Assignment 2-Written Part: Due 1/26/18

Major Sources of Error: Rounding Error, Truncation Error, Measurement Error, Modeling Error;

For Scenarios 1 to 4, Identify the dominant source of error. (One of the four types above, only short answers are required). Put all your answers in the table at the bottom of the page.

Scenario 1: Mars Climate Orbiter Mission. Lockheed software that calculated the total impulse produced by thruster firings calculated results in **pound-seconds**. NASA's *trajectory calculation softward* used these results to correct the *predicted position* of the spacecraft for the effects of thruster firings. This software expected its inputs to be in **Newton-seconds.** A pound is 4.5 Newtons, so the spacecraft hit the Mars orbit too soon at too high of speed and disintegrated in the upper atmosphere of Mars.

Scenario 2: For Loop Summation. Consider the following block of C code where sum 0.1 a total of 1 million times. The exact result *should be* `sum=100000`. *However,* the value of `sum= 100958.34375` after the loop.

```
int j;
float sum=0;
for (j=0;j<1000000;j++)
   sum+=0.1;
```

Scenario 3: Falling Bowling Ball. We dropped a bowling ball out of plane from 3920 meters up. We predict the time and impact velocity using the height and velocity formulas [1]

$$h(t) = 3920 - 9.8t^2; \quad v(t) = -19.6t$$

Using these formulas **we predict** it will take 20 seconds to hit the ground, and the impact velocity will be 392 m/s. However, **the actual** impact velocity turned out to be 147 `m/s` and 39.1 seconds of flight time.

Scenario 4: Approximation of π. We can represent $\pi$with an infinite series:

$$\pi = \sum_{n=0}^{\infty} \frac{(n!)^2\, 2^{n+1}}{(2n+1)!}$$

If we stop the series at $n = 4$, we get:

$$\pi \approx 2 + \frac{2}{3} + \frac{4}{15} + \frac{4}{35} + \frac{16}{315} \;\Rightarrow\; \boxed{\pi \approx \frac{976}{315}}$$

Answer Table: Fill in the 6 blank boxes

Scenario	Dominant Source of Error	Absolute Error	Relative Error
1		NA	NA
2		958.34	9.58×10^{-3}
3			
4			

[1] $9.8\ \mathrm{m/s^2}$ is the force due to gravity on falling bodies on earth