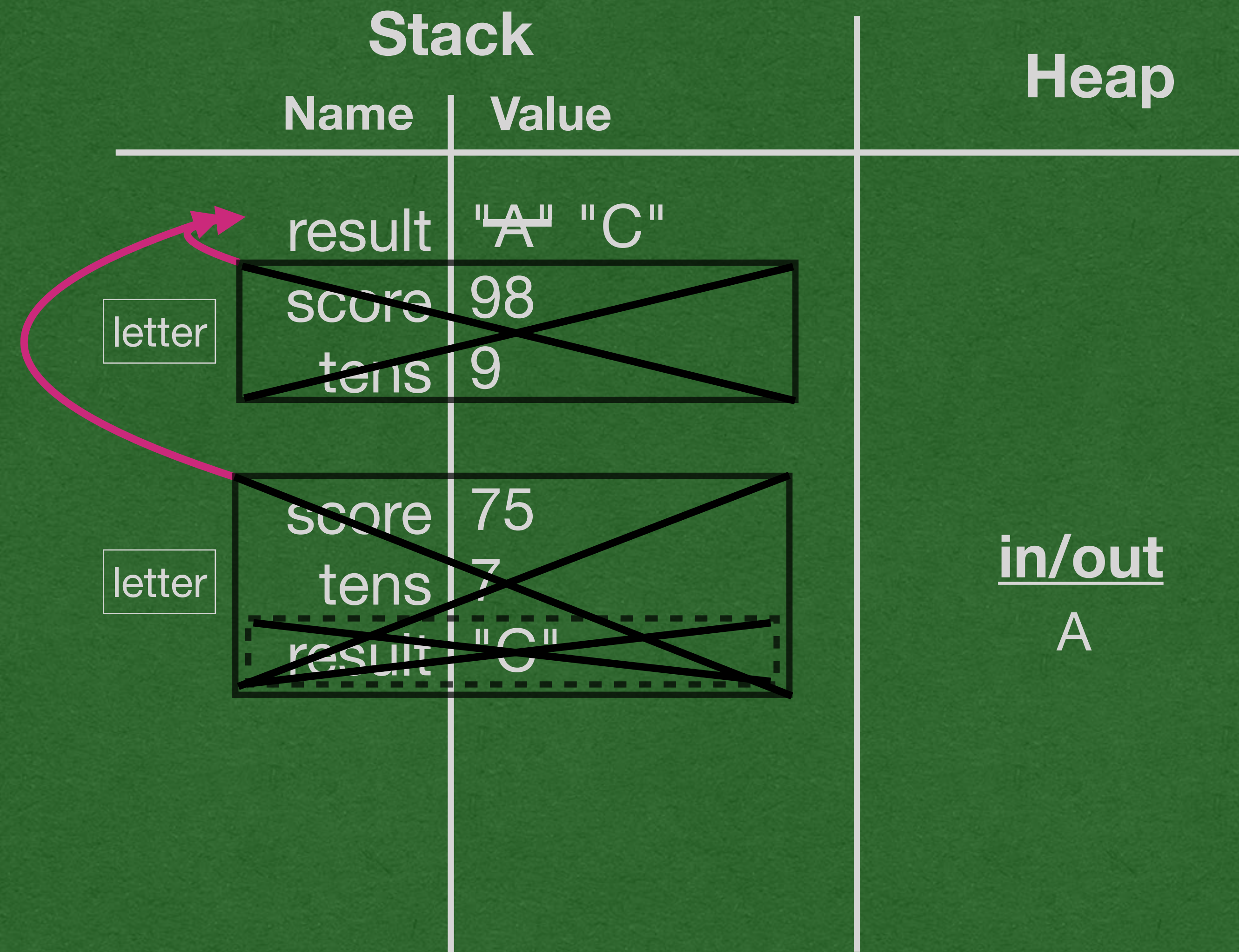
```java
package week1;

public class PlusMinus {
    public static String letter(int score){
        int tens=score/10;
        if (tens>=9){
            return "A";
        } else if(tens>=8){
            return "B";
        } else if(tens>=7){
            String result = "C";
            return result;
        } else if(tens>=6){
            return "D";
        } else {
            return "F";
        }
    }


    public static void main(String[] args) {
        String result = letter(98);
        System.out.println(result);
        result = letter(75);
        System.out.println(result);
        result = letter(30);
        System.out.println(result);
    }
}
```

