

NUMBER CONVERSION LAB (NUMBER 4) HANDOUT

CMSC 131

1. INSTRUCTIONS FOR LAB NUMBER 4

1.1. **Overview.** In this lab, you will write a free-standing method that takes two integer parameters, one for the number written in base-10 and the other for the desired base. This method's signature is:

```
public static String convertBase10toBase( int base10Val, int targetBase )
```

The first parameter, `base10Val` is a non-negative (base-10) integer. The second parameter is the desired base which must be an integer > 1 but less than 10.¹ The method returns the `String` that represents the original `base10Val` in the `targetBase`. For example the set of instructions

```
String ans = convertBase10toBase( 3, 2 ); // convert 3 base-10 to 3 base-2
System.out.println("3 in base 2 is " + ans );
```

prints

```
3 in base 2 is 11
```

1.2. **Reviewing some necessary Java operators.** Your Teaching Assistants will review the actual algorithm that we use to perform this conversion, which is given in strict pseudo-code below. You should learn the algorithm because you will likely be asked on exams, for example, do perform some simple conversions.

The algorithm requires that you use a few Java primitives that we have already reviewed in class:

remainder operator: This is written `a % b`, and it returns the remainder (as an integer) of dividing integer `a` by integer `b`.

division operator: This is written `a/b` and it returns the integer result of dividing integers `a` by `b`, which may be zero when $a < b$.

string concatenation: This appears as the `+` operator when this operator is given strings. Note, if given at least one string and the remaining arguments numbers, those numbers are converted into strings.

¹We could have had you specify a base up to 16, but this would make the assignment longer and more complex than is necessary to get across the main idea, which is about converting numbers to different bases.

Algorithm 1 Given two non-negative integers, one for a base-10 number, the other for the desired base, translate the base-10 number into a String that is its representation in the desired base.

```

function CONVERT( $n, b$ )                                ▷  $n$  is the number and  $b$  is the base
  if  $n = 0$  then
    return 0
  end if
   $str \leftarrow null$                                        ▷ set to the empty string
  while  $n > 0$  do
     $r \leftarrow n \% b$                                      ▷ obtain the remainder of  $n$  with  $b$ 
     $str \leftarrow r + str$                                   ▷ concatenate onto string
     $n \leftarrow n / b$                                      ▷ set  $n$  to the integer quotient of division with  $b$ 
  end while
  return  $str$ 
end function

```

2. ADMINISTRATIVE DETAILS . . .

Remember that you can and should work with another person in Labs (this is not the case for Projects, however).

Finally, if time permits, you should talk with your Teaching Assistants about how to “test” your code . . . , we will talk about this topic very soon. Finally, do not use any operators from Java’s `Math` package, nor should you use any of the methods from Java’s `Integer` class to complete this assignment! You might, however, use these when writing Test cases, however!