AP Computer Science A
Ticket Out the Door
Set 28: Recursion

Name _____ Period _____

Skill 28.3 Exercise 1

Complete the stack diagram for the code block shown, then indicate the output.

```
class Main {

public static void main(String[] args) {
          Recursion.reduceByOne(4);
     }
}

class Recursion{

public static void reduceByOne(int n){
          if(n > 0)
               System.out.println(n);
               reduceByOne(n-1);
               System.out.println(n);
          }
     }
}
```

Stack

~~reduceByOne(0)~~
reduceByOne(1)
~~reduceByOne(2)~~
~~reduceByOne(3)~~
reduceByOne(4)
main

Output

4
3
2
1
1
2
3
4

Skill 28.4 Exercise 1

Complete the stack diagram for the code block below.

Consider the following method.

```
public static int calcMethod(int num)
{
  if (num == 0)
  {
    return 10;
  }
  return num + calcMethod(num / 2);
}
```

We cannot return anything until the recursion is complete!

Complete the stack diagram for the following call, then indicate what is returned.

```
calcMethod(16)
```

Stack		Output
calcMethod(0)	→ Base case so return 10	Note: 1/2 = 0, so we are returning whatever calcMethod(0) returned which is 10
calcMethod(1)	→ returns 1 + calcMethod(1/2) = 11	
calcMethod(2)	→ returns 2 + calcMethod(2/2) = 2 + 11 = 13	
calcMethod(4)	→ returns 4 + calcMethod(4/2) = 4 + 13 = 17	
calcMethod(8)	returns 8 + calcMethed(8/2) = 8 + 17 = 25	
calcMethod(16)	returns 16 + calcMethod(16/2) = 16 + 25 = 41	

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Skill 28.4 Exercise 2

Complete the stack diagram for the code block below.

Consider the following method.

```
public String goAgain(String str, int index)
{
  if (index >= str.length())
    return str;

  return str + goAgain(str.substring(index), index + 1);
}
```

We cannot return anything until the recursive calls are complete!

Complete the stack diagram for the following call, then indicate what is printed.

```
System.out.println(goAgain("today", 1));
```

Stack		Output
goAgain("ay", 3)	returns ay	
goAgain("oday", 2)	returns oday + goAgain("ay", 3) = odayay	
goAgain("today", 1)	returns today + goAgain("oday", 2) = todayodayay	

Skill 28.4 Exercise 3

Complete the stack diagram for the code block shown, then indicate the output.

```
class Main {
public static void main(String[] args) {
          System.out.println(Recursion.pls(4));
     }
}
class Recursion{

     public static int pls(int n)
     {
          if (n == 0)
               return 5;
          else if (n == 1)
               return 11;
          else
               return pls(n - 1) + 2 * pls(n - 2);
     }
}
```

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pls(0)

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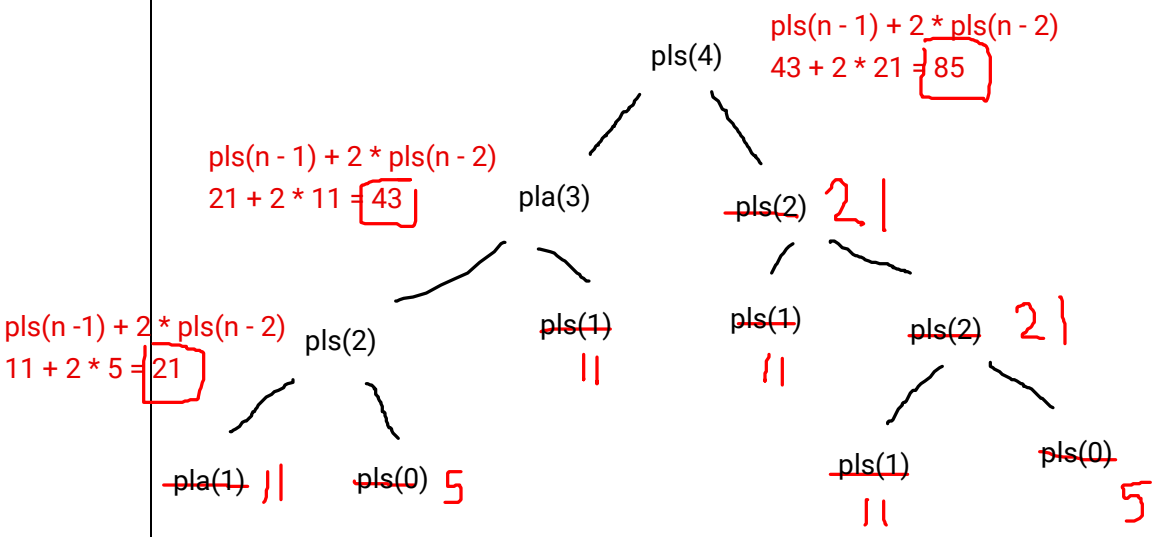
Stack



Output

85

Skill 28.4 Exercise 4

Complete the stack diagram for the code block shown, then indicate the output.

```
class Main {
public static void main(String[] args) {

          Recursion.homer(9));
     }
}

class Recursion{
public static void homer(int n)
{
     if (n <= 1)
          System.out.print(n);
     else
          homer(n / 2);

System.out.print(",” + n);

}
```

Stack

homer(1)

homer(2)

homer(4)

homer(9)

Output

1, 1, 2, 4, 9

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