Stack

Heap

Name	Value
result	"A"
score	98
tens	9

letter

score	75
tens	7
result	"C"

letter

in/out

A

- Code block are represented by dashed boxes

- Variables outside the code block can still accessed
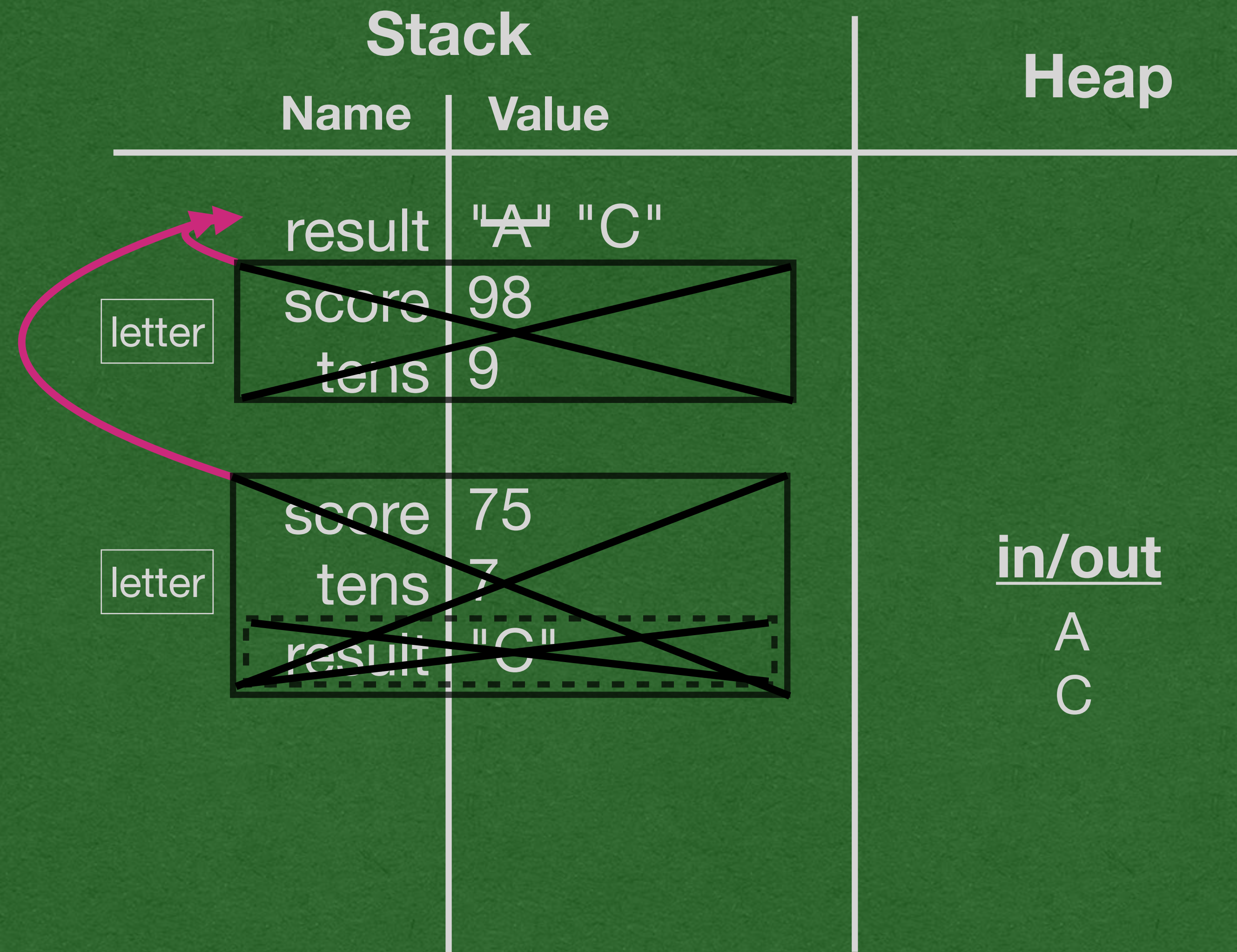
```java
package week1;

public class PlusMinus {
    public static String letter(int score){
        int tens=score/10;
        if (tens>=9){
            return "A";
        } else if(tens>=8){
            return "B";
        } else if(tens>=7){
            String result = "C";
            return result;
        } else if(tens>=6){
            return "D";
        } else {
            return "F";
        }
    }


    public static void main(String[] args) {
        String result = letter(98);
        System.out.println(result);
        result = letter(75);
        System.out.println(result);
        result = letter(30);
        System.out.println(result);
    }
}
```

