2. This question involves the `SignedText` class, which contains methods that are used to include a signature as part of a string of text. You will write the complete `SignedText` class, which contains a constructor and two methods.

The `SignedText` constructor takes two `String` parameters. The first parameter is a first name and the second parameter is a last name. The length of the second parameter is always greater than or equal to 1.

The `getSignature` method takes no parameters and returns a formatted signature string constructed from the first and last names according to the following rules.

- If the first name is an empty string, the returned signature string contains just the last name.
- If the first name is not an empty string, the returned signature string is the first letter of the first name, a dash (`"-"`), and the last name, in that order.

The `addSignature` method returns a possibly revised copy of its `String` parameter. The parameter will contain at most one occurrence of the object's signature, at either the beginning or the end of the parameter. The returned string is created from the parameter according to the following rules.

- If the object's signature does not occur in the `String` parameter of the method, the returned `String` is the value of the parameter with the signature added to the end.
- If the object's signature occurs at the end of the `String` parameter, the returned `String` is the unchanged value of the parameter.
- If the object's signature occurs at the beginning of the `String` parameter, the returned `String` is the value of the original parameter with the signature removed from the beginning and appended to the end of the parameter.

The following table contains a sample code execution sequence and the corresponding results. The code execution sequence appears in a class other than `SignedText`.

Statement	Method Call Return Value (blank if none)	Explanation
`SignedText st1 = new SignedText("", "Wong");`		The `SignedText` object `st1` has an empty first name and last name `"Wong"`.
`String temp = st1.getSignature();`	`"Wong"`	
`SignedText st2 = new SignedText("henri", "dubois");`		The `SignedText` object `st2` has first name `"henri"` and last name `"dubois"`.
`temp = st2.getSignature();`	`"h-dubois"`	
`SignedText st3 = new SignedText("GRACE", "LOPEZ");`		The `SignedText` object `st3` has first name `"GRACE"` and last name `"LOPEZ"`.
`temp = st3.getSignature();`	`"G-LOPEZ"`	
`SignedText st4 = new SignedText("", "FOX");`		The `SignedText` object `st4` has an empty first name and last name `"FOX"`.
`String text = "Dear";`		
`temp = st4.addSignature(text);`	`"DearFOX"`	The signature does not occur in the `addSignature` parameter, so the returned string is the value of the parameter with the signature appended.
`text = "Best wishesFOX";`		
`temp = st4.addSignature(text);`	`"Best wishesFOX"`	The signature occurs at the end of the `addSignature` parameter, so the returned string is the unchanged value of the parameter.

Statement	Method Call Return Value (blank if none)	Explanation
`text = "FOXThanks";`		
`temp = st4.addSignature(text);`	`"ThanksFOX"`	The signature occurs at the beginning of the `addSignature` parameter, so the returned string is the value of the original parameter with the signature removed from the beginning and appended to the end of the parameter.
`text = "G-LOPEZHello";`		
`temp = st3.addSignature(text);`	`"HelloG-LOPEZ"`	The signature occurs at the beginning of the `addSignature` parameter, so the returned string is the value of the original parameter with the signature removed from the beginning and appended to the end of the parameter.

Write the complete `SignedText` class. Your implementation must meet all specifications and conform to the examples in the table.

3. This question involves pairing competitors in a tournament into one-on-one matches for one round of the tournament. For example, in a chess tournament, the competitors are the individual chess players. A game of chess involving two players is a match. The winner of each match goes on to a match in the next round of the tournament. Since half of the players are eliminated in each round of the tournament, there is eventually a final round consisting of one match and two competitors. The winner of that match is considered the winner of the tournament.

Competitors, matches, and rounds of the tournament are represented by the `Competitor`, `Match`, and `Round` classes. You will write the constructor and one method of the `Round` class.

```
/** A single competitor in the tournament */
public class Competitor
{
  /** The competitor's name and rank */
  private String name;
  private int rank;

  /**
   * Assigns n to name and initialRank to rank
   * Precondition: initialRank >= 1
   */
  public Competitor(String n, int initialRank)
  { /* implementation not shown */ }

  /* There may be instance variables, constructors,
     and methods that are not shown. */
}
```

