CISC 3115
Midterm Exam

Please complete the exam and submit it as a plain text email with the subject "CISC 3115 Midterm Exam" to nzhou@brooklyn.cuny.edu by midnight on Wednesday, March 24.

Question 1

Does each of the following programs compile and run? If no, explain the reason; otherwise, give the output.

1.
```
public class P1 {
    public static void main(String[] args){
        System.out.println(f(4,2));
    }
    static int f(int x, int y){
        return x > y ? x : y;
    }
}
```

2.
```
public class P2 {
    public static void main(String[] args) {
        System.out.println(f("567"));
    }
    public static int f(String s) {
        int n = s.length();
        if (n == 0)
            return 0;
        else
            return f(s.substring(0, n-1)) + (s.charAt(n-1) - '0');
    }
}
```

3.
```java
public class P3 {
    int p;
    public P3() {
        this(0);
        System.out.println("P3");
    }
    public P3(int p) {
        this.p = p;
    }
    public void setP(int p) {
        this.p = p;
    }
    public static void main(String[] args) {
        P3 o = new P3();
        System.out.println(o.p);
    }
}
```

4.
```java
public class P4 {
    public static void main(String[] args) {
      int n = 2;
       f(n);

       System.out.println("n is " + n);
    }

     static void f(int n) {
       ++n;
    }
}
```

5.
```java
public class P5 {
    public static void main(String[] args) {
        System.out.println(f(567));
    }
    public static String f(int n) {
        StringBuilder s = new StringBuilder();
        do {
            s.append(n%10);
            n /= 10;
        } while (n != 0);
        return s.toString();
    }
}
```

Question 2

Write a function (static method) of the following specification:

```
public static int[] myCopyOf(int[] origArr, int len)
```

The function, which has the same behavior as `copyOf` in `java.util.Arrays`, takes an array `origArr` and returns a copy of `origArr`. The returned copy should have the specified length `len`. If `len` is greater than `origArr`'s length, then the extra slots are filled with zeros. No functions of the `Arrays` class can be used.

Question 3

Write a class for parking meters that has the following specification.

```
class ParkingMeter {
    final int maxTime;
    float rate;
    int time;

    public ParkingMeter(int maxTime, int rate);

    public void addQuarter();

    public int getTime();
}
```

The class has three member variables: `maxTime` for maximum parking minutes, `rate` for parking rate (minutes per quarter), and `time` for remaining parking time. The method `addQuarter` inserts a quarter, and the method `getTime` returns the remaining parting time.

Question 4

Consider the following functions:

```java
public static int f(String s) {
    return f(s, s.length(), 0);
}

public static int f(String s, int n, int acc) {
    if (n == 0)
        return acc;
    else
        return f(s, n-1, acc + (s.charAt(n-1) - '0'));
}
```

- What is the return value of the function call `f("123")`?

- What does the function `f` return in general?

- Convert the recursive function to an iterative one.

Question 5

Write a class, named `MyString`, that mimics the `String` class in the Java library, and provides the following API:

- `public MyString(char[] chars);`

- `public char charAt(int index);`

- `public int length();`

- `public MyString substring(int begin, int end);`

- `public MyString toLowerCase();`

- `public boolean equals(MyString s);`

No methods of the `String` class can be used.

Question 6

Write the following functions on `BigInteger`:

- The function `digits` takes a `BigInteger` and extracts the digits into an array of characters.

  ```
  public static char[] digits(BigInteger x){
      return x.toString().toCharArray();
  }
  ```

  Rewrite the function into one that uses neither the `toString` method nor the `toCharArray` method.

- The function `sumDigits` takes a `BigInteger` and returns the sum of the digits as a `BigInteger`.

  ```
  public static BigInteger sumDigits(BigInteger x)
  ```

  For example, for `x = 123`, the returned value is `6`.