Stack

Heap

Name	Value

result | "A" "C"

letter

~~score 98~~
~~tens 9~~

letter

~~score 75~~
~~tens 7~~
~~result "C"~~

in/out

A
C

- Print "C"
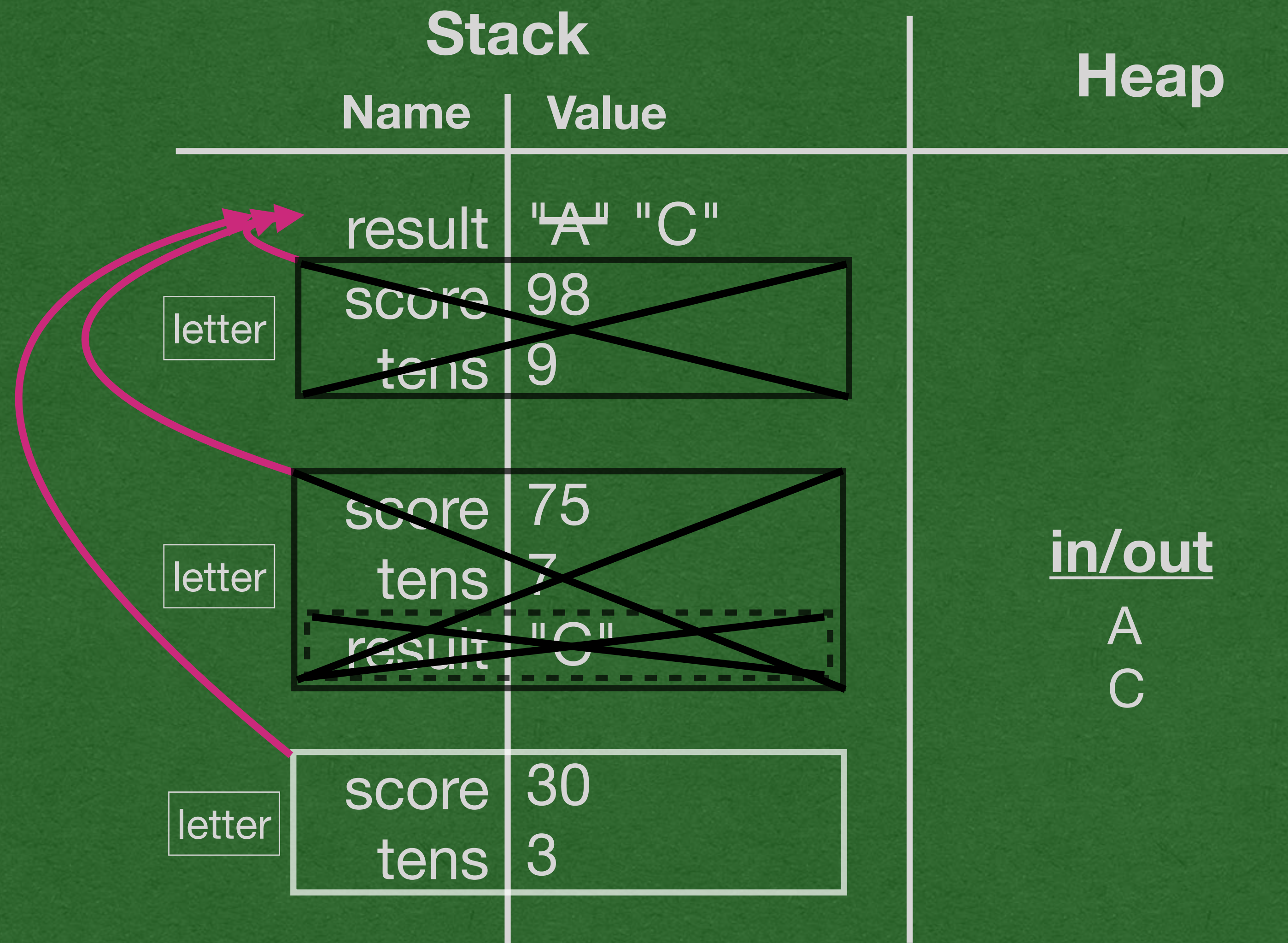
```java
package week1;

public class PlusMinus {
    public static String letter(int score){
        int tens=score/10;
        if (tens>=9){
            return "A";
        } else if(tens>=8){
            return "B";
        } else if(tens>=7){
            String result = "C";
            return result;
        } else if(tens>=6){
            return "D";
        } else {
            return "F";
        }
    }

    public static void main(String[] args) {
        String result = letter(98);
        System.out.println(result);
        result = letter(75);
        System.out.println(result);
        result = letter(30);
        System.out.println(result);
    }
}
```