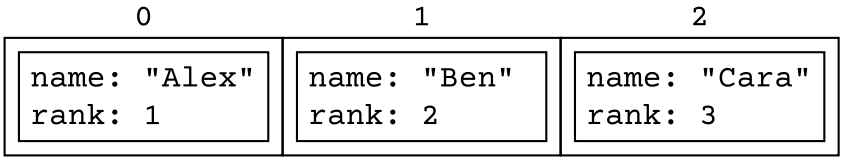
```
/** A match between two competitors */
public class Match
{
  public Match(Competitor one, Competitor two)
  { /* implementation not shown */ }

  /* There may be instance variables, constructors,
     and methods that are not shown. */
}


/** A single round of the tournament */
public class Round
{
  /** The list of competitors participating in this round */
  private ArrayList<Competitor> competitorList;

  /** Initializes competitorList, as described in part (a) */
  public Round(String[] names)
  { /* to be implemented in part (a) */ }

  /**
   * Creates an ArrayList of Match objects for the next round
   * of the tournament, as described in part (b)
   * Preconditions: competitorList contains at least one element.
   *                competitorList is ordered from best to worst rank.
   * Postcondition: competitorList is unchanged.
   */
  public ArrayList<Match> buildMatches()
  { /* to be implemented in part (b) */ }

  /* There may be instance variables, constructors,
     and methods that are not shown. */
}
```

A. Write the constructor for the `Round` class. The constructor should initialize `competitorList` to contain one `Competitor` object for each name in the `String[] names`. The order in which `Competitor` objects appear in `competitorList` should be the same as the order in which they appear in `names`, and the rank of each competitor is based on the competitor's position in `names`. Names are listed in `names` in order from the best-ranked competitor with rank `1` to the worst-ranked competitor with rank *n*, where *n* is the number of elements in `names`.

For example, assume the following code segment is executed.

```
String[] players = {"Alex", "Ben", "Cara"};
Round r = new Round(players);
```

The following shows the contents of `competitorList` in `r` after the constructor has finished executing.



Complete the `Round` constructor.

```
/** Initializes competitorList, as described in part (a) */
public Round(String[] names)
```

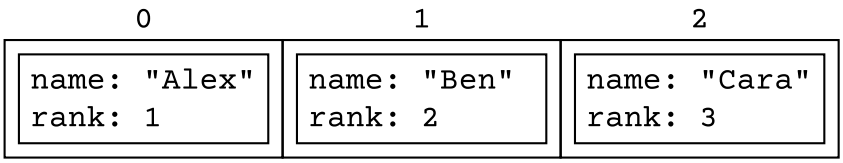
B. Write the `Round` method `buildMatches`. This method should return a new `ArrayList<Match>` object by pairing competitors from `competitorList` according to the following rules.

- If the number of competitors in `competitorList` is even, the best-ranked competitor is paired with the worst-ranked competitor, the second-best-ranked competitor is paired with the second-worst-ranked competitor, etc.
- If the number of competitors in `competitorList` is odd, the competitor with the best rank is ignored and the remaining competitors are paired according to the rule for an even number of competitors.

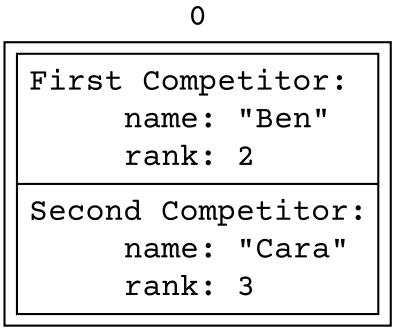
Each pair of competitors is used to create a `Match` object that should be added to the `ArrayList` to return. Competitors may appear in either order in a `Match` object, and matches may appear in any order in the returned `ArrayList`.

The following example shows the contents of `competitorList` in a `Round` object `r1` containing an odd number of competitors and the `ArrayList` of `Match` objects that should be returned by the call `r1.buildMatches()`.

`competitorList`:

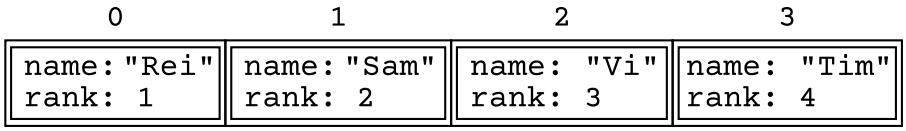


The `ArrayList` to be returned contains a single match between Ben and Cara, the second and third-ranked competitors:

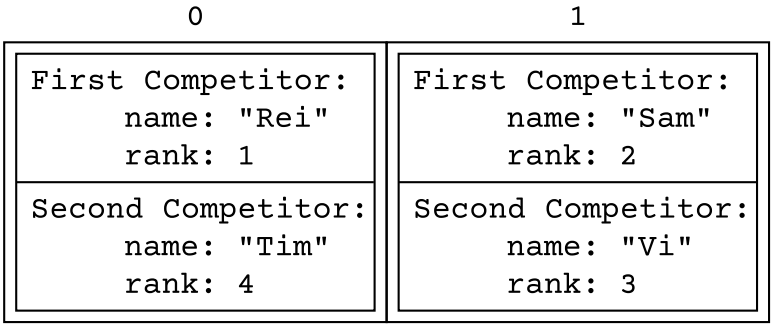


The next example shows the contents of `competitorList` in a `Round` object `r2` containing an even number of competitors and the `ArrayList` of `Match` objects that should be returned by the call `r2.buildMatches()`.

