MA3750 Homework #4

Write a SAS program which performs the following tasks. ***Make sure*** that your file...

- has an initial set of comments stating the course, homework set (#3), and your name
- has a `footnote` statement with your name, and a `footnote2` statement with "MA3750 Homework #3"
- uses comment "sections" in the code to denote each new exercise

Multiple Choice

For the following multiple choice questions, create a *temporary* SAS data set which has the variables EXNUM and ANSWER. The variable EXNUM should be the value of the exercise number (1, 2, 3, ...), and ANSWER should be a character variable which is your choice to the question. Use a `datalines` statement containing the values of these variables. Print your data set with a descriptive `title`.

1. The following SAS program is submitted:

```
data sums;
  do n=1 to 5;
    sum + n;
  end;
run;
```

   How many observations will be in the data set `SUMS`?

   (a) None, the program fails to execute

   (b) 1

   (c) 5

   (d) 6

2. Refer to question 1. What will be the value of `n` in the last observation of the data set `SUMS`?

   (a) `.` (a missing value)

   (b) 1

   (c) 5

   (d) 6

3. The following SAS program is submitted:

```
data compound;
  balance = 500;
  do while(balance < 500);
    balance = balance * 1.04;
  end;
```

   What will be the value of `balance` in the first observation of the data set `compound`?

   (a) There are no observations in the data set `compound`

(b) . (a missing value)

(c) 500

(d) 520

4. The following SAS program is submitted:

```
data iterations;
  balance = 500;
  output;
  do until(balance>600);
    balance + 20;
  end;
```

What will be the value of `balance` in the last observation of the data set `iterations`?

(a) There are no observations in the data set `iterations`

(b) 500

(c) 600

(d) 620

5. The following SAS program is submitted:

```
data iterations;
  balance = 500;
  output;
  do until(balance>600);
    balance + 20;
    output;
  end;
```

What will be the value of `balance` in the last observation of the data set `iterations`?

(a) 500

(b) 580

(c) 600

(d) 620

6. How many variables and observations will be created in the following SAS data set?

```
data roth_ira;
  start = 1000;
  do year = 1 to 30;
    savings + 5000;
    do month = 1 to 12;
      int = savings * (.05/12);
      savings + int;
    end;
    output;
  end;
run;
```

(a) 4 variables, 12 observations

(b) 4 variables, 30 observations

(c) 5 variables, 12 observations

(d) 5 variables, 30 observations

Programming

Edit the remainder of your SAS program to complete the following tasks. ***Make sure to check your work***. Particularly, it is a good idea to make sure data sets are read correctly, labels and formats are assigned correctly, and variables are created correctly.

7. Suppose that we wish to get a numerical approximation to an initial-value problem using Euler's method. Namely, we wish to solve the differential equation

   $$y'(x) = \frac{x}{1 - y(x)}, \quad y(0) = 4$$

   If we forgot how to use separation of variables to solve this differential equation, Euler's method can be used to come up with a numerical approximation to the solution on some interval. This is an iterative process which estimates a solution to the above equation by setting

   $$y_0 = 4, \quad x_0 = 0$$

   and then updates values of y and x by the equations

   $$y_{t+1} = y_t + \frac{x_t}{1 - y_t} \cdot h, \quad x_{t+1} = x_t + h$$

   Here, h is a step size that should ideally be rather small.

   Create a temporary SAS data set called Euler which does the following tasks:

   - Create variables `x`, `y`, and `h`, initializing them to 0, 4, and 0.001, respectively. Output an observation.
   - In a do loop...
     - update the value of y by assigning a new value to it using the above formulas
     - update the value of x by assigning a new value to it using the above formulas
     - output another observation
   - Do this iteration for as long as $x \leqslant 3$

   When you have created this data set, create a plot of it with `proc sgplot`. This can be implemented with a "time-series" plot, such as

   ```
   proc sgplot data = euler;
     series x = x y = y;
   ```

8. Write a SAS data step which uses a series approximation to estimate the value of log(1.9) Note that

   $$\log(1 + x) = x - x^2/2 + x^3/3 - x^4/4 + x^5/5 - ...$$

   with the error in this approximation no greater than $x^{n+1}/(n+1)$ Keep adding terms to the polynomial approximation UNTIL the error can be bounded from above by 0.00005, outputting the number of terms in the approximation, as well as the value of the polynomial approximation each iteration.

9. Complete Exercise 10 in Chapter 8 of your textbook. After reading the input correctly (there should be a total of 30 observations, with the variables Method and Score), sort the data set so that scores are sorted in ascending order within each method. Then write another data step which calculates the minimum, maximum, and average score within each of the three methods. You will need a `RETAIN` statement for this task. Output only the last observation in each method (so this data set will have three observations), writing only the variables for Method, minimum, maximum, and the average. Print this data set.