Stack

Heap

Name	Value
result	"A" "C"
score	98
tens	9

letter

score	75
tens	7
result	"C"

letter

score	30
tens	3

letter

in/out

A
C

- I'll do it again.
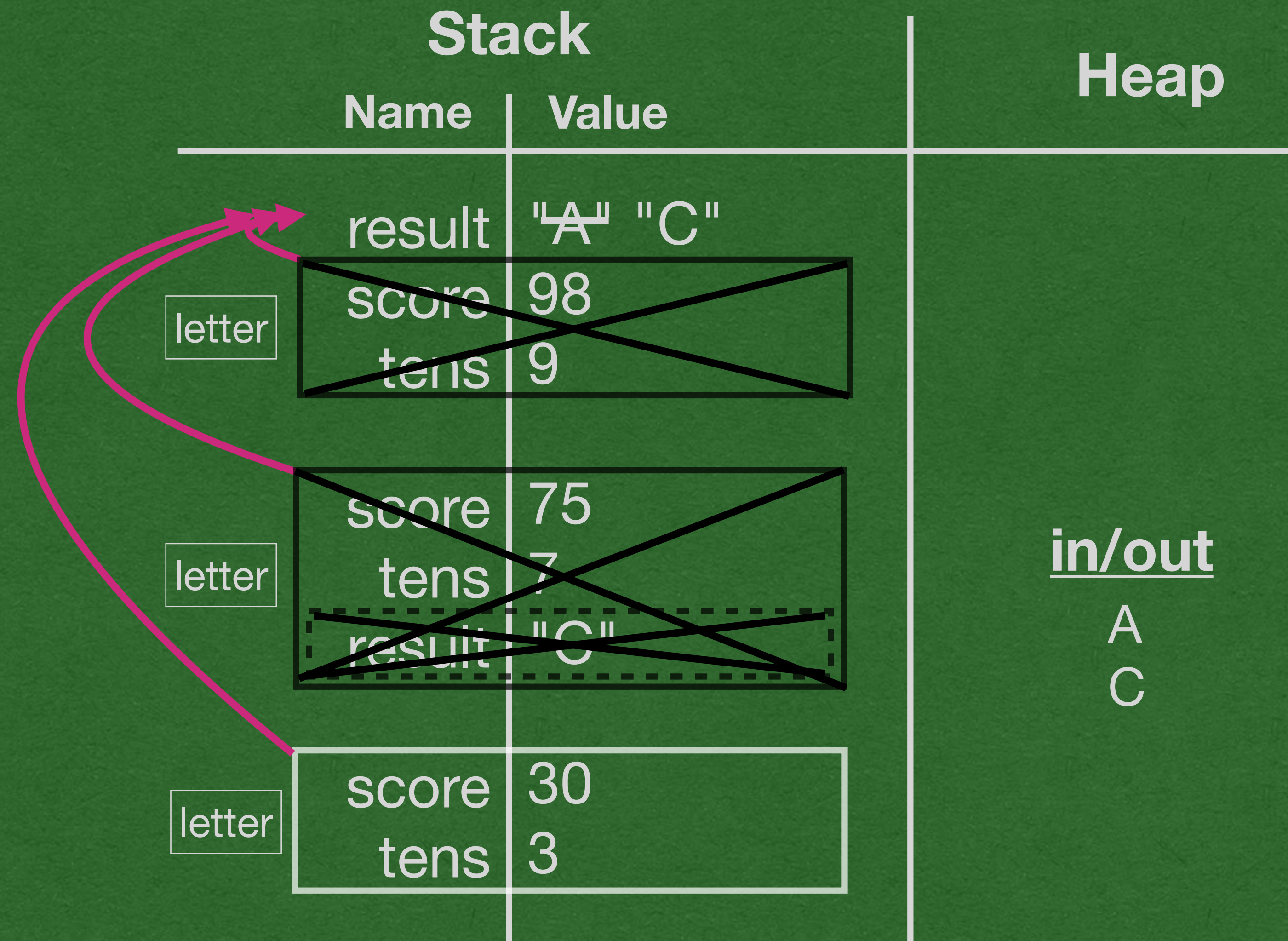
```java
package week1;

public class PlusMinus {
    public static String letter(int score){
        int tens=score/10;
        if (tens>=9){
            return "A";
        } else if(tens>=8){
            return "B";
        } else if(tens>=7){
            String result = "C";
            return result;
        } else if(tens>=6){
            return "D";
        } else {
            return "F";
        }
    }

    public static void main(String[] args) {
        String result = letter(98);
        System.out.println(result);
        result = letter(75);
        System.out.println(result);
        result = letter(30);
        System.out.println(result);
    }
}
```

