

## Loops, Loops, and More Loops (and Decisions)

110 Points Total

**Part A** While Loop

10 Points

Write a complete program using the "while loop" to calculate and output 1! to 12! using "long" variables. Note: There isn't any input for this program.

**Part B** For Loop

10 Points

Write a complete program using the "for loop" to calculate and output 1! to 12! using "long" variables. Note: There isn't any input for this program.

**Part C** Do...While Loop

10 Points

Write a complete program using the "do...while loop" to calculate and output 1! to 12! using "long" variables. Note: There isn't any input for this program.

**Part D** Funny Output

10 Points

Using one of your programs from Parts A to C, modify your program to calculate and output 13!, 14!, 15!, 16!, 17!, and 18!. Are there anything unusual about them?

**Part E** Short Variables and Factorials

10 Points

Using one of your programs from Parts A to C, modify your program to use "short" variables in place of "long" variables and find the largest factorial you can using this program. Note: There isn't any input for this program.

**Part F** Harmonic Series

20 Points

In Calculus 2, you studied the harmonic series as a divergence sequence. Write a complete program to see how quickly this series actually diverges by finding and outputting the number of terms it takes to exceed your age/4 if you are 25 or younger or your age/5 if you are 26 or older.

**Part G** Fun Math

20 Points

Write a complete program to show the computer's results of reproducing this sequence (multiply the (double) fraction by 2 and if greater than 1, subtract 1, then repeat - requires an "if" and this while loop: "while(input != 1.0)":

0, 4, 8: 1/7: 1/7, 2/7, 4/7, 1/7 (was 8/7), 2/7, 4/7, 1/7, ...

1, 3, 7: 1/15: 1/15, 2/15, 4/15, 8/15, 1/15 (was 16/15), 2/15, 4/15, 8/15, 1/15, ...

2, 5, 6, 9: 1/3: 1/3, 2/3, 1/3 (was 4/3), 2/3, 1/3, 2/3, ...

**Part H** More Easter Fun

20 Points

Modify your Easter program from the last lab assignment to accept from the user the starting year and ending year and output the date for Easter for each year including the starting and ending years. Your program should be able to handle the case where the starting and ending years are the same and the case where the ending year is earlier than the starting year by reversing the years and continue running the program.