MA/CSC 427 PROJECT 1 Name: _____ Due 09/11/2013

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1. Estimate both the largest *positive* computer number ϵ_1 and the smallest *positive* computer number ϵ_2 such that $1 \bigoplus \epsilon_1 \leq 1$ and $\epsilon_2 \leq 0$ on your computer. (*Write a simple program to do the calculation. It will be helpful to keep a track of the number of loops being taken.*) Are these two numbers the same? Explain why.

2. Assume that a floating-point number system has 32 bits per word with 24 bits for mantissa and does rounding. Represent the numbers $\frac{1}{2}$, $\frac{2}{3}$ and $\frac{3}{5}$ as floating-point numbers on this system for both cases. Assume that the first bit is implicit.

3. Consider the following Fortran program:

```
      H = 1./2.
      X = 2./3. - H
      Y = 3./5. - H
      E = (X+X+X) - H
      F = (Y+Y+Y+Y+Y) - H
      Q = F/E
      WRITE(6,10) Q
      STOP
   10 FORMAT(1H, G20.10)
      END
```

   The variable Q can take on several different values depending on either the floating-point arithmetic hardware or the compiler used by the computer. Execute the above program on at least three computing devices/environments to see what values of Q will be returned. Explain your results by applying the floating-point arithmetic *step by step* with the representations obtained in Problem 2 to these numbers.

All results need be typed up. Your report should contain four sections:

- *Introduction. This is the place where you introduce background information such as any relevant history, additional reading, and interesting remarks.*
- *Mathematical issues. This is where you review the mathematical theory that is applicable to this project.*
- *Programming issues. Describe any programming tactics or design details you have employed in your code. Remember to attach your code here.*
- *Conclusion. Analyze your observations and draw conclusions of your experiments here.*