Stack

Heap

Name	Value

letter — result "A" "C"
score 98
tens 9

letter — score 75
tens 7
result "C"

letter — score 30
tens 3

in/out

A
C

- All boolean expressions are false

- We hit the else block

- No variables are declared in the block so we don't draw a dashed box (It would be empty, so why bother)
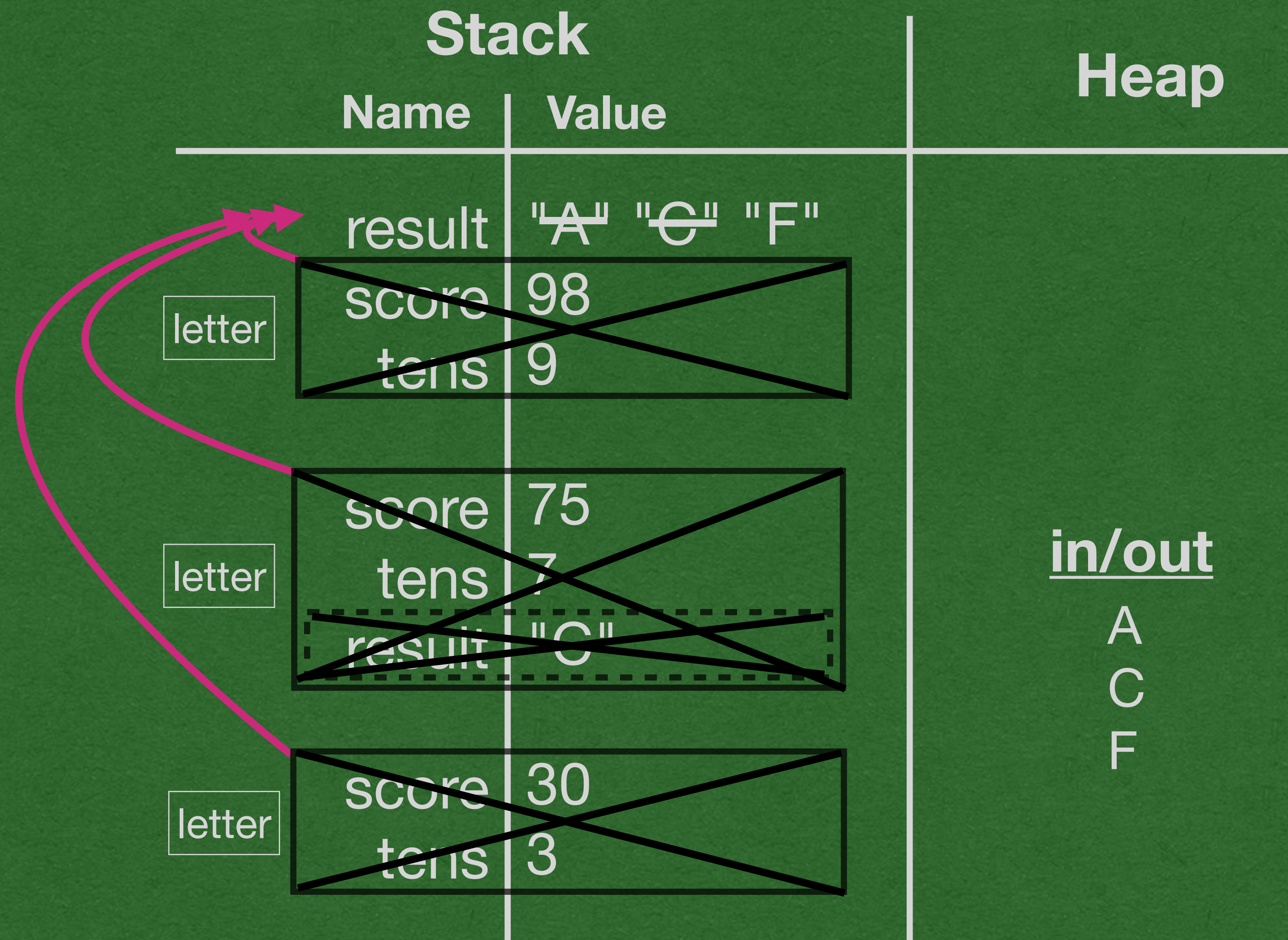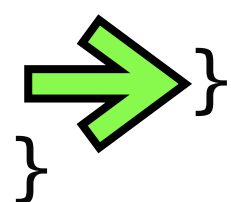
```java
package week1;

public class PlusMinus {
    public static String letter(int score){
        int tens=score/10;
        if (tens>=9){
            return "A";
        } else if(tens>=8){
            return "B";
        } else if(tens>=7){
            String result = "C";
            return result;
        } else if(tens>=6){
            return "D";
        } else {
            return "F";
        }
    }

    public static void main(String[] args) {
        String result = letter(98);
        System.out.println(result);
        result = letter(75);
        System.out.println(result);
        result = letter(30);
        System.out.println(result);
    }
}
```