`competitorList`:



The `ArrayList` to be returned contains two matches: one match between the first- and last-ranked competitors Rei and Tim, and a second match between the second- and third-ranked competitors Sam and Vi:



Complete the `buildMatches` method.

```
/**
 * Creates an ArrayList of Match objects for the next round
 * of the tournament, as described in part (b)
 * Preconditions: competitorList contains at least one element.
 *                competitorList is ordered from best to worst rank.
 * Postcondition: competitorList is unchanged.
 */
public ArrayList<Match> buildMatches()
```

1. The `APCalendar` class contains methods used to calculate information about a calendar. You will write two methods of the class.

```
public class APCalendar
{

   /** Returns true if year is a leap year and false otherwise. */
   private static boolean isLeapYear(int year)
   {  /* implementation not shown */  }

   /** Returns the number of leap years between year1 and year2, inclusive.
    *  Precondition: 0 <= year1 <= year2
    */
   public static int numberOfLeapYears(int year1, int year2)
   {  /* to be implemented in part (a) */  }

   /** Returns the value representing the day of the week for the first day of year,
    *  where 0 denotes Sunday, 1 denotes Monday, ..., and 6 denotes Saturday.
    */
   private static int firstDayOfYear(int year)
   {  /* implementation not shown */  }

   /** Returns n, where month, day, and year specify the nth day of the year.
    *  Returns 1 for January 1 (month = 1, day = 1) of any year.
    *  Precondition: The date represented by month, day, year is a valid date.
    */
   private static int dayOfYear(int month, int day, int year)
   {  /* implementation not shown */  }

   /** Returns the value representing the day of the week for the given date
    *  (month, day, year), where 0 denotes Sunday, 1 denotes Monday, ...,
    *  and 6 denotes Saturday.
    *  Precondition: The date represented by month, day, year is a valid date.
    */
   public static int dayOfWeek(int month, int day, int year)
   {  /* to be implemented in part (b) */  }

   // There may be instance variables, constructors, and other methods not shown.

}
```

(a) Write the static method `numberOfLeapYears`, which returns the number of leap years between `year1` and `year2`, inclusive.

In order to calculate this value, a helper method is provided for you.

- `isLeapYear(year)` returns `true` if `year` is a leap year and `false` otherwise.

Complete method `numberOfLeapYears` below. You must use `isLeapYear` appropriately to receive full credit.

```
/** Returns the number of leap years between year1 and year2, inclusive.
 *  Precondition: 0 <= year1 <= year2
 */
public static int numberOfLeapYears(int year1, int year2)
```

(b) Write the static method `dayOfWeek`, which returns the integer value representing the day of the week for the given date (`month`, `day`, `year`), where `0` denotes Sunday, `1` denotes Monday, ..., and `6` denotes Saturday. For example, 2019 began on a Tuesday, and January 5 is the fifth day of 2019. As a result, January 5, 2019, fell on a Saturday, and the method call `dayOfWeek(1, 5, 2019)` returns `6`.

As another example, January 10 is the tenth day of 2019. As a result, January 10, 2019, fell on a Thursday, and the method call `dayOfWeek(1, 10, 2019)` returns `4`.

In order to calculate this value, two helper methods are provided for you.

- `firstDayOfYear(year)` returns the integer value representing the day of the week for the first day of `year`, where `0` denotes Sunday, `1` denotes Monday, ..., and `6` denotes Saturday. For example, since 2019 began on a Tuesday, `firstDayOfYear(2019)` returns `2`.
- `dayOfYear(month, day, year)` returns *n*, where `month`, `day`, and `year` specify the *n*th day of the year. For the first day of the year, January 1 (`month = 1, day = 1`), the value `1` is returned. This method accounts for whether `year` is a leap year. For example, `dayOfYear(3, 1, 2017)` returns `60`, since 2017 is not a leap year, while `dayOfYear(3, 1, 2016)` returns `61`, since 2016 is a leap year.

Class information for this question

```
public class APCalendar

private static boolean isLeapYear(int year)
public static int numberOfLeapYears(int year1, int year2)
private static int firstDayOfYear(int year)
private static int dayOfYear(int month, int day, int year)
public static int dayOfWeek(int month, int day, int year)
```

Complete method `dayOfWeek` below. You must use `firstDayOfYear` and `dayOfYear` appropriately to receive full credit.

```
/** Returns the value representing the day of the week for the given date
 *  (month, day, year), where 0 denotes Sunday, 1 denotes Monday, ...,
 *  and 6 denotes Saturday.
 *  Precondition: The date represented by month, day, year is a valid date.
 */
public static int dayOfWeek(int month, int day, int year)
```