CS1010J Programming Methodology
Tutorial 10: Simple Recursion

> What doesn't kill you makes you stronger.
>
> ~ *Friedrich Nietzsche*

To students:

Recursion is often used in CS2040 Data Structures and Algorithms. Hence it is important for you to understand the basics well in CS1010J.

Please be reminded of the submission deadline of **Problem Set 4: this Saturday 6pm.**

I. Manual tracing

1. [CS1010 AY2013/14 Semester 1 Exam, Q1.4]

   Assuming that **n** is a positive integer, consider the following four methods.

```
public static int f1(int n) {
  int sum = 0;
  for (int a = 1; a <= n; a++) {
    sum += a;
  }
  return sum;
}
```

```
public static int f2(int n) {
  int sum = 0;
  while (n > 0) {
    sum += n;
    n--;
  }
  return sum;
}
```

```
public static int f3(int n) {
  if (n == 1) {
    return n;
  } else {
    return n + f3(n-1);
  }
}
```

```
public static int f4(int n) {
  return n*(1+n)/2;
}
```

Which of the following statement is true?

A. Given a positive **n**, **f1** and **f2** will return different values.
B. Given a positive **n**, **f1** and **f3** will return different values.
C. Given a positive **n**, **f2** and **f4** will return different values.
D. Given a positive **n**, **f3** and **f4** will return different values.
E. Given a positive **n**, all the four methods will return the same value.

2. Manually trace and write down the output of each of the following code snippets.

(a) [CS1010 AY2010/11 Semester 1 Exam, Q1.2]

Given the following method, what does **calculate(5)** compute?

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

(b) Trace the method below manually and write down the return value of **q(5)**.

```
public static int q(int n) {
  if (n < 3) {
    return n + 1;
  } else {
    return q(n-3) + q(n-1);
  }
}
```

(c) [CS1010 AY2012/13 Semester 1 Exam, Q1.3]

Given the following method **f()**, what is the return value of **f(4)**?

```
public static int f(int n) {
  if (n == 1) {
    return 3;
  } else if (n == 2) {
```

```
    return 8;
  } else {
    return 2 * ( f(n-1) + f(n-2) );
  }
}
```

(d) What does the following method do?

```
public static int smallestDigitPairs(int n) {

  if (n < 100) {
    return n;
  }

  int val = smallestDigitPairs(n/100);

  if (n%100 < val) {
    return n%100;
  } else {
    return val;
  }
}
```

II. Programming

3. **[Problem Set 4 Exercise #20] Conway Sequence**

4. **[Problem Set 4 Exercise #22] Square Sum**

5. **[Problem Set 4 Exercise #23] Contains**