Stack

Heap

Name	Value

result "A" "C" "F"

letter
score 98
tens 9

letter
score 75
tens 7
result "C"

letter
score 30
tens 3

in/out

A
C
F

- Print one last time

- Program ends

Loops

Java - While Loop

```java
double val = 10;
while (val > 1) {
    System.out.println(val);
    val /= 2;
}
```

- Same syntax as a conditional

- Except: The code block executes **until** the boolean expression is false

- This loop runs until val <= 1

Java - While Loop

```java
double val = -5;
while (val > 1) {
    System.out.println(val);
    val /= 2;
}
```

- While loops might not run at all

- If val is initialized to -5, the boolean expression is false and the body of the loop never executes

Java - For Loop

```
for (int x=0; x<5; x++) {
    System.out.println(x);
}
```

- The for loop is similar to a while loop, but with additional power

- This loop executes while x<5

- When the loop is first reached, the variable x is declared and assigned 0

- **Each time** the end of the code block is reached, x is incremented by 1

  - "x++" is equivalent to "x = x+1"

Java - For Loop

```
for (<initialization>; <boolean_expression>; <increment>) {
    <loop_body>
}
```

- A for loop is composed of 4 separate statements

- <initialization>: Runs only once when the loop first starts

- <boolean_expression>: loop_body executes while this resolves to true

- <increment>: Executes after each iteration of the loop (at the end of loop_body)

Memory Diagram 😃

```java
package week1;

public class Loops {
    public static void main(String[] args) {
 ⇒   double val = 10.0;
        while (val > 1) {
            System.out.println(val);
            val /= 2;
        }

        for (int x=0; x<5; x++) {
            System.out.println(x);
        }
    }
}
```

Name	Value
val	10.0

in/out

- Let's see these loops in action!

- Initialize val to 10

Stack

Name	Value
val	10.0

Heap

in/out

```java
package week1;

public class Loops {
    public static void main(String[] args) {
        double val = 10.0;
        while (val > 1) {
            System.out.println(val);
            val /= 2;
        }

        for (int x=0; x<5; x++) {
            System.out.println(x);
        }
    }
}
```

- Check the condition of the while loop
- 10 > 1 == true so the loop body executes
- No variables are declared inside the loop so we don't draw a dashed box

```java
package week1;

public class Loops {
    public static void main(String[] args) {
        double val = 10.0;
        while (val > 1) {
            System.out.println(val);
            val /= 2;
        }


        for (int x=0; x<5; x++) {
            System.out.println(x);
        }
    }
}
```

Name	Value
val	~~10.0~~ 5.0

Heap

in/out

10.0

- Print 10

- "val /= 2" is another shortcut that mean "val = val / 2"

  - Same applies for +=, -=, *=

```java
package week1;

public class Loops {
    public static void main(String[] args) {
        double val = 10.0;
    ➡> while (val > 1) {
            System.out.println(val);
            val /= 2;
        }

        for (int x=0; x<5; x++) {
            System.out.println(x);
        }
    }
}
```

Stack

Name	Value
val	~~10.0~~ 5.0

Heap

in/out

10.0

- We reach the end of the body of the while loop

- Check the boolean expression again

Stack

```java
package week1;

public class Loops {
    public static void main(String[] args) {
        double val = 10.0;
        while (val > 1) {
            System.out.println(val);
    ⇒      val /= 2;
        }

        for (int x=0; x<5; x++) {
            System.out.println(x);
        }
    }
}
```

Name	Value
val	~~10.0~~ ~~5.0~~ 2.5

Heap

in/out
10.0
5.0

- Since 5 > 1, we run the body again

- We avoid integer division since val is a double

```
package week1;

public class Loops {
    public static void main(String[] args) {
        double val = 10.0;
        while (val > 1) {
            System.out.println(val);
            val /= 2;
        }

        for (int x=0; x<5; x++) {
            System.out.println(x);
        }
    }
}
```

