CSCI 689 **Computer Assignment 2** **Fall 2017**

(10 points)

Perfect Numbers

Greek mathematicians took a special interest in numbers that are equal to the sum of their **proper divisors,** which is simply any divisor less than the number itself. They called such numbers **perfect numbers.** For example, 6 is a perfect number because it is the sum of 1, 2, and 3, which are integers less than 6 that divide evenly into 6. Similarly, 28 is a perfect number because it is sum of 1, 2, 4, 7, and 14.

Write a predicate function isPerfect that takes an unsigned integer n and returns true if n is perfect, and false otherwise. Test your implementation by writing a main program in C++ that uses the isPerfect function to check for perfect numbers in the range 1 to 9999 by testing each number in turn. When a perfect number is found, your program displays it on stdout and also displays its divisors. The first two lines of the output should be 6 = 1 + 2 + 3 and 28 = 1 + 2 + 4 + 7 + 14. Your program should find two other perfect numbers in the range as well.

Each perfect number n should be displayed as $n = d_1 + d_2 + ... + d_m$, where $d_1, d_2, ..., d_m$ are the divisors of n with $d_1 = 1$. Generate such sequence as a C++ string by a divisors function. To convert each divisor (an integer) to a string, you can use the conversion function to_string from the C++ library.

Programming Notes:

- Name your source file as prog2.cc and your header file as prog2.h. Guard the statements in your header file using the following format:

  ```
  #ifndef CONST–VALUE  // which is not defined any place else
  #define CONST–VALUE // same const value as for ifndef directive

  // put all statements for your header file here

  #endif
  ```

- Include all system header files (that you need in your program) in your header file prog2.h. For example, to gain access to the iostream library, which defines a set of simple I/O operations, insert the line #include <iostream> in your header files, and to use the strings in your program, insert the line #include <string> in your header file; and at the top of your source file prog2.cc, insert your header file by the statement: #include "prog2.h". Define the constant value 9999 as an unsigned integer and put its definition in the program header file. Also put the prototypes of all your functions in the header file as well.

- To compile and link your program with the system library routines, execute: Make N=2. To test your program, execute: Make execute N=2. This command executes your program prog2.exe and displays the output of your program both on the terminal screen and in prog2.out. After you are done, you don't need the object and executable files any more. To delete them, execute: Make clean.

- You can find the correct output of this program in file prog2.out in directory: ~cs689/progs/17f/p2.

- Submit your source and header files to your TA by executing: mail_prog.689 prog2.cc prog2.h.