Name	Value
val	~~10.0~~ ~~5.0~~ 2.5

in/out
10.0
5.0

- Check the expression again

- 2.5 > 1 == true means we're going around again

```java
package week1;

public class Loops {
    public static void main(String[] args) {
        double val = 10.0;
        while (val > 1) {
            System.out.println(val);
            val /= 2;
        }


        for (int x=0; x<5; x++) {
            System.out.println(x);
        }
    }
}
```

Stack

Name	Value
val	~~10.0~~ ~~5.0~~ ~~2.5~~ 1.25

Heap

in/out
10.0
5.0
2.5

- Print and divide

```java
package week1;

public class Loops {
    public static void main(String[] args) {
        double val = 10.0;
        while (val > 1) {
            System.out.println(val);
            val /= 2;
        }

        for (int x=0; x<5; x++) {
            System.out.println(x);
        }
    }
}
```

Stack

Name	Value
val	~~10.0~~ ~~5.0~~ ~~2.5~~ 1.25

Heap

in/out
10.0
5.0
2.5

- 1.25 > 1 == true

- Why does this example loop so many times..

```
package week1;

public class Loops {
    public static void main(String[] args) {
        double val = 10.0;
        while (val > 1) {
            System.out.println(val);
            val /= 2;
        }

        for (int x=0; x<5; x++) {
            System.out.println(x);
        }
    }
}
```

Name	Value
val	~~10.0 5.0 2.5 1.25~~ 0.625

Heap

in/out
10.0
5.0
2.5
1.25

- Print and divide

Stack

```java
package week1;

public class Loops {
    public static void main(String[] args) {
        double val = 10.0;
➡️      while (val > 1) {
            System.out.println(val);
            val /= 2;
        }

        for (int x=0; x<5; x++) {
            System.out.println(x);
        }
    }
}
```

Name	Value
val	~~10.0 5.0 2.5 1.25~~ 0.625

Heap

in/out
10.0
5.0
2.5
1.25

- Check the boolean expression again

- This time, 0.625 > 1 == false

- The loop ends

Stack

Name	Value
val	~~10.0 5.0 2.5 1.25~~ 0.625

Heap

in/out

10.0
5.0
2.5
1.25

```java
package week1;

public class Loops {
    public static void main(String[] args) {
        double val = 10.0;
        while (val > 1) {
            System.out.println(val);
            val /= 2;
        }

        for (int x=0; x<5; x++) {
            System.out.println(x);
        }
    }
}
```

- Since val was declared outside the loop, it remains in memory after the loops ends

```java
package week1;

public class Loops {
    public static void main(String[] args) {
        double val = 10.0;
        while (val > 1) {
            System.out.println(val);
            val /= 2;
        }

        for (int x=0; x<5; x++) {
            System.out.println(x);
        }
    }
}
```

Stack

Name	Value
val	~~10.0~~ ~~5.0~~ ~~2.5~~ ~~1.25~~ 0.625
x	0

Heap

in/out
10.0
5.0
2.5
1.25

- When we reach a for loop, first execute the initialization statement

- If a variable is declared, it is inside the code block on the stack

```java
package week1;

public class Loops {
    public static void main(String[] args) {
        double val = 10.0;
        while (val > 1) {
            System.out.println(val);
            val /= 2;
        }

        for (int x=0; x<5; x++) {
            System.out.println(x);
        }
    }
}
```

Stack

Name	Value
val	~~10.0 5.0 2.5 1.25~~ 0.625
x	0

Heap

in/out
10.0
5.0
2.5
1.25

- Check the conditional: 0<5 == true so the loop executes

- Note that if this were false, the loop body would never run

```java
package week1;

public class Loops {
    public static void main(String[] args) {
        double val = 10.0;
        while (val > 1) {
            System.out.println(val);
            val /= 2;
        }

        for (int x=0; x<5; x++) {
            System.out.println(x);
        }
    }
}
```

Stack

Name	Value
val	~~10.0 5.0 2.5 1.25~~ 0.625
x	0

Heap

in/out
10.0
5.0
2.5
1.25
0

- Print x
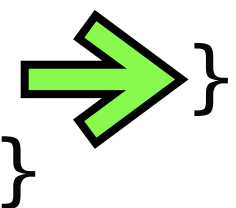
```
package week1;

public class Loops {
    public static void main(String[] args) {
        double val = 10.0;
        while (val > 1) {
            System.out.println(val);
            val /= 2;
        }

        for (int x=0; x<5; x++) {
            System.out.println(x);
        }
    }
}
```

Stack

Name	Value
val	~~10.0 5.0 2.5 1.25~~ 0.625
x	~~0~~ 1

Heap

in/out
10.0
5.0
2.5
1.25
0

- When we reach the end of the loop body, run the increment statement

```java
package week1;

public class Loops {
    public static void main(String[] args) {
        double val = 10.0;
        while (val > 1) {
            System.out.println(val);
            val /= 2;
        }

        for (int x=0; x<5; x++) {
            System.out.println(x);
        }
    }
}
```
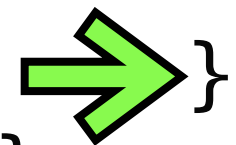
Stack

Name	Value
val	~~10.0 5.0 2.5 1.25~~ 0.625
x	~~0~~ 1

Heap

in/out
10.0
5.0
2.5
1.25
0

- Then, check the condition again

- 1<5 == true so we run the body again

```java
package week1;

public class Loops {
    public static void main(String[] args) {
        double val = 10.0;
        while (val > 1) {
            System.out.println(val);
            val /= 2;
        }

        for (int x=0; x<5; x++) {
            System.out.println(x);
        }
    }
}
```

Stack

Name	Value
val	~~10.0 5.0 2.5 1.25~~ 0.625
x	~~0 1~~ 2

Heap

in/out
10.0
5.0
2.5
1.25
0
1

- Print x

- We increments x (Run x++) each time we reach the end of the loop body

```
package week1;

public class Loops {
    public static void main(String[] args) {
        double val = 10.0;
        while (val > 1) {
            System.out.println(val);
            val /= 2;
        }

        for (int x=0; x<5; x++) {
            System.out.println(x);
        }
    }
}
```

Stack

Name	Value
val	~~10.0~~ ~~5.0~~ ~~2.5~~ ~~1.25~~ 0.625
x	~~0~~ ~~1~~ ~~2~~ ~~3~~ 4

Heap

in/out
10.0
5.0
2.5
1.25
0
1
2
3
4

- Let's jump forward to the point where x == 4 and we just printed 4 to the screen
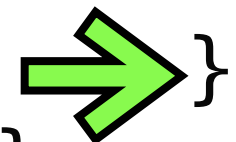
```
package week1;

public class Loops {
    public static void main(String[] args) {
        double val = 10.0;
        while (val > 1) {
            System.out.println(val);
            val /= 2;
        }

        for (int x=0; x<5; x++) {
            System.out.println(x);
→       }
    }
}
```

Name	Value
val	~~10.0~~ ~~5.0~~ ~~2.5~~ ~~1.25~~ 0.625
x	~~0~~ ~~1~~ ~~2~~ ~~3~~ ~~4~~ 5

in/out
10.0
5.0
2.5
1.25
0
1
2
3
4

- We reach the end of the loop body and run x++ to increment it to 5

```java
package week1;

public class Loops {
    public static void main(String[] args) {
        double val = 10.0;
        while (val > 1) {
            System.out.println(val);
            val /= 2;
        }

        for (int x=0; x<5; x++) {
            System.out.println(x);
        }
    }
}
```

Stack

Name	Value
val	~~10.0~~ ~~5.0~~ ~~2.5~~ ~~1.25~~ 0.625
x	~~0~~ ~~1~~ ~~2~~ ~~3~~ ~~4~~ 5

Heap

in/out

10.0
5.0
2.5
1.25
0
1
2
3
4

- This time, 5<5 == false

- The loop ends

```
package week1;

public class Loops {
    public static void main(String[] args) {
        double val = 10.0;
        while (val > 1) {
            System.out.println(val);
            val /= 2;
        }

        for (int x=0; x<5; x++) {
            System.out.println(x);
        }
    }
}
```

Stack

Name	Value
val	~~10.0 5.0 2.5 1.25~~ 0.625
~~x~~	~~0 1 2 3 4 5~~

Heap

in/out
10.0
5.0
2.5
1.25
0
1
2
3
4

- Whenever a code block ends, cross it out

- The variable x is no longer in memory after the loop ends

```java
package week1;

public class Loops {
    public static void main(String[] args) {
        double val = 10.0;
        while (val > 1) {
            System.out.println(val);
            val /= 2;
        }

        for (int x=0; x<5; x++) {
            System.out.println(x);
        }
    }
}
```

Heap

Name	Value
val	~~10.0~~ ~~5.0~~ ~~2.5~~ ~~1.25~~
	0.625
~~x~~	~~0~~ ~~1~~ ~~2~~ ~~3~~ ~~4~~ ~~5~~

in/out

10.0
5.0
2.5
1.25
0
1
2
3
4

- The program ends